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Sustainable Development and Courage:

Culture, Art and Human Rights

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Welcome message by the Conference Chairs

This summer was a memorable and unique experience for all participants and organisers of the 28th annual conference of the International Sustainable Development Research Society – ISDRS 2022 in Stockholm. On the same turf of the United Nations conference in Stockholm in 1972 and its Stockholm +50 sibbling, and after two annual online versions of the conference forced upon us, it was with great joy and pleasure we met up again in Stockholm, Sweden. With 35+ re-occurring tracks, a hybrid set-up of both on campus and online conferencing, and with six collaborating universities in Stockholm: Marie Cederschiöld University, Stockholm School of Economics, Swedish Defence University, Stockholm University of the Arts, Södertörn University and University College Stockholm, the conference committee truly took us on a complex challenge. . The participants successfully navigated between five different campi while enjoying the this years conference with the overall theme "**Sustainable Development and Courage. Culture, Art and Human Rights**".

We were proud to accommodate over 400 delegates from 50+ countries and all six continents around the world, all of which engaging in the important endeavour of creating more knowledge to make our world a more sustainable one. The six key note panels can be view in its full length on the ISDRS YouTube channel launched in August 2022 with playlists for a few of the recent conferences.[1] For this particular conference panels, please view the playlist for ISDRS 2022.[2]

We want to thank the vice chancellors, communication departments, technical support staff and administrators at the six universities. We furthermore want to thank the ISDRS board, the secretariat, and the NPG: the New Professionals Group. We are thankful to the sponsorship by Ersta Diakoni, allowing twelve scholars from Africa, Asia, Eastern Europe, Middle East and South America to participate online, free of charge.

Last, but not least, a very special THANK YOU to our conference coordinator Johanna Holmberg and her team of about 20 student ambassadors. Without your support this would not have been possible!

- Peter Dobers, Södertörn University
- Malin Gawell, Södertörn University
- Johan Gärde, Marie Cederschiöld University
- Michael Hjälm, University College Stockholm
- Juliette Mapp, Stockholm University of the Arts
- Pierre Guillet de Monthoux, Stockholm School of Economics
- Stefan Silfverskiöld, Swedish Defence University

For any post-conference contacts with the Organising Chairs, please mail us at: isdrs2022@isdrsconferences.org.

[1] https://www.youtube.com/channel/UCRpIdW_p9r1nLXWH96mlNHA/featured
[2] https://www.youtube.com/playlist?list=PLu-70cD5hTjNf2X3ppxTBx6444mqo86pA

Welcome message by the Editors

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

Authors of abstracts, posters and full papers are searchable in the PDF reader of your choice, such as any keywords of your choice. This kind of publication will most likely remain as an electronic version, never printed out fully in a paper copy of 1700+ pages, and therefore, the most powerful tool of finding texts from ISDRS 2022 in Stockholm, Sweden, is by using the search tool on your computer or electronic device.

Without the help of many hands this achievement would not have been possible. First of all, we would like to express our thankfulness to all the engaged reviewers which invested their time to secure the highest scientific excellence and soundness. The review process was made possible through the support by the many unnamed reviewers.

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

- Peter Dobers, Södertörn University
- Malin Gawell, Södertörn University
- Johan Gärde, Marie Cederschiöld University
- Stefan Silfverskiöld, Swedish Defence University

For any post-conference contacts with the Editors about this publication, please mail us at: isdrs2022@isdrsconferences.org.

Proud Sponsors of ISDRS 2022

ISDRS 2022 is proud to announce that Ersta Diakoni and Stockholms Sjukhem are very valuable sponsors of the conference allowing us to support twelve scholars, mostly PhD students, from the following nine countries on four different continents to take part in the conference, some of which took part on campus:

- Algeria
- Bangladesh (2 scholars)
- Israel
- Myanmar
- Nigeria (3 scholars)
- Peru
- Russia
- Rwanda
- Ukraine

Ersta Diakoni is gold-level sponsor to ISDRS 2022. Ersta Diakoni has developed and worked with health care and social care since 1851. The organization rests on a Christian foundation. “We see the whole person and want to create a dignified welfare for everyone. As an idea-driven actor, our profit is reinvested in the venture - always with the aim of being able to help more people”. Ersta Diakoni is Sweden's largest player in idea-based health care and social care. They provide health care, social work, education and research and want to continue to grow to be able to offer even more people a dignified welfare. https://www.erstadiakoni.se/

Stockholms Sjukhem is a bronze-level sponsor to ISDRS 2022. Stockholm Sjukhem has cared for people with chronic or long-term illnesses since their inauguration in 1867. Stockholms Sjukhem is a non-profit organization, a private hospital and nursing home owned and operated by a foundation formed in the 1860s. The work is primarily conducted on the basis of care agreements with municipalities and Stockholms county council. Their areas of expertise and profiling are advanced home care, geriatric care, rehabilitation, palliative care and residential care for people with illness because of old age or neurological or dementia illnesses. https://www.stockholmssjukhem.se/

Plenary speakers of the 2022 Conference

Carlton Waterhouse

Carlton Waterhouse serves as the Deputy Assistant Administrator for EPA's Office of Land and Emergency Management. He was appointed by President Biden in February 2021. Carlton began his legal career as an attorney with EPA, where he served in the Office of Regional Counsel in Atlanta, Georgia, and the Office of General Counsel in Washington, D.C. Before rejoining EPA in 2021, he held a joint appointment as a professor at the Howard University School of Law and the Howard University School of Divinity. Carlton is a Fulbright research scholar and an international expert on environmental law and environmental justice.

Azza Karam

Dr. Azza Karam serves as the Secretary General of Religions for Peace – the largest multi-religious leadership platform with over 90 Interreligious Councils, as well as grassroots Interfaith Youth and Women's networks. She also holds a Professorship of Religion and Development at the Vrije Universiteit in Amsterdam (The Netherlands) - of which she is a citizen. She has served in intergovernmental, international and non-governmental organisations since the early 1990s and has lectured in various academic institutions in Europe, North America (including the United States Military Academy/West Point), and in the Arab region. She has published widely on transnational political dynamics, including development, gender and religion.

Prajal Pradhan

Prajal Pradhan studied agricultural engineering and environmental management. He was a lead author of the IPCC Special Report on Climate Change and Land and a contributing author of the AR6 IPCC WG III Report and the AR6 IPCC WG II Report. Prajal has experience in developing relevant research on climate change and sustainable food systems. He is an expert in food system emissions, food security, climate change, and sustainable development goals (SDGs). Currently, Prajal is a PI of the BIO-CLIMAPATHS project. His current research focuses on understanding urban transformations, investigating impacts of climate change on bioeconomy, and SDG interation. Three key words: SDG interactions, Sustainable transformations, Adequate actions.

Björn-Ola Linér

Björn-Ola Linnér is professor in Environmental Change and at the Centre for Climate Science and Policy Research, Linköping University and the programme director of Mistra Geopolitics. His research focuses on transnational governance on climate change and sustainable development goals, societal transformations, the geopolitics of sustainability, and methods for policy analysis and dialogue. His latest books are the co-authored The Political Economy of Climate Change Adaptation (Palgrave MacMillan 2016) and Sustainability Transformations: Agents and Drivers of Social Change (Cambridge University Press 2019).

Sabina Alkire

Sabina Alkire is the Director of the Oxford Poverty and Human Development Initiative (OPHI) and Professor in the Oxford Department of International Development, University of Oxford. Her research interests include multidimensional poverty measurement and analysis, welfare economics, the capability approach, and human development. Previously, she worked at the George Washington University, Harvard University, and the World Bank. She is a Fellow of the Academy of Social Sciences.

Sidonie Hadoux

Sidonie is a photographer and filmmaker based in Lille, France. After studying journalism, she studied photography at the Market Photo Workshop in Johannesburg, South Africa in 2016, and she is currently enrolled in an online mentorship with Through The Lens Collective, [also] based in Johannesburg. Her current work explores the notion of landscape in the post-industrial areas of Northern France, through the lens of a new ecofeminist visual imaginary. Sidonie photographs in response to the concept of female gaze, questioning the consequences of capitalist patriarchy on our lands and bodies.

Carl Anders Säfström

Carl Anders Säfström is a Professor (full) of Educational Research and Director of the Centre for Public Education and Pedagogy at Maynooth University Ireland. He is also an adjunct professor of Education at CRESI, University of Southern Australia. His latest book was published by Routledge in 2020 under the title "A Pedagogy of Equality in a Time of Unrest'. He is working on a manuscript for Springer, on "Education for Everyday Life. A Sophistical Practice of Teaching", which are to be published in early 2023. His interest is currently in exploring the place and role of improvisation in art, music and teaching.

Cecilia Sjöholm

Cecilia Sjöholm is professor of Aesthetics at Södertörn University. Her research is particularly focused on the relation between art and politics in contemporary culture. She has published extensively on aesthetics and critical theory. Her latest book, Through the Eyes of Descartes; Seeing, Thinking, Writing (with Marcia Cavalcante Schuback, forthcoming at Indiana University Press) looks at the relation between Descartes'thought and climate issues. She is one of the initiators of a new platform for research in the arts in times of climate change and societal transformation at Södertörn University.

Mats Bigert

Mats Bigert is a Swedish artist and one half of artist duo Bigert & Bergström. Bigert & Bergström have been collaborating since meeting at the Royal Institute of Art in Stockholm 1986. Since then B&B have done artworks and projects ranging from large-scale sculptures and installations to performance and film. Often with a conceptual edge, the core of their work is positioned between humanity, nature and technology. The duo is known to analyze scientific and social issues discussed in contemporary society, such as climate change or environmental sustainability. Between 1-19 June their large scale installation Tipping Point is shown at Galärparken on Djurgården as part of a collaboration with Liljevalchs konsthall, The institute for Future Studies and The Global Challenge Foundation.

Marie-Andrée Robitaille

Marie-Andrée Robitaille is an artist based in Sweden, currently doctoral candidate in performative and mediated practices at Stockholm University of the Arts (SKH). She has worked as a circus artist with Cirkus Cirkör among others and as a talent scout for Cirque du Soleil. From 2009 to 2018, she was an assistant professor and head of the Bachelor's program in Circus at SKH. In her previous artistic research projects, she investigated the representation of women in circus (Gynoïdes Project), sonic interactions (Sound of Circus), and sense-perception (Hidden Circus). In her doctoral project, "Circus as Practices of Hope", she focuses on alternative modes of composition as a method to support the emergence of posthuman practices in circus arts.

Emma Stenström

Emma Stenström is Associate Professor and Director of the Research Center for Arts, Business & Culture at Stockholm School of Economics (SSE). Her research concerns aesthetic, creative and innovative aspects of sustainable business, the intersection between arts and business, and the humanistic side of management. She has published hundreds of research-based articles, chapters, and columns. Beside her academic career, Emma has been a regular columnist in Dagens Industri since 2000.

Malena Britz

Malena Britz pro-Vice Chancellor at the Swedish Defence University. She holds a PhD from Stockholm University (2004) and is Associate Professor in Political Science at the Swedish Defence University. Her areas of research include different aspects of European security and defence policy, Europeanisation, and Nordic co-operation. She has studied different aspects of security policy from defence industry policy, development of EU security and defence, European states' participation in international operations, as well as international aspects of civil protection.

Tinna Joné

Tinna Joné, Assistant professor in documentary storytelling and responsible MA programs in Film and Media at SKH. Research about reality in the digital media landscape, exploring how new technology can support development towards more equal representation in the contemporary documentary narrative. 30 years professional experience in film and media. Directed documentary films for cinema in Sweden and abroad. Made investigative journalism, produced feminist radio and do art, performance and soundwalks in the public space.

Lars Strannegård

Lars Strannegård is the President of the Stockholm School of Economics and a professor of business administration with a focus on leadership. His research has dealt with issues of sustainability in large organizations, questions regarding branding, and how art and culture affect organizations. He is particularly interested in how higher academic activity is affected by digitization and how educational programs and environments can be designed in ways that consider the world we live in today. He is especially interested in how the logical-scientific and aesthetic forms of knowledge relate to each other.

Jakob Trollbäck

Jakob Trollbäck is the founder of the sustainability agency The New Division and the branding and design studio Trollbäck + Company. He is the main architect behind the communication language for the United Nation's 17 Global Goals, an ambitious and inspiring agenda for a better world by 2030. With offices in Stockholm and New York, he specializes in strategy and communication for sustainability.

Anna Enström

Anna Enström is a researcher, writer, and lecturer with a PhD in Aesthetics from Södertörn University, Stockholm. Her research is specialized on the aesthetic thought of Immanuel Kant, post-Kantian theories of art and contemporary critical theory. Her acclaimed and well received thesis is entitled Gemütstimmung, laughter and hypochondria: On aesthetic experience in Kant’s third Critique (2021) and among her most recent articles is “Kant’s globe – the critical philosophy, the lectures in physical geography and the sensibility of thought” in OEI magazine (2022).

Annick T.R. Wibben

Annick T.R. Wibben is Anna Lindh Professor for Gender, Peace & Security at the Swedish Defence University. Her research straddles critical security and military studies, peace studies, and feminist international relations. She is most frequently associated with Feminist Security Studies and Feminist Peace Research. Her publications include a monograph, Feminist Security Studies: A Narrative Approach (2011), and two edited volumes, Researching War: Feminist Methods, Ethics & Politics (2016) and Teaching Peace & War: Pedagogy & Curricula (with Amanda Donahoe, 2020).

Michel Östlund

Michel Östlund is an artist and film producer, living in Uppsala, Sweden. His work has a focus on existensiell issues and human rights. He express life, death, time, freedom speech with sculptures and paintings. He experiments with a blending of different disciplines into an interesting whole, where art, music, film, theater and architecture interact with each other. He works internationally. The last seven years his work has been around human rights and a mission to express what Human Rights is through art and culture. He has both educated and inspired next generation to understad the meaning of human rights with start at UN, New York to worldwide.

Robert Egnell

Robert Egnell (PhD London) is the Vice-Chancellor of the Swedish Defence University (SEDU) and a professor of leadership. Previous positions include Georgetown University, the Swedish Defence Research Agency, and the University of Dar es Salaam, Tanzania. Robert's research and expertise is best summarized with "the conduct and effectiveness of peace and stability operations". He has over the years has studied civil-military relations, counterinsurgency operations in Iraq and Afghanistan, peace support operations, state-building and security sector reform, gender in military operations, women in combat, as well as the connection between security and development.

Table of Contents

1. Sustainability and Science 1

1a. Theoretical approaches 1

Abstracts 2

Co-Producing 'The Future(s) We Want': Imaginaries of sustainability and collaborative knowledge-action models in Swedish sustainability and research policies 3

Dominant Leadership Styles: A multi-flex leadership styles blend towards educational effectiveness 4

Entangling the Security Paradox – moving beyond a normative construction of social sustainability and security 5

Human-nature Partnership – a normative framing for relational sustainability science? 6

Sustainability Science as Co-creative and Care-full Research Praxis 8

Full papers 9

Courage for Sustainable Development 10

Posters 22

1b. Research methods and methodologies 24

Abstracts 25

Circularity: Just Science Fiction? A science fiction prototype experience 26

How do the Ratings that Measure the Sustainability of Universities Integrate the Circular Economy? 27

LCA of Eco-efficient Techniques and Lifestyle: Case-study of a family unit with an agricultural holding 28

Full papers 29

Assessing the impact of Vehicle Development Process Improvement on Sustainable Development Goals 30

Enabling online backcasting: Experience and best practices from applying Gameful Backcasting (GAMEBACK) 5

Fostering Narratives through Arts-based Research 23

Posters 39

1c. Assessing sustainability 42

Abstracts 43

Assessing Stakeholder Engagement in Non-financial Reporting: Evidence from companies listed on the Italian stock exchange 44

Assessing the Impact of Circular Strategies at the Company Level: Design and validation of the SCEIA framework (Strategic Circular Economy Impact Assessment) 46

Drivers and Barriers to Organizational Learning in Non-Governmental Organizations contributing to the Sustainable Development Goals 47

The Pareto Checklist for Sustainable Development 48

Triple Loop Learning in Environmental Management Practice: Evidence of the RedES-CAR dissemination program 49

Using Meadows' Leverage Points as a Tool to Assess Effective Sustainability Impacts 50

Full papers **51**
Environmental Impact of Maritime Means of Transport: A case study of maintenance activities in ferries 52
Sustainability as Societal Value & Cultural Fact: A framework for value accounting 65
Posters **82**
2. Education **86**
2a. Provision, quality of and access to education **86**
Abstracts **87**
Advancing Care-full Scholarship within the Sustainability Sciences 88
Marrying Young: The surprising effect of education 89
The Role of Dilemmas and Paradoxes in Transdisciplinary Research Settings 90
Posters **91**
2b. Education for sustainability **93**
Abstracts **94**
Assessing the Development of Knowledge and Attitude for Sustainable Leadership through Simulation-based Learning: The preliminary findings 95
Education for Sustainability: The teaching of skills to achieve the sustainable development goals of the 2030 Agenda 96
Energy: A philosophy of practice 97
EUSTEPs MOOC: Leveraging ecological footprint for lifelong sustainability learning 97
Expanded Learning: Examples of embodied sustainability education practices 99
Exploring Accounting Educators' Perspectives on Sustainability: A Freirean critical pedagogic perspective 100
How to Achieve Reduction of Excessive Consumption? An educative approach with middle school students and their families 101
In Search of a Sustainable University: Lessons from a Brazilian case study 102
Marine Litter: Design, implementation, and evaluation of an educational intervention for young people to raise awareness and stimulate co-responsibility and sustainable behaviors 103
Philosophy in Nature. Walkshops as a pedagogical-didactical tool for planet proof education 104
Public Institutions for SDGs: Between didactic (participation teaching method) and social impact assessment 105
Relations between Universities and Recyclable Material Collectors: An analysis of the production of knowledge in action research 106
Short-term and Long-term Impact of Education for Sustainability on the Behaviour of Students 107
Teaching to Embrace Uncertainty – using SDGs as shared objects 108
The Impact of Teaching Engineering for Sustainability on Students. A comparative study on different levels of sustainability integration in University of Technology 109
The Regenerative Campus and Sustainable Wellbeing - an exploratory literature review on nature-based and transformative approaches in higher education institutions 110
The Educational Worldview Journey. A transformative learning tool for exploring, exchanging, and expanding perspectives in a world in crisis. 111

Universities Driving Sustainability: Exploring cross-cultural pathways to a circular economy of plastics on campus 112
Walkshops towards a Sustainable World. Teaching environmental philosophy in the woods 113
Full papers **114**
Creativity, Leadership and Education for Sustainability 115
Developing Social Sustainability with Circus-based Methods 133
Embedding Enterprise Focused Education for Sustainable Development: Lessons from undergraduate student experiences in product design 146
'Leading Change for Sustainability in Schools' Simulation: The training tool for educators in Vietnam 167
Socio-environmental Citizenship from the Perspective of University Social Responsibility. 178
Teeter Tru 186
University Social Responsibility experiences in Higher Education: Engaged research in Kyoto University 199
Posters **216**
2c. Beyond the Resilient Subject: Art, Education, and Imagination **219**
Abstracts **220**
A Blend of Indigenous and Non-indigenous Learning for Improved Educational Outcomes 221
A description of *Aesthetic Knowing*'s role in Ecologies of Courage, followed by some Educational Considerations 222
ARCHIPEDAGOGY: An Art Education for the Anthropocene 223
Dancing with the Other. A kinaesthetic and ethical shift from the egological to the ecological 224
Flying High, Falling Hard – Sustainability and presence in the performing arts 225
Reducing Carbon Footprints and Environmental Impact of Performing Arts Production 226
Rethinking Resilience in Environmental Education 227
The Potential of Arts-based Pedagogy to Face Imaginaries of the Anthropocene. A case study in Business School 228
Full papers **229**
Children's Rights to make their Voices Heard and Listened to 230
3. Biodiversity and ecosystem services **247**
3a. Life on land **247**
Abstracts **248**
Legal and Institutional Framework on Forest Confronted with Colonial Hrauma: how to decolonize and achieve SDG 15 in DRC? 249
Full papers **250**
Enhancing Sustainable Development on Land: Using birds of prey to disperse flocks of native birds that threaten resource use and human activities 251
Landscape-based Strategies to Avert Human-Elephant Conflict 263
3b. Life below water **275**
Abstracts **276**
Source Tracking of Fecal Contamination in Northern Oligotrophic Rivers 277

Transdisciplinary, Global, Important, and Challenging: Reflections on ocean climate finance projects in the sustainable development agenda 278
3c. Ecosystem services 279
Abstracts 280
A Healthy Environment and Human Development: Is it possible to achieve both objectives? 281
Cultural Services of City Parks – measurement and improvement options 282
Factors Affecting the Use and Value of Traditional Ecological Knowledge in Conservation and Management of Savanna Ecosystem Services among the Rural Communities of Capricorn District Municipality, Limpopo, South Africa 283
Impact of Rural Transformation on Land use and Ecosystem Services in Three "Real Labs" in China 284
Rational Management of Veterinary Antiparasitic Treatments in the South-east of France . 285
Soil Fungi as a Tool for Carbon Sequestration in the Mitigation of Climate Change 286
4. Climate change & Energy 287
4a. Predictions and responses 287
Abstracts 288
Assessing Farmers' Perception of Climate Change and Adaptation Behaviour: A study of Kashmir valley, Western Indian Himalayan Region 289
Assessment Framework of the Transport related Carbon Mitigation Options for Efficient Fleet Management 290
Decentralized PV Generation can Satisfy Electricity Demand in Urban Areas: A city case study at Santarém, Portugal 291
The Impact of Climate Change on Hungarian Agriculture 292
The Potential for Hydropower Carbon Capture and Storage (HPCCS) - Measuring CO2 degassing from turbines at a medium-sized hydropower station in Northern Sweden 293
Posters 294
4b. Affordable and clean energy 298
Abstracts 299
Measuring Sustainable Energy Transition: A comparison of indicator sets 300
Full papers 301
Improving the Implementation of Green Public Procurement 302
Life Cycle Assessment of a Proton Exchange Membrane Unitized Regenerative Fuel Cell for Residential Buildings 318
Posters 330
5. Production, consumption and innovation 332
5a. Corporate Sustainability and Corporate Social Responsibility 332
Abstracts 333
CO2 as Important KPI in the 21st Century for Corporate Performance 334
Economic Assumptions Informing the Climate Change Scenarios of Australian Corporations 335
Managing Sustainability in Arts and Culture Organisations: The journey of Nottingham-based SMEs as change actors 335

Sustainability in Public Institutions in Germany: Enablers and barriers to organisational change in cultural production and basic services organisations 337
Sustainability Leadership of Social Entrepreneurs: The Driving force for sustainable development 338
Sustainability Management Initiatives in Non-Profit Organizations: An integrative review 339
Full papers **340**
Corporate Governance and Non-financial Disclosure: A bibliometric and critical review.... 341
Evolving Purpose towards Sustainability 363
Moral Identity of Sustainable Entrepreneurs 382
Supporting sustainable transformations in corporations 397
Posters **414**
5b. Design for sustainability **418**
Abstracts **419**
Co-designing Measurement and Reduction of Food Loss and Waste: A case study of developing and refining tools 420
Connect the Dots by Digits: How can complementors link themselves to existing business models in sustainable ecosystems? 421
Does Collaborative LCA Improve Engineering Competencies for Sustainability? A comparative analysis 422
Hacking the Campus: Art and creative engagement to design a sustainable environment.... 423
Integrating Sustainability in Industry of the Future Technological Learning Programs: A platform to co-create and mutualize course experiences 424
Life Cycle Assessment of a Newly Lightweight Automotive Component Design: Linkage of design for sustainability and the sustainable development goals 425
Supporting Product Planning for a Circular Economy: Evaluation of a case study within the white goods industry 426
Sustainable Fashion and Textile: Contemporary Scenario 427
Traditional Indian Textile Crafts and Paintings: A sustainable heritage 428
What a Waste – A norm-critical study on how waste is understood and managed through integrating perspectives 429
Full papers **430**
Sustainable Redesign Process of Foldable Plastic Crate Suitable to Grape Transport 431
Posters **449**
5c. Circular Economy **452**
Abstracts **453**
A Critical Analysis and Comparison of Circular Economy Policies in three European Cities 454
Adapting Circular Packaging Design from an Absorptive Capacities Perspective: Theoretical perspectives and practical insights 455
Assessment Model of Circular Economy Implementation: A proposal for Latin American SMEs 457
Assessment of Circular Economy Scenarios in the Mineral Water Production Sector 458

Can Circular Economy (CE) Promote the Sustainable Development Goals (SDGs) and vice versa: Investigating the interactions between the CE and SDGs in the EU? 459
Circular Value Stream Mapping (C-VSM): Rethinking production process in the agri-food sector 460
Colombian Consumers' Perspective on Circular Economy Paradigm for Attaining Sustainable Development 461
Coming at the Circular Economy from Different Angles – a text-mining and contingency-based analysis of 3000 projects 462
Exploring Circular Economy Criteria of EU's Taxonomy for Sustainable Activities 463
Flexible Circular Index for Responsible Cities 464
How can the Financial Perspective Facilitate the Transition towards Circular Business Models? Insights from a literature review 465
Lessons on Extended Producer Responsibility in the Context of Circular Economy 466
Textile and Metal synergies: Two potential sectors for sectoral industrial symbiosis implementation in Portugal 467
Ultimate Producer Responsibility for e-waste Management - a proposal for just transition in the circular economy based on the case of used European electronic equipment exported to Nigeria 467
Full papers 469
Agility within the Scope of Bio Refineries: Identifying main characteristics and key factors for agile bio refineries 470
A Transition Management Methodology Framework towards a Circular Economy in Industrial Contexts: Reflections on the Humber Region scenario 485
Circular Bio-based Materials for Sustainable Buildings: A literature review of case studies and assessment methods 511
Circular Economy Practices in the Agri-food Sector: A literature review 534
Circular Indicators for Agri-food Sector: Test and validation 545
Closing the Loop in the Agri-food 558
Information Challenges in a Circular Economy 573
Key-Drivers shaping Circular Economy Transitions 590
Which Visions of Bioeconomy are most Common in the New Research Field of Circular Bioeconomy? 611
Posters 634
5d. Value chains and trade 636
Abstracts 637
The Food Retail Sector towards a Circular Economy 638
Full papers 639
Applying Oiconomy Pricing 640
5e. Sustainable consumption and consumers 657
Abstracts 658
Consumers' Attitude for Fish and Seafood in Portugal: Opportunities for footprint reduction and more sustainable consumption 659
Consumers' Post-purchase Behaviour of Fashion Products 659

Dates from which Waste Derives: Multifaceted research to improve date mark labels for consumers to reduce food waste 661
Gamified Apps for Sustainable Consumption: A systematic review 662
Other Ways of Living – producing and consuming in pace with nature 663
Prosumption - state of the art and implications for sustainable development 664
Sustainability-Related Consumer Attitudes Towards Ecological Food Products: Does a consumer healthy lifestyle determine them? 665
Full papers 667
Analysis of Wastage Mechanisms in the Supply Chain of Fish Products in a Circular Economy Perspective: An empirical research 668
Emerging Prosumers and Company Management – A stakeholder approach 686
Consumers' Post-purchase Behaviour of Sashion Products 698
Going Back to the Roots: Finding the positives in the old practices 721
Role of Behavioural Cost, Habits, and Lifestyle in Green Food 737
Posters 758
5f. Food security and agriculture 760
Abstracts 761
Revealing the Temporal and Spatial Patterns of Nrop-specific nutrient Utilization in China 762
Sustainability of the Zero Hunger Support Systems of Faith-Based Organisations in Nigeria 762
Technical Efficiency-Food Security Nexus : A case study of Poultry farming households in Oyo state, Nigeria 764
Full papers 765
Vegetable Buying Options in Bangalore - A consumer and Retail Perspective 766
Yield Effects of Climate Change Adaptation Strategies in Nigeria: Did anchor borrower's progamme play any role? 779
6. Cities and regions 797
6a. Urban and regional transformations 797
Abstracts 798
Delivering Carbon-neutral Goals through End-user Driven Energy Rransitions: A cross-cultural perspectives on smart social learning in three Asian cities (Kyoto, Seoul and Hong Kong) 799
Diagnostic Social-Ecological-Technological Lens and Co-design Toolkit for Complex Wrban water Systems Transformation 800
Experiments for Urban Sustainability Transformations and Causal Inference 801
Improving Urban Green Infrastructure for the Sustainable Development of Cities 802
Institutional Logic for Centralizing Local Environmental Responsibilities in China 803
Local Sustainability Analysis Revealing the Perceived Relationship between Digitalization and Adaptation in Hungary 804
Reassessing Urban Containment and Nature Preservation in Spatial Planning: A spatial-institutional analysis of the Green Heart in the Netherlands 805
The Structural Violence of Private Electric Automobility 806

The Sustainable Development Goals and Urban Transformation: City government engagement with the SDG agenda. 807
Urban Transformation through Decision-making and Governance: The role of actors and institutional settings to achieve urban systems sustainability 808
Full papers 809
Dynamic Framings of Critical Infrastructure are Needed for Increasingly Complex Environments 810
Learnings from Emerging Implementation of Strategic Sustainable Development in a Regional Context 830
Teaching Smart City for Sustainable Guandu Plain in Taipei: A reflection on transdisciplinary education 856
Transforming Interface Spaces for Urban Sustainability in Taipei 873
Unlocking Co-Financing Strategies for Urban Nature-based Solutions 894
Posters 906
6b. Urban and regional resilience 908
Abstracts 909
Conceptual Perspectives on Urban Water Systems Transformation through the Lens of Social-Ecological and Socio-Technical Systems Frameworks 910
Contribution to the Preservation of the Cultural Heritage of Road and Rail Infrastructure: Characterisation of vulnerability to flooding as a basis for resilience building 911
Mainstreaming Innovative Funding Mechanisms: A case example of Gothenburg, Sweden. 912
Pedestrian Thermal Comfort Mapping for Evidence-based Governance and Sustainable Urban Design; A systematic literature review 913
SDG targets and the Sub-national Scale – How to adapt a global agenda to the context of local authorities in developed countries 914
Understanding the Institutional Work of Boundary Objects in Climate-proofing Cities: The case of Amsterdam Rainproof 915
Full papers 916
Advancing Climate Resilience: 917
The Role of Structured Decision-making in Community-based Adaptation: A systematic scoping review 937
6c. The power of art and culture in sustainable cities and communities 964
Abstracts 965
Artful Organizers: Images of cultural entrepreneurship practices in urban and suburban settings 966
Climate Artivism or Death. Extinction rebellion, school strike for climate and earth strike – case of Krakow, 2018-2021 967
Differences in Sustainability Approaches of European Contemporary Art Museums 968
Practices of Listening 969
Shedding Light on City Tunnels: Problematic boundary work in city development 970
Spaces for Creative Entrepreneurship in the Art City - Venice as an incubator 971
Full papers 972
Engaging Culture Phronesis for Cities in Future 973

7. Social-economic aspects of sustainability 985
7a. Global inequality and poverty 985
Abstracts 986
Addressing Historical Inequalities: National and global challenges in the post-pandemic era 987
Full papers 988
Memories of Resistance of Solid Waste Collectors to Institutional Voids that Promote Poverty in four Recycling Cooperatives in southern Brazil 989
Posters 996
7b. The future of employment and good work 998
Abstracts 999
Circular Jobs: Exploring sustainable business practices that contribute to social justice in Latin America 1000
Posters 1001
7c. Sustainable economic models 1003
Abstracts 1004
General Collective Intelligence and the Sustainable Development Goals 1005
Towards Sustainable Economic Models through Technological Eco-innovation in Developing Countries 1006
Full papers 1007
Purpose and Resilience in the Context of Corporations: The mediating effect of sense of community 1008
8. Social foundations of sustainability 1030
8a. Gender, inclusivity and human rights 1030
Abstracts 1031
Gender Equality at the Corporate Top – justifications for an open-minded view into gender equality 1032
Gender, Technology and Prosperity in Canadian and Swedish PPP: Interrogating connections and contradictions in Agenda 2030 1033
Globalizing Dissent for an Inclusive and Sustainable Society: A postcolonial reading of Arundhati Roy's The God of Small Things and the Ministry of Utmost Happiness 1034
The Good Ancestor, Dag Hammarskjöld 1035
Transformative Interventions for Gender Equality 1036
Full papers 1037
Agricultural Air Pollution Impacts on Rights to Health in Myanmar 1038
Algorithmic Authority and the Defence Sector 1052
Are Environmental Impact Assessments (EIA) a Suitable Tool to assess Human Rights Impacts? 1066
Recycling and Poverty in Brazil: 1081
Reducing Disease Vulnerability with Health Education and Legal Framework for Sustainable Development: Perception of public health and legal practitioners 1099
The Evolution of Women's Agency Related Perceptions and Practice among the Gaddi Women of Himachal Pradesh in India 1117

8b. Communication for sustainability 1135
Abstracts 1136
Developing Sustainability Strategy for Community Disaster Risk Management 1137
Leveraging United Nation's International Day for Yoga (IDY) to Promote Sustainable Lifestyles and Wellbeing: Setting a research agenda 1138
Full papers 1139
Sustainable Development in the Portuguese Press 1140
8c. Just transitions 1153
Abstracts 1154
A Hidden Dimension of Energy Poverty in Brazil Revealed by Covid 19: Access to education 1155
Are Hard-to-reach Energy Users being Left out of a Just Transition? Exploring the hard-to-reach concept through an energy justice lens 1156
Beyond Coal - progress towards a sustainable future in Poland in the light of Just Transition and post pandemic reconstruction 1158
Full papers 1159
Articulating Voices of the Young: How to bring youth into contemporary planning and governance? 1160
Justice in the Shadows – Land, Labour and Migration in India's Clean Energy Transition 1170
9. Governance, power and institutions and weakness of SDGs 1184
9a. Peace and sustainable development 1184
Abstracts 1185
Carbonomics, H2Onomy, and the Age of Disruption: A thought experiment for the decade humanity reoriented, reimagined, and (perhaps) renewed itself 1186
Ethnicity, Inequalities, and Collective Grievances: The changing the contours of democracy and political community in India 1187
Interactive Governance of Smart Cities: Collaborative participation of the citizen o to sustainable development in the metropolitan region of Baixada Santista 1188
9b. Collaboration and co-creation for sustainability, SDG initiatives and scale of governance 1189
Abstracts 1190
A Variety of University Initiatives Aiming at Promoting Collaboration for Sustainable Development. Reflections on strategies and collaboration practices as Södertörn University. 1191
Collaboration Capacity as an Institutionalized Practice for Sustainable Travel 1192
Community-based Innovators and their Innovations Emerging in the Developing World as an Enabler of Co-creation of Collective Actions toward Sustainable Futures: Emergence of legitimate leadership, trust-based network, and partnerships with scientists 1193
Dynamic Laboratories for Local Sustainability: Insights of the ODSlocal project (Portugal) 1195
Evaluation Synthesis on Private Sector Engagement in International Development 1196
Mismatches in Practice Centered Research Processes on the Challenges of Youth in Swedish Suburbs 1197

The CareLab for People and Planet: Collaboration and co-creation under the lens of care for enhancing inner and outer sustainability 1198
Universities as Enablers of Collaborative Learning in Communities of practice: The case of the Sustainable Enterprise Network in Colombia 1199
Quadruple Helix in Eliminating Poverty: The case study of *Asnafprenuer* program in Malaysia 1200
Posters 1201
9c. Public participation and the role of stakeholders 1203
Abstracts 1204
Curating Participation: Understanding micro-democracy in grassroots movements 1205
How can Nature Participate as a Real Stakeholder in Public Policy-making and Decision-processes? 1206
Sustainable Cities: How stakeholder engagement in SEA advances sustainability 1207
Sustainability in Sporting Mega-Events: The case study of the Birmingham 2022 Commonwealth Games 1208
Full papers 1209
Participatory System of Local Indicators of Sustainable Agriculture: the case of Minas Gerais, Brazil 1210
Reflections on Sustainable Development Planning and Implementation: 1229
9d. Legal aspects of sustainable development 1244
Abstracts 1245
Building Coherent Social Protection Systems: A comparative legal analysis of mechanisms in Sub Saharan Africa 1246
Business towards Sustainability Transformation: The example of the transitional economy states 1247
Could Human Rights be 'Environmentally Friendly'? Bridging environmental degradation and right to life in the jurisprudence of the human rights committee 1250
Creating a System for Biodiversity Offsetting in Finland: The case of land use planning .. 1251
Governance Mechanisms for Sustainable Development 1252
How Should Trees Have Standing? Rights of nature and indigenous cosmovision 1253
Interface of policy and institutional framework for Co-management of Marine and Coastal Resources and Challenges to Effective Implementation 1254
Legal Measures to Overcome Green vs Green Conflicts Related to Renewables in Japan . 1255
Measures of Continued Ecological Functioning do not release from Species Derogation Procedures? An analysis of EU-nature conservation judgements 1256
Optimizing SDGs 13 and 15 in the Democratic Republic of Congo: Updating the existing legal and policy framework and promoting the courage of actors of change 1258
Protection of the Environmental Human Rights Defenders for Achieving the Sustainable Development Goals 1259
Restoration & Liability Duties for Environmental Damages "from the past"? The interplay of EU's environmental liability, habitat & birds directives and Swedish fiber banks 1261
Righting the Green Transition for Indigenous Peoples: Lessons from the Fosen Norwegian Supreme Court Decision 1262

Study on the Adequacy of Laws for Climate Change Mitigation and Adaptation in Malaysia and Indonesia 1263
The implementation of EU marine biodiversity protection in Finland 1264
The new legal system of urban gardens 1265
The role of law in the making of deforestation in the Peruvian Amazon 1266
The Sustainability Challenges for Agri-food Value Chains 1267
The UN Post 2020 Biodiversity Framework and the EU Habitats Directive: United we stand for Net Gains 1268
Urban law, climate change and sustainable development 1269
Water as a Human Right: a comparative analysis between Brazil and the US 1270
Full papers 1271
A proposal to develop a "Culture of sustainability" in the legal framework of agriculture 1272
Benefit-sharing in International Law 1292
Circular Economy and Industry Self-Regulation 1307
Developing an Analytical Famework for Assessment of Adaptation Pathways: A case study of Food Production Systems in the Vietnamese Mekong Delta 1316
Indigeneity, Gender, Sustainability, & Development: 1329
Legal and political framework for CCUS with negative carbon emissions development in Asia 1329
Lessons for International Aid from Indigenous Women's Rights Activism in Inle Lake, Myanmar 1344
Log-off Right and Digital Technologies in Worker's Life. A«New» Fundamental Right? 1361
Participatory Democracy, Access to a Fair Decision and the UN's SDG 16 1381
Rivers Weep and Trees Hurt – Recent Legal Developments in South Asia Concerning Rights Relating to Nature 1399
Realizing Equity and Sustainable Development in Climate Regime of Bangladesh 1415
SLAPP Auits in South Africa: A new Dawn or a Constitutional Quagmire? 1444
Understanding the Economic and Environmental Impact of the COVID- 19 Pandemic through the UN Global Communication Using Computer- Assisted Text Analysis Tools 1457
Who Will Tie the Bell? Climate Change Policy Implementation Authority of Bangladesh 1470
10. Special themes 1489
10a. Sustainability and Africa 1489
Abstracts 1490
Adsorption Study of Methylene Blue Dye and wastewater from local Textile Industry using Pennisteum pupureum (Elephant grass) 1491
Comparative Study of Different Parameters for measuring the Performance of Improved Cook Stoves in Rwanda 1492
Leveraging principles of economic geography and tourism climatology for sustainable tourism development in Egypt's New Administrative Capital 1494
Negotiating the Contours of Inequalities, State Power and Social Mobilisation for Sustainable Development in Africa 1495
The augmented EKC and a new Measure of Water Pollution – An Investigation of Pollution in Africa 1496

Posters **1497**
10b. Sustainable development in Latin America: challenges and opportunities **1501**
Abstracts **1502**
A Decolonial approach to Socio-Environmental Justice and Indigenous Community-Based Eco-Tourism in Ecuador 1503
Community Action and the urgency around climate and health policy in the Caribbean: agency and shaping of local priorities 1504
Intercultural learning through indigenous tourism: emerging spaces where decoloniality can be expressed and enacted 1505
Posters **1506**
10c. Quality Management and Sustainability **1508**
Abstracts **1509**
"Sticking power": Tracking employee well-being and organizational culture for insight into sustainability and quality 1510
Sustainable quality culture and characteristics of top management teams - Can it be measured? 1511
The Journey to Strong Sustainability Starts With Understanding Organizational Culture .. 1512
UNIDO Good Governance Standards for Sustainable Business Practices: How much do Nigerian Entrepreneurs Know? 1512
Full papers **1514**
Arts-based Interventions in Business 1515
Teaming for Quality in the VUCA Landscape 1534
The Role of the Main Customers and Key Stakeholders in Value Creation within a School System. 1551
Understanding Attractive and Sustainable Quality to Increase Customer Value in Education 1564
Using a Process Based System Model (PBSM) for sensemaking - the case of sustainable building blocks in Sub Saharan Africa 1577
Value Creation through Educational Partnerships Focused on Preparing Students for Citizenry in a Sustainable Global Society 1590
Posters **1602**
10d. One Health, SDGs and ethical conflicts **1604**
Abstracts **1605**
Assessing risk and building resilience to facilitate the transition towards circular food systems 1606
How to solve ethical conflicts in One Health approaches 1607
One Health *Praxis* as an Ethos for the Sustainable Development Goals 1607
Overview of ethics, One Health and sustainability goals 1609
Solidarity and One Health in The Age of Covid-19 1610
Workshop on 'One Health, SDGs and ethical conflicts' – creating a roadmap 1611
Posters **1612**
10e. Handbook of Sustainable Development Goals **1614**
Abstracts **1615**

Chances and Challenges In Implementing Sustainable Development Goals in Disaster Risk Management and Post-Catastrophic Crisis Management – Case Study on the German Ahr Valley Region 1616
Co-Design and Regenerative approaches towards SDGs Territorialisation for the Communities in Transition. A pilot project for the implementation of Agenda2030 in the Metropolitan City of Reggio Calabria..... 1618
Conserving Water Resources for Achieving Sustainable Development Goals in Bangladesh: A Legal Analysis..... 1620
Exploring Agenda 2030 through the 5Ps lens 1621
Operationalization of an Innovative Theoretical Research Approach for Spatially Determining SDGs – Implementing Spree Forest and Lusatia Regions Land and Environmental Systems Model into the flood disaster-damaged Ahr Valley Region in Germany 1622
The core values and drivers for building future businesses – How born-sustainable and sustainability-driven companies contribute to the SDGs..... 1624
10f. Religion, Courage and Sustainable Development 1625
Abstracts..... 1626
Catholic Green Social Teaching -The Devil in the Details 1627
Political Socialisation, Enrolment Process and Ideology Building of College Youth..... 1628
The Political Economy of Faith and Coexistence in a Failed State in West Asia and North Africa (WANA) 1629
Tracing the history of Bangalore's Infant Jesus Church through oral history and memory 1629
Full papers..... 1631
Laudato Sì and Sustainability..... 1632
Religious Systems in Transition..... 1647

1. Sustainability and Science

1a. Theoretical approaches

Abstracts

Co-Producing 'The Future(s) We Want': Imaginaries of sustainability and collaborative knowledge-action models in Swedish sustainability and research policies

Tatiana Sokolova

Södertörn högskola, Stockholm, Sweden

Abstract

In the wake of the global sustainability agenda implementation, collaborative sustainability research has been actively endorsed at many institutional levels. Co-production of research and action, transdisciplinarity and actionable science have been incentivised and heavily invested in - seen as an 'epistemic imperative' for the politics of sustainability. However, neither sustainability nor collaborative research are sedimented phenomena; they are both infused with conflictual interpretations and take diverse conceptual and practical forms along the political and scientific spectra. Furthermore, the logics by which 'knowledge' and 'action' come together vary widely across disciplinary perspectives, contexts and actors. Evidence suggests that these conflicts between interpretations, logics and practices, if not acknowledged, potentially hinder the contribution of collaboration processes to 'sustainabilities'. However, there is also evidence that, if acknowledged and understood, these conflicts can promote reflexive sustainability governance by opening up political processes at various levels and creating spaces for change. This article examines how research policy supports the political imaginaries of sustainability in Sweden, and what implications the connections between the two may have for collaborative sustainability knowledge production. Empirically, the article analyses the overarching sustainability and research policies, focusing on the central documents produced by the government and public research financiers. The dominant metaphors and imaginaries employed by the documents, as well as the 'contamination' of the collaborative research policy with linear assumptions about knowledge-action connection, might enable research which strictly adheres to the dominant logics of efficiency, 'decoupling' environmental impacts from 'societal development', and production of knowledge as a commodity. Implementations of such policies are likely to reproduce the dominant sociotechnical imaginaries, precluding re-imaginings of democratic sustainabilities.

Keywords: sustainability policy, knowledge politics, co-production of knowledge, sustainability governance, science-policy interface

Track
Track 1a Theoretical approaches

Dominant Leadership Styles: A multi-flex leadership styles blend towards educational effectiveness

Dr. Mani Man Singh Rajbhandari

St. Xavier's College, Maitighar, Nepal

Abstract

The purpose of this study was to explore the dominant leadership styles among the four traditional leadership styles 1) Autocratic, 2) Bureaucratic, 3) Democratic and 4) Laissez –Faire/Free rein/Abdicratic. Within these four traditional leadership styles, this study attempts to explore the dominant leadership styles through a multi-flex leadership style blends. Leadership is a core component of any organization that enhances the sustainability and development. This is achieved through application of appropriate leadership styles within the organization to sustain the employees wellbeing and concern towards the mindfulness. Although all leadership styles discussed in this study is appropriate but the fit appropriateness of leadership styles depends on contextual settings and followers domain. Therefore, the wellness, wellbeing and the mindfulness of employees and generating the conducive organizational climate can in addition contribute towards sustainability and development of the strategies, policies and organization as a whole.

A conceptual theoretical construction amongst the leadership styles were blended to categories while arriving at the multi-flex leadership styles. Thorough investigations were made of these four traditional leadership styles towards blending each style with another to represent various multi-flex leadership styles.

This exploration finding generated six multi-flex leadership styles with the blending of each traditional leadership styles with one another. Moreover, blending three or more leadership styles produces lesser multi-flex leadership styles reflecting towards dominancy of leadership styles. A dominant leadership styles were predetermined by the three factors the context, followership domain and the leader. Any two leadership styles can generate multi-flex leadership styles (higher applicability of one styles and lesser to another or vice versa). Thus, leadership applicability of these styles generates twelve sets of multi-flex leadership styles. Not all of these leadership multi-flex blends can produces reliability to contextual settings or to the followership domain. Therefore, appropriateness of leadership blend is an utmost pivotal aspect that a leader must contain towards understand both the demand from the context, the followership needs and the capability to release the one dominancy style with another. The COVID-19 pandemic instigated the need for change, thus it necessitated a change in leader style flexibility and tendencies towards mobility from style-fix to style-flex. Higher applicability of any one leadership style with another being lesser applicability within the multi-flex blend that fit the context and matches the followership domain can/may be considered a dominant leadership style. Thus, a higher applicability of any one leadership style with the multi-flex blend being lesser applicability of another style blend that fit the context and matches the followership domain can/may be considered as a dominant leadership style.

Track
Track 1a Theoretical approaches

Entangling the Security Paradox – moving beyond a normative construction of social sustainability and security

Ms Irja Malmio

Swedish Defence University, Stockholm, Sweden

Abstract

This paper uses a deconstructive approach to analyze the "messy" relationship between social sustainability and the concept of security, while also discussing the limitations of binary thinking that is mediated by a normative framework. When examining crises and security issues, social sustainability can be described as a key component, as areas that are prioritized items on the agenda for the "western liberal" defense sector, such as maintaining democratic values and strengthening society's overall ability to deal with stress, bears a deep association with goals for social sustainability. This conjunction, however, also involves a paradox where security sometimes imply an obstruction of civil emancipation principles, therefore presenting a possible trade off situation between social sustainability and security. A paradox perspective on this relationship acknowledges a core value in military strategy that is opposed to social sustainability due to an embedded power dimension which supports the idea of an aggressor, a potential victim and someone or something that can neutralize the threat, thus opposing the idea of the peoples right of autonomy, emancipation and self-government. Furthermore, the ambiguous nature of the concept of security bolsters this paradox and solidifies an understanding of sustainability and security as insurmountable to merge.The overall idea present in the co-production perspective is that security and sustainability not only are interrelated but also co-contingent, in a sense where one cannot exist without the other. The co-production perspective also cultivate a view on development and security as intimately connected, In accordance with this proposition, this paper identifies a need to reformulate the view on security, development, and the liberal idea of "protection". Another point of departure is to treat paradoxical logics, and messy research areas, not as a source of conflict, but as a starting point for a deepened understanding of the interdependence of pluralistic values, that promotes sustainability and democratic principles.Therefore, a suggestion is to move beyond binary thinking and normative evaluation and instead treat the security – sustainability nexus as a system composed of many different parts, which is not in opposition, but are co-constructive and interdependent phenomenon's that can deepen our understanding for the social dimension of security as well as sustainability.

Keywords: Social Sustainability, Sustainable Development, Paradox Theory, Human Security, Normative Values

Track
Track 1a Theoretical approaches

Human-nature Partnership – a normative framing for relational sustainability science?

Dr. Martina Artmann[1], Philip Harms[2], Mabel Killinger[2], Susanne Müller[2]

[1]Leibniz Institute of Ecological Urban and Regional Development (IOER), Dresden, Germany. [2]Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany

Abstract

Despite scientific and political efforts to respond to today's social-ecological crisis, challenges such as climate change, biodiversity loss as well as social and environmental injustice are intensifying. For addressing "deep" leverage points for transformational change, sustainability research sees the need to engage with paradigms and worldviews that separate humans from nature. Such dichotomies are also mirrored in current scientific concepts such as ecosystem services emphasizing the instrumental values of nonhuman nature and building on a human-centered worldview. As an alternative normative framing of human-nature relations overcoming this anthropocentric paradigm, this talk will reflect upon the concept of human-nature partnership for sustainability science. The theoretical grounding of the concept will be nourished by the resonance theory by Hartmut Rosa.

This social science theory was developed to provide a solution for acceleration-oriented modern societies characterized by an increasing alienation in daily life such as from nature. Resonance is to be understood as a counter-term of mute relations and describes responsive relations between humans and the world strengthening in normative terms a good life. Basic preconditions of resonance are its unavailability and that the relating entities are speaking with an own voice. By translating these ideas into a concept of human-nature partnership for sustainability science, the talk will argue that it needs a shift from mute to resonating human-nature relations. Thus, mute human-nature relations are characterized by making nonhuman nature available such as through resource depletion thereby denying her agency, intelligence, and sentience. In contrast, resonating human-nature relations are characterized by a material and immaterial reciprocity and respecting nature´s unavailability and dignity with a morality of care and justice. Such relational qualities can be understood as a human-nature partnership, taking into account that both human and nonhuman nature have the right to flourish. Human-nature partnerships are characterized by respecting that both sides as well as their relations hold intrinsic value and are related to each other through a reciprocity exchange of giving and taking while neglecting dominance and hierarchy.

How the conceptual framing of human-nature partnership can feed into a real-life context will be discussed by focusing on urban human-nature relations from various perspectives. Collective urban human-nature partnership will reflect about the role of urban planning as a value-based collective endeavour. In this regard, the talk with shed light on moral implications of urban planning for shaping human-nature relations and possible tensions with currently prevailing planning approaches. Another focus will be laid on individual human-nature partnerships in cities by enriching the resonance theory with insights from indigenous ontologies, mindfulness research, and spiritual rituals. By doing so, some first insights into the development of a practical relational tool will be presented. As a third example, human-food relations will be discussed as an individual but also collectively shaped relational quality with high potential implications for sustainable transformations towards human-nature partnerships. In the end of the talk, this contribution will make up some open questions for future inter- and transdisciplinary research that can strengthen fundamental shifts towards human-nature partnerships in cities and beyond.

Track
Track 1a Theoretical approaches

Sustainability Science as Co-creative and Care-full Research Praxis

Professor Alex Franklin

Coventry University, Coventry, United Kingdom

Abstract

In this presentation, drawing on a conceptual frame of a feminist ethics of care, I argue for the co-creative potential of research to be more actively and reflexively nurtured throughout the sustainability sciences. In doing so I pay particular attention to the value of plural knowledges, to socially inclusive forms of engaged research praxis and also to research as a relational and embodied pursuit. My aim is to stimulate further reflection and debate on the role of 'co-creativity' – but also, the sustainability sciences more broadly - in enabling transformative sustainability agendas. A key guiding question which I consider during the presentation is how co-creative research practice, as a generative process, can best be used to support the emergence of alternative – potentially even transformative – ways of being in the world? The term co-creativity is understood here as encompassing both individual methods and overarching research approaches that, through action and reflection, stimulate alternative understandings of why and how things are, and how they could be. In drawing on feminist care theory I make a case for the importance of researching 'with' as a core principle of sustainability science scholarship. Supported by a number of illustrative examples (sourced primarily from my own recent experience of co-ordinating a four-year Marie Curie Innovative Training Network) I evidence how a retained openness for the unknown and unforeseen can act as a golden thread for a simultaneously rigorous and impactful research methodology; an approach which I argue can, in turn, also contribute to the on-going pursuit of more 'care-full' sustainability scholarship.

Track

Track 1a Theoretical approaches

Full papers

Courage for Sustainable Development

A virtue ethics perspective

Pauline PICOT[1], Bertrand GUILLAUME[2]

[1] *University of Technology of Troyes, pauline.picot@utt.fr*
[2] *University of Technology of Troyes, bertrand.guillaume@utt.fr*

Abstract

The whole Sustainable Development Goals (SDG) intends to orientate action toward a desirable, valuable future. In this way, their pursuit falls within the scope of normative ethics as part of axiology, which is the philosophy of values. If the axiology of the Anthropocene was to be studied, it would without a doubt underline the weight of science, which produced the knowledge at the origin of the "Anthropocene" proposal, but stands also as a powerful analysis tool as well as an assistant toward decision-making. However, sustainable challenges do not only stand as scientific issues, they imply to develop new ways of living thus entail social and cultural dimensions. That is why a discussion about axiology in the Anthropocene must go beyond the value and virtue of science. In this paper, we raise the need for other "virtues" (moral characters) complementary to science and, in particular, we explore the problem of "courage" in the face of the Anthropocene and sustainability challenges. We first discuss "virtues" as an approach to normative ethics before and beyond deontology (rules of actions) and consequentialism (effects of actions). In ancient Greek, "virtue" is related to "excellence", it is a quest toward self-improvement intimately linked to the "*logos*", the rational thinking. In this sense, we can understand the linkage of virtue to knowledge and knowledge production, but virtue is also a matter of practice, it is learned by the daily exercise of rational thinking in the way we behave. We then review the substantive meanings of "courage" considered as a cardinal virtue. Indeed, Plato identified it as one of the four cardinal virtues of humans, to be adjoined notably with wisdom, the perfection of knowledge. Beyond Plato, we intend to consider the evolution of the meanings of "courage" today in contrast with ancient texts, and apply such a philosophical investigation to the threats of current un-sustainable development and planetary crisis. We finally discuss our results, and conclude in the framework of the conference regarding the potential of the "courage" virtue in for scientists for both analysis and action in seeking for sustainable development. Indeed, regarding the SDG, we believe that courage is most relevant in the fight against inequalities (SDG 10), the fight against biodiversity loss (14-15), the shift toward responsible consumption-production (12) and the fight against climate change (13): all of these objectives together ask for the courage to face our deep dependence to nature, the planetary limits and re-interrogate our acts, and projected futures on that basis.

Keywords: Courage, Science, Virtue Ethics, Anthropocene

1. Introduction

For at least a decade, literature has been developing that defends the relevance of a reinvestment of virtue ethics in the context of the Anthropocene (for instance: di Paola [2015]; Goffi [2009]; Pelluchon [2017]). This model of ethics takes its roots in Greek ancient philosophy, that is in a political, social, and even climatic context that seems far from ours. The reasons for this "return to roots" could then be interrogated.

The Anthropocene is first of all a scientific reality, its denomination comes from and echoes the geological description of time: it designates a rupture with the Holocene. It is an unprecedented phenomenon, and it constitutes in this sense a new representation of the world that is constituted, documented by scientists from various disciplines. However, this new reality points to our ways of living, acting as destructive and requires a shift, an engagement into a transition toward sustainable ways of inhabiting the world. Sustainability then demands an evolution of our cultures, of our values and in consequence falls into the scope of ethics as part of axiology, the philosophy of values. We wish to warn the reader that this paper has been written by two researchers from a western high-income country and that, consequently, we write from this point of view.

In this perspective, virtue ethics is relevant: as we will later develop, virtue ethics is primarily concerned with the individual and her progress thanks to the culture of virtues. It thus allows thinking the evolution, the transformation (Pelluchon, 2017) of the individual human being in accordance with ecological issues that we are facing.

Because the required transition is global, we support that sciences are also concerned. Guillaume (2021) identifies three challenges to knowledge in the Anthropocene: the continuing of its development in a move toward unification, that is, disciplines are not to remain isolated from one another; the implementation of knowledge into politics and ethics; its appropriation in culture. Scientific practices, relationships of sciences to society and cultures as they are today established are to be subject to transformation. In that perspective, it seems relevant to us to mobilize virtue ethics in a reflection on the figure of the scientist in the Anthropocene.

We choose in particular to focus on the virtue of courage. On the one hand, this choice is motivated by a rather straightforward and shared intuition: it requires courage to face the scientific reality of the ecological crisis and to put into question our ways of living. On the other hand, courage as a virtue has a long history in philosophy, coming back at least to Plato. This allows us to position our argument in continuity but also in contrast to this philosophical inheritance that is in an evolving line which echoes the understanding of sustainability as an evolution, a transformation.

We choose moreover to discuss courage rather than fortitude. Courage and fortitude have similar meanings, but fortitude primarily concerns mental strength, it firstly refers to the internal dispositions of the subject. Yet, although internal dispositions are essential for the development of virtues, these last are firstly to be observed in situations, in action, in behaviors. In this sense, we prefer to discuss courage rather than fortitude in order not to have this accent on the mental state over action.

In the following section, we first position virtue ethics as being before and beyond the other main models of ethics (deontology and consequentialism) and support its particular relevance in the Anthropocene. In section 3, we elaborate our conception of courage as a virtue. We discuss in section 4 the place of courage in sciences and finally, in section 5 we justify the importance of virtue ethics for scientists in the Anthropocene.

2. Positioning of the paper: Virtue Ethics before and beyond Deontology and Consequentialism

The origin of virtue ethics leads us back to the Ancient Greek philosophical tradition. The Greek term for virtue "*arete*" can as well be translated into "excellence" (Pellegrin, 2016): an excellence sought in anyone's behavior. The expression of virtue is thus first in situations: a virtuous agent would be recognized for her habit to act virtuously. As a habit, virtue is to be learned, it is commonly considered that every human being possesses the seeds of virtue and that they are to be cultivated by daily exercise, by moral education. A virtuous behavior requires good use of practical wisdom. In this sense, even if the virtuous agent acquires virtuous behavior as a habit, the exercise of virtue demands engaging in reasoning, in an evaluation of the situation. It is not pure instinct. Practical wisdom, *phronesis* in Greek, also understood as prudence in action, is described in Aristotle's texts as the right deliberation (Pellegrin, 2016). This deliberation conditions the rational choice regarding the way to act. The *phronesis* is an intellectual virtue and, by its use, is the condition for the other virtues. Virtuous actions according to Aristotle are always a right measure, each virtue being a mean between two extremes (Aristotle, 2014). As an illustration and to anticipate our next argument, courage is the mean between cowardice and rashness, respectively lack and excess of courage. However, each virtue expresses the opposite of lack and excess, thus virtue as a mean does not express mere moderation in Aristotle's views but is an extreme as well. This translates the difficulty to reach virtue.

Acting appropriately is nevertheless not enough to act virtuously. The action has to be done with the right motivation: someone who acts for fear of punishment or in seeking personal reward is not virtuous. Virtuous action is recognized in the absence of regret and of any kind of reluctance in the decision of doing it. In consequence, virtuous actions are not limited to an insensitive rational choice, but ask for a full affective investment of the individual. This lack of regret, of difficulty in the resolving to act makes place for *eudaimonia*, happiness, the true aim of any human life. An affective difficulty in the ethical act indicates that the subject is not yet fully virtuous, but, again, it is by

practicing that the habit will be developed and make the action easier. The culture of virtue joins the accomplishment of any human: happiness (Annas, 2007).

Virtue, as singular, actually gathers several virtues that are linked one to another, and that may ever be conditioned one to another as the previous example of the *phronesis* that conditions other virtues. We will not subscribe here to a given and fixed list of virtues. On the contrary, we will assume that, over time, space, and cultures, diverse conceptions of virtues have existed. In that perspective, the number of identified and/or identifiable virtues may have evolved along with, obviously, their denominations.

Plato, for instance, identifies four cardinal virtues: temperance (*sophrosyne* - self-control, mastering of pleasures), courage (*andreia* - capacity to judge formidable threats), wisdom (*sophia* - excellence of knowledge), justice (*dike* - the perfect ordering of different virtues in a whole) (Brisson & Pradeau, 2016; Plato, 1966).

The example of Plato allows us to introduce the link between virtue ethics and politics. Indeed, the parallelism is direct between the virtues of a single human and the virtues of the City (Plato, 1966). The ideal Republic that Plato imagines is organized in three orders, each of them fulfilling a specific function: laborers, Guardians, and the governing class (the best among the Guardians). Temperance in the City is reached when the wisest class is governing the others. Courage is to be mastered by the Guardians that aim to protect the City and to maintain the law within it. Wisdom is associated with the governing class and the Guardians in the deliberation toward political action. The last virtue, justice, is positioned as resulting from the correct articulation of the three orders between them, just as three organs in the same body.

We argue in this article that virtue ethics goes before and beyond the two other main ethics models: deontology and consequentialism. The first one of these two considers an action as ethical if it complies with a set of rights and duties that can be defined a priori, out of any specific situation; whereas the second one positions the ethical choice as the result of a calculation that focuses on the expected effect of actions and compares them.

Ethics virtue goes before these two other models of ethics chronologically, but we argue that it precedes them as well in the sense that virtue can be the fundamental of ethics without needing to refer to a set of rights or to a calculation mode that would be more fundamental. We follow here the argument of Kawall (2017) who takes a non-controversial example of a wrong action: torturing puppies. He aims to explain why this is wrong thanks to virtues only. He reasons that it is wrong because of the formidable pain that it would inflict on them, pain that would move the virtuous agent thanks, in particular, to its virtue of compassion. For this reason, the virtuous would disapprove of the act, and in reason of this disapprobation, torturing puppies is wrong. Then, it could be argued that Goodness and Wrongness are arbitrary, only relying on subjective judgment rather than objective properties. To answer this counter-argument, Kawall introduces an analogy between the judgment of a virtuous and our visual perception: even if this one is dependent on the way our brain interprets the image it received, it fundamentally depends as well on the human eye, on our perceptive apparatus. This point refers to the distinction between innate and acquired at the heart of virtue ethics: virtue is cultivated and is thus acquired for a part, but it also comprises a part of innate, each

all have a certain sense of compassion. This clarifies as well how the praised virtues may change from one cultural context to another without resulting in a complete relativization of virtue ethics.

Moreover, we argue that these parts of innate and acquired, this dimension of the culture of the virtues makes virtue ethics particularly relevant in the context of the transition toward sustainability. This argument positions virtue ethics beyond deontology and consequentialism. Indeed, the ecological crisis calls into question our ways of living and with them, not less than our way to inhabit this planet and our relationship with the world. In that sense, an ecological transition is inseparable from a cultural dimension. Because virtue is cultivated, it allows for the description of a "process of self-transformation" (Pelluchon, 2017) which starts from human, in its corporeality, and with it from its relationship to the world. Furthermore, this transformation is complete in the sense that it engages our reasoning as much as our affects. This affective dimension of sustainability is also highlighted in the ecosophy T of Naess (Pelluchon, 2017) and by Albrecht in the need to answer solastalgia, that is pain while seeing our home, close environment transformed, destroyed (Albrecht et al., 2007).

A virtuous action demands as much to deliberate properly as a full emotional investment in the action. Pelluchon gives the example of the learning of the aesthetic experience of nature: the knowledge of our links, of our dependence on nature contributes to it as well as the sensory experience of it. These two dimensions nourish each other.

In contrast, the main models of environmental ethics do not allow describing such a transformation of the individual. Indeed, biocentrism can be considered, depending on the formulation, as a form of deontology (deriving rules from the acknowledgment of a right to live of every being - see for example Taylor [1986]) or of consequentialism (seeking for maximizing the satisfaction of biological needs - see Attfield [1994]) (Maris, 2010). Ecocentrism gives a non-instrumental value to ecosystems or species, thus it departs from nature and then addresses the individual in terms of moral obligations (Pelluchon, 2017).

3. Substantive meanings of "courage" as a cardinal virtue

As mentioned previously, courage is identified as a virtue since, at least, Plato. In his works and notably in the *Republic*, the paradigmatic *andreia* (courage) is the *andreia* of the guardians, in charge of maintaining public order and above all protecting the *polis* (city) between external threats (Plato, 1966; Zavaliy, 2020b). Thus, the *andreia* concerns firstly the courage of the soldier facing an enemy, that is facing a potential death, and who still holds his position and fights for his City. The *andreia* is thus political (*politikos*). Like any virtue, courage is to be cultivated and Plato develops widely the training of guardians, this allowing us for understanding the role of reasoning and the activity of affects in the exercise of courage. Indeed, cultivating courage consists in a culture of the *thumos*, the anger necessary to engage in risky behavior and thus necessary for courage (Plato, 1966; Zavaliy, 2020b). The *thumos* also refers to a certain ferocity and animality. Its culture consists in the channeling by reason and in its reorientation toward the interest of the City: any personal interest must disappear in the motivation of the guardians. The only threats that are to be feared and in face of whom the *thumos* must be felt are the threats that go against the interests of the City. The reason intervenes in the establishment of the knowledge of the situation, in the appreciation of the faced

philosopher describes courage as the right mean, the right measure between cowardice and rashness, between fear and confidence, this right measure being informed by the knowledge of the situation (Aristotle, 2014; Zavaliy, 2020a). Courage according to these two authors is thus not the absence of fear. Besides, Aristotle recognizes as well the intervention of the *thumos* in engaging in courageous action (following Zavaliy [2020a] in his interpretation of Aristotle [2014], 1117a4-6). However, contrary to Plato who does not forbid the existence of courage in other situations than military fight, Aristotle reduces the *andreia* to this single situation, to the courage to face a noble death (Zavaliy, 2020a, 2020b). Through this criterion of nobility, the predominance of the general interest over personal interest can be understood. A difficulty that appears in consequence of this statement is however the relationship between the virtue of courage and *eudaimonia*: how does risking his life at fighting contribute to a happy life? A plausible answer is that the aimed *eudaimonia* is not the one of the individual but the one of the City, or rather the maintaining of the City in order to provide to its inhabitants the conditions to reach *eudaimonia* (Zavaliy, 2020a).

As previously argued, virtue ethics gives space for cultural variations through, for instance, differences in the identification of virtues. For this reason, the descriptions of Plato and Aristotle would be considered situated in their epoch. As such, we will assume that the predominance of courage as military courage echoes the mythical context of that time. Aristotle's account of courage can even be read as an attempt to bring back the virtue of courage to the Homeric conception of courage (even if he refutes that any true example of courage can be found in Homeric texts) (Zavaliy, 2020a). Moreover, we may suggest that the particular importance of the military courage in Plato's texts is called by the aim that the philosopher is pursuing: the description of courage is notably elaborated in the *Republic*, which is in an effort for imagining a just, ideal Republic.

In consequence, we will consider that courage as we understand it today has evolved since its Greek preceding *andreia* without negating the heritage of this one in current thought. To defend this argument, we will refer to examples that are recognized in popular culture as expressing courage.

We will retain from the above that courage always implies a *facing*: for the Antiques, it consisted essentially in facing the imminent possibility of death. We argue that this point is too restrictive for the common understanding of courage. The courage in face of physical danger is of course still recognized as such (we can think for example about the fireman in face of fire) but we would as well introduce a political courage that does not imply an enemy exterior to the City, in a more contemporary understanding, exterior to society. As a first example, we will think of the famous act of resistance of Rosa Parks, done despite the risked sentence. In general, the fight of the Black people for the equality of rights between Black and White people offers an example of a political fight intern to a State risked despite physical danger.

Another example to which we will refer is the one of Simone Veil, a French politician who carried the law for the legalization of abortion in France. This political fight remained famous for its success, but as well for the violence of the insults and threats that she had to endure. Demonstrating courage is not just exposing herself to a physical danger, but also to a psychological one.

In these different examples, it can be noticed that a characteristic that remains common to the Greek

than the personal interest and concerns a defense of, a demand for justice or for Good. Courageous action is altruistic. In consequence, courage implies as well reasoning, it is an act or a series of acts guided, oriented by reason.

Because it implies a danger, an exposure to it, and to some extent suffering from it, the subject cannot keep an affective distance to her action, this last cannot be just cold insensitive rationality. The agent is necessarily affected and her affects will necessarily intervene in her engagement in action (we could remember the Greek *thumos*, more generally a discussion could be led on the question of the affects leading the agent to engage in risky action). A courageous action constitutes a full experience, implying in dialogue reason and affects.

Among these affects, but without reducing them to it, is of course to be found fear. In that sense, as courage demands to channel and overcome her fear, it consists as well of an internal facing. To fear could be adjoined as well the idea that courage can be found in facing anxiety. Whereas fear has a defined and immediate object, we distinguish anxiety by a worry about the future. Indeed, anxiety accompanies the perception of a threat whose actual realization, the situations that it will create, are rather unpredictable and beyond the control of the subject (Anderson, 2004). Facing anxiety means thus facing indetermination, uncertainty, a kind of unknown.

4. Courage Virtue and Sciences

Due to their seeking for producing knowledge, *known*, scientists are logically dealing with unknown, with uncertain. Making science is even seeking for this uncertain, in the sense of seeking for widening the field of the known, but as well in the sense of the culture of doubt, of the (re)questioning and (re)testing of hypotheses, of what is thought to be known.

In line with that perspective, the epistemologist Bachelard describes the scientific mind as a constantly fighting mind, in a violent effort to overcome “epistemological obstacles”, among them: opinion based on observation (opposed to experimentation) but as well the abusive will to generalize, to make system. The scientific mind progresses then by rupture, in destroying and reorganizing knowledge. In that sense, the scientific mind must always remain open to newness, to this fight (Bachelard, 1996; Bontems, 2010).

We would interpret this position of the scientist as a perpetual seeking for the right amount of confidence in her result, more generally in the current corpus of science as she knows it. This position is finally the one of fleeing in front of the tempting comfort that would offer a complete trust in sciences as established.

In counterweight and by this open-mindedness, this acceptance of instability, of an *uncertain*, we would suggest that practicing science has to do with anxiety and in the end with certain courage. We have however stated that courage as a virtue is a political courage, at least an altruistic courage. Yet, considering that sciences are among all an affair of truth, they do not immediately appear as seeking for good.

Research in technology offers nonetheless multiple (ancient as well as contemporary) examples of a direct relationship between scientific activity and politics, understood in the large sense of what relates to the *polis*, the Greek City-state, or the society. We understand here “technology” in the sense that its etymology

to the concrete example of the "Internet of Things" (IoT), a growing economic sector, supporting deep transformations of our societies and sector in which scientific research participates actively: a quick search on Scopus gives almost 25,000 scientific articles mentioning in their title the expression "Internet of Things". However, the various devices and uses that this area concerns raise important privacy and security issues, as summarized by Karale (2021). They are thus far to be ethically or politically neutral. It can be added that the digital sector to which IoT is related takes its part in the ongoing ecological crisis. Estimating the carbon footprint of the global digital sector is complex and always subject to uncertainty, but it can be assessed between 1.1 to 1.4 GtCO2e in 2020, which represents 2-2,5 times the global footprint of France (figures from Roussilhe [2021] and *Estimation de l'empreinte carbone de 1995 à 2020* [2021]). Social issues can as well be pointed to, the Ph.D. thesis of Marquet (2019) illustrates it: he studied the controversy and issues caused by the installation of data centers lived by the inhabitants of a city at the North of Paris.

As a distant example, mining sciences can be mentioned as they combined fundamental sciences and research with industrial technical issues along with research toward new marketable products in the 18th century in Prussia (Klein, 2020). Klein, who studied these scientific activities among others in the same area and period, concludes as follows and we align ourselves with her conclusion: whereas the "technosciences" are often thought as new and specific to the 20th century, they are actually inscribed in a much longer history of dialogue and co-evolution of sciences and industry, of scientific and technological knowledge, of sciences and economic interests (Klein, 2020).

In addition, we would assume that fundamental sciences cannot be separated from politics either. Indeed, their development is framed by institutions whose funding and organization depend on the political and societal context (the history and role in the development of sciences of the learned societies such as the Royal Society can be mentioned to support this argument).

We would conclude, then, that sciences, in their practices, are a transformative force of society and in that perspective cannot be separated from the political. On that conclusion and having suggested that scientific practice can have to do with anxiety and confidence, we will argue in the next section that the Anthropocene challenges the scientists in its behavior and practice and requires from her culture and exercise of courage understood as a virtue.

5. Discussion: Courage Virtue and Sciences in the Anthropocene

We support that sciences nourish the Anthropocene in at least three ways:

they instruct its scientific reality: the term "Anthropocene" itself originates from a scientist.
Its factual reality is constructed by scientific research, the IPCC (Intergovernmental Panel on Climate Change) or the IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) can be mentioned as obvious examples;

research activities in themselves actively participate in this reality by their ecological impact: travels for conferences are an obvious and on-the-point example, but more generally, it can be underlined that research activities participate in the global ecological footprint of the university campus (as an example see Genta et

al. [2022]) and indirectly to ecological footprints of various sectors (the IoT example can be mentioned again here);

in consequence of the two preceding points, sciences instruct our way of inhabiting the world, they are intrinsically linked to our representations, our ways of thinking, acting, and suffering in this world. Yet, it is precisely these ways of inhabiting the world that are pointed as destructive. The required cultural transformation thus comprises a transformation of sciences, of our ways of making them, of their relation and status in the *polis*.

Moreover, we argue that facing this transformation issue, reacting to these three points requires from the scientist a courage that can be considered as relevant of virtue.

The first point obviously implies that a scientific courage in the Anthropocene consists in facing the produced scientific reality. Eco-anxiety is today a widely documented phenomenon (Panu, 2020) and we suggest that this verifies our previously argued idea of a link between scientific activity and anxiety. For a scientist, this indicates as well a collapse of the distance between subject and object in the researcher position: she cannot maintain a distance to the studied object but is impacted, *affected* by it. This can be interpreted as an engagement in an experience in which (scientific) reasoning and affects dialogue.

A first courage thus lies in the reception of this experience, in the assumption of this collapse between object and subject, and, as a consequence, in engaging in re-interrogating our ways of making sciences, in our scientific practices. This means to face, to overcome several cognitive dissonances. Engaging into and cultivating an interrogating position and beyond it a transformation constitutes then a courage that answers, that faces our second point above.

It is to be noticed that the Anthropocene being a reality that goes beyond the individual, we assume that such an engagement is political and thus in coherence with the conception of the courage described previously.

The re-interrogation of scientific practices includes a re-interrogation of the way scientific results are disseminated. We can only observe the gap between the scientific knowledge we have and the absence of inflection in the trajectories of our societies. This would suggest that scientific knowledge is not enough to induce a complete self-transformation as required in the context of the Anthropocene. We suggest that to fill this gap, to increase its transformative power, the dissemination of sciences cannot limit itself to cold rational speeches, to the position of the scientist standing on a stage in front of her public, but rather take the form of a shared experience. We would like then to address to the reader this open question: How to make the sciences of the Anthropocene a shared experience?

For our part, we consider that a possible answer may be found in the development of interdisciplinary and transdisciplinary research. Interdisciplinarity is not new, however, dissonance can be observed between a disciplinary tradition, organization, and specialization in science on the one hand and recurrent calls and praise for interdisciplinarity on the other (Andersen, 2016). Besides, both examples of research in technology from the previous section are as well examples of interdisciplinarity. In consequence, we do not

acknowledgment and seeking for interdisciplinarity as necessary in order neither to confine research in sustainability to a single discipline nor to confine it in several separate ones. Natural sciences and human sciences have been constituted respectively in excluding humans for the first one and nature for the other (Bonneuil & Fressoz, 2016). However, the Anthropocene designates the overflowing of one of these categories into the other: humanity has become a geological force, and nature in crisis collides with our cultures. In consequence, understanding the Anthropocene as a phenomenon of the natural sciences requires integrating humans into models; understanding the Anthropocene as cultural requires taking into account nature, an environment that is not anymore a mere passive exteriority. In that perspective, the Anthropocene and with it sustainability cannot be grasped by established disciplines. They require overflowing.

We distinguish transdisciplinarity from interdisciplinarity by the strong link of non-academic actors that implies the first one, whereas the second one was considered as internal to the scientific domain in the argumentation above.

We subscribe to the principles of transdisciplinarity as described by Scholz (2020). They characterize transdisciplinarity by a strong collaboration between sciences and stakeholders from society in a position of equality and mutual learning. Scholz argues further that transdisciplinary is necessary to achieve sustainability due to the complexity of the issues to be faced and due to the different societal interests that are engaged in them and add to the complexity. In that perspective, it is difficult for a single community of scientists to pretend to be able to get a complete and comprehensive view of the issue at stake without engaging with the different stakeholders. This implies for the scientist to cultivate open-mindedness and readiness to combine her knowledge and practices with non-scientific knowledge and practices.

Interdisciplinarity and transdisciplinarity thus both demand open-mindedness to the scientist, demand her to face instability, (re)newing. This position echoes the description of the scientific mind of Bachelard that we have interpreted as a form of courage.

By this intellectual openness and by their definitions, interdisciplinarity and transdisciplinarity must result in new and plural knowledge and forms of knowledge, in new and plural ways of making sciences. Such transformations of sciences cannot but impact our ways of representing, acting, and inhabiting the world. In this sense, we answer here the third of the points we identified at the beginning of this section.

6. Conclusion

Acting virtuously supposes to act appropriately and for the right motive. In this sense, the virtuous action requires the mobilization of reasoning for the determination of the right way to act and an emotional engagement: the real virtuous action is not undertaken reluctantly or in seeking personal profit. Courage as a virtue is primarily in Greek philosophy the courage of the warrior protecting his City. We argued that such a conception of courage is too restrictive for our time and proposed to understand virtuous courage as the altruistic action to choose to expose herself to danger, to physical or psychological suffering in seeking a Good or a justice that goes beyond her personal interest. Courage does not imply the absence of fear or anxiety but overcoming them for the right motive. We have suggested that scientists, by cultivating criticism and doubt in their refusal of excessive confidence in the current state of their knowledge, express the qualities

the Anthropocene, this thesis is verified by the scientific reality itself: by the threat that it represents and the demand for transformation that it constitutes. We suggest then that a first scientific courage lies in facing this reality. This means not to consider this last anymore as an observed distant scientific object but to receive it as impacting us as subjects. That implies abandoning an affective distance toward it, thus receiving it as a lived experience that makes dialogue reason and emotions. Courage then lies in engaging in an effort of transition. Indeed, sciences participate in the Anthropocene in documenting its reality but also in making this reality and in nourishing more broadly our representations of the world. They are thus part of the transition toward sustainability and that requires from the scientist an openness for re-organization of sciences, their practices, their relationships to society, that is a readiness to face newness and uncertain. There lies the second courage to be cultivated from our point of view. In this sense, we suggest that a relevant question in the perspective of the transition of sciences toward sustainability is not only how to share scientific knowledge of the Anthropocene but how to share the experience of it (experience understood as implying both reason and affects in the reception of knowledge). We argue from our point of view that interdisciplinarity and transdisciplinarity may be part of the possible answers.

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Posters

Biodiversity viewed from three sustainability models, and two systems ecology textbooks

Erik Grönlund

Erik Grönlund
Ecotechnology and Sustainable Building Engineering,
Mid Sweden University, Östersund, Sweden

Mittuniversitetet
MID SWEDEN UNIVERSITY

Biodiversity viewed from three sustainability models, and two systems ecology textbooks

1. Intro

Biodiversity is identified as one of the major environmental sustainability issues, alongside with global warming, and is often defined including the three levels genes, species, and landscape.

In this paper the concept of biodiversity is viewed from five different angles, see sections 2.1 to 2.5.

2.1 The Daly model

Herman Daly's model of a full or empty world show a finite world of 1) sources for energy and natural resources, and 2) so-called sink capacity, the biosphere's ability to assimilate our wastes in solid, liquid, and gaseous form (Figure 2). Biodiversity, on the resource side, is a diversity of organisms for the economy to choose from; on the sink side a biodiversity of, mainly, microorganisms that enhance the decomposing capacity to assimilate more types of solid, liquid, and gaseous waste.

A difference between biodiversity and other resources are, however, that the biodiversity in itself is not used up. The biodiversity can be seen as working similar to a catalyzer, building structure by converting resources of different types to goods and services in society.

2.2 The Natural Step

The model behind The Natural Steps four systems condition framework is similar to Daly's model in having society embedded in a biosphere where resources are delivered to society and wastes from society are assimilated (Figure 1). Similar to Daly's model the biodiversity is not necessarily used up but widening the basis of the input and output quality.

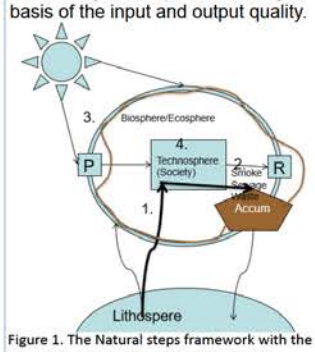

Figure 1. The Natural steps framework with the four systems conditions (also called socio-ecological principles) depicted as number 1-4.

Figure 2. Daly's full and empty world model.

2.3 Source, sink, integrity sustainability

Both the Herman Daly model and the The Natural Step model highlights the feature of not overusing either the resources nor the assimilative capacity on the input and output side of the system. Even though not commonly used, the terms source and sink sustainability seem relevant to use in this context, indicating a long-term, sustainable, use of resources and assimilative capacity.

However, as pointed out biodiversity may be distinguished from this source and sink sustainability, since the diversity is more of a system property that is not used up in the process from input to output and recycling. In systems science this feature is sometimes called the integrity of the system (Richmond 2001, Meadows 2008) suggesting a third sustainability term called systems sustainability. Since this is a very general term, a more unique term can be used instead: integrity sustainability.

In the Natural Step model condition 2 represents the sink sustainability, and condition 3 represents the source sustainability. Both of them can, however, also be said to have an integrity sustainability aspect, where enough capacity must be maintained on both sides.

2.4 GRI (Global Reporting Initiative)

GRI is a widespread voluntary reporting framework for sustainability work by companies and organisations. The environmental part of GRI (the 300-series) consists of the basic approach of energy and mass balances (301, 302, 303), and then the three typical sorts of waste: solid (306), sewage and gaseous waste (305). Biodiversity (304) differs substantially from the other categories by not being quantitative or use performance indicators in a similar way. Again, the label integrity sustainability fits better to biodiversity, while source and sink sustainability fits to the others.

2.5 Two systems ecology textbooks

The H.T. Odum textbooks does not mention the term biodiversity. A possible reason for this may be that the term biodiversity did not have a major breakthrough until 1986 at the famous conference hosted by Edward O. Wilsson and others (see Worster, 1994). Odum's first edition was published in 1983, and is mainly adjusted regarding the energy hierarchy concept in the 1994 second edition. It is, though apparent that Odum is well aware of the aspect, since the term diversity have several entrances in the book index, and are important parts of several models in the book.

Jørgensen (2012) devotes a full chapter to diversity in ecosystems (chaper 10). Noticing that biodiversity is often defined by the three levels mentioned at the beginning (genes, species, landscape), Jørgensen takes a more detailed grip on the concept of diversity. Noting earlier in the textbook that ecosystems have a hierarchical organization, he discuss and calculate the theoreticly possible diversity for each one of the hierarchical levels from molecules, genes, cell types, organs, individuals, species, populations, communities, ecological networks, and finally the ecosystem level. For each one of these levels, he gives calculation examples showing that the possibilities for diversity - the number of possible combinations - is overwhelming, often of the theoretical size 10^200 and similar.

A major difference between Odum's and Jørgensen's textbook's are that Odum takes the human presence for granted in his approach. The last part of the book (part four) is named "Systems of nature and humanity", and alongside with natural ecosystems are presented also economic systems of nations (chapter 23), ecosystems with humans (chapter 24), cities and regions (chapter 25), and world patterns (chapter 26). A summary chapter (27) concludes the unity of systems whether human dominated or natural.

Jørgensen on the other hand, don't explicitly omit humans from the systems, but have no examples where humans are parts of the systems other than disturbing it with eutrophication and toxic substances – the traditional environmental impact approach. One way of capturing this is using the categorization by Jablonka and Lamb (2005, 2014) to different types of information carriers where Jørgensen has a main focus of the the two first levels, genetic and epigenetic, while Odum includes also the third level of behavioral evolution.

3. Conclusions

The paper concludes that biodiversity stands out compared to other environmental issues when viewed from the first three angles chosen. While source and sink sustainability are good labels for most environmental issues, integrity sustainability may be a better label for the biodiversity type. The two textbooks also underline biodiversity as a systems property, where integrity sustainability may be a better term. Jørgensen explicitly points out several more hierarchical levels of diversity than the three levels usually pointed out by the biodiversity concept. Finally, the paper also speculates if economic, social, and cultural sustainability can be better captured with the integrity sustainability label.

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1. Sustainability and Science

1b. Research methods and methodologies

Abstracts

Circularity: Just Science Fiction? A science fiction prototype experience

Santiago Perez[1], Heather Rogers[2], Malgorzata Lekan[2], Aodhan Newsholme[3]

[1]Université de Technologie de Troyes, Troyes, France. [2]University of Hull, Hull, United Kingdom. [3]University of Hull, Hull, France

Abstract

Since 2015, with the adoption of the Circular Economy Action Plan by the European Commission, the Circular Economy (CE) paradigm was established as a solution to transition to more sustainable societies. The concept of CE, even when it carries many definitions across stakeholders, is widely used among academics and practitioners working towards social, environmental, and economic sustainability.

This article is the result of a workshop during the 2021 Actionable Science for Urban Sustainability conference, where the authors proposed a Science Fiction Prototyping (SFP) session. Such a session established a fictional scenario in the year 2100, where a high degree of circularity has been achieved, from where the participants generated stories about how people might navigate their lives in this circular whole new world. The result is a collection of twelve rich and unique stories describing thought-provoking potential scenarios using vibrant, colourful language for expressing complex ideas and emotions. These stories were shared and discussed to unpack the differences and the themes in common. Each story has undergone a qualitative analysis using the categories of analysis of Governance, Education and learning, Collaboration, Employment, Relationship to objects, and Wellbeing. Those categories were selected by the authors beforehand, based on previous research.

The SFP methodology allowed the participants, not only to forecast a circular future but also to trace back the steps the current society had to have gone through to achieve such a high level of circularity. Reflections on the social, technological, environmental, and economic spheres for each one of the described categories were expressed in the stories. Exploring the operationalisation of the concept of CE, as we understand it today, in a distant utopian and/or dystopian future, resulted in an enriching and telling experience. One exploring the possible advantages and disadvantages of establishing CE as a strategy responding to today's unsustainability paradigm. SFP helped both academics and practitioners to build future scenarios and inquire into the challenges we can potentially face when building more just sustainable societies.

This article relates closely to the SDG 11 and SDG 16. As the article related to the construction of a fictional reality of a circular society, the research is related to the following targets: 11.3, 11,.4, 11.6, 16.6, 16.7, 16a and 16b. All those targets address the conditions that must be fulfilled to generate societies with more sustainable behaviours. The role of institutions and the citizens is tightly entrenched in the resulting stories from the SFP session.

Also, SDGs 12 and 17 are touched by the theme of this article. Methodologies as Science Fiction Prototyping (SFP) in the context of sustainability put in evidence not only the preconceptions and biases from the participants but also the foreseen challenges and obstacles they fear (or fear not) to face. This methodology brings together the scientific knowledge and the intrinsic and extrinsic values of the participants and merge them into a coherent narrative of the future. Such complex narratives are fully charged of the experience of being human, expressed by cultural norms, art, and political expressions.

Track

Track 1b Research methods and methodologies

How do the Ratings that Measure the Sustainability of Universities Integrate the Circular Economy?

Tania Bishara, Joan Manuel F. Mendoza, Daniel Justel

Mondragon Unibertsitatea, Faculty of Engineering, Mechanics and Industrial Production, Mondragon, Gipuzkoa, Spain

Abstract

Circular economy is a concept that is gaining attention as an approach to help accelerate the transition towards sustainability globally, in this sense different types of organizations are adopting aspects of circularity, one of these are Higher Education Institutions through their through its operations and processes with workers and students. In this way, the ratings that measure the sustainability of Higher Education Institutions have emerged, which are intended to provide a framework for understanding sustainability in all sectors of higher education, enable meaningful comparisons over time and across institutions using a common set of measurements, create incentives for continual improvement toward sustainability, Facilitate information sharing about higher education sustainability practices and performance, and build stronger and more diverse communities of students and workers for campus sustainability. Through the participation of institutions in these ratings, they can earn points to obtain a rating that represents significant leadership in sustainability.

This article is focused on analyzing the ratings that measure the sustainability in Institutions of Higher Education (STARS, Times Higher Education, UI Green Metric) in terms of Circular Economy, for this the sustainability ratings of Institutions of Higher Education are compared with the "Circulytics "circularity indicators that measures circularity performance, supports decision making, highlights strengths and blindspot, provides transparency, opens up opportunities in order to identify the level of integration of the circular economy in these sustainability ratings.

As a result of the analysis, it is observed that although the ratings consider aspects such as climate change, energy consumption, material purchases, transportation, waste management, and water consumption, they do not consider a holistic vision of the circular economy, so it is It is necessary that its measurement aspects integrate eco-design criteria, reduction of materials, reduction of materials and recovery of waste through of collection, maitenance, reuse, redistribute, refurbish, remanufacture, recycle, regenerate, share, optimise, loop, virtualise, exchange, servitization, among others.

Track
Track 1b Research methods and methodologies

LCA of Eco-efficient Techniques and Lifestyle: Case-study of a family unit with an agricultural holding

Francisco Mariano[1], António Galvão[2], Dr. João Joanaz de Melo[2]

[1]NOVA University Lisbon, Almada, Portugal. [2]CENSE, NOVA University Lisbon, Almada, Portugal

Abstract

Our society is based on an increasingly global economy and dependent upon many products from the international market. All nations import several products extracted and transformed elsewhere (fossil fuels, food, technological products, and consumer goods, among others). The production and transportation of such products entails high environmental burdens.

Our choices are not only the driver but also the solution to solving our current ecological and climatic crisis. It is essential that we rethink the way we live and consume, avoiding unnecessary consumption, favoring local production, increasing resource use efficiency, and thus building a true circular economy.

The goal of this work is to analyze how a family's environmental footprint can be reduced, through the adoption of a lifestyle that actively seeks sustainable solutions. The environmental performance for a set of these consumption solutions was assessed with life cycle analysis using the EcoBlok method's key performance indicators. The results where then compared to a previous study on Portuguese families' environmental performance that used the same methodology.

The selected case study was an agricultural holding with a family residence, located in the municipality of Castelo Branco in Portugal. The consumption solutions studied were: a rainwater catchment system; a domestic composting installation; food production in a family farming system; and the improvement of the house energy balance through thermal insulation and the modernization of the climatization and sanitary water heating systems. Transportation was not included in the study scope.

The results obtained show that the environmental footprint of a family can be considerably reduced through the application of the proposed solutions. The bulk adoption of the more sustainable solutions studied allowed: a reduction of greenhouse gas emissions by 93% and other air pollutants by 80%, due mainly to the improvement in energy efficiency; a reduction in water abstraction by 84% and of water and of soil pollution by 97%, mainly due to home farming techniques and composting; and a reduction of the need for land use by 95% and of resource extraction by 92%, due to a combination of energy efficiency, home farming and composting.

Track
Track 1b Research methods and methodologies

Full papers

Assessing the impact of Vehicle Development Process Improvement on Sustainable Development Goals

Sai Kausik Abburu[1], Carlos Casanueva Perez[2], Ciarán O'Reilly[3]

[1] KTH Royal Institute of Technology, The Centre for ECO[2] Vehicle Design, SE-100 44 Stockholm, Sweden, abburu@kth.se

[2] KTH Royal Institute of Technology, The Centre for ECO[2] Vehicle Design, SE-100 44 Stockholm, Sweden, carlosc@kth.se

[3] KTH Royal Institute of Technology, The Centre for ECO[2] Vehicle Design, SE-100 44 Stockholm, Sweden, ciaran@kth.se

1. Abstract

The transport industry is a significant contributor to emissions and other toxic wastes which pollute the environment. To alleviate these negative effects, United Nations introduced the Sustainability Development Goals (SDGs). And the automotive industry is constantly striving to improve the Vehicle Development Processes (VDPs) to comply with the SDGs. However, the impact of these improvements in VDPs on SDGs is not investigated thoroughly. Therefore, this paper is a comprehensive attempt to understand and analyse the impacts of improving the VDPs on SDGs. The effect on each goal and target is investigated by questioning its impact on SDGs due to the presence and absence of these improvements in VDPs. Based on the analysis at the goal level, the impacts on SDGs are initially classified into five categories: Indirect Negative Impact, Direct Negative Impact, No Impact, Indirect Positive Impact, and Direct Positive Impact. Further, the impact on SDGs at a target level is analysed, and the results indicated that 55% of the targets had no impact, 36% of the targets had a positive impact, 2% of the targets had a negative impact, and 7% of the targets had both positive and negative impact. To understand this imbalance of impact and to gain further clarification, the SDGs are divided into three groups, namely society (1,2,3,4,5,6,7,11, and 16), economy (8,9,10,12, and 17), and environment (13,14, and 15). The analysis of targets and SDGs in groups indicated that the environmental targets have the most positive impact, followed by economic targets. The societal targets have the least impact among the three. The rationale behind this disparity at the target and goal level was that the automotive industry has been more focused on the economic benefits, and the sustainability factor has been integrated into its processes only recently. Moreover, the concept of sustainability has always been associated with and presumed to be revolving around the environmental aspects. The integration of social aspects such as quality education, gender equality, poverty, and hunger was given little relevance. To alleviate this disproportion, the automotive industry has taken initiatives that indulge in Corporate Social Responsibility. It is being realised that achieving societal SDGs could be vital in developing a better workforce and subsequently lead to sustainable economic growth and thus the economic SDGs.

Although the analysis focuses on all SDGs, the SDGs related to the environment (13,14, and 15) and economy (8,9,10,12, and 17) are more relevant as they have higher direct impacts due to the improvements in VDPs compared to the societal SDGs (1,2,3,4,5,6,7,11, and 16).

Keywords: Impact, assessment, Vehicle-development, synergies.

1. Introduction

The global mean temperature has increased by 0.7°C in the last decade (2009 - 2018) (Sippel, Meinshausen, Fischer, Székely, & Knutti, 2020). Pollution rates and greenhouse gas emissions are increasing, and the high-elevation glaciers are melting (Thompson, 2010). These are all direct consequences and indicators of the ongoing large-scale, pervasive, rapid climate change. To subdue this rapid change in Earth's climate and its impact on the social, economic, and environmental aspects, the Sustainable Development Goals (SDGs) were established by the United Nations General Assembly in 2015 as a part of Agenda 2030. The 17 sustainable goals are displayed in Figure 1. The predecessor to SDGs, the Millennium Development Goals (MDGs), primarily focuses on improving the social aspects of developing countries. However, the SDGs encompass issues across various fields covering social, infrastructural, technological, economic, environmental, and industrial aspects for both emerging and developed countries.

Figure 1: 17 Sustainable Development Goals established by the United Nations

With the introduction of SDGs and the Paris Agreement in 2016, various rules, regulations, and policies governing different industries have been revised with stricter restrictions to accommodate these goals. Many industries were impacted due to these changes in regulations; among them is the transport industry. It is one of the highest contributors to greenhouse gases, accounting for 24% of all greenhouse gas emissions in the EU (Omahne, Knez, & Obrecht, 2021). The vehicle industry has initiated developing efficient and sustainable solutions to keep up with this increasing austerity in regulations. Research is continuously conducted to constantly improve the various processes involved in developing the vehicles, enabling the transition towards sustainability in every aspect of vehicle development. This transition towards 'sustainable solutions' entails changes across different dimensions such as

technological, material, organisational, institutional, and sometimes even political, economic, and socio-cultural (Omahne et al., 2021). These changes across different dimensions could act as both enablers and inhibitors for achieving the SDGs. Thus, in this paper, the manner in which the vehicle development processes (VDP) impact the achievement of the Sustainable Development Goals is analysed.

2. Method

To analyse the impact of improving the VDPs on SDGs, a few elements of the method described in (Laurent et al., 2020) are taken as inspiration and adapted for the method developed in this paper. The method to analyse the impact of VDPs on SDGs includes six significant steps:

1. Identify the research area
2. Define the scope of assessment
3. Identify different processes and activities involved
4. Create two worlds: Baseline and New System
5. Analyse the impact of the new system on SDGs at the goal level
6. Analyse the impact of the new system on SDGs at the target level

2.1. *Step 1: Identify the research area*

The area of research in which the impact assessment is performed is identified. The research area can be narrow or broad depending on the research area determined. In this paper, the wider research area of 'Vehicle Engineering' is considered the focus of assessment.

2.2. *Step2: Define the scope of assessment*

Once the research area is identified, the scope of the research area must be defined. Since Vehicle Engineering is a broad field of engineering and can include many fields, the scope is limited to certain aspects of vehicle engineering. In this paper, the scope is limited to processes involved in the development of the vehicle, i.e., all and any activities and processes required for the development and manufacturing of a vehicle are considered. The scope shall also include the sub-processes required for the preparation and successful implementation of the VDPs.

2.3. Step 3: Identify different processes and activities involved

Different processes and activities involved in developing and manufacturing a vehicle are identified. These include raw material procurement, concept development, model and prototype development, simulation of vehicle models, manufacturing of components, assembly of vehicles, painting of vehicles, testing of vehicles, and end-of-life management of vehicles. Improvements in the vehicle's use phase are not considered for the assessment as these do not fall under the VDPs.

2.4. Step 4: Create two worlds: Baseline and New System

After different processes in the defined scope are identified, two worlds are created: baseline and new system. The baseline is a scenario in which the research in focus is not present or not introduced to the world. Consequences of such a "business-as-usual" scenario on different processes are identified. The second scenario is the new system. In this scenario, the research in focus is introduced to the world. Various positive and negative consequences due to the introduction of this research are identified. The consequences of shifting from a baseline to a new system could be numerous. Therefore, this paper identifies and focuses on the consequences relevant to the SDGs.

For instance, the manufacturing of chassis, components, the assembly of vehicles, and the painting of vehicles consume large amounts of energy and water and are responsible for a large percentage of emissions (Giampieri, Ling-Chin, Taylor, Smallbone, & Roskilly, 2019; Semmens, Bras, & Guldberg, 2014a). If this continues, it will lead to an undesirable consequence of a significant increase in emissions. Thus, improving these processes could curb emissions to a manageable level.

Another example would be in the case of processes such as concept development, prototype development, and simulation of the developed vehicle models. These occur in most cases before the actual manufacturing of the vehicle. Therefore, these processes are essential in shaping the vehicle in terms of energy efficiency, material requirements, and environmental impact. If no improvement is introduced to these processes, the ability to improve material, water, and energy efficiency during the manufacturing phase would be limited. Therefore, improving these processes would improve manufacturing and vehicle efficiency. Furthermore, developing accurate prototype models and simulations of the vehicle would minimise the iterations required in full vehicle testing and crash testing. This is beneficial since the full vehicle testing and crash testing account for a large amount of wastage, energy consumption, and emissions.

2.5. Step 5: Analyse the impact of the new system on SDGs at the goal level

Once the consequences of both worlds (i.e., the business-as-usual scenario and the scenario in which the research in focus is implemented) are determined, the manner in which these consequences impact the achievement of the SDGs is analysed. To analyse the impact of these consequences, the impacts are classified into five levels: Indirect Negative Impact, Direct Negative Impact, No Impact, Indirect Positive Impact, and Direct Positive Impact. To classify a consequence into an impact category, the following questions are asked: Does the consequence of maintaining the practices and processes in baseline impact the achievement of SDGs in any way? And does the consequence of implementing the new system impact the achievement of SDGs?

These questions will clarify the consequences due to the presence and absence of the new system. For example, suppose a process/activity in the baseline scenario proved to act as an inhibitor to SDGs. In that case, it indicates that introducing the new system would serve as an enabler for SDG achievement. Thus, the baseline scenario simply acts to understand and justify the classification of the impact of the new system.

If the impact new system directly enables or contradicts SDG achievement, then it is classified as direct positive impact and direct negative impact, respectively. Suppose the new system's impact leads to a consequence that directly affects the achievement of SDGs positively or negatively. In that case, it is classified as indirect positive impact or indirect negative impact. Weak links such as "the money allocated for the improvement of VDPs can be rerouted to mitigating poverty and hunger" are not considered as they can be stated for any such problem. If such a weak link exists, it is classified as having no impact. Also, if the implementation of the new system has no impact on the achievement of the SDGs, it is classified as having no impact.

With the explained method, each SDG is evaluated, and the obtained results are described in the Analysis section of this paper.

2.6. *Step 6: Analyse the impact of the new system on SDGs at the target level*

Once an initial assessment on the goal level is made, a similar procedure is used to evaluate the SDGs at the target level. The questions previously stated would be asked again for every target of every SDG and classify the impact as stated before (Indirect Negative Impact, Direct Negative Impact, No Impact, Indirect Positive Impact, Direct Positive Impact). Two elements are required to classify the impact as direct or indirect positive and direct or indirect negative. First is a reference to the existence of a problem due to the baseline processes. This shall indicate that due to the current practices, a problem exists and needs to be addressed for achieving SDGs. The second is a reference stating that shifting to the new system could be beneficial. This means that by overcoming the shortcomings presented in the baseline, there are positive or negative effects that impact SDG achievement. These references must be in the form of a research paper, certified reports of established organisations, or verified articles from established organisations. If the consequence of the new system has both positive and negative effects, the target is considered to have both positive and negative direct/indirect effects.

With the explained method, each target of every SDG is evaluated, and the obtained results are described in the Analysis section of this paper.

3. Results

The results from the analysis of the impact of improving the VDPs on SDGs at goal and target levels are presented in this section.

3.1. Assessment of impact on SDGs at the goal level

An initial assessment of the impact of improving the VDPs on achieving the SDGs is performed with the help of the SDG Impact assessment tool. As mentioned in the method section, each goal is categorised into Indirect Negative Impact, Direct Negative Impact, No Impact, Indirect Positive Impact, and Direct Positive Impact. Each goal is questioned on its impact on achieving the SDGs due to the presence and the absence of the baseline and new system and its consequences. Depending on the answer, they are classified accordingly. Obtained results are presented in Figure 2.

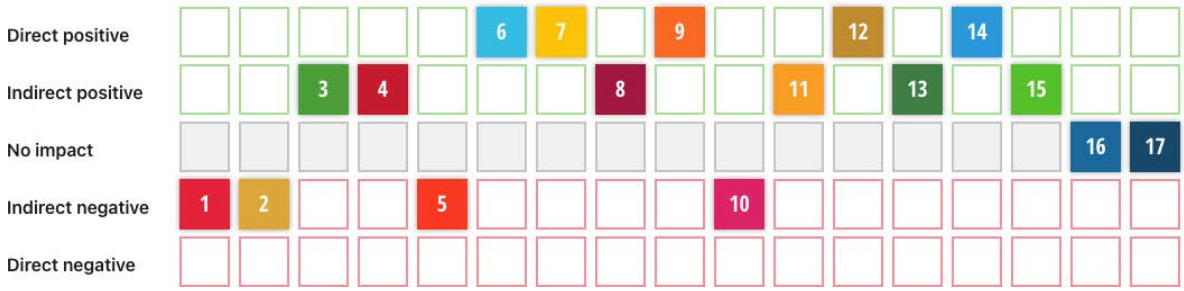

Figure 2: Results of assessment on the impact on SDGs at the goal level

3.1.1. *Direct positive impact*

From an initial assessment, the SDGs Clean Water and Sanitation (SDG 6), Affordable and Clean Energy (SDG 7), Industry, Innovation, and Infrastructure (SDG 9), Responsible Consumption and Production (SDG 12), and Life below water (SDG 14) have a direct positive impact on improving the vehicle development processes. Development, manufacturing and production of vehicles are energy and water intense processes, and they contribute to a large percentage of CO2 and greenhouse gas emissions during these phases (Babel, Oo, Shinde, Kamalamma, & Haarstrick, 2020; Fysikopoulos, Anagnostakis, Salonitis, & Chryssolouris, 2012). This might be because many of the VDPs focus more on maximising economic productivity than the sustainability aspect of the process. However, this is changing as more and more companies are trying to adopt more sustainable practices in their VDPs (Alayón, Säfsten, & Johansson, 2017; Enderle, Nowak, & Kvas, 2012; Pechancová, 2017). Improving the VDPs sustainably will help reduce the water and energy consumption, shift to sustainable energy sources, reduce the emissions from the processes involved, and improve material efficiency, thus being directly responsible for achieving the goals mentioned above.

3.1.2. *Indirect positive impact*

From an initial assessment, the SDGs Good health and well-being (SDG 3), Quality Education (SDG 4), Decent Work and Economic Growth (SDG 8), Sustainable cities and communities (SDG 11), Climate Action (SDG 13), and Life on land (SDG 15) have an indirect positive impact due to the improvement in VDPs. One of the primary motivations for improving the VDPs is to enhance the safety of the vehicles and thus the safety of the passengers. Nearly 1 million people every year lose their lives, and up to 50 million people are injured due to accidents. Thus, the automotive industry is constantly striving to improve the safety of vehicles by integrating safety and sustainability in all the processes involved in developing a vehicle (Godoi, Prakash, & Bhandari, 2021). Thus, enabling the achievement of SDG 3.

Improving the VDPs could lead to the automation of many of the processes involved. This would drive the need for more high-skilled labour proficient in (Science, Technology, Engineering, and Mathematics) STEM fields. This forces the education system to train the students with skills required for the industry (Griffin & Mary, 2020). Thus, improving VDPs will help achieve a more quality education (SDG 4). This requirement for high-skilled labour would further mean that majority of the employees enjoy higher compensations and a better working environment. Thus, helping achieve decent work and economic growth (SDG 8). As previously mentioned, the processes involved in vehicle development produce a large share of wastes in the form of emissions, and toxic sludge, thus polluting the air, water, and land. In the recent times, more focus has been given to curbing these emissions and therefore, it would help in reducing health-related issues due to pollution, reducing the water consumption, thus conserving the marine and terrestrial ecosystems, and thus enabling the achievement of developing sustainable cities and communities (SDG 11), combating climate change (SDG 13), and protecting the life on land (SDG 14 and SDG 15).

3.1.3. *Indirect negative impact*

From an initial assessment, the SDGs No poverty (SDG 1), Zero Hunger (SDG 2), Gender Equality (SDG 5), Reduced inequalities (SDG 10) have an indirect negative impact due to the improvement in VDPs. Improving the VDPs would entail automation of processes, which would further cause the replacement of low-skilled jobs (Griffin & Mary, 2020; Khatiwada, 2020) with high-skilled labour. Since a considerable share of employees working in the automotive industry are low-skilled blue-collar jobs, replacing these jobs would tip the opportunities toward high-skill labour. Inequality within the economic classes is further increased. Thus, the aim of alleviating poverty and reducing hunger is led in a negative direction. Therefore, the achievement of SDGs No poverty (SDG 1), Zero Hunger (SDG 2), and Reduced Inequalities (SDG 10) are negatively impacted due to the improvement in VDPs. The number of female employees in the automotive industry is low.

Furthermore, the number of women with STEM education is comparatively lower. Therefore, this requirement for high-skilled workers would further aggravate the imbalance of unequal participation with respect to gender (Griffin & Mary, 2020; ILO, 2019). Thus, the achievement of gender equality (SDG 5) is negatively impacted.

3.2. Assessment of impact on SDGs at the target level

After an initial assessment at the goal level, the impact of improving VDPs on SDGs is re-evaluated at a target level. Every target of every SDG is questioned on its impact in achieving the SDGs in the presence and absence of the new system. Depending on the answer, they are classified accordingly. Unlike at the goal level, a target can be classified as having both negative and positive impacts. Although the number of goals classified as 'No Impact' in the previous section is minimal, it is found that 55% of the targets have no impact due to the improvement in VDPs, as displayed in Figure 3.

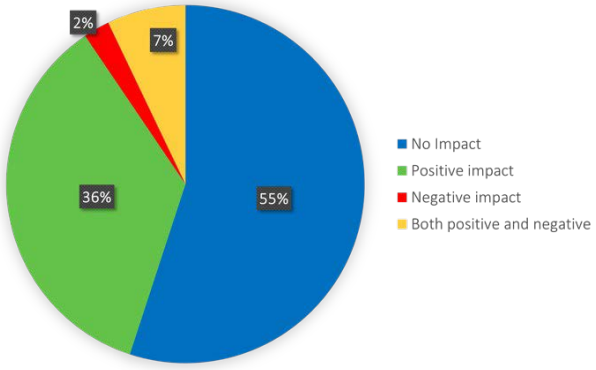

Figure 3: Results of assessment on the impact on SDGs at the target level

To investigate and understand this division of impact on SDGs at the target level, the SDGs are classified into three groups: Society, economy, and environment, as mentioned in (Vinuesa et al., 2020). The goals in each group are displayed in Figure 4. In each group, the assessment is performed at a target level to understand which aspect of SDGs has the highest impact and lowest impact due to the improvement in VDPs.

Figure 4: Classification of SDGs

3.2.1. *SDG Group: Society*

The impact of improving the VDPs on achieving the SDGs pertained to societal aspects is evaluated, and the results are presented in Figure 5. The percentage share of the targets is depicted in Figure 6.

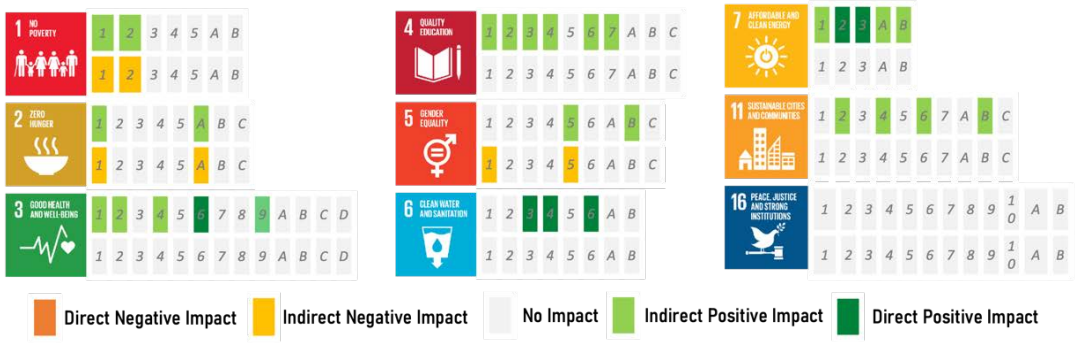

Figure 5: Impact Assessment of the societal group SDGs at the target level

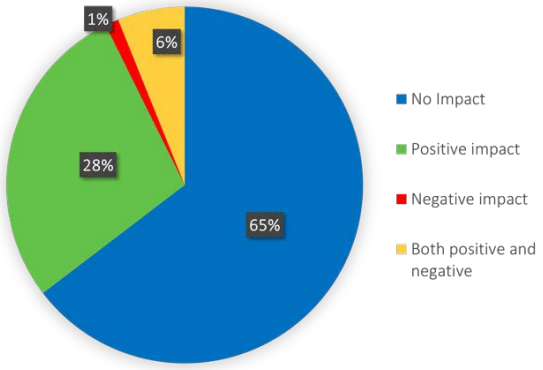

Figure 6: Percentage share of the Societal group SDG targets

The traditional methods of VDPs involved a significant amount of manual work. This provided a significant percentage of employment for low-skilled and blue-collar employees. However, in recent times, to improve efficiency, introduce sustainability, and reduce the cost of developing vehicles, much of this low-skilled work is being replaced by automation, putting the low-skilled and blue-collar jobs at risk (Khatiwada, 2020). Moreover, with the shift from combustion engine-based vehicles to electric motor based vehicles, the number of components required for the vehicle is decreased, further causing a loss in many jobs (Frey & Osborne, 2017; Griffin & Mary, 2020). Since the automotive sector is a major employer of the low-skilled workers, this shift towards automation and electric vehicles is acting as an inhibitor for achieving the SDG goals 'No poverty' and 'Zero hunger'. However, several reports and articles state that this improvement in VDP does not affect a large share of employment. Furthermore, it will create even more opportunities in other parts of the automotive field, such as in the electricity generation, manufacturing of batteries, electrical components and machinery, building required infrastructure and maintenance of charging stations (UNECE & ILO, 2020), development and

provision of services and products to facilitate the future transport requirements (Griffin & Mary, 2020). Therefore, it also acts as an enabler for achieving the SDGs 'No poverty' and 'Zero hunger'.

Some of the important motivations behind improving VDPs are to curb the emissions, reduce the pollution and the health problems caused due to that, and improve the safety of the vehicles and thus ensure the safety of the passengers. Air pollution is considered one of the major causes of non-communicable diseases (Schraufnagel et al., 2019), health issues in pregnant women (Hu et al., 2014; Malley et al., 2017) and also children (World Health Organization (WHO), 2018) which can even lead to their death. The number of people killed and injured due to vehicular accidents is very high. Close to 1.3 million people are killed, and up to 50 million people are injured. Therefore, an improvement in VDPs reduces air pollution and thus, reduces the number of people affected due to the pollution, alleviating the number of fatal accidents as well. Therefore, it acts as an enabler for achieving SDG 3, 'Good health and well-being'.

A high-skilled and well-trained workforce is necessary to automate processes and improve modelling and simulation methods. Core skills such as social and interpersonal skills, optimal management of tasks, and foundational and technical skills become an absolute requirement to get employed. Interviewers have stated that it is increasingly difficult to identify and recruit engineers with relevant skills (Khatiwada, 2020) due to the lack of quality education that serves and trains the students with the skills required for being industry-ready. Therefore, this immediate skills requirement will encourage the education and vocational training systems to integrate these skills into their curriculum. Thus enabling quality education for all men, women, and youth (Anderson & Rainie, 2017; ILO, 2017). Thus, an improvement in VDPs allows the achievement of SDG 4, Quality Education.

Although there is a growing acknowledgement that women are underutilised in the automotive industry, the number of women employed in the automotive industry is three times less than that of men in EU member states (Griffin & Mary, 2020). They represent only 27% of the workforce (Of & Statistics, 2015), and they make up less than 8% of all executives in automotive companies, half of which had no women executives in their team in 2018 (Findings, Hackett, Kruger, & Muller, 2018). Moreover, a recent survey from ILO and LinkedIn shows that women are less likely than men to possess the required digital skills that are necessary in the automotive industry (ILO, 2019), as the number of women enrolled in STEM-related fields of study are two times less than that of men (Harvey, 2016). If this trend continues, the inequality will further be aggravated. But with the improvement in VDP, the recognition of the requirement to improve gender equality is increasing. Therefore, an improvement in VDP could both hinder and very indirectly enable the progress of achieving SDG 5, Gender Equality.

Vehicle development is water and energy-demanding process. Approximately 5.2 - 5.95 m^3 of water per vehicle is being utilised directly in the manufacturing processes (Bras, Tejada, Yen, Zullo, & Guldberg, 2012; Semmens, Bras, & Guldberg, 2014b) and 41.8 MJ/kg of energy per vehicle is being

utilised (Sato & Nakata, 2020). Such levels of water consumption occur mainly from freshwater sources, and the energy being utilised may not entirely be from renewable sources. Moreover, freshwater ecosystems are polluted by toxic sludge released during painting, water that is discarded from cooling and lubrication processes. However, more recognition is being given to developing practices to recycle the water. Practices such as using closed-loop water systems and recirculating stormwater for cooling are being followed to reduce freshwater consumption (Alayón et al., 2017).

Furthermore, many companies such as Volvo and Scania are improving their VDPs so that their whole manufacturing and production process are carbon-neutral by following practices such as using industrial waste heat and biogas for heating purposes. This shift towards using renewable energy and waste heat energy would encourage policymakers and investors to develop more infrastructure on renewable energy. This could further allow for the provision of renewable energy not only for industries but also for all people.

Therefore, improvements in VDPs act as an enabler towards achieving the SDG 6 Clean water and sanitation and SDG 7 Affordable and Clean Energy.

This shift towards renewable energy would reduce CO2 emissions and reduce the stress on the local ecosystems and protect local natural heritage. It further enables less wastage from the automotive industry. Thus, preserving the locality and making it more sustainable for human settlement. Therefore, improving the VDPs will help achieve SDG 11, Sustainable cities and communities.

3.2.2. *SDG Group: Economy*

The impact of improving the VDPs on achieving the SDGs pertained to economic aspects is evaluated, and the results are presented in Figure 7. The percentage share of the targets is depicted in Figure 8.

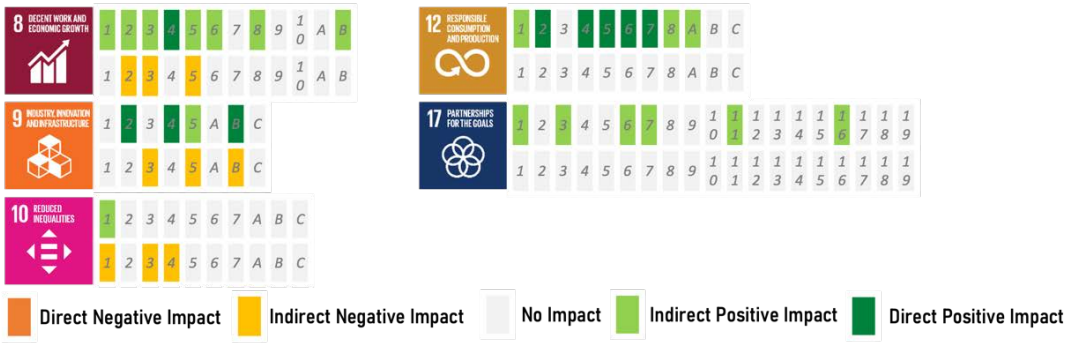

Figure 7: Impact Assessment of the economic group SDGs at the target level

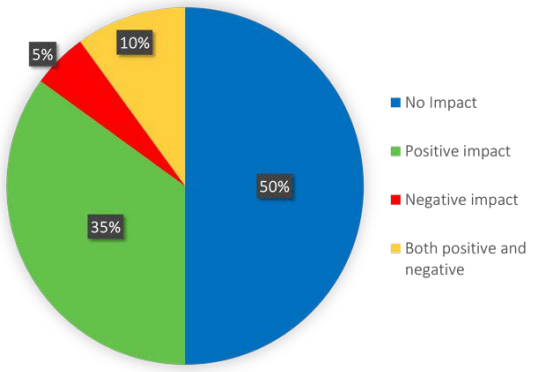

Figure 8: Percentage share of the economic group SDG targets

The impact of improving the VDPs on SDG 8 and SDG 10 is similar to the effects on the societal group. Improving the VDPs in emerging countries such as India, which hosts several manufacturing companies, would drive up the employment rate and reform the education system to meet the employer's requirements (Ma & Zhang, 2019). This improvement also means automating some jobs, transforming, and creating jobs in other forms. This type of job creation depends on sustainable enterprises that foster innovation and generate inclusive growth and productive employment (ILO, 2017). However, in emerging countries, where the share of low-skilled blue-collar employment is relatively higher than the availability of high-skilled workforce, shifting the employment requirement towards high-skilled jobs would cause an imbalance and cause a higher loss in low-skilled jobs (Dachs, 2018), as explained in the societal section.

The benefits and limitations of improving VDPs for SDG 9 and SDG 12 are similar to that of other SDGs. SDG 9 has particular synergy with SDG 8 and SDG 4. SMEs play an essential role in promoting inclusive and sustainable industrialisation and fostering innovation (Small and Medium Enterprises). They are more resilient to the continuous technological changes and improvements in the automotive industry. This type of adaptability and innovation in SMEs allows for more employment with higher quality and compensation. Although they are resilient, they are always trying to catch up with these technological changes and improvements rather than prepare for the future. This is mainly due to the lack of funds. Therefore, SMEs would require proper funding to enable their involvement in macroeconomics and develop an efficient workforce with the required skillset. This would further allow them to compete or collaborate with multinational corporations.

However, many of the R&D sectors are located in developed countries rather than in emerging countries, thus creating more bias in terms of employment standards between emerging and developed countries (Needham, 2014). This means manufacturing will continue to happen in emerging countries where labour is cheap. Even some of those jobs could be automated, leading to further losses concerning economic stability. Thus, improving VDPs could enable the achievement of SDG 8, SDG 9, SDG 10, and SDG 17. But also as an inhibitor in achieving SDG8, SDG 9, and SDG 10.

One of the most beneficial consequences of improving VPDs in terms of economy and sustainability is that consumption is optimised. This optimal use of materials would mean that the natural resources are efficiently utilised, and the wastes and emissions released from these processes are minimised (Hąbek & Lavios Villahoz, 2018). This means the employees are trained about the importance of following sustainable practices and the economic benefits of following such practices. This form of benefits would further influence transnational companies to adopt more sustainable practices (Gaudillat, Antonopoulos, Dri, Canfora, & Traverso, 2017) and integrate them into the national policies (da Rocha, 2017). Therefore, improving VDPs will act as an enabler for achieving SDG 12.

3.2.3. *SDG Group: Environment*

The impact of improving the VDPs on achieving the SDGs pertained to environmental aspects is evaluated, and the results are presented in Figure 9. The percentage share of the targets is depicted in Figure 10.

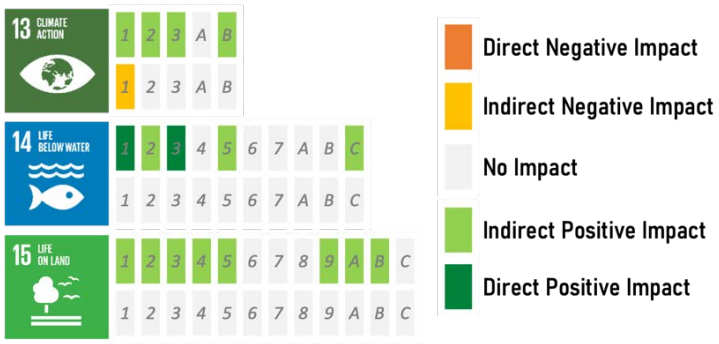

Figure 9: Impact Assessment of the environmental group SDGs at the target level

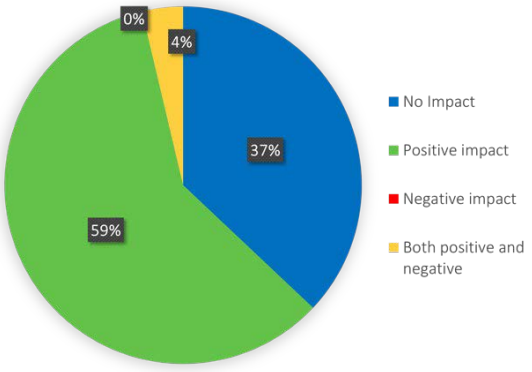

Figure 10: Percentage share of the environmental group SDG targets

One of the important consequences of improving the VDPs and the reverberation of achieving other SDGs is to protect and conserve the natural resources and thus alleviate this rapid climate change. The national policies, regulations, and standards are being reformulated to achieve the climate goals. This reformulation and the need to get ahead of the sustainable economic growth led to companies integrating many sustainable practices such as improving water efficiency (Schlei-Peters et al., 2015), energy efficiency, and reducing the automotive wastes (Zini, Longhi, Jonko, & Giovanela, 2020). This

helps reduce pollution by minimising the toxic sludge released into the marine ecosystems and reducing oceanic acidification. Furthermore, the policies are reformulated such that for a share of the land a company uses for its uses, it must plant trees for a percentage of the land it uses. Also, companies have started practices to preserve biodiversity as they are affected indirectly by the emission caused by VDPs (Jasiński, Meredith, & Kirwan, 2016). Many companies even invest in Corporate Social Responsibility practices and try to conserve the local biodiversity. Barren lands are sometimes used so that the fertile land is not torn down to make way for the companies. These practices help achieve SDG 13, SDG 14, and SDG 15.

3.3. Synergy and trade-off interaction between SDGs

While assessing the impact of improving VDPs over SDGs at both goal and target levels, it was observed that there are several synergies and some trade-offs in achieving them, i.e., achieving one goal could help achieve another goal or even act as a hindrance. The different synergies and trade-offs identified within the context of the vehicle development process are displayed in Figure 11.

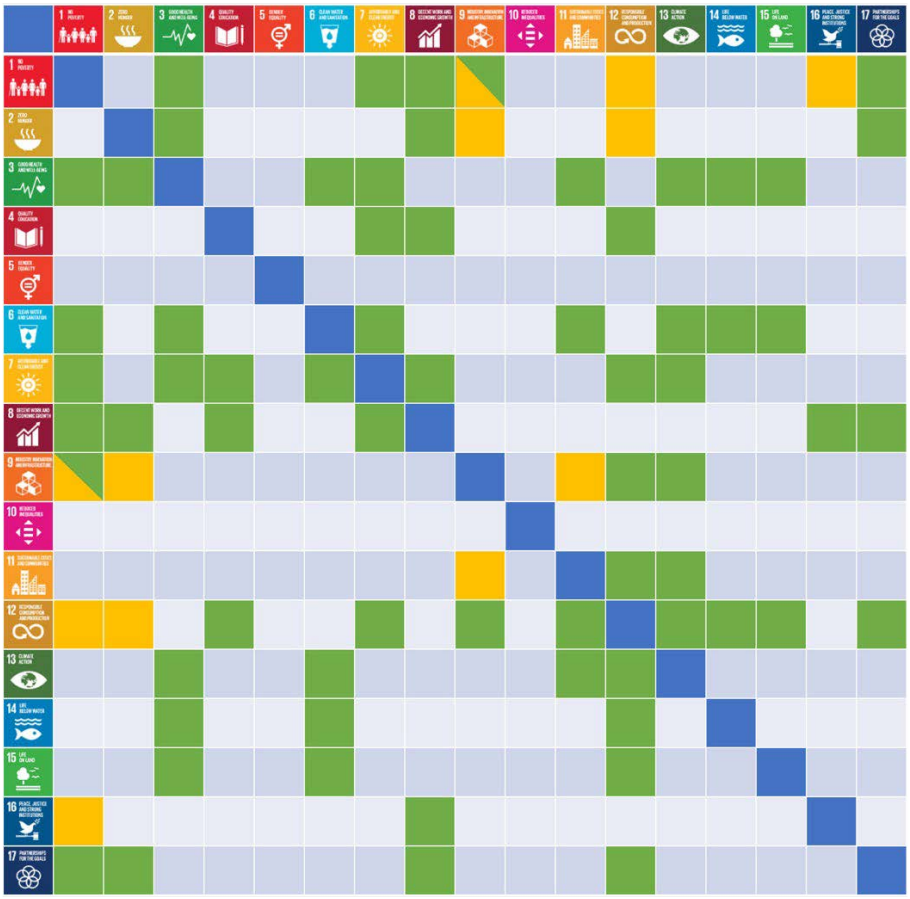

Figure 11: Synergy and trade-off interaction effects between SDGs

4. Conclusion

This paper focused on understanding the impacts of improving the vehicle development process on Sustainable Development Goals by developing a comprehensive method to analyse the effect at both goal and target levels. The impact is divided into five categories. The category in which a particular goal is classified depends on the answers to the questions about the impact of the presence and absence of the improvement practices. From an initial assessment, the different impacts on SDGs due to the improvement in VDPs were determined, and the reasons behind it were briefly introduced. Subsequently, the assessment of impact due to the improvement in VPDs on SDGs at the target level indicated that 55% of the targets had no impact, 36% of the targets had a positive impact, 2% of the targets had a negative impact, and 7% of the targets had both positive and negative impact. This disparity is analysed further by dividing the SDGs into three groups: society, economy, and environment. The impact on each target was assessed. It was found that the targets and goals related to the environment had the highest positive impact on improving the VDPs, followed by the economy group. The targets and goals from the society group had the least impact.

This disproportion is mainly contributed to the automotive industry's misconception of the idea of 'Sustainability' and its principal focus on economic benefits. Sustainability has always been associated with environmental aspects, and the societal aspects of sustainability were given little relevance. Moreover, being a competitive industry, the economic aspect was more focused. It can be noted that even the positive impacts on targets in the societal group can be credited to the improvement in environmental aspects such as clean water and lesser air pollution. However, with the introduction of SDGs, the societal aspect of sustainability was introduced relatively recently, and many practices such as Corporate Social Responsibility are being introduced to alleviate this disparity as it is being realised that achieving societal SDGs could be vital in developing a better workforce and subsequently lead to sustainable economic growth and thus the economic SDGs.

This paper was an extensive attempt to understand the influence of vehicle development processes on SDGs and vice versa. The method involved identifying literature that confirmed the problem's existence and the possible benefits of introducing solutions to the issues identified. However, most assumptions were subjective, and the analysis was qualitative. More tools, case studies, and models are required to perform a more quantitative analysis of the influence of VDPs on SDGs and the interdependencies between SDGs.

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Enabling online backcasting: Experience and best practices from applying Gameful Backcasting (GAMEBACK)

Georgina Guillen[1], Jaco Quist[2], Juho Hamari[3]

[1]*Gamification Group. Tampere University, georgina.guillen@tuni.fi*

[2]*TU Delft, j.n.quist@tudelft.nl*

[3]*Gamification Group. Tampere University, juho.hamari@tuni.fi*

Abstract

Although the corpus of gamification and participatory backcasting, a strategic planning process, keeps growing, more empirical research is needed to fully understand how an entirely gamified backcasting process can be carried out online. This article explores how gamefulness contributes to overcoming some of the challenges of online backcasting, such as keeping the participants engaged while working remotely for different units and pursuing diverse priorities. Analyzing the process to develop the GRI Academy's (the online training platform of the Global Reporting Initiative) strategic roadmap as a fully gamified online activity, some findings indicate that using some of the playful elements online systems use the most, such as badges and a leader board, may play no role for the participants' engagement; however, self-made avatars seem to be a source for relating with the content they create. The 32-hour long planning process took place between February and June 2021; by the time this article was written, most of the prioritized actions for the short-term were already underway. This interpretative study is intended to serve as a steppingstone for gamifying further online backcasting experiences, facilitating the selection of gameful elements, tools, and methods to be implemented throughout the entire strategic planning process.

GAMEBACK was developed as an approach to contribute to SDG 12.8 – facilitating practice shifts towards more sustainable lifestyles, as it explores gamification from the perspective of "technological, economic, cultural, and societal developments in which reality is becoming more gameful". This case elaborates further on the framework's first intention by presenting an evidence of a process that harnesses technological developments towards enhancing capacity building and facilitating transparency building worldwide, which is also in line with three of the five targets of the SDG 17.

Keywords: Online backasting, gamified strategic planning, gamification, participatory processes, COVID-19

1. Introduction

Participatory Backcasting, a strategic planning methodology characterized by its crafting of a common, ideal, sustainable visions and scenarios towards which current actions can be defined, planned, and strategized as roadmaps “looking back from the future” (Quist, 2011), is an approach that has largely been implemented through workshops and in-person setups. Participatory backcasting (PB) involves a wide range of societal players defining and searching for common solutions and conditions to meet shared visions, thus bringing together social, economic, and environmental aspects to facilitate transitions towards sustainability (Quist and Vergragt, 2006). Participatory backcasting (PB) has been recognized as a promising approach to tackling today’s wicked sustainability challenges. PB empowers diverse stakeholder groups to collaborate towards the establishment of a direction, aligning their efforts and committing to act; this is, enabling shared leadership (Hull et al., 2018) at global, national, regional, and organizational levels across different industries and sectors (Gonzalez et al., 2020; Sandström et al., 2020; Wen et al., 2017). The participatory processes also require critical thinking and reflective decision-making that may take the participants out of their comfort zone. Thus, finding approaches to enable future social action and sustainability solutions requires experiences with shared meanings, co- owned objectives, and self-determined action plans (Bodinet, 2016). Some of the shortcomings of PB include a limited inclusion of end-users, difficulties in developing detailed roadmaps, dominance from individual participants, biased judgments, establishing trust and confidence both in the process and the results, or even keeping the interest and engagement of the participants, particularly in processes that are either too short or span through several months/years (van de Kerkhof et al., 2002; Quist, 2007; Carlsson-Kanyama et al., 2008; Zimmermann et al., 2012).

Research about the topic notes that participatory backcasting is "an interactive workshop-based method" (Thoren and Vendel, 2018) that encourages involvement, learning, and "breakthrough leaps" for improvement (Gjellebæk et al., 2020). In most of the recent literature where PB features as a fundamental part of a planning process, it is reported as a workshop (or series of); working sessions and focus groups (Cuppen et al., 2020; Everard et al., 2021; Vitale Brovarone et al., 2021), or proposed as meetings where it is possible to interact with participants and give them a sense of agency, for example (Bendor et al., 2021). Depending on their scale and intention, these processes could be multidisciplinary and inter-sectoral; or limited to a small number of members of the same organization or even the same team. Backcasting can also be top-down as the result of expert-based interactions or bottom-up through the consolidation of future images and visioning (Timislina, 2021).

PB's interactive and participatory nature, which includes the provision of feedback, goal setting, and overcoming challenges, presents ample room for the implementation of gameful approaches, a set of activities that denote the qualities of gaming (Deterding et al., 2012). These approaches can incentivize higher motivation levels among participants and potentially invite further engagement beyond the process itself (Guillen Mandujano et al., 2021). Gamification is an umbrella concept that broadly refers

to the intentional application of game-inspired principles into activities, services, or systems, serving instrumental and experiential ends (Liu et al., 2017); thus, motivating behavioral and psychological outcomes with potential to initiate change, both at the individual and communal levels, enabling cognitive, affective, motivational and social benefits (Hamari, 2019). Gamification presents itself as an approach to enable participants' engagement and motivation throughout the entire process, either in-person or online.

While the last couple of years have seen a proliferation of non-academic resources (online tutorials, consultancy toolkits, blogs) for carrying out strategic planning processes online, some incorporating games at some point, none of them presents backcasting as an entirely gamified process. This situation is also reflected in academic research studying PB processes online, which is scarce. On the other hand, the literature on considerations and implications of online collaborative experiences keeps increasing, highlighting technical and physical factors to consider. The former represents a barrier to accessibility in many dimensions, from access to the internet to limitations related to the type of device, operating systems, licensing, updates, etc. Physical challenges range from distractors and non-verbal actions, like keeping the cameras off (Gerhes et al., 2021), to overall levels of stress and resilience, with the term "Zoom fatigue"[1] becoming more relevant in the planning and execution of online activities. Furthermore, with the COVID-19 pandemic, people are experiencing more anxiety, isolation, and even depression, appearing unresponsive when attending online synchronous meetings, affecting the interactions' nonverbal dynamics, and retaining attention as they multitask online (Peper et al., 2021).

Against this background, the designers of online participatory experiences, Participatory Backcasting included, should be able to keep the participants engaged and capable of producing the desired results, bearing in mind the physical and technological limitations inherent to the virtual, collaborative setups. In this paper, we question whether considering the participants of a fully gamified online backcasting process as players of an online gaming experience contributes to overcoming some of the shortcomings of online interactions and even of backcasting in general. Therefore, this study poses the research question of **what experiences and best practices emerge from applying fully gamified participatory backcasting processes online?**

This best practice presentation is structured as follows: Section 2 describes the case analyzed, including the methods and tools applied. Section 3 presents the results that lead to the discussion (section 4), and Section 5 is the conclusion.

2. The Case Study

[1] The term not only applies to the teleconferencing program Zoom but to all forms of videoconferencing.

To address its research question, this interpretative study presents the development and outcomes of a best practice where a gamified backcasting framework, called GAMEBACK, was entirely implemented as an online activity. This section presents the context and methodology applied.

2.1 The case organization

From February to May 2021, the principal researcher facilitated the delivery of a gamified backcasting process together with members of the executive and management teams of the Global Reporting Initiative (GRI). The GRI is a leading organization in sustainability reporting that created an online alternative to its existing in-person training offer, named the GRI Academy. While the GRI Academy was originally developed to complement the GRI's well-known in-person training and certification scheme, the high demand for online training derived from the COVID-19 pandemic led the GRI Academy team to speed up their internal development plan.

The GRI Academy team had two clear objectives: i) develop their long-term strategic roadmap; and ii) identify opportunities for improving their users' experience, particularly their learning journey. With these ends in mind, the gamified online strategic planning process aimed at immersing members of the GRI executive and management teams in a first-hand experience of gameful approaches with the potential of leveraging their programs.

2.2 The methodology

While a Google search of "backcasting online" (November 24, 2020; February 23, 2021) returned nearly half a million entries, most of them related to blogs, definitions, and training kits from consultancies. A search of academic research on the topic, introducing the words "Backcasting" and "online" in the SCOPUS database, returned nine articles in February, June, and September 2021. None of these publications touches upon the possibility of carrying out participatory backcasting as an online activity in its entirety. One of the closest academic publications on the topic, called e-backcasting, applies an iterative process through social media to formulate visions for the city of Abuja, Nigeria (Achuenu, 2021) and offers an interesting insight into the design and application of social media platforms to engage participants across the city. The little academic information about backcasting processes implemented online poses an opportunity to explore different approaches to enable efficient, interactive, and valuable backcasting without having the participants physically together.

Given the researcher's involvement in implementing the gamified backcasting framework (GAMEBACK), the data collection methods used for this case include observation, unstructured interviews, recording of the sessions, and textual analysis. Figure 1 illustrates the steps to build this best practice; the steps are explained in the following subsections.

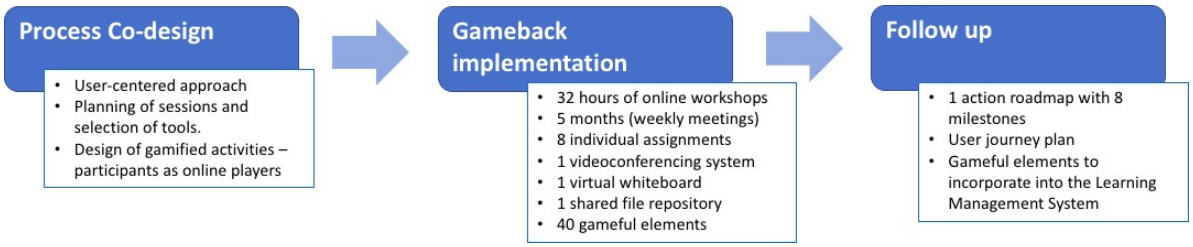

***Figure 1**. Steps to build the best practice*

2.2.1 The implementation framework

The process was developed according to GAMEBACK, a fully gamified backcasting framework developed during 2019-2020. This framework brings together the five steps of the backcasting process (Quist et al., 2011; Quist, 2016) with six elements of game design that facilitate the creation of gamified experiences: information, exposition, choice, reflection, engagement, and play (Nicholson, 2015). Furthermore, this framework aims to help overcome some of the biggest challenges of PB, such as keeping participants motivated to partake throughout the process (particularly in very lengthy ones) and facilitating an experience that invites them to follow up on the planned agenda (Guillen Mandujano, 2021). Considering the GAMEBACK framework was developed through the retrospective analysis of two cases and tested in two different academic setups (Guillen Mandujano et al., 2021), the present research represents its first application as an online process, building upon the postulations that:

1. The process is co-designed with people who will also partake in the experience. This step intends to tailor the activities according to the needs and objectives of the groups involved.
2. The participants are aware that this is a gamified strategic planning process and are invited to consider themselves serious players, meaning they know they will engage in game-like activities that have other purposes than entertaining.

2.2.2 The co-design process

The process was designed following a user-centered design approach, considering limitations such as design time, user feedback collection and application, missing the big picture, and lack of communication and practices to overcome them (Mao et al., 2005; Sy and Miller, 2008). During the preparation stages, the principal researcher held several meetings with the two team members of the GRI Academy responsible for driving the strategic planning process; both persons were also participants in the complete process. These meetings facilitated the optimization of both the design process and the implementation. The latter included two feedback streams: directly after the strategic planning session and a continuous dialogue through the discussion board. This way, the users' feedback was promptly collected and introduced.

To meet the objective of improving the learning journey of the GRI Academy users, the implementation of GAMEBACK followed some of the characteristics of a Massive Online Open Course (MOOC), the format used by the GRI Academy to deliver its programs. Moreover, part of the experience consisted of

participants to walk in the shoes of their users. The experience helped the participants gain a different perspective to include in their strategic actions, facilitating the discovery of elements that they would like to see as part of their programs (or not) and other features that may help improve the overall learning experience.

Expectations setting, time planning, and implementation overview - The online application of GAMEBACK had two approaches: individual, asynchronous work, and live sessions with the group. For the former, the participants could access the material at their own pace and, minding the set deadline, complete tasks according to their time availability and understanding of the content. The content developed through individual activities serves as input for the online group work.

The live interactions allowed for real-time group reflection, exchange of feedback and reaching agreements. The implementation was divided into two phases:

- Phase 1 focused on the roadmap development and had the presence of 2 members of the Executive Team (ET) and 1 member of the Management Team (MT) for all the sessions. Two additional ET members joined a workshop to validate the strategic problem orientation and input to the vision. One additional member of the MT joined two workshops to facilitate the transition to Phase 2.

- Phase 2 aimed at improving the user experience and overall offer of the Academy. Besides the 3 people of Phase 1, three new members joined the discussion, one of them part of the MT.

The resulting Strategic Roadmap and Action Plan was validated by all the members of the Executive Team through an online workshop.

Tools and interactions - The process was designed using a series of tools that comprise many of the most used Learning Management Systems gamification elements, such as progress bars, badges, and discussion boards. Because of the objectives of the process and its bringing together participants from different teams across the organization, the process happened in weekly sessions. This way, the participants could plan their participation according to their daily responsibilities and availability. All sessions were scheduled before the process kicked off, preventing delays due to unavailability or difficulty finding dates that worked for everyone. The process was carried out as follows:

- 32 hours of online workshops in a five-month period (mostly weekly meetings). All these sessions were recorded and used as data to consolidate the current best practice.

- 8 individual assignments (using templates, which included game-like elements previously designed by the facilitator) to provide input for the next session to be discussed as a group. Badges were given for: prompt returning of the assignment, additional input provided (not part of the assignment), finding Easter eggs, and thoroughness of the input.

- additional material to explain the assignments and/or part of the online working sessions, like handouts and future stakeholder profile sheets (personas).

- a video conferencing system (Zoom) that allows virtual whiteboards and show presentations.

- a virtual whiteboard (Mural) to facilitate group work.

- shared file repository to access all the material (SharePoint) that included a Word document to play the role of a discussion board.

Selection and implementation of the gameful elements - The second postulate of GAMEBACK, considering the participants as players, led to analyzing the motivations to play games online as a reference for selecting the activities and game-like elements to be implemented throughout the process. To this end, this case applied Yee's gamer-motivation model (2006), translating the motivation to play as the desire to co-develop a strategic plan online rather than hiring an external party to do the job for them.

The participant selection criteria, this is, the selection of people to invite to partake of the process and become players, consisted of factors such as the participants' time availability, their function within the GRI, their length in the organization, role within the Academy's structure, and decision-making capability. While the process could benefit from the experience and suggestions from all the people behind the courses, during the design process, the player selection criteria determined the size of the group, which ended up being a small one comprising people in top-management positions and responsibilities of the Academy's key processes. When additional input was necessary, selected team members, appointed by the process' participants, would be approached to collect the information.

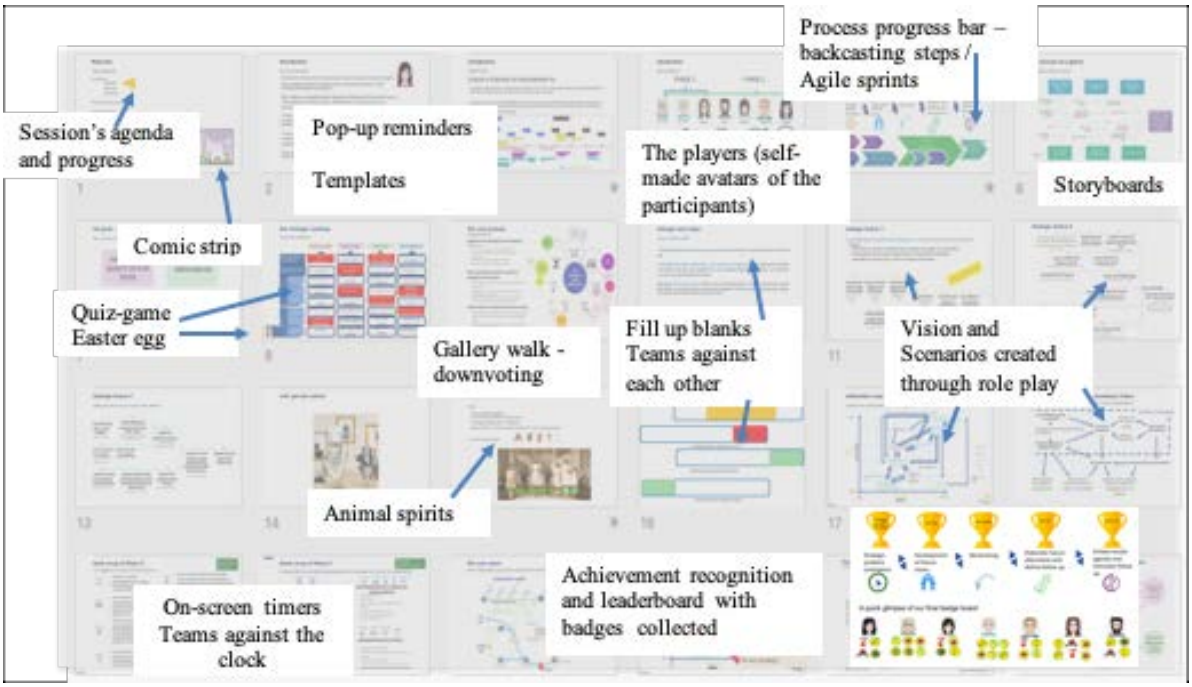

***Figure 2**. Some of the applied gameful elements*

According to Yee's model (2006), there are three overarching components for playing online: achievement, immersion, and social. These components allow identifying the purposes of each element that afford game-like experiences have. Table 1 presents some of these gameful elements, which are also illustrated in Figure 2. The complete list of gameful elements is available in Appendix A.

It is worth noting that the subcomponent "escapism," which implies hiding away from real-life problems in online environments, is here presented as the opportunity for the team to discuss issues that they would not address in their daily activities. Thus, the facilitated online interactions were a sort of a "safe space" from their routine.

Table 1. *Gameful elements according to player motivations..*

	Purpose	**Game-like element**	**Application**
ACHIEVEMENT	Advancement	Agenda progress. Process track (every session)	Check in. Progress bar throughout the entire session
	Mechanics	Templates to provide input individually and as a team. Also to review what the others introduced	Individual input sheets and teamwork during live sessions
	Competition	Two teams against the clock	User journey session
IMMERSION	Discovery	Easter eggs with information or with badge earning opportunities (animal spirit guides)	Two individual input sheets and during four live sessions
	Role-playing	Understanding the Academy's current and future stakeholders	Visioning session
	Customization	Avatar creation and presence on discussion boards	Created before the backcasting step started, the avatars featured throughout the rest of the process.
	Escapism*	Session-specific whiteboards	Every session
SOCIAL	Socializing	Express emotion with mime. Various games.	Check in / check out activities
	Relationship	5-word summaries. Ice-breakers.	Activity reflection and translation of outcomes into elements of the roadmap
	Teamwork	Fill out blanks against a timer Downvoting in a gallery walk	Three sessions (one with the timer on screen)

2.2.3. The backcasting process

Despite being designed for in-person interactions, the GAMEBACK framework offers an opportunity to carry out the strategic planning process in asynchronous, mixed, online interactions that combine online group work with individually developed offline input. During the co-design process, it was

possible to identify the questions that would guide the selection and implementation of game-like experiences. To do so, the GAMEBACK implementation template (Guillen Mandujano, 2021) was used, reviewed, and adjusted throughout the process. Figure 3 shows the final version of the GAMEBACK implementation plan.

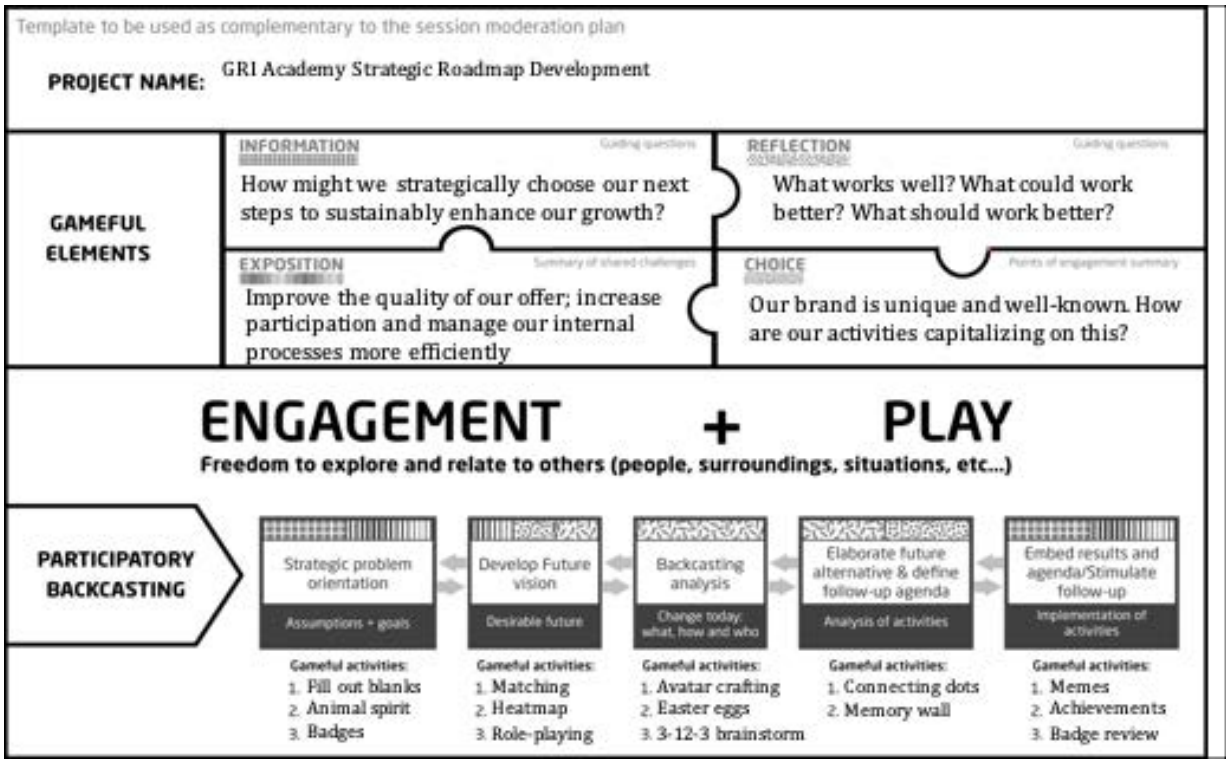

***Figure 3**. GAMEBACK template filled for the GRI Academy online backcasting process*

3. Results

This case explores the online implementation of a fully gamified backcasting process and analyzes the learning that emerged from this experience. Thus, the results are presented and discussed according to the group composition (the players), motivation components, and the implementation methods.

3.1 About the players

The results comprise the work of 10 people from different teams across the organization; the six members of the Executive Team and three members of the Management were involved in different capacities. However, this team did not partake in all the elements of GAMEBACK at the same time. The size of the group for the online meetings played a role in terms of the number of outcomes and even the motivation to engage in more gameful interactions. The larger the group, the interactions were more playful and lively. The group size did not hinder the data collection as the participants managed to reach agreements within the time available.

The feedback round after every online session proved to be very useful for implementing the subsequent group discussion. Furthermore, this flexibility was highly praised by the participants of the process.

3.2 About the motivation components

The participants agreed it was good to have an overview of how far they had moved on the day's activities (progress bar). Moreover, the presentation of how they were progressing through the overall backcasting process was also highly appreciated. It was noted that sometimes the process felt quite long, and it was good to see how they were moving forward.

The sense of completion was shared among the participants during the feedback rounds at the end of each process step. Each of these sessions concluded with a virtual trophy for the team (Figure 4).

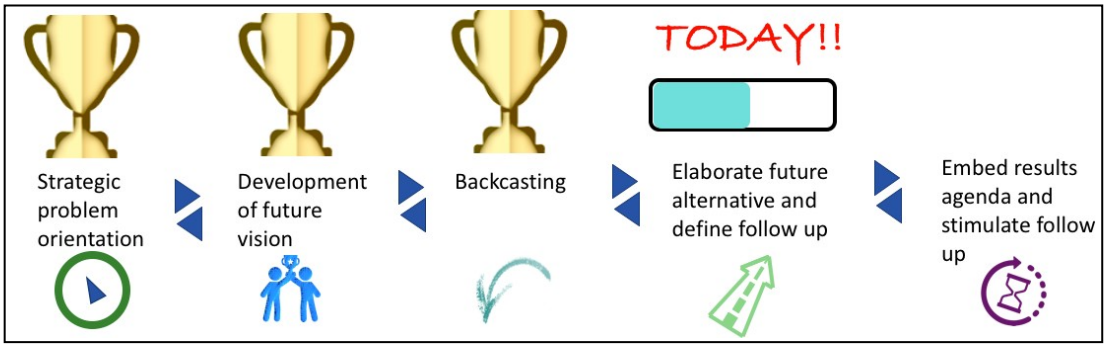

***Figure 4**. Screenshot of progress bar during feedback session*

Only once the groups worked in two teams competing against each other with a timer visible on the screen. It was noted that, while they were well aware of the time available for the activities and that the facilitator was keeping track of it, the visual presence of the timer had a negative effect, as it introduced a sense of hurry, and the participants were left feeling that they might have missed something from their discussions. A sense of urgency drove the team; someone noted, "we are competing against time" (Participant C, 8th session). Therefore, while the use of templates was highly appreciated, mainly when working together using the online platform, the team reckoned that the most important was the possibility to start acting on some of the issues discussed, even if the roadmap was still under construction.

Many of the discussions included observations such as “how did you come up with that?” or “we weren’t aware of this before,” as the participants reviewed the consolidated input of their contributions and outcomes of the research to help to contextualize their input. Having their self-made avatars on the board helped to visualize these discussions; at some point, a participant started adding icons or speech bubbles to her image, and others followed her example.

The team expressed their willingness to overcome the challenges that they had identified as part of their development process and were motivated by the possibility of designing a strategic action roadmap that could help them to prioritize their activities, distinguishing the low-hanging fruits and these actions

that, though desirable, would be better to plan for the mid and the long runs. Despite the increased use of symbols on the board, the most discussed gameful element were the stakeholders developed for role-playing the Academy in the future and crafting the scenarios.

Because of the group's composition, there was a shared keenness to co-create a practical roadmap, ensuring they included all relevant topics and activities and could start bringing them into practice before the year's end. Therefore, the process was driven by the two subcomponents of relationship and teamwork, which were strengthened by the opportunity to socialize while working online.

The application of GAMEBACK online benefits from the gameful elements that enable participants to feel excited about the process, helping to build a sense of community while developing strategies to overcome challenges (that's the objective of the planning process itself). Besides providing the proper sense of completion for each step of the process, it is important to have a connected storyline as the roadmap heads towards a long-term desired future (co-developed during the visioning session). The narrative must be engaging and consistent with what the participants want to achieve. Because of the characteristics of the process, the design elements had a heavier weight for the smooth implementation of the process and the engagement of the participants.

3.3 About the implementation

Tools and design - The lack of an LMS did not represent a problem, as the team agreed to use a repository in the cloud. All the material for the online group discussions was developed using PowerPoint to facilitate the visualization of content, particularly the outcomes of the individual assignments. Most of the interactions online were aided by an online whiteboard that gave more agency to the participants.

It is worth noting that the participants' perception of the gameful elements plays a relevant role in the appreciation of its utility as a motivator (Mekler et al., 2013). During the final feedback round, the participants considered that the presence of badges and a leaderboard was not very relevant for the online strategic planning process; however, they acknowledged these would be helpful features to use in their LMS to motivate students. "They will certainly appreciate the reward; the more they get, the more advanced they will be in the courses" (Participant B, session 12). A similar sentiment was shared concerning the use of memes, gifs, and other aesthetic-related features introduced to create a more playful atmosphere.

Methodology - As the participants worked towards a common goal, the overall experience was driven by a strong sense of cooperation rather than competition. Throughout each online group session, different gameful elements were tested while working on each step of the backcasting process. In addition, the participants were introduced to the methodology before the planning process started, allowing them to raise questions and express their ideas and suggestions from the beginning of the process.

After the first online session, the participants were excited and ready to continue the discussion. However, the time was over, and the group would reconvene only one week later, which some of the participants recognized was a bit of a "put off" since the first discussions were very insightful and lively, "I am so inspired right now!" (Participant C, session 1). Therefore, the participants were invited to channel that inspiration into their individual input sheets, to be used in the next session. With this activity, it was possible to introduce the award system (badges) and leaderboard by acknowledging the work of each of the participants and giving a badge to each of them.

The third online meeting consisted of developing a future vision, which was also the longest session programmed due to the role-playing activity.

This step proved to be challenging for the participants due to several reasons. The ones discussed at the end of the session were:

- the distance of the timeline. The year 2050 was felt as "too far" even though the team agreed on it as a desirable long-term horizon. This apprehension was noted with comments such as "this is so far off, we can't really plan something tangible for this" (Participant A, session 3). Although this perception did not affect the role-playing itself, it did impact the vision, as the same participant noted that the outcomes of this step of the process were "fluffy ."Interestingly, the other session participants cracked a couple of jokes and beckoned this person to keep playing along.

- although the session featured three short 5-minute breaks after 45 minutes of work and one 30 -minute long break, the participants were quite exhausted towards the end of the meeting. It is worth noting that during the feedback round, one of the participants commented that the process could be more "agile" – this is, dividing the work into small batches that could be delivered more quickly. Although each of the steps of the backcasting process was designed as a series of sprints similar to the agile project management method, despite the playfulness, the length session affected the perception of efficiency achieved during the first two shorter and faster-paced sessions.

This finding is an invitation to think about how to enable playful, immersive visioning activities that could take place in shorter time slots. Also, it shows that role-playing works best for large groups or with a very small number of characters. The latter is a shortcoming if the purpose is to bring the voice of all the stakeholders identified earlier in the process.

For the backcasting step, the participants were invited to create an avatar, which was later introduced to all the material showing on screen how they were moving through the process. This activity was considered highly enjoyable, with conversations that ranged from similarities in their chosen outfits to whether to include avatar-making as a feature of their LMS or not. This step was the transition between phases 1 and 2. It introduced the first roadmap draft, which served as a reference for zooming into the user journey, and the Academy as an online educational offer. These elements were analyzed in detail

during the future alternative definition and the agenda creation, which helped review the action roadmap and validate some of the milestones.

During the last two sessions, it was shared that two of the strategic actions deemed as the most critical next steps were already started. The development of the roadmap facilitated the prioritization of tasks, and the people responsible for these particular actions managed to organize themselves to get the processes started. As they were two weeks into these activities, they could provide feedback on the roadmap and include some initial results during the validation workshop with the Executive Board.

Table 2 summarizes the steps of the process and the general feedback and observations collected.

Table 2. *General feedback and observations about the process*

	Strategic Problem Orientation	Visioning	Backcasting	Future alternative and agenda definition	Embed results and stimulate follow up
Sessions	1, 2	3 , 4	5, 6, 7	8, 9, 10	11, 12
Participants' feedback	The discussion time felt too short as there were many topics emerging.	It was exciting and very challenging at the same time.	At points, it felt repetitive as the stakeholder map and the vision were revisited.	Using the online templates to fill out during the discussion and having new participants helped to see things from a different perspective.	"We have already started with…" The team was keen on seeing the final roadmap.
Observations	The participants had already talked about these issues but this was the first time they were putting them together "on paper".	Session 3 was the longest of the entire process (3 hrs) and session 4 was designed to conclude this step of the process.	The transition to Phase 2 started on this step introducing new team members into the process.	The introduction of the Academy's users' feedback and market analysis led to revisiting the vision and the milestones. The roadmap was thoroughly reviewed.	As some of the planned activities were already taking place, the roadmap was welcomed as a visualization of their "to do" list.

Process results – because of the two-phased approach, the structured roadmap with milestones for the short and mid-terms, was already in place by the time that the second phase kicked off. Besides the vision, the scenarios and the strategies, the team also developed a competitor analysis, a user-experience

map and a learning journey plan. By the time that the process ended, the GRI Academy website already featured some of the changes featuring in their plan.

4. Discussion

The pilot study sheds light on some potential shortcomings and possibilities for improving the application of GAMEBACK as an online experience. After a year of online interactions, the participants welcomed the novelty of the approach presented. Even though the overall process consisted of only 32 hours online spread across five months, towards the end of the second month, some participants observed that the offline, individual input was too time-consuming. They would prefer more online teamwork together to save time. This format was explored when the content allowed to do so. Although the discussions were lively and productive, the fact that new team members were joining the process also led to returning to the individual work prior to the session and spending the online sessions working on the consolidated content of the individual input sheets to formulate joint decisions.

Limitations: Although the participants enjoyed being awarded a badge and always commented on their standing on the leaderboard, they also noted that the process could have worked just fine without these additional elements. One reason behind this is that the team had a very clear objective in mind, so they did not need any additional motivator. However, the participants also expressed their interest in introducing a badge system for their students as they found the overall experience quite exciting. Moreover, their LMS's elements include a dashboard with individual progress tracking, badges, leaderboard, and discussion groups. All of the elements that the group piloted as part of the user experience. While the user-centered design approach proved its value in developing and implementing the process, the principal researcher spent on the content development, collecting individual inputs, processing the results, and consolidating the outputs exceeded the time initially allocated for these tasks. One reason for this is that 80% of the material was developed from scratch, usually building upon the outcomes of the group discussions; however, the template development time was reduced once the whiteboard software, which includes a collection of templates for different types of analyses, was introduced. The facilitator plays a crucial role in keeping up the implementation of the gameful affordances according to the desired outcomes of the backcasting process and in managing any technical difficulty or any other unexpected challenges.

The application of GAMEBACK as a MOOC-styled interaction offers many advantages for educational and organizational purposes. First, it helps to design the interactions among participants as close as possible to the setup where the action plan will be implemented. Such design aims to allow the participants to immerse themselves in the position of their intended users, thus identifying opportunity and challenging areas that they can already address without waiting for the users to bring their attention to them.

Reflection: The design process also allowed the necessary flexibility to reschedule some sessions when necessary, something that the participants welcomed. The technical aspects also played a role in the

time allocation, both when interacting online and for the offline processes. Having less but more versatile tools may help overcome the challenges related to access to information, online interactions, and overall coordination of activities. Bearing in mind the factors related to implementing the process, developing a badge–leaderboard system is recommended for further implementations of GAMEBACK online, particularly when bringing together representatives of different units of the organization or diverse stakeholder groups (Mekler et al., 2013). Some of the advantages of working with such a small group include the possibility of in-depth discussions and even getting to know each other. The latter was highlighted as one of the most important outcomes of the process since two people new to the organization joined during the second phase. "These discussions helped me to not only to get a very detailed 'big picture' but also gave me the possibility to get to know people I am not sure I would have talked to in other circumstances" (Participant D, final feedback session). While the strategic roadmap could have been developed without the gameful elements, the participants welcomed the approach as it was different from any other online interaction they had. "The dynamic spirit of our sessions made the whole process a time well-used" (Participant B, final feedback session); "I am looking forward to our weekly discussions; they are interesting, fun, and very insightful. Most of the time I wished we could spend more time discussing, but I am very thankful that you listen to our suggestions for improving the content and give us time to talk" (Participant C, Session 8).

Broader relevance and contribution: This implementation of GAMEBACK online is the first of its kind, and it serves as a stepping stone for further development in the areas of online, gamified strategic planning processes, particularly backcasting. The results presented offer ample room for improvement; they provide a basis to develop material that can be adapted to different stakeholder groups and setups; moreover, they present backcasting online as an enjoyable activity that can yield substantial results.

5. Conclusions

This study explores the experience of designing and implementing a fully-gamified backcasting process online using GAMEBACK, a gamified backcasting framework, to facilitate the strategic planning process of an organization offering online training for sustainability reporting. The experience consisted of applying different game-like elements designed to motivate users of online games throughout the entire online backcasting process.

The feedback collected during and after the implementation process helped provide a detailed overview of the participants' impressions, experiences, and overall motivation to remain engaged in realizing the goals they set for the organization, particularly for the short and mid-terms. Therefore, the presented best practice interprets the experience expressed by the process participants, from the first discussions to the design of the delivery system to the very last feedback round. The latter included the reflections after the validation workshop with the Executive Team and the presentation of the final strategic roadmap, which was already underway by the time the process ended.

Despite some of the initial limitations, such as the time between sessions, participants' regular activities, and internal deadlines, the overall experience was positive for everyone involved, particularly because, acknowledging the presence of the gameful elements, the participants enjoyed the planning process and are satisfied with the results achieved. The team feels fully responsible for the outcomes of the process and is actively working on the implementation of their action plan. There is a stronger sense of ownership, and by the time this article was completed, several of the strategic activities established during the backcasting process were already underway.

Gamifying the entire PB process to implement it online may be challenging for projects with very tight deadlines or large groups. However, involving some of the participants in the design of the process, inviting them to see themselves as players of an online experience, helps to present this particular online experience as a break from the all-too-familiar online interactions that demand high levels of attention for listening and looking to a screen all the time.

Through this study, the case of a fully gamified online backcasting proved appropriate to motivate the participants from different units within an organization to keep engaged throughout the process and put themselves in the shoes of their users. While face-to-face interactions are still desirable, the possibility of carrying out parts of the gamified backcasting process as an online activity, a hybrid backcasting approach, is also open to exploration. The material, experience, and best practice of this first online implementation lay the groundwork for designing and implementing fully online or hybrid backcasting processes.

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Appendix A

FULL LIST OF GAMEFUL ELEMENTS

Check in – out games	Adjective with initial of our names
	Color feeling as surname
	Crazy idea summary (2 words)
	Express emotion with mimes
	Inner weather check in
	Labyrinth with avatars
	Making a totem (for welcoming new team members)
	Memory – last session screen name
	Quick meditation
	Today's Nick Cage
	Song / movie to define our mood
Every session	Achievement recognition - pop up congratulatory messages
	Achievement recognition – champion cup
	Animal Spirits
	Animated pictures (Gif)
	Badges
	Easter eggs (hidden objects in the presentation slides or Mural)
	Icons
	Leaderboard
	Level-up indicators
	Matching topics
	Online discussion board
	Points
	Progress overview
	Time checks (agenda progress)
	Upvoting (prioritizing)
Session specific	Animation – introduction to backcasting
	Avatar creation
	Comic strips
	Fill out blanks
	Gallery walk
	Matching year with happening (timeline)
	Memes
	Multiple choice quote (EB member quote, Lady Gaga, Adam Smith, Thales of Miletus)
	Role playing
	Scenario puzzle
	Story-like presentation
	Time reminders
	Word cloud

Fostering Narratives through Arts-based Research

A methodological exploration

Kristen M. Snyder[1] and Elizabeth Turesky[2]

[1]*Mid Sweden University, kristen.snyder@miun.se*

[2]*University of Southern Maine*

Abstract

Culture has been central to societal development for centuries as an experienced-based event, and a catalyst for change. Culture is now recognized as a fourth cornerstone for achieving sustainable development. This paper contributes to the ISDSR Agenda on culture and sustainable development through the lens of qualitative research methods. Specifically, this paper explores methodological possibilities and implications to apply arts-based practice as a dialogic tool to foster multiple narratives, the inclusion of voice, and diversity of perspective contributing to Track 1B.

Qualitative researchers continue to push methodological boundaries to study social phenomena. Among the methodological developments is an exploration of the application of the arts. Research methodologists suggest that the arts open new possibilities in research through the very nature of the arts to stimulate and evoke perspectives. The arts promote dialogue which yields new insights; highlights multiple meanings, opens space for diversity, and questions norm-based traditions. The purpose of this paper is to present findings from a duo-ethnography to explore the application of the arts as a dialogic-reflexive process during the data analysis phase in qualitative research. Findings contribute with concrete insights into how science and culture can be combined as a methodological approach to garner perspective and invite voice to achieve sustainable development.

1. Introduction

For centuries, culture has been central to societal development, reflecting life, stimulating thought, and challenging the status quo. Culture is now recognized as a fourth cornerstone for achieving sustainable development (CAE, 2020). The Culture Action Europe (2020) states that "culture offers exploratory, interrogative, and critical approaches to the world and its systems, and nourishes the ability to identify and analyze current and complex challenges that need transversal and multidisciplinary responses to be understood and acted upon. But above all, culture is the common good, its gain is fundamentally social and collective, contributing to the creation of equal, diverse, and supportive societies" (p. 1). The inherently social nature of the arts holds promise for individuals, organizations, and communities to develop a new language through which to socially construct (McKinley, 2015) a sustainable and shared future.

The Creative Clash (KEA, 2011) suggests that "culture-based creativity…is a driver of innovation, social well-being, and inclusion. It is through the process and ability of art to

Schiuma (2009) arts-based experiences create an environment that frees people from traditional ways of seeing and working by moving them out of their comfort zone, creating space for reflection, and making the invisible visible (Carlucci & Schiuma, 2018). The experiential nature of the arts stimulates learning in unique ways expanding the focus from cognitive knowledge to include embodied knowledge (Nissley, 2010). This broader approach to knowledge development expands the ways in which we understand and shape meaning through co-construction. Lee et al, (2018) highlight the numerous studies that examine the value-added from the arts in business, They suggest that arts-based initiatives are now recognized as powerful tools that can help organizational members and leaders to think outside the box and stimulate value co-creation and sustainable practices (i.e. Carlucci & Shiuma, 2018; Nissley, 2008; Lee et al, 2018; Berthoin, et al., 2016). Such developments invite questions about how the arts can be applied in a variety of social settings, both formal and informal, to encourage multiple perspectives and co-creation/construction of experience through which meaning is derived.

In the field of qualitative inquiry, the arts have been explored since the late 1980s as a tool for data collection and representation. As a research method, arts-based practices use the expressive qualities of the arts to awaken and convey meaning (Barone & Eisner, 2012). Research methodologists suggest that the arts open new possibilities in research through the very nature of the arts to stimulate and evoke perspectives. The arts play a critical role in helping us understand that there are multiple answers to a problem or question; life is not necessarily linear and absolute (Eisner, 2002). Godfrey (1992) writes that "art plays an integral role in civilizing a society and its members. If introduced early and incorporated regularly into instruction, art teaches us about our capacity to communicate ideas and feelings in a variety of modes and media; to analyse data through analogy and illustration; to accept compromise, ambiguity, and difference as positive human traits, and to construct ethical standards of judgment and action...Art is amazingly inclusive as an uninhibited entity in society" (1992: p. 596-597).

Many examples of ABR exist in which the arts are used for either data collection or data representation. Less developed is the use of arts during data analysis phase in qualitative research. The use of the arts during the data analysis phase is a critical gap in the methodology literature that needs attention. The interpretative nature of qualitative data analysis requires that researchers set aside their assumptions and open space for the voices and representation of the study's participants (Patton, 2002). Critical theorists and feminist epistemologists have argued for decades about developing a praxis in qualitative research that de-privileges the researcher's role, thus emancipating the study's participants (Lather, 1991). According to Brookeld (1995, in Brown & Sawyer, 2016), "we are our assumptions"; consequently, "becoming aware of the implicit assumptions that frame how we think and act is one of the most challenging intellectual puzzles we face in our lives" (p. 2). Using arts-based methods to create interactive spaces that evoke embodied experience may provide researchers with tools to make visible assumptions and challenge those assumptions.

dialogic- reflexive process during the data analysis phase in qualitative research. Two professors in academia, also professionally trained artists (a dance and a musician), conducted the study. Interest emerged when one of the researchers questioned the validity of their analysis to give voice to the study participants. Findings contribute concrete insights into how science and culture can be combined as a methodological approach to garner perspective and invite voices to achieve sustainable development.

2. Background

One of the unique elements of Arts-based research (ABR) is the opportunity for researchers to disrupt perspective through their participatory practice and re-conceptualize perception from their new embodied experience. The arts promote dialogue through embodied knowledge (Tanaka, 2011), highlight multiple meanings, and question norm-based traditions. This is important for creating new architectures of dialogic-reflexivity to give rise to voice. Engaging in dialogue, that is based on reflection and self-reflexivity (Hertz, 1997) creates consciousness about who we are in relation to one another, including our ideological perspectives, cultural backgrounds, and the like. In so doing, we expand our collective space and invite room for multiple voices to be present and represented. Through a shared experience, possibilities to disrupt the dominant discourses (Bruner, 1986) are made possible.

The dialogic nature of ABR is now promoted as a fourth essential practice in ABR to stimulate critical thinking and reflection, value social construction, and foster voice. Through participatory practice, researchers can re-conceptualize perception from their new embodied experience that involves dialogic reflection (Rashid, 2018). Bakhtin (1986) contends that dialogue can serve as an important framework for knowledge construction. Moreover, Brown and Sawyer (2012) argue that dialogue is important to move acts of reflexivity from the solitary to the collective, suggesting that new perspectives can be stimulated through interaction. The key to dialogic reflexivity in research is in new structures that emerge during the research process. The interactive nature of embodied knowledge that emerges through the arts provides a vehicle for research to challenge assumptions, both in terms of data collection, analysis and representation.

Leavy (2015) explores the array of artistic forms and their application to research. In this paper, we highlight music and dance to reflect our own artistic backgrounds applied in this study. Music's role in society has been central for centuries, serving as a social function as well as in healing (Stevens, 2012). Music is also used in education to stimulate learning, facilitate expression, and develop skills in listening, collaboration, and teamwork (Snyder & Cooper, 2015). Musicians have a unique ability to listen and interact with sounds (Rostron, 2003; Sorsa, et al. 2018). They are trained in fine-tuning their listening skills to identify small nuances. As Leavy (ibid) suggests, "music-based approaches to research can help researchers access, illuminate, describe and explain that which is rendered invisible by the research practices" (p.128). She quotes Huxley who said that 'after silence, that which comes nearest to expressing

Bresler (2005) sites that music can help researchers build their listening skills, which is essential in qualitative research. The language of music, based on melody, harmony, rhythm, tonality, form, and dissonance can be transferred to everyday settings to help researchers fine-tune their skills in listening (Bresler, 2005; Snyder, 2019). Leavy (2015) suggests that the components of music can help qualitative researchers enhance their perception, conceptualization, and communication. She also recommends that researchers consider the above categories when analysing interview data.

Dance is another art form that can serve well research methodology according to Leavy (ibid). Like musicians, dancers use form, structure, and rhythm to express themselves. As a form of knowing, dance has been described as physical thinking; a process of using the body as an instrument of cognition (Kirsh, 2011) Muntanyola-Aura and Kirsh (2010) talks about the unique interaction that the body and mind can offer a thought. In their words, the body can serve as a "simulation engine or as a representational system, that allows a thinker to interactively formulate thoughts about a domain. Thought can be more body-centric (p. 1). Leavy (2015) refers to the work of Clark-Rapely (1999) who suggests that dance "is a form of transformative human action that expresses an individual's being…and can thus support, rather than alienate communal relations" (Leavy, p. 159).

Combining music and dance in a duet enrichens the embodied experience through the interaction of different forms of expression. The use of a duet, as performed by distinct art forms, adds perspective in unique ways. It stimulates a dialogic-reflexive component, that can strengthen the researcher's the ability to challenge assumptions that lie within their own perspectives. Both music and dance use form and rhythm to express and communicate. Dance also introduces movement to the duet while music introduces tonality and melody. Interacting in this expanded space opens the possibilities to stimulate thought and develop a more complex interaction that may serve to reflect the complexities embodied in human experience (as derived from the qualitative data). In so doing, the improvisational duet has the potential to become an embodied act of dialogic-reflexivity.

3. Methodology

The study presented in this paper is an embodied research study (Finlay, 2014) based on a Duo ethnographic methodology. Duo ethnographers seek to generate new perspectives about a topic through the interaction of differences: "Rather than reaching a consensus, duo ethnographers make their disparate opinion explicit" (Norris & Sawyer, 2012, p. 14) and in doing so attempt to disrupt the metanarrative "by questioning held beliefs" (Norris & Sawyer, 2012, p. 15). Duo ethnography is an emerging methodology that intentionally juxtaposes multiple perspectives to de-center preconceived notions of reality. The researcher's background is used to probe, explore, question, and stimulate perspectives around the research data (Norris & Sawyer, 2012). With this form of personal inquiry, two researchers investigate a topic of interest using their own life as the

interaction, and reflection are central to the methodology to stimulate new insights and understandings.

As researchers, we are both academics and artists. We are Professors in leadership and organisational development and quality management. One is a professionally trained dancer, and the other is a professionally trained musician. The common knowledge base for the experiment was leadership studies and artistic expression. The point of departure was qualitative interviews conducted by one of the researchers in a separate study that examined what women in high positions of leadership experience during their rise to the top. The other researcher was not privy to the interview data and thus served to interrogate perspective from a distance.

The experiment was carried out over a two-day period during which improvisation and reflective dialogue were integrated. The experiment was guided by the question, "how can embodied knowledge (as created through music and dance) inform a deeper understanding of the concept, "Deviance", which was identified in the initial qualitative analysis of the interview data. Two practices were included in the experiment: 1) Free improvisation, and 2) dialogic as reflective practice. Improvisation is the creation of something without a pre-conceived plan (Nunn, 1998). Self-reflexivity is a process used by researchers to mediate the balance of position between the researcher and researched to lend voice to the respondents (Russell & Kelly, 2002). Dialogue is defined as a conversation without sides (Isaacs,1999). It reflects a communication paradigm in which "process" is given more weight than "outcome".

The improvisation was approached as a dialogue between the flute and the dance. The function of the flute was to listen in, feedback, mirror, and challenge what was performed in the dance. The function of the dance was to express different aspects of the stories shared by the interviewees that reflected their journeys to high positions in leadership.

Four dances were completed and recorded. The first two dances (warm-ups) lasted between three to five minutes in length. The second two dances (reported in this paper) lasted between seven to fifteen minutes. Following each dance, a reflexive dialogue was held during which we explored our embodied experience as it related to examining more deeply the qualitative research data from the interviews. We worked to understand each other, what we were experiencing, communicating and what more we might need to add to our free improvisation to take us into the deeper levels of data analysis with the interviews. Among the elements, we explored were space, rhythm, listening, and collaboration. Of significance was to understand how our different artistic forms could be in dialogue with one another and integrated to support the analytical process.

4. Results

In this paper, we present findings from two of the improvisational dances that focused explicitly on the concept of deviance as a construct among women who had achieved high-level leadership positions. The construct had been identified by the dancer in this study during a qualitative

The Deviance Improvisation part 1:

To get inside the stages and experiences that the women leaders went through to achieve their high appointments over the years, the dance began low, on the floor, spiralling up over time to reflect the stories of the women interviewees and their rise to power. The spiralling elements reflected their non- linear journeys. The music began on the lowest tone of the flute and meandered up the scale, slowly, spiralling with the dance, interacting with the movements as they emerged, becoming intertwined. At times the dance returned toward the floor representing elements of the backlash to success that many of the interviewees experienced along their journey; reflecting once again the non-linear dimensions for women to achieve positions of power.

As the dance progressed, wandering sideways and upwards to success, the tonality in the music shifted from one of a heavy burden to lightness and inspiration reflecting the inner strength that was evident in interviewees' stories. The dance began to reflect the steps that the women leaders took on their journey to rise through the ranks emancipating their power. Pushing through power plays, moving barriers, claiming space.

Figure 1: excerpts from the first improvisational dance

The dance ended with upward movements and large steps forward that reflected a sense of arrival shared by the women leaders when they had achieved a certain position in the ranks. And the end of the dance we both found ourselves inspired to want to climb more and continued spiralling upward. The dance ended after 5, 37 seconds. We paused for a moment, soaking in the experience. The dancer (Liz) began to feel that she was entering the data but needed to have more with her if she was going to dig deeper into the complexities of deviance. After further dialogue and reflection, she stated, "Let's work with the concept of encounters. I feel the need to get more percussive. Aggressive. Assertive. I think these ideas can help me get inside the concept of deviance, which I perceive is a part of the experience for women in high leadership positions; that they "deviated from the norm to get to where they are today."

The Deviance Improvisation part 2:

And so began the dance for a second time. Just like the first dance, this second iteration also started from the floor to represent the journey of the women in leadership. Yet this time with more focus on the theme of encounters. The dance evolved around the elements of struggle, communicated in more percussive gestures, and deeper emotional movements reflecting frustration, fear, at times confusion, questioning, and testing possibilities.

Figure 2: excerpts from the second improvisational dance

The music followed the rhythm of the dance more closely this time, speeding up with quick movements and slowing down with softer movements. When the moves were directed upward, so too followed the music. This close interaction with the music mirroring the dance was intended to give space for reflexive improvisation as the dancer navigated insights into the themes of encounter, percussive-aggressive- assertive.

Figure 3: excerpts from the second improvisational dance reflecting themes of encounters

After 5 min and 43 seconds into the improvisation, Liz stopped abruptly, looked, and said: "I need to make noise!" And she started to stomp on the floor in a percussive dance as she grasped her fits and pounded against the air above her head. The flute followed with a crazed melody, bouncing off the percussive steps of the dancing feet, and the wildly swirling hands. The percussive gestures repeated themselves, each time with new facial expressions that illuminated a sense of inner craze.

Figure 5: excerpts from the second improvisational dance reflecting dichotomous emotions

After the third such gesture, the dance turned toward a kind of resolve: the energy of frustration had been identified and released. The movements began to spiral back down through a series of flighting gestures that ended in a calm. The flute followed as the arms extended softly while the body continued to spiral out of the percussive encounter, landing in a sense of peace and calm. The movements became elongated as the dancer circled through the entire floor space with strength, reflecting a kind of empowerment that appeared to engulf the women in leadership in the study. The dance ended shortly after (at 7, 23 minutes), and there began our most profound reflection which also served as the pivot point in the analysis.

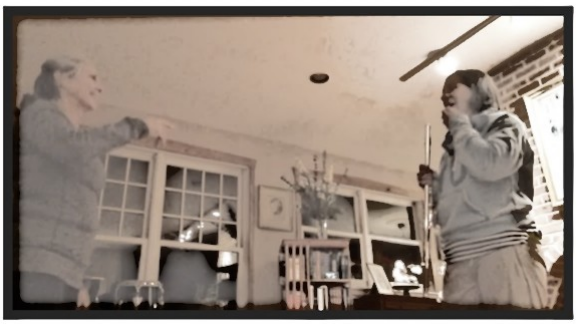

Figure 5: reflective dialogue after an improvisational performance

"There is something missing, I am not being honest". Reflected Liz. There is something that I really couldn't express. Could you understand that while I was dancing?"

Wow, that's interesting. I think so. I found myself playing in a chromatic scale for a while and then I realized that I needed to change my own playing as a way to also help you to come out. I saw that your gestures were ready to move out and expand to celebrate the women's power. If I were to write the music to it, I think it would be similar to Aaron Copelands Appalachian Spring where the music just opens up.

"Yeah I felt too", shared Liz "it was really a sense of freedom to be whoever you are, where ever you are. That's one of the powerful findings from the data that I began to see more clearly. ".

I also realized for myself that I couldn't dance out something like "Deviance" by myself. I needed to push against someone. In the process, there is a lot of misunderstanding; hurt, and fear. I was trying to do the experimentation. But I couldn't get to it. Part of it was that the music didn't feel like it fit the deviance that I was feeling inside. That was a place perhaps where the music could have stopped. I could have just pounded out alone because there is nothing gentle about that. The other thing is that I don't dance percussive. I was thinking of pulling out the drums (which were in our space)

This is interesting. What you are describing is a typical perception of what is deviance and how it occurs.

Yes, I think so. It feels like it is how it would be to be deviant. I was thinking about people who are deviant in society as I was dancing.

My question to you is, what if that's not what women in high positions actually go through? What if there is another picture in the data that is not illuminated because we are guided by that one perspective (traditional) of deviance. If we keep the traditional notion of deviance we assume that the women in your study must have gone through hell, must have gone through a battle. But did they?

Yes, some of them really did. Some of them didn't. Some talked about being moved into positions of power because of their networks.

You described in your dance needing to have something to push against. Did the women also describe things that they pushed against?

Yes, like husbands. But some of them weren't willing to share those kinds of details. They just talked about the straight path and mentioned there were battles, but not what they were.

It's interesting to hear you reflect on the improvisational process and how there were parts that didn't work for you or some elements that were missing

Some parts worked for me.

I am wondering if there might be something more to examine. Can we ask questions about the things that were missing for you in your dance, or that didn't work for you? Perhaps we can identify new questions that you can bring to your analysis?

That's a good question. And what you asked me about "did all the women go to battle" is one of those kinds of questions. And did they feel they were getting out of a comfort zone? Did they feel free? When you discover that you are not the norm, what happens?

….

Our conversation continued along this path to explore the concept of "being different". Over time, the dialogue moved back to the start of the conversation, to deviance, recognizing that the concept of deviance needed to be further explored and considered from multiple lenses. We also returned to our improvisation to understand it more deeply, including perhaps hidden elements that we didn't consider and their potential implications to explore deviance. Liz began reflecting on different movements that she could have chosen to explore more in-depth her own inner experience with the concept of deviance. We began to re-interpret some parts of our interaction that we initially determined to be problematic.

If we go back to our improvisation, the music tried to follow the dance. At times it was disturbing because it wasn't in sync with, for example, the stomping. But how might that music then represent something else that is a part of the bigger picture?

Yes, the music that was playing was a kind of constancy. The world goes on, and here I am stomping, but the music kept going.

Yes, that rights, and that's how it should have been. I just should have kept going and stomping and been even more out of sync with the norm (a sign of deviance).

We began to reflect on the experience and power of improvisation to access emotions, assumptions, and perceptions. It became an analytical device embedded within an ethnographic study, that stimulated us to ask questions of one another, of our interpretations, and possible alternative interpretations as well.

How about you? You weren't playing deviance. How would you do that? Liz asked.

If I think about deviance, and I take the flute and it has pureness in its sound. We expect the purity to be there, we expect the melodies to be beautiful. If I were to play deviant, I would alter the expectations that we have for the flute. Change keys in the middle unexpectedly. Use tonal experimentation to create a harsh sound.

And then that would be it "deviant" until you are comfortable being out the circle, then you are no longer deviant." Liz reflected

> *"I think to have deviance in music, you need to have percussion. You also need to deviate from the form".[reflective pause] "Another thing is that there is an assumption that deviance isn't beautiful. But if we think about some of the great artists who didn't follow the norm, they created beautiful art, but it deviated from the norm of acceptability."*
>
> *This is interesting. There is an assumption that deviation is harsh and tough. But you can deviate from a musical scale, and it becomes something different, but it still has beauty. When we don't understand the scale, we perceive it as 'wrong' or 'false'. Yet when it is something, we recognize, it no longer deviates from our own personal norm and expectation", I reflected.*

5. Analysis and Discussion

In the analysis, we highlight five key insights drawn from the experiment to understand how the arts can be used in research to foster multiple narratives and stimulate deeper awareness of alternative perspectives. Among the five insights highlighted are 1) curiosity and questions serve as a guidepost for improvisation and exploration; 2) Test improvisational forms and negotiate a collaborative space; 3) Building reflective dialogue into the improvisational space; 4) Dialogical reflection as deep learning requires time and structure; 5) Journaling promotes dialogic reflexivity and deep learning

Curiosity and questions serve as guideposts for improvisation and exploration

The experiment in "deviance dance" showed several key elements that were important to both process and transformation of thought. The process was guided by curiosity and question. The curiosity was to explore how we might use our artistic forms of expression (dance and music) as a vehicle to interpret qualitative interview data that gave space for voice and multiple perspectives. The question behind this curiosity was derived from the research setting in which one of the researchers articulated a need to probe the multiple perspectives in the voices of the respondents in new ways. The curiosity and the need became the guideposts within which the architecture of our experiment was shaped. Asking big questions, getting curious, and staying open to possibilities are significant to frame strategic thinking and innovation (Brown, et al. 1999; Brown & Isaccs, 1996). It is through our questions and getting curious that we are stimulated into reflection dialogue and reflection (Bohm, 2004)).

Test improvisational forms and negotiate a collaborative space

Combining artistic forms (music and dance) in the research process was new to both of us, and as such, it required a phase of experimentation. The first two dances were performed as pure exploratory improvisations during which we developed an understanding and praxis for how we would work together. Among the key insights were 1) the need to frame the dance with a particular research-based question. When the music and dance were combined without a probing question, it became just another dance. Connecting the arts and science needs a common denominator. 2) the need to understand the interplay between the different art forms and their role in the non-verbal

interacting with a third dimension. The musician was interacting with the dance. This raised questions about how the decisions we make (i.e. to take a breath, to stop a movement, to change the rhythm) impact each other. This is a standard component of dialogue in which we interact with one another's words (Isaac, 1996), intonation, rhythm, and the like. When the words are missing from the dialogue, we need to develop new spaces in which to interpret and understand one another. 3) Understanding space, what it is, and what role it has in dialogue and reflection is important. Space can be conceptualized and communicated differently in the arts. For example, in painting and sculpture, black and white create a spatial balance.

In dance, movement and stillness are used to create space and in music, sound and silence create space. The inquiry into the movement in space and time can open to reflections about how we as researchers cause others to move in our rhythm, and our perceptions.

Building reflective dialogue into the improvisational space

The dialogue was an integral part of each dance. The dialogue and reflections tended to be unintentionally guided by the focus of the dance. For example, in the first two dances in which the focus was on developing an improvisational process, the dialogue reflected the experience of partnering to create a common language for communication. In the latter two dances, the reflective dialogues focused on digging deeper into our interpretations around a research theme and drawing on theoretical knowledge as well as embodied knowledge.

Dialogical reflection as deep learning requires time and structure

Building on a previous improvisation enabled both of us to deepen and enrichen our exploration of the data, this time adding to the pot the new themes. Combining embodied experience through the arts with deep reflection can serve well the concept of deep learning promoted by Senge (1994). This kind of deep learning, Senge et al (1994) claim, takes place within a particular architecture that includes 1) guiding ideas, 2) innovation in infrastructure, and 3) theory, methods, and tools. The guiding principles include systems thinking that we are all a part of a larger system and we do not need to create inter- relationships for they already exist. The second principle is the "community nature of the self", which suggests that individuals are a part of a larger culture; we are talking about the collective when we talk about the self. The third principle is "the generative power of language", arguing that we co-create our realities through our own understanding of experience.

Journaling promotes dialogic reflexivity and deep learning

Journaling about what was learned was an essential part of the process, no matter the form. In our experiment, we both used different types of journals. Digital journaling was used to capture the dialogues and improvisational performances. Text-based journaling was used after the improvisational space to further explore the embodied experience further and arrive and new insights and knowledge. The continuity of journaling both during and after the event created a space for continued reflection, which when shared with others served to stimulate new insights and understanding of multiple perspectives.

6. Conclusions

The five insights shared above reflect some of the key learnings that we draw from the Duo ethnographic study of the improvisational dances. They suggest ways in which the arts can serve as a dialectic tool in qualitative data analysis to provoke an awareness of assumptions and perspectives. Based on our experience, communication was expanded through the arts, to include both verbal, non-verbal, cognitive, and embodied knowledge. Immersion in artistic creation, we suggest, establishes a deeply reflective space that is transferable beyond research. Such an experience can offer conditions for time and space to stop, pause, create, and reflect. When facilitated skilfully, such a space, allows people to open to a deep exploration of their own perceptions, practices, and their root influences.

Among the interpersonal dynamics explored through artistic practice in this study were aspects of space, in relation to others, and in our case the object of study. The arts-based practice created an architecture within which to explore this space. Transferring the dialogue to a collective experience, stimulated new awareness about our spatial relations to one another: how we impact each other and are impacted by one another. This is a critical skill to develop as a global community to develop cultural sensitivity and develop behaviours of appreciation for difference and community. This also has strong implications for role relationships in dialogue and the art of listening (Snyder, 2019). How we develop an interactive balance between one another so that no one voice has power over the other is a contemporary and future challenge to achieve equity and democracy for a sustainable future.

The dialogue that took place during the improvisations included a conscious commitment to diversity and voice. We were keenly aware that we needed to develop a praxis to open our minds to consider different perspectives; to shake our assumptions. As a human race, one of our greatest challenges to achieving sustainable development is developing consciousness about how we relate to one another and value each voice. The arts can provoke us into awareness as we become the instruments and art forms that make up a collective rhythm, shape, and movement. Sustaining this, however, will require that we develop an architecture that fosters non-judgemental dialogue and reflexivity.

Culture is an integrated part of our local and global society. As a social praxis, the arts are used to reflect espoused values, challenge perspectives, and represent thought, among other things. Culture is also ladened by questions of access that have stimulated debate for decades. Revisiting the contemporary global challenge for culture to serve as the fourth dimension toward sustainable development suggests the need to explore the ways in which the arts can be expanded and applied in a variety of social settings and institutions to make them more accessible; not just as a reflector of society, but also as a forum for social constructivism to emancipate voice and approach equality. Integrating social constructivism through art initiatives involves a specific methodological design and strategy. It is also important to note that one need not be trained in the arts to invoke the arts in

power to transfer the language of the arts to every life and everyday setting.

Combining the creation of art, discussion, and reflection together offers participants experiences that embody significant social, psychological, and developmental dimensions. Engaging in an artistic participatory process invites an experience-based object against which to reflect. The shared experience, if cared for, has the potential to shift power imbalances and promote social constructivist spaces. The space needs to recognize the common experience and the unique relationship that each one of us may have to the experience, colored by our own backgrounds and perceptions. Meeting at the crossroads of our shared experience can enrichen our collective awareness and open space for multiple voices and perspectives. Arts-based practices have the capacity to remove the "I" from the equation and shift focus to a common space in which equality and democracy are bred and sustained.

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Posters

Exploring the knowledge of sustainable development: Overview of ready-to-use methods with a life cycle perspective
Margarida Goncalves and M. Estreta

An urban metabolism approach to sustainability in the city of Östersund, Sweden
Emiel Driessen, Nathalie Burdová and Erik Grönlund

Exploring the knowledge of sustainable development: Overview of ready-to-use methods with a life cycle perspective

Introduction

The United Nations Sustainable Development Goals aim to boost sustainable development. Life Cycle Sustainability Assessment (LCSA) methodology has been pointed out not only as a way of assessing the sustainability performance of the value chain but also as a tool to enhance circular economy and industrial symbiosis in the manufacturing sector.

Goals

This study aims to perform a systematic review of the application of LCSA methodology to case studies. The goal is to identify the main trends regarding the Key Performance Indicators (KPIs) and methods - for the Life Cycle Assessment (LCA), Life Cycle Cost (LCC), and Social Life Cycle Assessment (S-LCA).

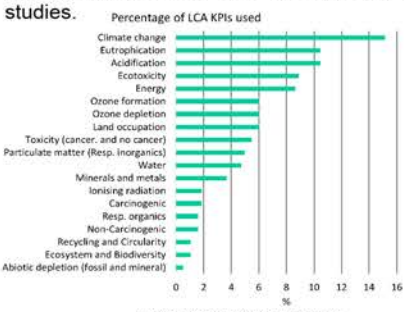
Methodology

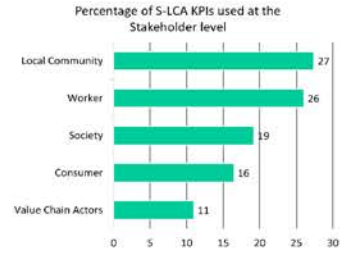
The scientific literature research was conducted on Scopus. The keywords used were Life Cycle Sustainability Assessment" in the title, abstract, and keywords and the use of case study(-ies), for studies published between 2018 – 2021. Among the results, studies neglecting one or more dimensions of sustainability were excluded from the sample. A total number of 53 scientific studies are included in the analysis (a total of 55 case studies).

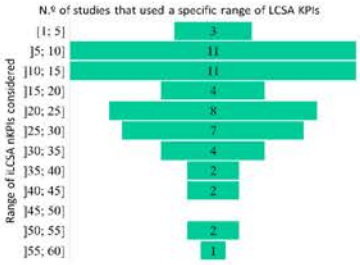
Results & discussion

The authors identified a common trend regarding the most reported indicators (e.g., climate change for the environment, production costs for the economy, and local community and worker stakeholders for the social). The number of indicators strongly differs in each case study (e.g., varying between 3 to 60). However, most studies used 5 to 15 indicators. No consensus was obtained regarding the communication of results; some studies analysed each dimension of sustainability separately, and others, usually the studies with the higher number of KPIs, single score values.

Regarding the sector, most of the studies focused on the energy sector, followed by food, construction, and transportation. The manufacturing sector only accounts for 5 studies.

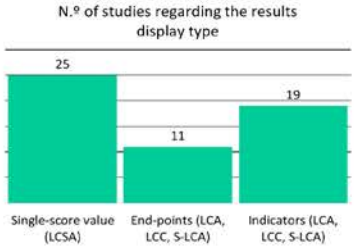


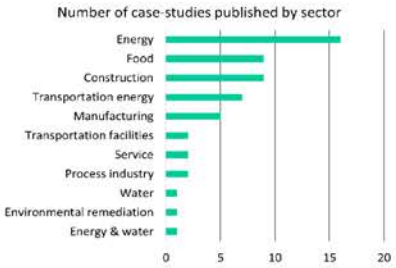


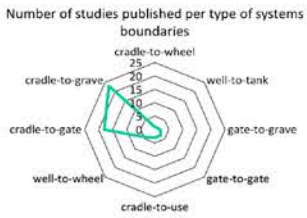


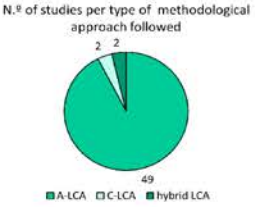
Another finding related to technical details suggested that despite the fact that most studies aim to accomplish broader system boundaries, i.e., cradle-to-grave, this life cycle thinking was only fully applied to the environmental dimension, to some extent to the economic and poorly to the social dimension. Mixing different system boundaries in the same case study can induce gaps in the results obtained, and consequently in the identification of hotspots for further improvements.

The methodological approach for the majority of the case studies relied on the Attributional LCA.









Conclusions

To avoid mixing different system boundaries and provide timely and robust conclusions for the decision-making process it is recommended that the LCSA should be conducted, in the first instance, in a gate-to-gate approach. In conclusion, current efforts are still being made in the robustness and standardization of the LCSA methodology, namely in the development of a normalized framework for the economic and social analyses.

M. Gonçalves (mmgoncalves@isq.pt; m.serragoncalves@gmail.com), M. Estrela, Low Carbon & Resource Efficiency, R&Di, ISQ – Portugal; M. Despeisse, Chalmers University of Technology - Track 1b Research methods and methodologies

15-17/06/2022

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An urban metabolism approach to sustainability in the city of Östersund, Sweden

Introduction

Urban Metabolism (UM) is a metaphor that allows us to look at the city as a living organism. Just like an organism, the city requires food and water for its existence and turns them into wastes. Having information on how much of certain material is flowing in and out of the city can create a picture of its efficiency and sustainability. In 1965, Abel Wolman put up an urban metabolism model for a hypothetical North American city of 1 million people, evaluating some material in- and outflows [1].

As a start for UM research in the city of Östersund, located in the mountains of mid Sweden, a small literature review accompanied with a first assessment of the metabolism of the city were performed [2]. Two research questions were formulated:

- How has research on urban metabolism developed?

- What are the major material and energy flows in and out of the city of Östersund?

Literature review

The UM concept has been further developed since the first attempts done by Wolman and others. The literature review shows the development of different approaches to UM regarding 1) Internal and circular flows [3]; 2) consumption patterns, e.g. the ecological footprint approach [4]; 3) environmental impact, e.g. LCA [5]; 4) ecosystem approaches, based on an energy backbone, e.g. emergy accounting [6]; 5) spatial aspects addressed with GIS assessments [7]; 6) urban planning and design approaches [8]; 7) social-industrial ecology [9]; 8) urban ecology approaches [10]; 9) urban political ecology approaches [11] and hybrids [12]. It is also notable that there is not yet a standardized framework.

Method

The first estimation of the urban metabolism of Ostersund city had an energy- and material flow approach. Three general methods were used to collect or produce data on material flows:

1) Local data was used as they were or recalculated to the population; 2) Regional data assumed to be representative also for the city of Östersund, often recalculated based on per capita or land use; 3) National data assumed to be representative also for the city of Östersund, often recalculated based on per capita or land use. A priority was given to local or regional data over national data.

First estimation

The results from our first estimation of some of the major material and energy flows in Östersund can be seen in Figure 1.

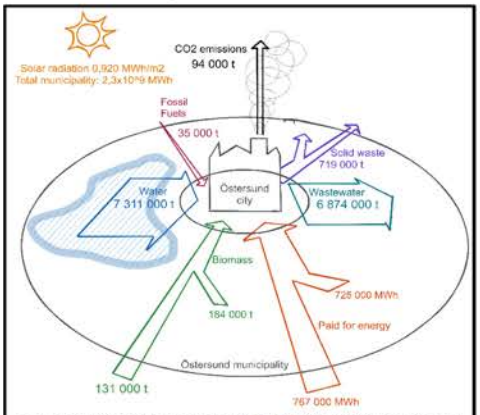

Figure 1. Annual major material flows (in tonnes) and energy flows (in MWh) used in Östersund city. A distinction is made between local production or treatment, and the import or export from and to outside of the municipality.

As can be seen from Figure 1, the flow of water is large compared to the other flows. Biomass and energy are both partially imported and partially produced locally to meet the rate of consumption.

Biomass

In Figure 2, local biomass production is specified. Most of the biomass weight produced comes from forestry while only a small part comes from agriculture. Within agriculture, most of the produced biomass is used to feed animals for meat, milk and eggs.

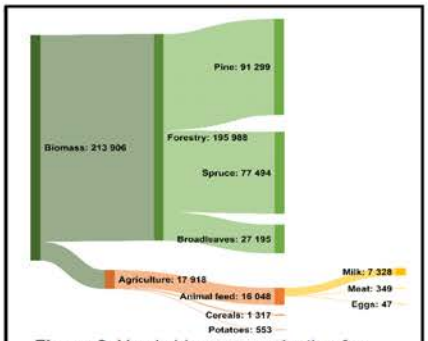

Figure 2. Yearly biomass production for consumption in the municipality of Östersund by industry and product, in tonnes

Energy

The distinction between the energy use in different sectors and different sources of energy is made in Figure 3. It shows how energy production in Östersund is dominated by renewable sources except when it comes to the transport sector.

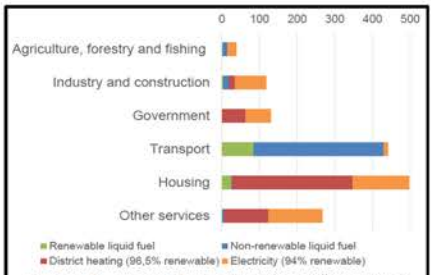

Figure 3. Energy use in the city of Östersund per sector and energy source in 2019, in GWh.

Discussion & conclusion

The material and energy flow analysis is a useful tool to better understand the major flows needed to maintain the city in its current state. This study starts to reveal the major flows of that type. The literature review shows that it can be used as the bigger picture, to which decisions in the different sectors of the city must relate, e.g. the impact of suggested circular flows, urban planning initiatives, or sustainable development policies and suggestions in general. Together, the large-scale assessment and the small-scale solutions can create a meaningful picture.

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Emiel Driessen, Nathalie Burdová and Erik Grönlund,
Department of Ecotechnology and Sustainable Building Engineering
Mid Sweden University

16/5/2022

1. Sustainability and Science

1c. Assessing sustainability

Abstracts

Assessing Stakeholder Engagement in Non-financial Reporting: Evidence from companies listed on the Italian stock exchange

Dr. Saverio Petruzzelli, Prof. Francesco Badia

University of Bari Aldo Moro, Bari, Italy

Abstract

Non-financial reporting is a fundamental aspect of the organizational learning process toward sustainability in the business context (Stolowy & Paugam, 2018). Among the necessary requirements for the realization of advanced practices of non-financial/sustainability reporting, there are stakeholder engagement and materiality analysis. Stakeholder engagement (Noland & Phillips, 2010) implies the process of involving an organization's stakeholders in understanding their interests and consequent information needs. Therefore, stakeholder engagement is recognized as a fundamental accountability and responsiveness mechanism, which implies the involvement of the subjects interested in the organization's activity, aimed at identifying and replying to their problems, expectations, and concerns, connected with sustainability. By performing effective stakeholder engagement, organizations can gather the necessary information to identify significant stakeholder issues, thus allowing a materiality analysis (Khan et al., 2016) of relevant information to be disclosed in sustainability reporting. The principle of materiality implies that the disclosure of non-financial information leads to highlighting those topics that have significant economic, environmental, and social impacts, or substantially influence stakeholder assessments and decisions. In this sense, materiality can represent a sort of beacon in the evaluation processes of sustainability strategies and their effectiveness (Whitehead, 2017). Stakeholder engagement and materiality analysis are strictly interconnected and find their theoretical reference in stakeholder theory (Freeman, 1994; Donaldson & Preston, 1995).

Starting from these premises, the purpose of this work is to investigate the quality of disclosure in the stakeholder engagement process. The research method utilized an assessment model based on 12 variables identified from an academic literature review and from the most common international sustainability reporting standards. Then, a specific system of indicators was identified for each variable. The disclosure quality assessment scores were obtained through the development of a content analysis (Krippendorff, 2018) on the non-financial statements published by companies listed on the Italian Stock Exchange.

The results reveal that during the stakeholder engagement process, the fundamental principle of inclusivity envisaged by stakeholder theory was not fully respected and observed. Moreover, the research shows lights and shadows regarding aspects such as reporting balance and impartiality, description of the impacts, and their corresponding influence on stakeholders, which appeared to be worthy of further investigation.

Supplementary information: Reference to SDG(s). Primary reference: SDG 12—Responsible consumption and production, Target 12.6; secondary references include SDG 8—Targets 8.5 and 8.8; SDG 12—Targets 12.2 and 12.5.

Relation to the conference topic. The connection of this work with the general conference theme lies in the research's attempt to highlight how sustainable development paths can be implemented by companies only in the presence of effective stakeholder engagement strategies and analysis of their effects on the system of stakeholder decisions. In this sense, the work seeks to promote a new "cultural" approach to the concept of sustainability in organizations based on the assessment of sustainability strategy effectiveness.

Track

Track 1c Assessing sustainability

Assessing the Impact of Circular Strategies at the Company Level: Design and validation of the SCEIA framework (Strategic Circular Economy Impact Assessment)

Erik Roos Lindgreen[1], prof. Roberta Salomone[1], Prof. Tatiana Reyes[2]

[1]University of Messina, Messina, Italy. [2]UR INSYTE, Troyes, France

Abstract

Companies require assistance in assessing the sustainability of circular solutions prior to strategic decisions on their introduction. This article proposes and validates an ex-ante, holistic circular economy (CE) assessment framework SCEIA (Strategic Circular Economy Impact Assessment) at company level, using a mixed-methods approach. First, the framework's normative core and objectives are formulated. A critical literature review method is used to position this article's view that CE, as a concept, is valuable only when contributing positively to all three dimensions of SD. Secondly, a descriptive literature review of previously applied methods in CE assessment is used to design the framework's basic methodological structure, matching its previously defined normative core and objectives. The selected methods comprise a combination of the existing methods of Life Cycle Assessment (LCA), Life Cycle Costing (LCC), Social Life Cycle Assessment (S-LCA) and Material Flow Analysis (MFA). The number of resulting indicators can subsequently be tailored to the company's goals through a materiality assessment (MA). A Multi Criteria Decision Analysis (MCDA) TOPSIS approach is optional to assist in decision-making. Thirdly, the procedure of using the framework in a decision-making process at the strategic level is made explicit by connecting it to existing strategic decision-making frameworks and specifying its application routine. As a final step, the framework is validated through a dual triangulation process, consisting of an expert panel survey and online practitioner focus groups with companies. The expert panel consists of eleven CE assessment experts both from the academic realm as well as the private sector. Their input functions mainly as validation of the framework's objectives and methodological setup, while focus groups with eight companies provided insights into its practical feasibility. The triangulation process leads to various revised characteristics, which are reported on together with any potential contrasting inputs. The final SCEIA framework is designed to deliver valuable insights into the impacts of company-level CE activities. It has a modular structure and is applicable to companies with different levels of experience with assessment while preventing trade-offs and burden shifting.

Track

Track 1c Assessing sustainability

Drivers and Barriers to Organizational Learning in Non-Governmental Organizations contributing to the Sustainable Development Goals

Ms. Gillian Martin Mehers

Radboud University, Nijmegen, Netherlands

Abstract

Non-governmental organizations (NGOs) are important social actors and recognized for their diverse contributions as a sector to social development and to the Sustainable Development Goals (SDGs). They are, however, challenging to understand as a phenomenon. It is often problematic to refer to them in aggregate, as they are an extremely diverse set of organizations, and as such, hard to generalize, making the 'NGO' complex to study. Indeed, they are often categorized by what they are not – not government, nor business.

NGOs need to navigate an increasingly complex, dynamic and often unpredictable environment to survive and to achieve their social goals. This changing environment has prompted for many NGOs a move into new territory in terms of strategy, management practice, and organizational structures, as they shift towards hybridization and social enterprise models in search of their own sustainability. Organizational learning is connected in academic literature to improved performance and competitiveness, as well as adaptation to change. In spite of the (near) agreement of authors of the benefits of organizational learning for NGOs, there has been relatively little empirical research on the processes that could drive the adoption and effective use of organizational learning to help NGOs adapt to changes outside their organization and strengthen their outcomes.

This research paper aims to elucidate the drivers and barriers to organizational learning for NGOs in the sustainability sphere. To do so, both the drivers and barriers for organizational learning are analyzed. Then, a conceptual framework for understanding organizational learning in NGOs is presented. Building on a survey of NGOs and their external and internal stakeholders which yielded 206 responses from 155 unique organizations, factor analysis brings to the fore four key attributes that help explain outcomes: leadership, culture, capacity, and structure. Among these, the data suggest the latter two play the greater role in whether or not an NGO is perceived to be a learning organization. Finally, implications of these findings for facilitating organizational learning in NGOs are discussed.

Track

Track 1c Assessing sustainability

The Pareto Checklist for Sustainable Development

Mr Max Rosvall

Quality science, Visby, Sweden

Abstract

A sustainable development is the main concept capturing the grand process of achieving a good life for all while remaining a healthy planet. Since the early definition of the concept in Stockholm 1972 at the United Nations Conference on the Human Environment (UNCHE), it has always had the well-being of people in focus. With the inclusion of the future generations of people, the planet becomes the second main focus for sustainable development. However, with the increasing pressure from consumers and civil society the notion of sustainability has become a safe-haven for decision makers due to the ambiguity of the concept. Without any universal definition of the state of sustainability, the creation of narratives that goes ahead and harden the inherently unsustainable status-quo prompting for business as usual is of course present. In challenging this narrative, we can draw support from the scholarly field of quality applying a pragmatic approach with a focus on processes and fact-based decision making.

Building on the matrix Sustainability Opportunity Study (SOS), this paper complements previous research in guiding the identification and selection of key stakeholders and impacts for sustainable development. This is done with a focus on processes and applying a fact-based decision-making model. The pareto principle is used to filter out the few vital impacts and going beyond previous research by Isaksson et al (2015) a checklist with vital threats and opportunities for sustainable development is derived from frameworks like Planetary Boundaries, Agenda 2030 and the system principles from the framework for strategic sustainable development. We will focus people and planet to derive key stakeholders for which a needs-based approach is used to map out key sustainability impacts. The iterative nature of the SOS study calls for the framework to provide a second, third and Nth set of key performance indicators for sustainable development. This is not done in previous research, and remains as a challenge for future work.

Track

Track 1c Assessing sustainability

Triple Loop Learning in Environmental Management Practice: Evidence of the RedES-CAR dissemination program

Ms. Silvia Correal, Dr Bernardas Van Hoof, Msc Joan Salcedo

Universidad de los Andes, Bogota, Colombia

Abstract

Environmental management practice includes the processes related to the organizational changes meant to improve the environmental performance of a firm. Advanced levels of organizational learning involve cultural changes, also identified as triple loop learning. The purpose of this research is to evaluate the outcomes and conditions of triple loop organizational learning process occurring in companies that participated in a cleaner production dissemination program in Colombia. Literature on triple loop learning in environmental management practices provided a framework of analysis. Mixed research methods included regression analysis and empirical data comes from the RedES-CAR program, including 500 firms of which 45 identified triple loop learning and interviews with project leaders of firms evidencing triple loop learning in cleaner production implementation. Outcomes operationalize triple loop learning through newly develop cleaner production practices. Conditions on TLL, include information exchanges among participants and leadership of decision makers. This research adds to literature by using empirical data of how companies advance triple loop learning in the cleaner production practice. In addition, it determines factors supporting triple loop organizational learning in environmental management. Moreover, it further provides recommendations for managers involved in environmental management practice in firms and provide guidance for the design and development of dissemination programs aiming at cultural changes in firms.

Track
Track 1c Assessing sustainability

Using Meadows' Leverage Points as a Tool to Assess Effective Sustainability Impacts

Dr Giulia Sonetti

CENSE, Lisbon, Portugal

Abstract

The environmental crisis, in its current and dramatic global extension, may perhaps be the decisive stimulus for a radical transformation of sustainability science. To be able to carry out an ecological and cultural revolution, a new, impact-focused approach must then be transdisciplinary and transformative, through the assumption of individual and collective responsibility, a long-term scenario and socio-political empowerment.

But what does it mean to have an impact and provoke a systemic shift?

The aim of this research is to test meadows' leverage points theory as a tool to assess the efficacy and the impacts of transformative interventions described in the sustainability active research literature. We first tailored the implementation of every leverage points in accordance with our field of study; then, we made a search on Scopus and Web of Science databases to code the results via an algorithm in Python to select and cluster a final corpus of 77 papers suitable for our scope. Finally, we ranked those items looking at the outcomes of academic practices and their shallow/deep leverage potential in a Sankey diagram, to understand which factors really affected the success of the sustainability project. Most of the examples related to what Meadow considered "deep leverage points", i.e. leading to a systemic change of rules, assessment methods, and goals of an institution. Results show that interventions declare ambitious aims just added something new to stable systems, not hindering the system itself if not accompanied by a follow-up and tangible actions. Conclusions highlights that though many projects are aimed to touch deep leverage points for a complete paradigm shift of education, the collaboration between institutions and external stakeholders must be improved. Furthermore, teachers and researchers designing an intervention must reflect on how to create also a bottom-up perspective, changing the role and the relation between teachers and students and non-academic actors in transformative learning processes. Research also suggests paying attention to clear communication of results, quantitative and/or qualitative should they be, for an effective successful sustainability process.

Track
Track 1c Assessing sustainability

Full papers

Environmental Impact of Maritime Means of Transport: A case study of maintenance activities in ferries

Giovanni Mondello[1], Roberta Salomone[2], Francesco Lanuzza[3], Giuseppe Saija[4], Teresa Maria Gulotta[5]

[1]*Department of Economics, Sustainability Lab, University of Messina, Messina, Italy, giovanni.mondello@unime.it*

[2]*Department of Economics, Sustainability Lab, University of Messina, Messina, Italy, roberta.salomone@unime.it*

[3]*Department of Economics, Sustainability Lab, University of Messina, Messina, Italy, francesco.lanuzza@unime.it*

[4]*Department of Economics, Sustainability Lab, University of Messina, Messina, Italy, giuseppe.saija@unime.it*

[5]*Department of Economics, Sustainability Lab, University of Messina, Messina, Italy, tegulotta@unime.it*

Abstract

The maritime sector is considered one of the most important contributors to the international and European economy. The European Commission highlighted that among the identified seven sectors that include all the main blue economy activities, maritime transport, the activities of the port, and shipbuilding and repair contributed about 40% to the total added value of the blue economy, in 2019. In addition, although shipping is currently deemed the most low-carbon way of cargo transportation, its environmental impacts increased during the last years, requiring additional improvements oriented to increase its performance. This is particularly true when the whole life cycle of a maritime means of transport is considered, including design, shipbuilding, operation, maintenance, and end of life. The Life Cycle Assessment (LCA) method has been widely adopted for assessing the environmental charges related to the maritime sector, particularly focusing on the assessment of ships. Despite this, few studies have been performed for evaluating the maintenance and repair activities. Besides, among the international scientific literature, there is a lack of inventory data specifically focused on ship maintenance. In this context, the study here presented aims to assess the potential environmental impacts connected to the maintenance activities of a Roll-on/Roll-off (Ro-Ro) ferry, through the application of the LCA method, by first analysing the maintenance processes as an overall, considering the amount of steel used in the hull and superstructure carpentry and the electricity consumed (System A), then, by specifically focusing on the hull maintenance and related processes (System B). In addition, the study provides a dedicated inventory related to such maintenance activities. Two functional units were defined to satisfy the aim of the study, in particular, "the extraordinary maintenance of the Ro-Ro ferry implemented during 47 days" for System A, and "the replacement of the damaged hull structures during the Ro-Ro ferry maintenance carried out in 47 days, resulting in 3.28 m^2 replaced surface" for System B. System boundaries were defined for both the systems by following a "cradle to gate" approach. Foreground data were collected through a shipping company operating in Italy, while background data were obtained using dedicated databases. The main results highlight that for both the systems under consideration the input of steel is responsible for the highest environmental impacts. For example, the 450.75 kg of steel used to replace 3.28 m^2 of damaged hull surface accounts for 1,364.17 kg

System B, the higher environmental impacts are caused by the welding and painting activities. The results also allow pointing out the need for alternative materials as substitutes for the steel used in shipbuilding as well as the necessity of analysing the maintenance phase in addition to the operation one when different means of transport are compared.

Keywords: ferry, cargo ship, Life Cycle Assessment (LCA), environmental impact, maintenance

1 Introduction

Nowadays, the maritime sector represents the core of the international economy being involved in 80% and 70% of the international trade, respectively, by volume and by value (UNCTAD, 2018). Focusing on the European context, among the main blue economy activities identified by the European Commission, maritime transport and related systems and services contributed 40% to the total added value of the blue economy in 2019 (European Commission, 2021). Despite maritime transport being considered the *most carbon-efficient mode of transportation*, with particular reference to cargo transport (European Commission, 2021), its related greenhouse gas (GHG) emissions increased from 977 to 1,076 million tonnes, between 2012 and 2018 (IMO, 2020). Thus, actions oriented at reducing and monitoring the environmental impacts caused by the transport sector are required. In this context, the Life Cycle Assessment (LCA) may be considered a robust and valid method for evaluating the environmental consequences of maritime transportation as well as for identifying strategies oriented at improving its environmental performance. According to Mondello et al. (2021), LCA has been widely adopted in this regard, specifically focusing on the assessment of the life cycle phases of maritime means of transport, i.e., shipbuilding, operation, maintenance, and end of life. The international scientific literature shows that most of the LCA studies specifically focus on the assessment of the operation phase (Mondello et al., 2021) by comparing, for example, different types of marine fuels (e.g., Perčić et al., 2020). On the contrary, few LCA studies focus on the assessment of the environmental impacts associated with maintenance activities. For instance, Wang et al. (2018) analysed the environmental and economic impacts of a ship hull specifically focusing on steel maintenance and coating in order to identify an optimal hull maintenance strategy. Furthermore, due to the huge amount of information and data related to ship maintenance activities, the LCA method is commonly applied by mainly using data obtained through formulas, estimations, and literature, instead of primary data for which the collection may be demanding. Besides, ship maintenance can be considered, on the one hand, a fundamental activity in maritime transport, ensuring travel security, efficiency and cost reduction and, on the other, an activity requiring remarkable amounts of materials and energy sources which may result in high environmental impacts.

In this context, this study aims to evaluate the potential environmental impacts connected to the maintenance activities of a Roll-on/Roll-off (Ro-Ro) ferry, operating in Italy, by implementing the LCA method. In particular, two different hot-spot analyses are performed. First, an evaluation of the environmental performance associated with the materials and energy sources, in terms of steel used for the carpentry of hull and superstructure, and electricity consumed during the whole maintenance activity, is carried out (System A). The choice of only assessing, as material, the steel focusing on carpentry, and thus

cargo ship. Then, the specific assessment of the hull maintenance is carried out by considering the amount of steel as input and all the related processes (e.g., cutting, welding, painting, etc.). Consequently, a Life Cycle Inventory (LCI) mainly based on primary and measured data related to the investigated Ro-Ro ferry maintenance activities is also provided.

2 Methods

In this section, first, the characteristics of the investigated ship are reported, and then the LCA method and related data used for carrying out the study are described.

2.1. The investigated Ro-Ro ferry

Table 1 reports the main characteristics of the naval unit under investigation, which is represented by a Ro-Ro ferry, operating in Italy, used for the maritime transportation of wheeled vehicles (i.e., trucks) and passengers. In contrast with the Lift-on/Lift-off type, in the Ro-Ro ships, the vehicles are loaded and uploaded by rolling instead of being moved by cranes (Kim et al., 2007).

Table 1. *Main characteristics of the investigated ship.*

Type	Roll-on/Roll-off; passenger
Passengers (max)	300
Load	340 m
Length	97 m
Engine	4x MAN D2842LE408 736 kW
Propeller	4 x Aquamaster Azimut Propeller
Hull surface	1527 m^2
Operation place	Italy
Maintenance place	Italy

Ferries are constantly subjected to maintenance activities including the refurbishment/restoration or substitution of the ship components as well as carpentry, washing, and painting processes. The investigated ferry is subjected to two different kinds of maintenance activities: a) ordinary, which occurs every month and is commonly performed without suspending the transport services, and b) extraordinary, which is carried out every two years, mainly on dry-dock. The extraordinary activity implies the inspection and maintenance of all the ship: i) engines and propellers, ii) outfitting, iii) valves, pumps, and pipes, iv) structures (i.e., hull, and superstructure).

2.2. The Life Cycle Assessment method

In order to satisfy the aim of the study here presented, the environmental performance of the analysed ship maintenance activities has been evaluated by implementing the LCA method. LCA is a standardised method that allows assessing the potential environmental impacts of a product, process, or service throughout its whole life cycle, from raw material extraction, through manufacturing, transport, use and final disposal (ISO, 2006a; ISO, 2006b). This method is characterized by four iterative phases, i.e., goal and scope definition, life cycle inventory

2.2.1. Goal and scope definition

LCA method was applied to assess the environmental performance related to an extraordinary maintenance activity of a Ro-Ro ferry by analysing two different systems. First, the assessment was focused on the amount of steel installed and removed during the carpentry activities carried out on the ferry structures (i.e., hull and superstructure) as well as on the electricity consumption for the whole maintenance process (System A). Then, the hull maintenance has been specifically analysed focusing on the processes involving the substitution of steel structures and the painting (System B).

Two different functional units (FUs) have been identified for both the investigated systems, respectively considering: i) "the extraordinary maintenance of the Ro-Ro ferry implemented during 47 days**"** for System A, and ii) "the replacement of the damaged hull structures during the Ro-Ro ferry maintenance carried out in 47 days, resulting in 3.28 m^2 replaced surface" for System B. System boundaries were defined following a "cradle-to-gate" approach, thus from the acquisition and production of raw materials and energy sources to the time in which the maintenance activities are completed and the ship is ready to be launched. In particular, for System A the system boundaries include the electricity used during the whole maintenance, from dry-dock to the launch of the ship, as well as the steel used to repair the damaged ship structures, considering both the hull and the superstructure. Whereas, for System B the system boundaries refer to all the carpentry and painting processes implemented during the hull maintenance, i.e., cutting, beveling, welding, washing, and spray painting as well as to the related inputs (e.g., steel, water, paint, etc.). System boundaries for both systems are graphically represented in Figure 1.

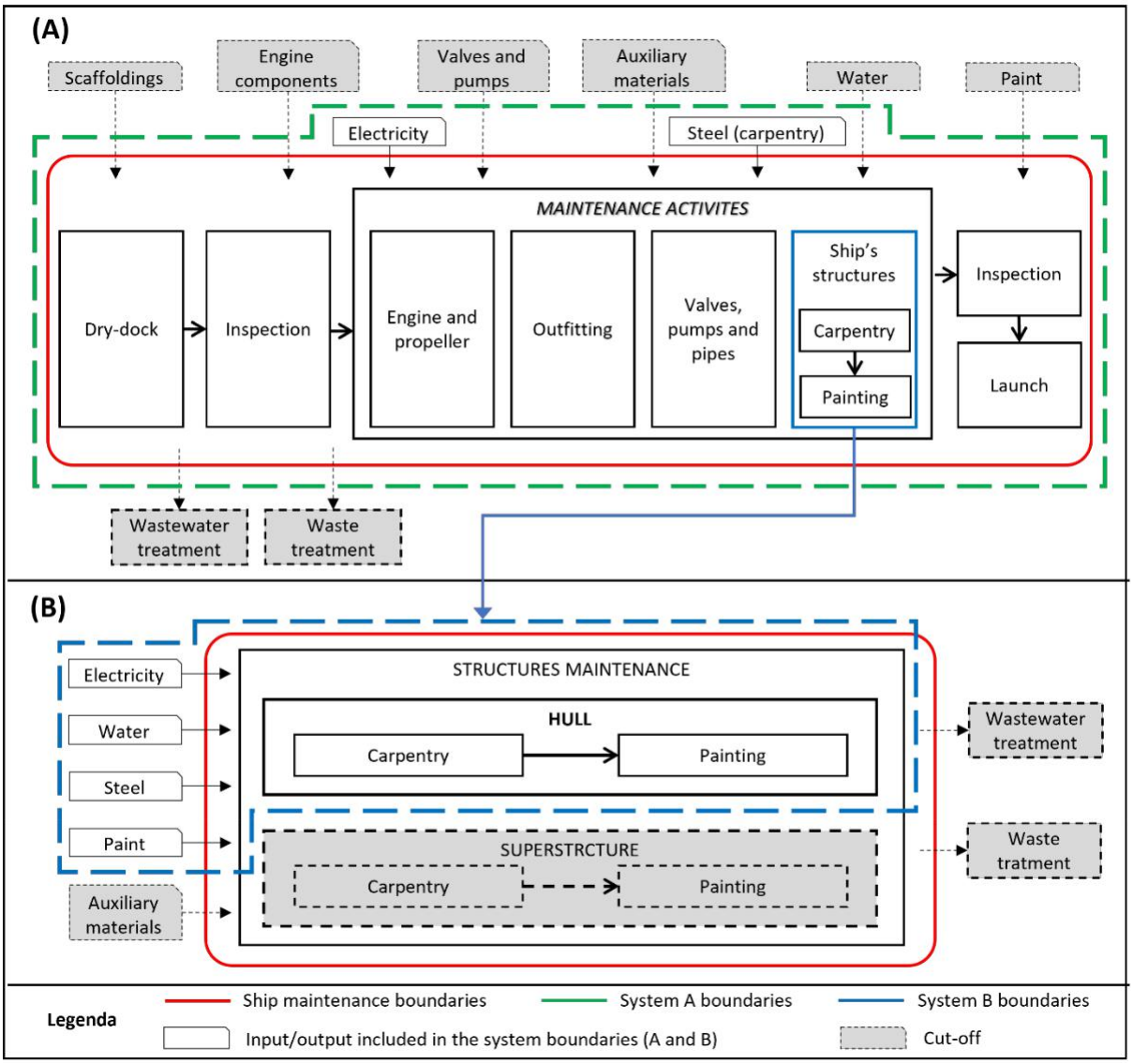

***Figure 1**. Analysed system boundaries for System A and System B.*

Cut-off criteria were defined by excluding processes and related input and output for which the assessment was not necessary because outside the scope of the present study (e.g., engine components, water, etc.), while, other processes were omitted due to the lack of specific information and inventory data (e.g., auxiliary materials in System B). Furthermore, infrastructures were also omitted from the analysis.

2.2.2. Life Cycle Inventory

The LCI phase has been carried out by using both primary and secondary data. In particular, primary data were obtained through questionnaires and direct interviews submitted to the company owner of the investigated Ro-Ro ferry. On the contrary, secondary data were gathered by dedicated databases (Ecoinvent 3.8 – Moreno Ruiz et al., 2021). Table 2 shows the main inventory data used for analysing the investigated systems, while table 3 reports the description and characteristics of the different processes implemented during the hull maintenance in System B. As reported above, for System A, only the amount of steel used for carpentry has been considered, while for System B, the processes of steel production and sheet modelling were accounted in addition to the amount of steel as an input.

System	Input/Output/Process	Unit	Amount	Data Source
A	Steel (carpentry)	kg	1,659.39	Measured data; Ecoinvent 3.8
	Electricity	kWh	2,774.00	Measured data; Ecoinvent 3.8
B	Steel (raw)	kg	450.75	Measured data; Ecoinvent 3.8
	Steel sheet (modelled)[a]	kg	405.68	Measured data; Ecoinvent 3.8
	Cutting	m	8.20	Measured data; Ecoinvent 3.8
	Beveling (electricity)	kWh	16.40	Calculated data; Ecoinvent 3.8
	Welding	m	43.80	Measured data; Ecoinvent 3.8
	Washing (water)	L	450.00	Calculated data; Ecoinvent 3.8
	Washing (electricity)	kWh	17.50	Calculated data; Ecoinvent 3.8
	Painting	m^2	6.56	Measured data; Ecoinvent 3.8

[a]10% of the raw steel (45.7 kg) is loss (as scrap) during sheet modelling (company communication).

Further information reporting the description and characteristics of the different processes implemented during the hull maintenance in System B are shown in table 3.

Table 3. *Activities carried out for hull maintenance in System B.*

Process	Description	Material/Equipment	Hull surface treated per hour[1,2,3]	Number of operators
Cutting	Removal of the damaged steel sheet from the hull	Oxy-fuel (oxyacetylene gas) cutting	10 m/h	1
Beveling	Edge refinement of the cut surface in order to make it ready for the subsequent welding	Angle grinder	1 m/h	1
Welding	Positioning of the new steel sheet and related welding to the hull	Metal wire/Gas Metal Arc Welding (GMAW) – MIG/MAG (ISO, 2019)	5 m/h	1
Washing	Cleaning of the repaired surface in order to remove impurities	Water/Industrial pressure washer	25.4 m^2/h	4
Painting	Coating the new steel sheet with two layers of painting in order to provide anticorrosive and antifouling protection	Antifouling silicone paint / airless spraying pump	509 m^2/h	4

[1]Direct communication by the company; [2]Amounts related to a steel sheet of 14 mm thickness; [3]The reported amounts are related to the number of operators carrying out the maintenance activity.

2.2.3. Life Cycle Impact Assessment

The potential environmental impacts related to the systems under consideration (System A and System were assessed by using SimaPro 9.3 software (PRé Sustainability, 2021) by applying the CML-IA baseline 3.07 method which includes ten different impact categories, specifically, abiotic depletion, abiotic depletion (fossil fuels), global warming (GWP100a), ozone layer depletion, human toxicity, freshwater aquatic ecotoxicity, marine aquatic ecotoxicity, terrestrial ecotoxicity, photochemical oxidation, acidification, and eutrophication. This method was selected because, on the one hand, it includes the most relevant impact categories to be considered for maritime context (Ling-Chin and Roskilly, 2016), on the other, it allows

3. Results and Discussion

In this section, first, an overview of the results related to System A is reported, and then a detailed analysis of the environmental impacts caused by System B and the related processes is provided.

3.1. System A

Figure 2 shows the contribution analysis related to System A, per each of the selected impact categories. The results highlight that the steel used for carpentry in System A causes the highest potential environmental impacts in all the investigated impact categories. Indeed, its percentage contribution ranges from 97.9% (6,024.48 kg 1,4-DB eq per FU) in freshwater aquatic ecotoxicity to 50.9% (1.25E-04 kg CFC-11 eq per FU) in ozone layer depletion. The high environmental impacts caused by steel are due to the production process for which secondary data from Ecoinvent 3.8 database were used. Regarding electricity, the results show that the main impacts (where percentage contribution is higher than 30%) are related to ozone layer depletion, abiotic depletion, acidification, and terrestrial ecotoxicity. Depending on the impact category considered the contribution of electricity depends on its production or distribution. For example, for ozone layer depletion the highest impacts are connected to the transport of natural gas through onshore pipelines.

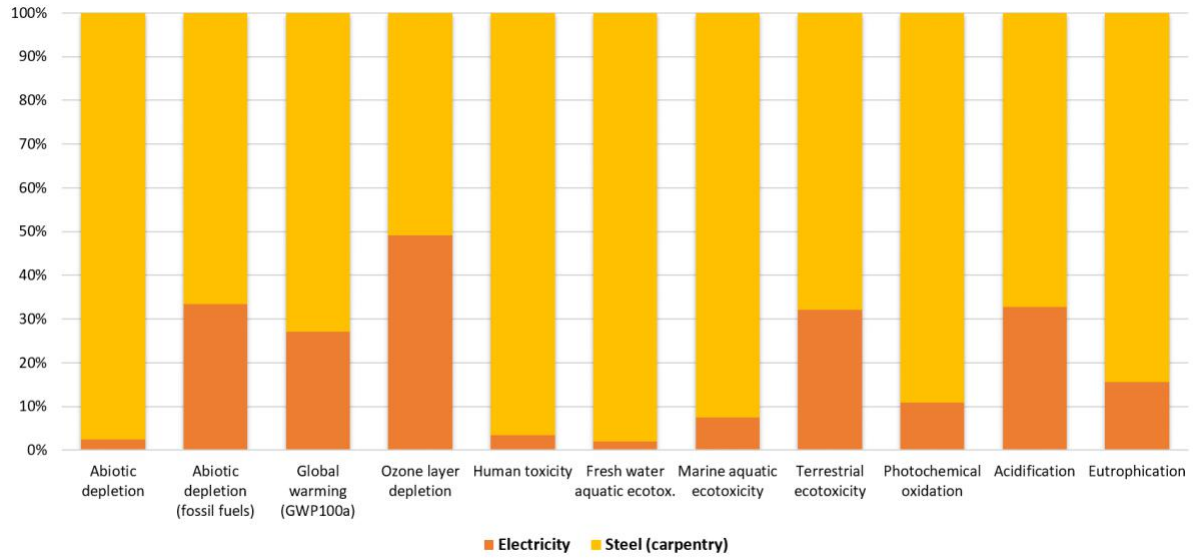

***Figure 2**. Contribution analysis of System A (CML-IA baseline – characterisation).*

The results here presented also point out the higher weight in terms of contribution to the environmental impacts connected to the use of steel in the Ro-Ro ferry. Indeed, despite the amount of steel considered in System A is only related to the carpentry activities, thus excluding the steel used in other maintenance processes (e.g., pipes, outfitting, etc.), it causes the highest contribution to the impacts when compared to the electricity consumption, for which data are representative for the whole ship maintenance.

3.2. System B

The overall assessment of the environmental impacts related to System B is reported in table 4. Focusing on global warming (GWP100a), which represents the most important impact category to be evaluated in maritime transport (Czermański et al., 2020), the hull maintenance of the investigated Ro-Ro ferry causes 1,364.18 kg of CO_2 eq per FU. Considering that maritime transport represents the most environmentally friendly mode of cargo transportation in terms of GHG emissions (European Commission, 2021), the results here presented underscore the need of analysing all the life cycle phases, including also the maintenance, when diverse means of transport are compared, instead of only evaluating the operation phase (e.g., fuel consumption, emission due to wear, etc.). This is particularly true considering that, on the one hand, the extraordinary and ordinary maintenance activities can extremely vary between different means of transport (e.g., truck, train, ship, and aircraft), on the other, those activities occur many times during vehicle lifetime.

Table 4. *Potential environmental impacts of System B* (CML-IA baseline – characterisation)

Impact category	**Unit**	**Total**
Abiotic depletion	kg Sb eq	2.13E-03
Abiotic depletion (fossil fuels)	MJ	14,312.88
Global warming (GWP100a)	kg CO_2 eq	1,364.18
Ozone layer depletion	kg CFC-11 eq	8.53E-05
Human toxicity	kg 1,4-DB eq	1,587.85
Freshwater aquatic ecotoxicity	kg 1,4-DB eq	3,537.47
Marine aquatic ecotoxicity	kg 1,4-DB eq	1.02E+07
Terrestrial ecotoxicity	kg 1,4-DB eq	1.40
Photochemical oxidation	kg C_2H_4 eq	0.55
Acidification	kg SO_2 eq	4.03
Eutrophication	kg PO_4^{---} eq	2.65

Figure 3 reports the percentage contribution of the processes implemented in hull maintenance as well as of the steel production and sheet modelling. The identified findings are in line with the ones obtained for System A, indeed, also in System B, the impacts associated with steel production and modelling contribute more than 90% to all the analysed impact categories (e.g., 1,364.17 kg CO_2 eq per FU in terms of global warming). Furthermore, the highest environmental impacts due to steel production and modelling are related to maritime aquatic and freshwater aquatic ecotoxicity, contributing 99.6% and 99.5% to the overall environmental impacts, respectively.

***Figure 3**. Contribution analysis of System B (CML-IA baseline – characterisation).*

An in-depth analysis highlights that the higher impact of sheet modelling caused in maritime aquatic ecotoxicity (table 5) is due to the electricity and heat used during the metalworking process. On the contrary, steel production results in higher impacts for photochemical oxidation, human toxicity, and global warming impact categories. This higher contribution, in comparison to the sheet modelling, is caused by the blast furnace process and, in particular, by the liquefied pig iron used in steel production.

***Table 5.** Potential environmental impacts of steel production and sheet modelling in System B (CML-IA baseline – characterisation).*

Impact category	Unit	Steel production	Sheet modelling	Total
Abiotic depletion	kg Sb eq	1.88E-04	1.88E-03	2.07E-03
Abiotic depletion (fossil fuels)	MJ	6,978.98	6,854.15	13,833.13
Global warming (GWP100a)	kg CO_2 eq	713.61	616.03	1,329.64
Ozone layer depletion	kg CFC-11 eq	3.39E-05	4.71E-05	8,10E-05
Human toxicity	kg 1,4-DB eq	985.11	562.28	1,547.39
Freshwater aquatic ecotoxicity	kg 1,4-DB eq	1,636.47	1,882.19	3,518.66
Marine aquatic ecotoxicity	kg 1,4-DB eq	1.98E+06	8.14E+06	1.01E+07
Terrestrial ecotoxicity	kg 1,4-DB eq	0.26	1.14	1.40
Photochemical oxidation	kg C_2H_4 eq	0.40	0.15	0.55
Acidification	kg SO_2 eq	2.08	1.95	4.03
Eutrophication	kg PO_4^{---} eq	1.37	1.28	2.65

Regarding the different processes involved in hull maintenance, figure 4 and table 6 respectively show the results in terms of contribution analysis and environmental impacts (absolute values). In particular, welding and painting represent the processes causing the main contribution to the impacts, instead washing is responsible for the lower environmental charges.

***Figure 4**. Contribution to the environmental impacts of the processes investigated in System B (CML-IA baseline – characterisation).*

From the analysis of each process emerges that the highest environmental impacts related to welding activities are identified in abiotic depletion, human toxicity, terrestrial ecotoxicity, and fresh water and marine aquatic ecotoxicity, for which the percentage contribution to the overall impacts ranges from 96% to 49.1%. Specifically, the higher impacts related to these categories are due to the steel wire used to weld the new sheet to the hull. Besides, the main impacts attributed to the painting process, in ozone layer depletion abiotic depletion (fossil fuels), and global warming, are due to the electricity consumed by the airless spraying pump. As for the painting, electricity use is also the major contributor to impacts caused by the beveling process. Lastly, both cutting and washing are the activities to which the lower environmental impacts are connected, contributing to less than 10.6% in all the impact categories analyses.

Table 6. *Potential environmental impacts of the maintenance processes in System B (CML-IA baseline – characterisation).*

Impact category	Unit	Cutting	Beveling	Welding	Washing	Painting	Total
Abiotic depletion	kg Sb eq	2.25E-08	1.08E-07	5.24E-05	3.04E-08	2.04E-06	5.46E-05
Abiotic depletion (fossil fuels)	MJ	3.13	76.28	72.68	21.01	306.64	479.75
Global warming (GWP100a)	kg CO_2 eq	0.54	5.80	6.85	1.60	19.75	34.54
Ozone layer depletion	kg CFC-11 eq	1.20E-08	7.10E-07	3.25E-07	1.96E-07	3.08E-06	4.32E-06
Human toxicity	kg 1,4-DB eq	4.28	0.77	29.97	0.22	5.22	40.46
Freshwater aquatic ecotoxicity	kg 1,4-DB eq	0.21	0.75	13.17	0.21	4.46	18.81
Marine aquatic ecotoxicity	kg 1,4-DB eq	8.54E+02	3.51E+03	1.96E+04	9.72E+02	1.47E+04	3.96E+04
Terrestrial ecotoxicity	kg 1,4-DB eq	0.01	2.71E-03	0.08	7.49E-04	0.01	0.11
Photochemical oxidation	kg C_2H_4 eq	2.31E-04	1.08E-03	2.65E-03	2.97E-04	3.64E-03	0.01
Acidification	kg SO_2 eq	1.26E-03	0.02	0.03	0.01	0.06	0.12
Eutrophication	kg PO_4^{---} eq	9.51E-04	0.01	0.02	1.76E-03	0.02	0.05

4 Conclusions

This study aimed to analyse the potential environmental impacts of the maintenance activities of a Ro-Ro ferry, operating in Italy, through the LCA method. Two different systems were investigated to obtain the environmental profile related to the materials and energy sources respectively used during the ship maintenance as a whole (System A) and the specific maintenance of the hull (System B). For System A the analysis was focused on the total amount of electricity consumed during the whole maintenance of the ship, as well as on the steel used for carpentry activity carried out in the steel structures of the ship (i.e., hull and superstructure). For System B the analysis was performed by considering the amount of steel in input, the steel sheet modelling and all the processes implemented during the hull maintenance (e.g., cutting, welding, painting, etc.).

The main findings from the analysis allowed highlighting that the higher contribution in all the selected impact categories was related to the steel used to repair the damaged ship structures, in both the investigated systems. This result is in line with Garfield (2018) who highlighted the higher impacts connected to steel structures and, in this regard, the increasing need for more environmentally friendly materials (e.g., fibre-reinforced polymers) in cargo shipbuilding, specifically for the construction of the hull and the superstructure. Focusing on System B, the results underscored that the impact in terms of global warming caused by the maintenance of 3.28 m^2 hull surface (representing only 0.2% of the whole surface of the investigated Ro-Ro ferry) was equal to 1,364.18 kg of CO_2 eq. In this context, despite shipping being considered the most carbon-efficient mode for cargo transportation, its comparison to other means of transport (e.g., truck, train, etc.) should not only be limited to the operation phase but it should be performed by analysing all the life cycle phases, thus also including the maintenance activities that, as resulted from this study, are responsible for high environmental impacts.

Regarding the processes investigated in System B, the main contribution to the impacts was connected to the use of steel wire for the welding activities, as well as to the electricity consumed by the equipment used for the painting process.

Lastly, considering the lack of dedicated inventory data to be used for assessing the maintenance activities or maritime means of transport, the present study allowed to provide useful data mainly gathered from primary sources that may be useful for researchers and ship-owners who want to perform a similar analysis.

Future research should be oriented toward assessing the whole maintenance activities of a cargo ship by also including the amount and type of materials used to repair the engines, outfitting and other ship components. This would allow obtaining a complete picture of the environmental performance related to the whole activities that occur during the maintenance of a cargo ship. In addition, the life cycle thinking approach should be adopted to analyse all the costs related to ship maintenance activities including the costs related to externalities. In this context, the application of the Life Cycle Costing method would further help ship-owners in decision-making processes.

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Sustainability as Societal Value & Cultural Fact: A framework for value accounting

Swaminathan Ramanathan[1]

[1]*Uppsala University, swaminathan.ramanathan@angstrom.uu.se*

Abstract

The World Economic Forum (WEF) & the International Business Council (IBC) in its key 2020 whitepaper on Measuring Stakeholder Capitalism put forward two concepts of Value Accounting and Dynamic Materiality. According to WEF, these two concepts are the foundation of a new 'form of capitalism' where a stakeholder is conceived to be as important as the owner. In the longer run, these concepts are expected to augment and potentially replace the two existing and well-established concepts of Revenue Accounting and Materiality. Revenue Accounting in simple terms is Profit & Loss (P&L) and Return of Investment (ROI) that is aggregated in the form a balance sheet: the main documentary evidence of formal financial reporting. It is the basic building block of all business models. Materiality is an accounting concept used for financial reporting. Materiality for sustainability reporting derives its inspiration from the same concept and is today largely operationalised through GRI's 'cradle-to-grave' materiality framework and the resultant Scope 1, 2, & 3 emissions accounting. Organisations have traditionally struggled with comprehensively measuring Scope 2 & 3 emissions, with Scope 3 emissions constituting as much as 98% of the emissions of many large companies that are tightly coupled to global supply chains. Sustainability materiality assessment has always been a challenge for companies. Now, with rapid climate change bringing to the fore the fact that sustainability reporting and assessment in its current form is neither sufficient nor adequate to help combat global warming, the spotlight is firmly on companies to stop 'greenwashing' their environmental, social and governance (ESG) footprints. WEF's Stakeholder Capitalism and its two pillars of Dynamic Materiality and Value Accounting can be considered a response to the criticism of 'greenwashing', yet they are also a further challenge to the already struggling companies to understand, define and measure their ESG footprint as per the concepts of Dynamic Materiality and Value Accounting. The authors explore three conceptual themes. The first is the theme of 'Stake' in Stakeholder Capitalism. For stake to be understood and defined in any practical manner for companies, there is need for an overarching assessment framework. The second is the theme of value. For value to be accounted for in the same or least equivalent manner as revenue it needs to be quantified in a manner that makes it comparable to revenue. In short, value needs a common foundation for understanding, defining, and measuring it. The third is the theme of materiality. For materiality to be conceived as a dynamic entity, there is scope to look at metrics and measures as part of a processes rather as an output or an outcome. The authors will engage in an initial manner with the Process Based System Model (PBSM) to lay out a case that sustainability can be conceived as a set of inputs, processes, and outputs. In conclusion, the authors argue that a Value Accounting framework will need to be deeply anchored to societal values and cultural foundations for sustainability to genuinely become part of daily life.

1. Introduction

Theoretically and conceptually, we do not have a common understanding and definition of sustainability. By extension, there is a lack of a common measurement framework of and for sustainability. As a result, sustainability can appear to be clear or blurred depending on one's domain, the key disciplinary boundaries, and its vantage points. Within the domain of social sciences an anthropologist, for example, may as a matter of theoretical approach and methodological training approach any issue of sustainability as one of practices of daily life of people and communities. Similarly, within the domain of natural sciences an evolutionary biologist, for instance, may approach sustainability as a key issue of microenvironments, biodiversity protection and ecological carrying capacity. There is no shared bridge for an anthropologist and an evolutionary biologist to come closer and evolve a comprehensive understanding and definition of sustainability. In such an environment sustainability quickly becomes a contested term, with sustainability being defined either in very broad terms of a worldview requiring a radical transformation or within an extremely narrow spectrum of solutions requiring a series of incremental transitions.

The one potentially useful way to approach sustainability in such contested environments is to functionally define it for a limited purpose of treating it as starting point for an enquiry into the key question of a practical understanding of sustainability for key user groups. Our paper uses this approach for the key user group of companies. From the vantage point of today, as a here and now moment, it is easy to agree that we are not sustainable globally. We currently use yearly the production of about 1.8 planets to satisfy our needs; with Sweden requiring as much as 4.3 planets to sustain its quality of life (Living Planet Report, 2022). We have crossed several planetary boundaries in areas such as climate change, novel entities, and loss of biodiversity (Steffen et. al., 2015; Persson et. al., 2022). The only way for us to understand, define and measure sustainability in a practical manner is to understand, define and measure unsustainability of today. In short, sustainability can only be understood as a bipolar opposite of unsustainability; or as a new equilibrium state for an existing system-of-systems (Snowden and Boone 2007; IBM, 2011) whose current state of equilibrium is misaligned with the required equilibrium of the Earth system (Steffan, Rockström, Richardson et. al. 2018).

Within this definitional context, there are three key developments that need to be highlighted. The first is connected directly to the future of Sweden. On April 7, 2022, Sweden became the first country in the world to commit to a Consumption-Based Emissions target (Sveriges globala klimatavtryck, 2022). Sweden's decision represents a concrete challenge and clear opportunity to researchers for evolving an integrated framework for measuring sustainability that simplifies reporting for companies and institutions. Currently about 60% of Sweden's emissions are released in countries that produce goods and services consumed in Sweden (ibid). Such emissions are not accounted for as part of Sweden's climate impact since carbon calculations are based on territorial-based or production-based emissions accounting

based emissions accounting framework (Lenk et. al. 2021; Bhattacharya, et. al. 2020) or a global shift to a consumption-based emissions accounting framework (Chen, et. al.

2018). There is also emerging work that is recommending emissions pathways to be framed within the boundaries of a "climate-social system" (Moore, et. al., 2022). Sweden's decision to adopt a consumption emissions target inclusive of the climate impact of its exports, emissions from flights and cargo ships comes in the immediate context of humanity's unsustainability: a fundamental disequilibrium of the anthropogenic system.

The second is connected to the state of the planet. The IPCC AR6 report released on April 4, 2022 clearly points out that limiting global warming to around 1.5° C of the pre-industrial levels as agreed and ratified by countries who signed the Paris Agreement requires not only the Greenhouse Gases (GHG) emissions to peak before 2025, but also to be reduced by 43% by 2030. Additionally, the report warns of a methane gas reduction by a third in the same period (IPCC, 2022). The primary sources of Carbon, GHG and methane gas are human [anthropogenic] activities, which largely are the result of an 'input-throughout-output' value creation processes of industries and companies. Global Co2 emissions [Co2eq], however, have increased from 24 billion tonnes in 2010 to 40 billion tonnes in 2021 (IEA, 2021). Five activities of electricity generation, construction, industry, transportation, and agriculture contribute to over 90% of carbon and GHG emissions. Across those activities, only 40 indicators need to improve for meeting climate goals, and none are currently set to meet their 2030 targets (Boehm, Lebling et. Al. 2021: State of Climate Action 2021). In short, humanity's unsustainability of a fundamental disequilibrium of the anthropogenic system, can now potentially be set in the direction of a new state of equilibrium more aligned to the earth system if the focus is only on 40 indicators [an application of the Pareto principle of prioritisation and choice].

The third is connected to the 1987 Brundtland Commission's key definition of Sustainable Development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' and the 17 Sustainable Development Goals (SDGs). The SDGs with its 169 targets (indicators) are technically supposed to be met by 2030. Available evidence seems to indicate at best, and broadly so, that some SDGs (like SDG9 on industry innovation and infrastructure) are doing better than others (like SDG1 of No Poverty [US$1.90 or less in a day]). To practically achieve the Brundtland Commission's definition of sustainable development at the very least requires the SDGs to be comparable. Comparability requires a theoretical and methodological framework for understanding, defining, and measuring sustainability not just in an integrated manner, but in a manner that is accessible and available to everyone as a shared 'societal value and cultural fact' (Appadurai, 1986; Rosling 2018). A secondary literature review by the authors on keywords "sustainability reporting" "climate change" and "SDGs" found 156 articles, with 73 in "Environmental Science", with 50 in Green Sustainable Science Technology. The result is indicative of a research gap in the field of integrated sustainability measurement and reporting systems that adequately covers Environmental, Social and Governance (ESG) as per the principles of Triple

Development and its practices; and particularly as part of a global efforts to 'reimagine capitalism from an ecological, environmental, politicoeconomic and social lens' (Banerjee and Duflo, 2019; Hendersson, 2020; Vollrath, 2020; Hickel, 2020).

2. Value and Stake: Theoretical Foundations and Practical Gaps

Without anchoring 'value' and 'stake' to a context and its system boundaries, the two terms can become diffused in terms of how it is understood and defined. For this paper, value and stake are positioned within the context of companies and their activities and our current system boundaries of socioeconomic and political processes. Additionally, the two terms are also anchored to Stakeholder Capitalism of WEF and the two concepts of Value Accounting and Dynamic Materiality. From the perspective of an existing theoretical foundation, there is robust body knowledge already available for reference. There is large amount of academic work that argues organisations should move towards a model focussed on sustainable value that 'balances the 3Ps of People, Planet and Prosperity' in its business model, operations and creation of profit and equity. (Edmans, 2020, Magill et al. 2015, Mayer 2018, Schoenmaker & Schramade, 2019, Stout (2012). There is also empirical evidence that by producing a public purpose and a consequent public good [as opposed to a private good] an organisation will create a long-term competitive advantage (Hart & Zingales, 2017). Deriving from the body of work focussing on purpose and sustainability, there is an emerging body of work that focuses on the power of the stakeholders, particularly consumers, to change the behaviour of organisations and companies through their choices, including the choice to exclude behaviours, companies, and products from buying decisions (Kitzmueller & Shimshack, 2012; Besley & Ghatak, 2007).

A stakeholder approach is often considered to be the foundation of "stakeholder theory" (Laplume et.al., 2008), which itself borrowed heavily from strategic management, organisation and systems theories and corporate planning. Stake and stakeholder became important concepts as the social and environmental impact of a company's activities connected to its production and distribution became prominent. The need to document a company's non-financial impact on the larger society led to research that mapped those with a stake [aka stakeholders] and 'their relative importance' to a company. The 'decomposition method of the parameters' (Pallavicini, 1968), for instance, is still the foundation for calculating the ethical, moral, social, cultural, and environmental dimensions of a company's activities, now largely referred to as Corporate Social Responsibility (CSR). Recent research in stakeholder theory has been followed two strands: one focussing on the 'inside out' view of the companies and its operations and the other focussing on the 'outside in' perspective of stakeholders and their connection to the power. The 'inside out' perspective is best exemplified by the work "moral or philosophical guidelines for the operation and management of the corporation" (Donaldson and Preston, 1995). This theoretical approach argues that a company's operation can be understood in three ways. The first is descriptive, where the characteristics and behaviour of firms can be explained in terms of management styles, board or directors and relationship of corporate constituencies like investors and shareholders. The second is instrumental, where data is used to identify

for better profitability and overall efficiency. The third is normative, where the 'moral core' of the firm is identified for purpose [and prosperity] rather than only profit.

The 'outside in' perspective of stakeholder theory (Mitchell et. al., 1997) focuses on identifying the stakeholders within a typology that is based on attributes of power, legitimacy, and urgency. Power is defined as the ability of a stakeholder to impose their will on a particular relationship, legitimacy as the degree of social acceptance and urgency as the acceptance of the stakeholder's claims of time sensitivity. Friedman and Miles (2002) combine these three attributes as a set of 'compatible-incompatible' binaries and identifies eight types of stakeholders, including traditional ones like customers and owners and newer ones like employees and non-government organisations (NGOs). Aligning the stakeholder theory closer to the systems theory [particularly from system-of-systems perspective and the Cynefin framework] has been a growing body of work that also segments stakeholders into normatively legitimate stakeholders, those to whom an organisation hold a legal, economic and moral obligation and derivatively legitimate stakeholders, who derive their status from their ability to affect and influence the organisation or its normatively legitimate stakeholders (Mansel, 2013; Freeman and Moutchnik, 2013; Phillips, 2003). Further, from an empirical perspective of understanding the connection between SDGs and organisations and companies, as a set of stakeholder maps, for example, the work of Rosati and Faria (2019a) use data collected from 2,413 companies in 90 different countries. Their research covers country-level institutional factors that influence the adoption of SDGs in companies' non-financial reporting, such as political and legal, economic, and financial, social, and cultural, technology and innovation, education and labour, and sustainability.

The robust theoretical and conceptual work on sustainable value creation and stakeholder management has not truly translated into any measurable or practical environmental, social and governance (ESG) impact at the ground level. Stake and value, ideally and as per theory, should have co-balanced each other to create a 'virtuous system-of-systems' that would have equitability in terms of wealth generation, income distribution, overall quality of life for all people on the planet and without significant harm to the environment: a key definition of sustainable development as per the 1987 Brundtland Commission report. The lack of such an expected progress is most visible in the steadily rising global Co2eq emissions, a key metric for climate change and global warming. Though close to 96% of 500 of the world's largest companies release their annual sustainability reports, the global Co2eq emissions has steadily increased from around 24 billion tonnes in 2010 to close to 41 billion tonnes in 2021 (IEA, 2021). In short, there seems to be no direct correlation between the increasing quantity and sophistication of sustainability reports and global Co2eq emissions. One of the key expectations of theories of TBL and CSR was that increased focus on metrics and measurement will lead to results. All available evidence indicates that expectation has not been fulfilled in any realistic manner. Simply put, then, there is a gap between theory and practice.

3. Bridging the Materiality Gap: Stakeholder Capitalism and Dynamic Materiality

This gap has been recognised by the corporate world, with some like billionaire hedge fund owner Chris

others like Blackrock CEO Larry Fink referring to 'stark reminder of our fragility – that it has driven us to confront the global threat of climate change more forcefully and to consider how, like the pandemic, it will alter our lives' (Larry Fink, 2021)[2]. It is not immediately self-evident, yet the gap manifests itself in the real world as a materiality challenge. A concrete example is how materiality is instrumentally used to define sustainability as a series of exclusions – also called as negative screenings – can be found in the category of socially responsible investment. According to the Global Sustainable Investment Alliance, nearly two out of every three dollars classified as socially responsible investment are in negative screen fund where the main criteria of including them are from a series of explicit exclusions (say, tobacco or firearms). Such investment funds may be attractive from a market segmentation perspective, but it does very little to track, promote, or reward ESG impact. A 2020 study by Barclay's looked at two decades of ESG investing and found no difference between the holdings of

sustainable and traditional funds, and an investigation by the Wall Street Journal revealed that eight of the 10 biggest ESG funds in 2019 were invested in oil and gas companies. The main problem is that the business idea is normally not included in conceptualisations of sustainable value creation or stakeholder interest and growth. This gap is directly reflected in the GRI standards where value is reported as revenue exemplified by Disclosure 201-1 "Direct economic value generated and distributed". This means that it does not matter from which business the economic value comes from. It could be guns or baby food. The Global Reporting Initiative's (GRI) framework for materiality assessment that is used by majority of companies for their sustainability reporting needs to understood better. The concept of materiality comes from the financial domain. For an auditor, materiality is the determination of the significance of a financial transaction or a discrepancy within a financial statement. The aim of a financial audit is for the auditor, as an independent third party vested with fiduciary responsibility, to endorse that a financial statement covers "all material respects in conformity with the reporting framework of Generally Accepted Accounting Principles (GAAP)." (IFRS, 2022; IASB, 2022). A key materiality principle is that an "accounting standard can be ignored if the net impact of doing so has such a small impact on the financial statements that a user of the statements would not be misled." (IFRS, 2022; IASB, 2022). Translated into an accounting rule, it gives the third-party auditor the flexibility to exercise judgement in deciding if a transaction is material or not.

GRI's materiality assessment framework seeks to mimic the audit and accounting framework for sustainability reporting with two critical pieces missing: an integrated set of sustainability standards similar to GAAP, and a policy, legal, regulatory and governance ecosystem tightly aligned to mandatory compliance and benchmarking. The lack of these two critical pieces positions both the principles of Triple Bottom Line (TBL) – Cradle-to-Gate – and the key materiality framework derived from it – GRI's Scope 1, 2 & 3 disclosure standards for GHG emissions accounting – as a terrain of subjective judgement: companies pick and choose standards and what to report. The authors, at the risk of oversimplification, consider this challenge as akin to the financial community making both the key principles of GAAP – revenue accounting for instance – and the key materiality framework derived from it – balance sheets, profit

Hohn that can be articulated thus: *Materiality assessment today is accurately accounting only for Scope 1 emissions with some degree of accuracy for Scope 2 emissions and practically no accounting for Scope 3 emissions.* Now, including the business idea and putting a stakeholder value on it is no simple task since it requires materiality to be envisaged as a filter of inclusion rather than exclusion.

It is this inclusive filter of materiality that underpins WEF's Stakeholder Capitalism. The concept of Stakeholder Capitalism has existed in some form or another for close to fifty years. In a simple way, it can be understood as a bipolar opposite to Milton Friedman's concept of Shareholder Capitalism, where shareholder value was paramount. Shareholder value is today represented by profit and loss statements and balance sheets, together constituting revenue accounting. Stakeholder Capitalism focuses on creation of long-term stakeholder value, with the shareholders being one of the several stakeholders of customers, employees, suppliers, local community, society, and environment. Klaus Schwab, who proposed the concept of Stakeholder Capitalism, and has been instrumental force behind the WEF's Davos Manifesto 2020 explained Stakeholder Capitalism thus:

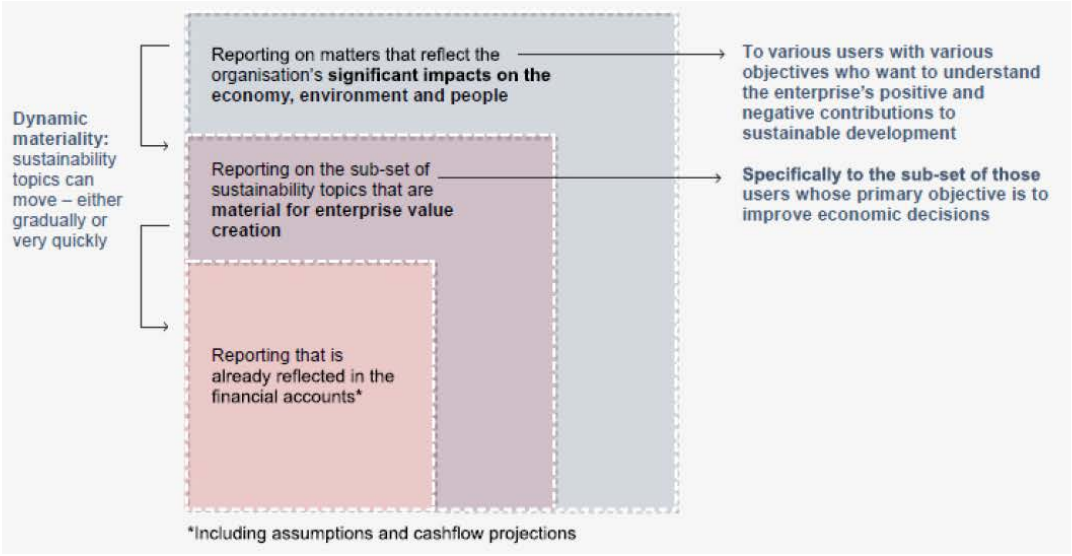
Advocates of shareholder capitalism had neglected the fact that a publicly listed corporation is not just a profit-seeking entity but also a social organism. Together with financial-industry pressures to boost short-term results, the single-minded focus on profits caused shareholder capitalism to become increasingly disconnected from the real economy. Many realize this form of capitalism is no longer sustainable.

Conceptually, such a definition transforms a company from a mere wealth generating unit to one that 'fulfils societal and human aspirations, clearly measures and fulfils its environmental, social and governance obligations and creates a balanced and equitable system by limiting and benchmarking executive renumeration to all its renumeration levels and to that of society' (WEF, 2020). By extension, then, a company is also one among all stakeholders, and *not the first* among all stakeholders, creating a "level playing field for global citizenship" (ibid). The September 2020 World Economic Forum (WEF) consultation paper captures the subtle expansion of materiality thus:

The rate at which issues that are currently immaterial become material is accelerating. As observed in recent works, the combination of transparency and rising stakeholder influence is, in part, driving this acceleration… in a hyperconnected world, one in which information can be disseminated widely and immediately… the ability to anticipate stakeholder reactions to emerging sustainability issues and how they could affect a business and its performance is therefore critical. Value-creation plans must optimize performance against current and future material ESG issues. The next stage in this evolution will be the introduction of initiatives that aim to improve performance on ESG issues that are likely to be material for a company in the future. Businesses that do this will gain a competitive advantage and investors that select companies taking this approach – or that encourage their management to do so – will benefit.

stakeholders, with over three-quarters of the respondents agreeing that reporting on a set of universal, industry-agnostic ESG metrics would be useful for their company, financial markets, the economy and for the society. The paper suggests 21 core metrics and disclosures and 34 expanded metrics and disclosures, with the core metrics being a curation and integration of established metrics and disclosures from different standards and reporting initiatives. The core metrics focus on activities within an organisation's own boundaries. The core metrics come under the bracket of materiality and covered currently by GRI's Scope 1 emissions. The expanded metrics aggregates 34 metrics and disclosures from several standards and frameworks that have traditionally been neglected but have a wider value chain scope or convey impact in a more sophisticated or tangible way, such as in monetary terms. They represent a more advanced way of measuring and communicating sustainable value creation. The aggregation, integration and expansion of the metrics and disclosures expands the current scope of materiality substantially. In expanding the scope of materiality in this manner (Figure 1), the consultation paper has set in motion key stakeholders, in particular institutional funders, large international investment corporations, to make the new version of materiality as one of the key conditions for accessing any ESG related funding and sustainability funds. It also turns materiality from a static entity, as it stands today, to a dynamic state. The framework of dynamic materiality blurs the boundaries between the GRI Scope 1, 2 & 3 emission capture norms.

Figure 1: Dynamic Materiality

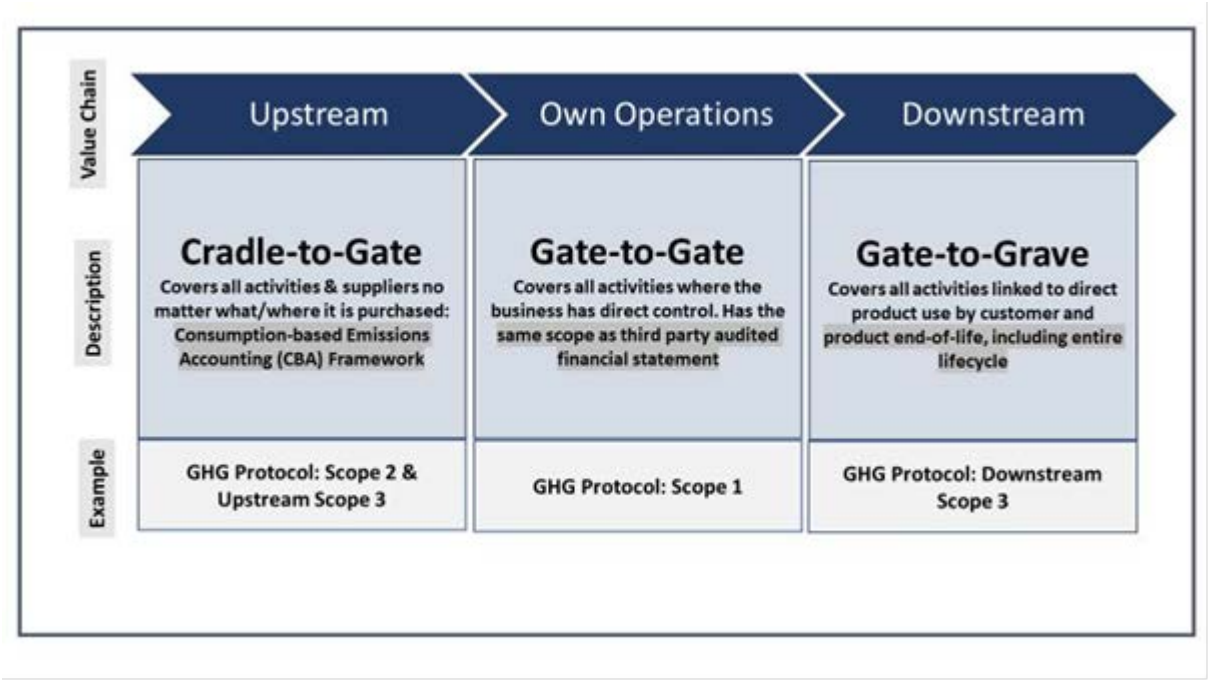


Source: WEF Stakeholder Capitalism & Davos Manifesto, 2020

4. The Connection between Dynamic Materiality & Value Accounting

This framework of expanded materiality turns the current understanding of materiality as a static entity, which is how materiality is interpreted today in form of Scope, 1, 2 & 3 disclosure norms, to a state that is dynamic and open to the possibility of continuous change and adaption. Dynamic materiality, as this expanded materiality is often referred to, means two concrete things. The first is that the concept of cradle-to-grave is now segmented into three parts, with each part interconnected to each other: cradle-to-gate, gate-to-gate and gate-to-grave. Additionally, each of these parts are to be put through a value accounting framework (Figure 2) that quantifies the value that each part generates in relation to climate impacts (VBA, 2022)[3].

Figure 2: End-to-End Value Chain Value Accounting



Source: Value Balancing Alliance (VBA), 2022

What this means in practical terms for those directly engaged with sustainability reporting is that they must adopt a value chain approach, at least at the bare minimum as a starting point, to measure carbon footprint and GHG emissions. The same value chain approach must be overlaid on the social and governance dimensions and parameters directly connected to value creation and value addition at each link of the value chain. The second is an explicit acknowledgement that what investors, shareholders, institutions, government, and regulatory bodies consider to be material environmental, social and governance issues will change over time.

[3]Please see: https://www.value-balancing.com/ [Retrieved on 28-01-2022]

One specific case in point is the microplastics in oceans and other waterbodies. The second case in point is the increasing amount of antibiotic resistance and endocrine disorders among the general human population as result of its indiscriminate use in meat and poultry industries.

Dynamic materiality is not something completely new. It has evolved from the concept of double materiality that in simple terms means that materiality is a two-dimensional entity: not only should material topics connected to the enterprise value of a company be reported, measured, and quantified, but also material topics emerging from a company that impact the environment and society should also be reported, measured, and quantified in a comparable manner. In theory double materiality was expected to bring together an organisation's positive impact in terms of profits, growth, jobs, livelihoods, and shareholder value with its negative impact on the society and planet in terms of traditional livelihood loss, sociocultural impact and ecological and environmental damage in an integrated manner and with a common impact score.

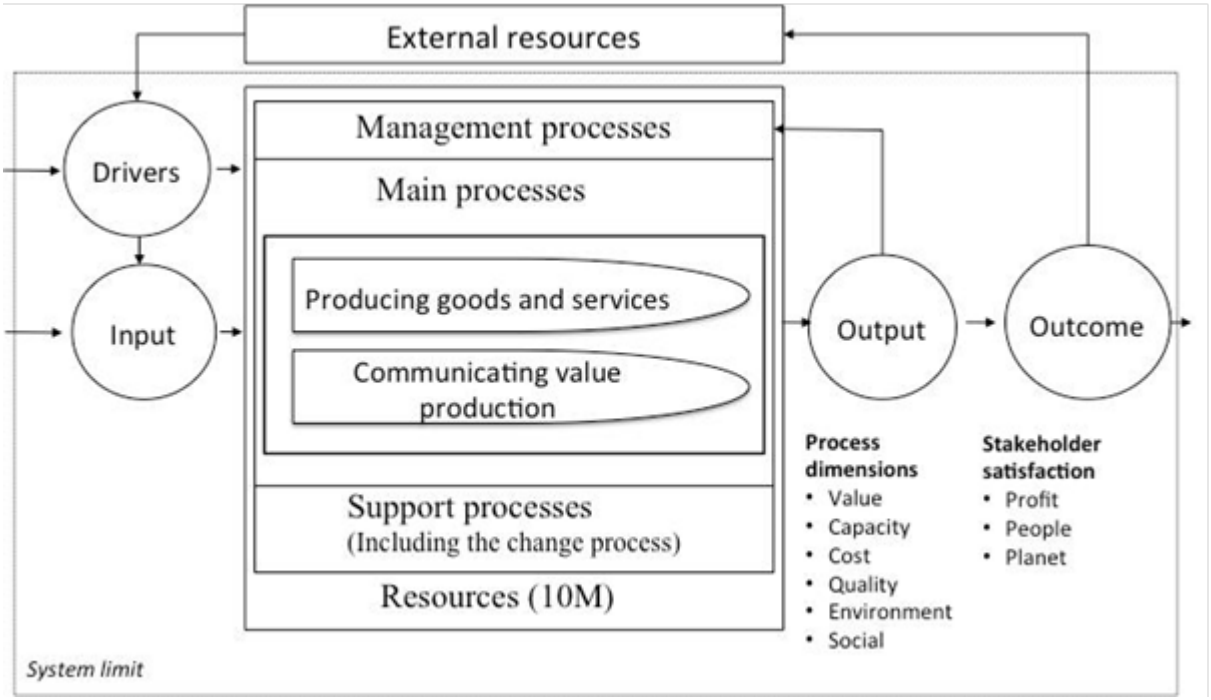
materiality analysis of the enterprise's impact on society and environment. A significant case in point is the proposal adopted by the European Commission in April 2021 to replace the Non-Financial Reporting Directive (NFRD) with the Corporate Sustainability Reporting Directive (CSRD) to make sustainability reporting on par with financial reporting. This makes third-party audit mandatory and on par with financial reporting. The new requirements become effective by January 2023 and sustainability reports as per new standards will have to be submitted by companies in 2024[4].

5. The Process Approach: Engaging with PBSM for Value Accounting

The key distinction between materiality and dynamic materiality is the focus on processes. Traditional materiality assessment was typically a method of exclusion [what is not material], while dynamic material is a process of continuous inclusion [what all is material] with end-to-end value chain mapping [cradle-to-gate] becoming the key foundation. A process-based approach helps understand cause and effect within organisational boundaries (as a key inside out view), and the degree to which they are related to each other. From a value accounting perspective, a Process Based System Model (PBSM) (Isaksson, 2006, 2016) allows for the identification of key system boundaries, specific external resources, main drivers, inputs, management, main and support processes [including activities, tasks, and sub-tasks], outputs, outcomes, and impact. Additionally, there are internal resources [10M] already available within the PBSM for value mapping to done at every level [Figure 3].

[4]Please see: https://www.iflr.com/article/b1w5p4mgfw070q/from-the-nfrd-to-the-csrd-long-story-short [Retrieved on January 24, 2022]

Figure 3: Process-Based System Model



Source: Isaksson, 2016

For dynamic materiality to be converted into a value accounting requires a framework that could capture all relevant steady state parameters across multiple scenarios. Such parameters, additionally, need to be understood and defined from the perspective of value creation. All value creation comes with a certain harm production. Value accounting is a way of understanding, defining, and measuring the balance between value creation and harm generation; to the extent that the ultimate expectation from value accounting is that it will provide everyone with a common shared value/harm framework to understand what kind of productive activities are ideal for creating and maintaining a balance between People, Planet and Prosperity. In short, what *pr*ocesses turn an input into a value-added output and outcome and how much harm does that value creation cause across the 3Ps of People, Planet and Prosperity. PBSM has the potential to provide that framework. PBSM allows the possibility of cross-tabulating multiple factors to evolve an integrated value/harm calculation. For the purposes of illustrating the potential utilisation of PBSM for value accounting from just an input-processes-output perspective, one can take a textile factory in Bangladesh. Giving an able-bodied person in Bangladesh a job in a textile factory is a value, but if the job requires that person to work with hazardous chemicals without protection or exploits that person in any other way, it can be deemed as harm [1P=People]. Using the same logic, if the person is also working with cotton that has not been sourced appropriately, in addition to working with hazardous chemicals without protection, then the harm is multiplied. Alternatively, if the cotton has been sourced appropriated and the famer paid fairly, and the person who in the textile factory is working directly with the cotton is also paid as per globally accepted standards and norms and is not exploited and given adequate protection, then the value is multiplied in the same way vested shareholder value multiples as per current equity norms in stock markets. Similarly, if the same textile factory is using groundwater from the local community for its operations it

and takes conscious part in water recharge and local aquifer regeneration activities then it is value [2P=Planet]. Again, using the same logic, if the factory owners earn megaprofits with rest of the workers and other employees earning a fraction of what the owners earn, then it is harm for overall prosperity, but if the profits of the company are shared in an equitable manner with the employees and to other communities where such activities take, while also contributing to, environmental and economic development, then it is value [3P=Prosperity]. A similar logic, from a value accounting perspective, can also be applied to drivers as well as external resources.

6. Discussion

Sustainability will become a clear and shared societal value only when the trade-offs and incentives of an overall system-of-systems is aligned towards a value accounting framework that starts treating all stakeholders as defined by WEF, and that includes environment, with an equal invested stake. There is a need to move from an actor-network model to a stakeholder model for an 'outside in' inclusive management model. An actor will act only when there is an incentive to act. For example, to smoke a cigarette is an act or to not smoke one is also an act. A person may decide not to smoke a cigarette because it degrades personal health and those around us. In short, the person's awareness about the ill-effects of cigarette is a strong incentive. It is an incentive that is vested in the person as also those around him. An actor will act for constructive improvement only when there is a stake. In short, an actor becomes a stakeholder only when there is a mechanism for the actor to act: capacity to act backed by a capability to act is what makes a stake. For stakeholder capitalism to succeed, sustainability needs to become a societal value and a cultural fact. A value needs a value accounting framework, which in turn needs a process-based approach to understand what value is created in which manner so that the harm generated as result of the value creation is both balanced and compensated in an accountable manner. PSBM has the potential, and needs to be explored for understanding, defining, and measuring sustainability as a societal value and cultural fact.

7. Conclusions

The paper is an initial attempt to engage with the questions of sustainability, materiality. and value accounting. The paper is also part of larger effort to understand the similarities and the potential synergies between quality science and sustainable development as part of continuing research on Quality for Sustainability (Q4S). A stakeholder needs perspective is necessary for sustainability to be operationalised and the Sustainable Development to be measured as per the definition of the Brundtland Commission report. Stakeholder Capitalism expands the notion of capitalism and brings into the fold of stakeholder framework both environment and ecology as equal and key stakeholders as customers, employees, suppliers, and local communities. Additionally, the change in the approach to materiality, from one accounting focused exclusion to one of measurement driven continuous inclusion, is a radical change, allowing for factors that are not even considered to be material at present [for example, massive and irreversible coastal flooding due to climate change] to become part of materiality. Additionally, dynamic materiality provides for such factors to move up and down the scopes, with such factors currently outside system boundaries become

work needed on engaging with PBSM within the developments in Stakeholder Capitalism, Dynamic Materiality and Value Accounting. The ultimate aspiration, and expectation, is to evolve a framework that allows for sustainability to become a shared societal value and a cultural fact.

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Posters

Operationalizing the regional sustainability assessment by indicators
Victor Tomaz de Oliveira, Denilson Teixeira and André C.S. Batalhão

Review of participatory approaches for the development of urban sustainability indicators at local level
Alexandre Cesar Motta de Castro, Denise Maria Penna Kronemberger and JoãoMiguel Custádio Ferrão Neto Simão

Representativeness of life cycle inventory data for olive oil: The Italian case study
Teresa Maria Gulotta

Operationalizing the regional sustainability assessment by indicators

Introduction

Although there are different currents of thought, the precept that sustainability is perceived from different pillars (economic, social, environmental and/or institutional) can support the Sustainability Assessment (SA) process through the use of Sustainability Indicators (SI).

Although applicable at all scales, the use of SI at the Regional level brings particularities that can infer specific obstacles. Some examples were listed by Wallis et al. (2007), Graymore, Sipe and Rickson (2008) and (Coelho et al., 2010).

- selection of indicators aligned with the sustainability vision of the evaluated area;
- the participation of stakeholders;
- accessibility and condition of the data;
- unavailability of georeferenced data;
- dialogue with the objectives of local and national developments;
- others.

Objective: To try to contribute to this debate, this chapter aims to discuss different operational particularities of Regional Sustainability Assessments (RSA) pointing out methodological paths to overcome challenges that we consider fundamental in the operationalization of the assessment.

Sustainability: a multidimensional concept

There is a definition of sustainable development that is widely adopted worldwide, whether in academic or political literature (Purvis, Mao and Robinson, 2019), and was popularized by the United Nations as one that strikes a balance between the needs of the current generation and those of generations future (UNITED NATIONS, 1987). But (Janouškov, 2018) adds that this definition can serve as a springboard for a variety of interpretations. Despite this, this anthropocentric view of SD pointed out by the United Nations, where economic, social and environmental systems are seen separately, but interconnected, is prevalent.

Multidimensionality that supports evaluation

Gibson (2006) considers that this separation in different dimensions can collaborate with the individual capacities of specialists who participate in the evaluation process, it shows confluence with the way in which much of the data are collected separately, in addition to the institutional structure of governments that, generally, , takes place in a sectoral manner. This supports the use and instrumentalization of SI.

RSA operational gaps and methodological paths

Multilevel interaction in ASR: interregional and intraregional.

For **inter-regional** interaction, Ramos (2009) proposes the definition of a Subset of Common Regional Indicators (SCRI) that should be composed of indicators that have as an intrinsic characteristic their availability for all regions within the scope of national governance, but, at the same time, that each region has its own set of main indicators in order to have a high power of communication of sustainability to decision makers. As for **intra-regional** interaction, the definition of a Subset of Common Local Indicators (SCLI) considering the strategic instruments of the municipalities, based not only on common local resources and characteristics, but also on shared objectives and goals.

Stakeholder participation in the RSA

This participation is especially important at regional and local scales because it is precisely at these scales that there is greater proximity between the community, experts and decision makers, which can represent a simpler and more effective interaction. These stakeholders can be public administration agents, private groups representing companies or industries and the general public with community representatives. Thus, it is possible to obtain a set of indicators that are actually relevant and that measure more precisely what is regionally significant..

Geospatial Approach in RSA

- Spatialization of data for the RSA: the SI are fed with environmental and socioeconomic data, however, due to the nature of the information, these data may have different collection methodologies, and may even be represented in different spatial contexts, resulting in geometric formats of different representations. e.g.

In other words, if, on the one hand, social and economic data are almost always collected considering spatial units that have been defined administratively, on the other hand, environmental data come from their own spatial variation.

- **Geospatialized ASR – 4 examples:**

Graymore, Wallis and Richards (2009) generated a regional sustainability index from a GIS-based decision support model. The authors applied limits that were set naturally and not by administrative standards.

Boggia et al. (2018) proposes the application of an RSA model based on a spatial multicriteria analysis. This approach shows promise for regional assessments as it manages to identify the spatial differences in the region.

Victor et al. (2020) developed a sustainability index on a regional scale where the boundaries represent a spatial interaction that goes beyond discrete objects and starts to adopt a characteristic of continuous fields. This was made possible by using geoprocessing tools.

PSSD (2001) proposes to adopt a subdivision of space into discrete squares, that is, into cells.

Conclusion

Although some gaps persist, here we point out some paths found in the literature in order to provide greater potential to ASR, through the use of IS, to influence decision-makers in taking sustainable initiatives.

Victor Tomaz de Oliveira[1], Denilson Teixeira[1], André C. S. Batalhão[2]
[1]UFG – Federal University of Goiás, Goiânia, Brazil
[2]CENSE – Center for Environmental and Sustainability Research, NOVA University Lisbon, Caparica, Portugal

Review of participatory approaches for the development of urban sustainability indicators at local level

Introduction

The literature review of indicators systems for assessing urban sustainability reveal a wide diversity of methodologies, involving different types of stakeholders and participation in their development, being necessary to understand the meanings of participation and it's effective contribution to build assessment tools in which there are a better acknowledge of what to measure and how to measure.

So the aim of this research is to conduct a systematic literature review of participatory approaches for the development of urban sustainability indicators at local level.

Methodology

A systematic literature review in the **Web of Science** data base was conducted during the last 20 years. Based on the literature review about participatory processes and local sustainability assessment tools, it is intended to propose an appropriate design, strategies and research methods for the development of an indicator system for urban sustainability assessment.

Criteria and steps used to search references

The following steps was implemented to search references: i) search in the main collection of Web of Science; ii) use of combinations of key words related to the objective of the study; iii) use key words between quotation marks to find exact match; iv) search documents using the option of *all fields*.

Variables used to analyze results

Identified the studies, the variables used to do the bibliometric analysis of the results were: i) categories from Web of Science; ii) authors; iii) affiliations; iv) editor; v) type of document; vi) year of publication; vii) countries/regions; viii) title of publication; ix) research area. Descriptive statistics was applied to explain the outcomes.

Findings

Although the search was successful in finding excellent quality references related to the research objective, the results show the need to refine the literature review, deepening the content analysis performed and promoting the use of the advanced search resources of the Web of Science to find documents that actually include approaches that link participatory processes to the development of indicators to assess urban sustainability at the local level.

Results from systematic literature review in Web of Science

When the *all fields* option is used in the search for documents, many results are reported in different *areas of knowledge* and *WoS categories* unrelated to the objective of the study, which is attested by the content analysis of the respective titles and abstracts, thus serving as an exclusion criterion for documents.

Results from bibliometric analysis

- Key words "participation" and "assessment tools" have a strong connection and are approached for many authors and institutions.
- Expressive concentration of publications is perceived in the last five years, showing the current relevance of the topics.
- Despite a large number of authors, there are frequent and relevant publications by some researchers.
- Some institutions play an important role in the volume and quality of production.
- Only a few publishers were responsible for the great majority of the publications.
- Less than ten journals published almost half of the publications.
- European and North America countries present a more relevant participation in this research area.

Conclusions

Participation or participatory process are important dimensions/key words to link with sustainability indicators; local level; urban sustainability; assessment tools; sustainability assessment; and local sustainability.

It is necessary further developments, especially using deeper content analysis and advanced search resources to refine the literature review and find more focused and relevant documents that can contribute effectively to the study objectives.

As participation is a theme approached in many different research areas with many different objectives, using it for the design of an appropriate strategy and research methods for the development of an indicator system for urban sustainability assessment require a deeper analysis of the references.

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Search can be done in:
https://www.webofscience.com

Data can be found in:
https://www.dropbox.com/s/q3der7vg7gn9q0s/ISDRS%202022%20-%20Web%20of%20Science%20-%20Final.xlsx?dl=0

Bibliometric analysis

	Key words	No of documents	WoS categories	Authors	Affiliation	Editor	Type of documents	Year of publication	Countries/regions	Title of publication	Research area
A	"participatory"; "urban sustainability"	95	39	291	189	26	5	67,4% since 2017	41	73	28
B	"participatory"; "sustainability indicators"	109	43	419	240	33	5	45% since 2017	53	72	27
C	"participatory" e "local scale"	164	55	749	444	48	5	59,1% since 2017	66	122	42
D	"participatory"; "assessment tools"	131	72	613	350	43	5	51,1% since 2017	45	114	49
E	"participatory"; "sustainability assessment"	144	46	560	307	27	4	54,2% since 2017	48	78	28
F	"participatory; "local sustainability"	25	16	85	62	11	2	56% since 2017	25	20	14
G	"participation"; "urban sustainability"	187	52	572	340	43	5	61% since 2017	56	129	40
H	"participation"; "sustainability indicators"	154	49	547	322	46	5	50% since 2017	63	103	37
I	"participation"; "local scale"	232	78	974	574	68	5	50% since 2017	68	188	58
J	"participation"; "assessment tools"	502	125	2.501	1.193	109	6	53,8% since 2017	62	416	94
K	"participation"; "sustainability assessment"	206	55	736	376	31	4	53% since 2017	59	111	38
L	"participation"; "local sustainability"	60	31	170	123	17	4	55% since 2017	27	52	22

Msc Alexandre Cesar Motta de Castro 1, PhD Denise Maria Penna Kronemberger 2, PhD João Miguel Custódio Ferrão Neto Simão 1, PhD Sandra Sofia Ferreira da Silva Caeiro 2. 1 Universidade Aberta, Lisbon, Portugal. 2 Brazilian Institute of Geography and Statistics (IBGE), Rio de Janeiro, Brazil. Track 1c Assessing sustainability.

CENSE center for environmental and sustainability research

Representativeness of Life Cycle Inventory data for olive oil: the Italian case study

Project aim

The Italian project (PRIN – Progetti di Ricerca di Interesse Nazionale 2017- Prot. 2017EC9WF2, sector ERC SH2, Linea C – financed by the Ministry of University and Research) "Promoting Agri-Food Sustainability: Development of an Italian Life Cycle Inventory Database of Agri-Food Products (ILCIDAF)" aims to develop an Italian database of Life Cycle Inventory (LCI) for some agri-food products (Figure 1).

Figure 1. Agri-food chains analyzed in the ILCIDAF project

Some numbers

The olive oil produced around Europe every year is about 2 million tonnes, divided as in Figure 2.

Figure 2. Statistical analysis from average olive oil produced in EU (a) to olive for oil produced in Italy among regions and data gathered (b)

2. Materials and methods

Functional units:

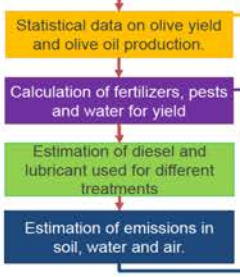
1 hectare (ha) of cultivated land.

System boundaries:

Soil management, fertilizer and pest management, irrigation plants and water consumption, harvesting and pruning olive trees.

Life cycle inventory (LCI):

Each statistical dataset was built by collecting statistical data from databases such as ISTAT and EUROSTAT. Based on olive yields, fertilizers and pesticides are calculated according to regional technical sheets of integrated cultivation of olive trees. While types of machinery for soil management, fertilization, irrigation, mechanical harvesting and pruning are estimated using the Italian agricultural handbook (Ribaudo, 2017). Then, for each contribution, the emissions on soil, water and air are calculated according to Nemecek & Kagi (2007) and Prasuhn V. (2006).



1. Introduction

The Life Cycle Assessment (LCA) is widely adopted for evaluating the potential environmental impacts of agri-food products. In recent years, its application has experienced a growing interest due to the need to develop a sustainable and carbon-neutral agri-food sector. When assessing agri-food products through LCA, it is crucial the use of primary foreground data able to be representative of the specific technological, temporal, and geographic characteristics of the cultivation and production processes. When primary foreground data are not available, the LCA method suggests to model the Life Cycle Inventory (LCI) using secondary data, such as those available from commercial databases (DBs), in which datasets could provide general information on input and output flows among system boundaries. However, several studies identified the current lack of datasets fully representative of the site specificity of the food product under examination.

In this context, this paper aims to show the highest variability of LCI for agri-food products focusing on olive oil production in Italy. A comparison among the 19 Italian regions' olive oil producers is proposed.

3. Results

Examples of data collected for LCI datasets are reported in Figures 3, 4 and 5, showing the standard deviations for olive yields, fertilizing and related emissions among the19 Italian regions' olive oil producers (excluding Valla D'Aosta).

Figure 3. Statistical analysis of average olive for oil yield among regions from 2015 to 2020

Figure 4. Statistical analysis of average fertilization among regions

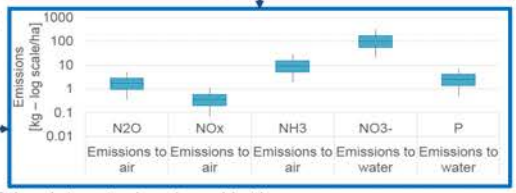


Figure 5. Statistical analysis of emissions generated by fertilization among regions

4. Conclusion

This study presents a partial description of the datasets developed in the project ILCIDAF, highlighting the need to have representative site-specific datasets usable by LCA practitioners to reduce uncertainty in results. The outcomes show that olive production per hectares among regions is about 2 ± 1.21 tonnes. This results in high variabilities of fertilizing inputs that could range from 15.94 (Sardegna) to 101.20 (Trentino) kg of N, from 22.78 to 144,57 kg of P_2O_5, 27.33 to 173.50 kg of K_2O per hectare of cultivated land. Furthermore, these variabilities are also reflected in emissions in air and water, showing the highest variation in NO_3^- emissions (46.80 ± 26.88).

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2. Education

2a. Provision, quality of and access to education

Abstracts

Advancing Care-full Scholarship within the Sustainability Sciences

Professor Alex Franklin[1], Dr Angela Moriggi[2]

[1]Coventry University, Coventry, United Kingdom. [2]University of Padova, Padova, Italy

Abstract

What is care-full scholarship, how is it relevant to the sustainability sciences and how can we teach and learn together about it in a higher education and/ or professional development setting? While as academic staff members we may be fully engaged with our work, how many times have we taken the time, for example, to ask ourselves: 'What, why, and how are we doing research? How do the things we deeply care about influence our teaching practice? In which ways can caring and care ethics help us to change the way we understand ourselves and our interaction with the Earth (Moriggi et al 2020) and prompt us to engage with alternative modes of scholarship?' Beginning with an argument in favour of the potential role of care-full scholarship in furthering sustainability science endeavour, this presentation will then explore how it might be more formally nurtured and enabled in practice. An online open access course, aimed at promoting a care-full scholarship (connectivist) community of learning will be introduced, with session participants given the opportunity to reflect on its relevance and value to their own professional practice as educators, researchers and net-weavers.

Track
Track 2a Provision, quality of and access to education

Marrying Young: The surprising effect of education

Dr. Madhuri Agarwal[1], Prof. Sayli Javadekar[2], Mr. Vikram Bahure[3]

[1]London School of Economics, London, United Kingdom. [2]University of Bath, Bath, United Kingdom. [3]University of Geneva, Geneva, Switzerland

Abstract

In a traditional marriage market, family's preferences and beliefs over bride types play a significant role in matching. In this paper, we study how an exogenous increase in female education, a preferred attribute in the marriage market, affects her age at marriage. The District Primary Education Program (DPEP) launched in India in 1994, provides a regression discontinuity set-up to estimate the causal impact of education. Using Demographic Health Survey (DHS) 2015-16 data, we find that the program leads to an increase in women's education by 0.8-1.5 years. Next, to see the impact of education on age at marriage, we use the program cut-off as an instrument for education. In contrast to the literature, we find one year increase in education leads to a decrease in age at marriage by 0.44 years. Using a simple transferable utility model, we provide a framework for a negative relationship between education and the age at marriage. As educated and young brides are more desirable in the marriage market, educated women are cleared from the marriage market before less educated women. Further, we find that an increase in education leads to a stable match. Finally, we check if the effect of education on age at marriage varies by the availability of an outside option in the labor market. Our results indicate that educated women in high-wage districts on average marry later than the low-wage districts. A 100 rupee increase in women's wages (25 percent of weekly income) leads to a delay in the age at marriage for educated women by 0.1 years.

Track

Track 2a Provision, quality of and access to education

The Role of Dilemmas and Paradoxes in Transdisciplinary Research Settings

Prof. Dr. Marlen Gabriele Arnold

TU Chemnitz, Chemnitz, Germany

Abstract

Transdisciplinary research processes empower fast problem identification and problem structuring, allow direct problem solving in cooperation as well as between science and practice and permit the direct integration in research contexts. Knowledge is generated meeting the complexity of today's problems and includes socially distributed knowledge beyond scientific boundaries. In transdisciplinary learning the Agenda 2030 and the Education for Sustainable Development (ESD) can be addressed, including sustainability competencies for implementing the 17 sustainability goals as well as systemic, inter- and transdisciplinary competencies. Hereby, the whole design process and specific tasks and roles of the researchers are impacted.

Indeed, addressing sustainability real-world problems, the acquisition of ESD competencies and the joint work on practice-related problems and questions by scientists and practitioners or stakeholders face role- and task-related trade-offs, paradoxes and conflicts. Fulfilling diverse activities and roles as researchers in sustainability science are part of transdisciplinary settings. This includes being a change agent, knowledge broker, process facilitator, reflective and self-reflexive scientist. Researchers even have to fulfil additional roles and activities when conducting transdisciplinary teaching together with students in transdisciplinary research contexts.

Therefore, the following questions need to be addressed; Which typical tensions, dilemmas and paradoxes need to be faced by researches in transdisciplinary settings?, and How does the role of the researchers change and goes beyond traditional research settings when operating in transdisciplinary settings surrounded by tensions, dilemmas and paradoxes?.

Using existing analytical frameworks of transdisciplinary research design and added by own teaching and researching experiences, main tensions, dilemmas and paradoxes are investigated and evaluated. The empirical part is based on observations of transdisciplinary settings at academia. Moreover, transdisciplinary research and lecture settings will be analysed and compared by transdisciplinary criteria.

Results show, in transdisciplinary settings, researchers or lecturers are more engaged with addressing poly-contextuality, the consciousness of the innovation paradoxes and the side-effects of ongoing interdependences. They take up multiple roles and have to deal with role ambiguity. Transdisciplinary lecture settings are even more demanding as they also have to meet the mentor role or maintain the students' learning progress.

The research contributes to the SDG 4 for ensuring inclusive and quality education for all and promote lifelong learning. Teaching and learning culture as well as the way how sustainability and SDGs are included and practiced are of high importance to laying the foundation for human future. Following the conference's topic of cultural issues learning and teaching setting and interaction foster or hinder a sustainable transition. Changing the learning culture always relates to changing transitory paths towards sustainability.

Track

Track 2a Provision, quality of and access to education

Posters

E-planning for quality school management: A case study in the context of Brazilian public education

Sumara Santos, João Correia de Freitas and João Joanaz de Melo

e-Planning for quality school management: a case study in the context of Brazilian public education

Objectives

This empirical study, carried out in public elementary schools in the Federal District, Brazil, seeks to characterize the use of ICT-supported data in this context, as well as to present practical measures using the e-Planning approach.

The e-Planning agenda includes research aimed at equity, modernization and stakeholder involvement, providing the innovative use of ICT in planning and decision-making processes, enabling new models of participation by the educational community, opening up possibilities for local transformation and improvement.

This approach is in line with the Sustainable Development Goals (SDGs), namely goal 4.1. It is expected that improving school management will also foster educational quality.

Methodology

Strategy
Multi-method research (qualitative and quantitative)
Exploratory, descriptive and correlational character

Participants
115 professionals from 110 schools (Proportional random probability sampling by management complexity level)

Instruments
Literature review
Semi-structured interviews
Digital questionnaire

Data analysis
Content Analysis (Atlas.ti)
descriptive and inferential statistics

Case-study

153 Scope - Public elementary schools of 2nd stage of fundamental education: 6th to 9th grade

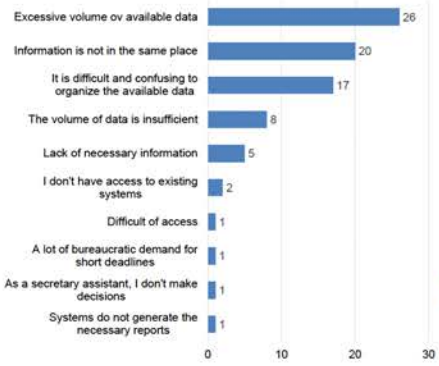
14 Regional Teaching Coordinations

Participating schools

115 Participating (quantitative research)
9 Participating (qualitative research)

Results

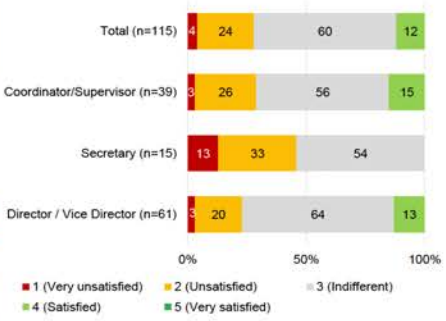
Number of respondents to difficulties faced in accessing information to support school management and decision-making



Benefits and "harms" arising from the excessive use of technologies, difficulty in accessing ICTs, insufficient and obsolete equipment, improvement in the reach of the internet used by the school were pointed out.

In general, respondents were indifferent to the ease of use of digital platforms, their usefulness and completeness, as well as the damage generated by the lack of information.

Community participation assessment (percentage by assessment and job title)



The data point to a reduced interest of the school community in school issues and insufficient participation in the construction of planning and decision-making.

In general, aspects related to the understanding and analysis of available information were evaluated as good. The quality of the communication used was the best evaluated aspect.

Proposals

1. Implementation of decentralized data teams. The effective use of data to inform decisions, achieve goals and solve problems in the school in a sustainable way, providing active community participation in school planning and improving quality.

2. Continuous and participatory internal institutional evaluation mechanism. Empowerment of school actors via ICT appropriation, through participatory instruments.

3. Implementation of electronic management data panel. The need to base education on evidence, with contextualized and interactive data, based on the need to improve the quality of education, with clear and measurable objectives.

Implementation of electronic school management data panel

Conclusions

- The use of ICT-supported data for school management is essential, but not enough, and excess can be a problem.
- The use of data in school management is a dynamic process and the school context matters (e.g. training of staff, background of students…)
- Most school managers recognise that democratic management is fundamental for the good functioning of the school and are aligned with the positive discourse of participation, but… "easy to say, difficult to do".
- Alignment and convergence around the positive "discourse" of participation.
- With the expansion of the use of ICT in the public schools, the e-Planning approach opens up new possibilities to enhance the planning and decision-making processes.

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PhD student Sumara Santos (Presenting) sdg.santos@campus.fct.unl.pt - NOVA University of Lisbon, Lisbon, Portugal
Doctor João Correia de Freitas jcf@fct.unl.pt – e-Learning Lab, NOVA University Lisbon, Lisbon, Portugal
Doctor João Joanaz de Melo jjm@fct.unl.pt - CENSE, NOVA University Lisbon, Lisbon, Portugal

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2. Education

2b. Education for sustainability

Abstracts

Assessing the Development of Knowledge and Attitude for Sustainable Leadership through Simulation-based Learning: The preliminary findings

Mr. Chatchai Chatpinyakoop

College of Management, Mahidol University, Bangkok, Thailand

Abstract

This empirical study aims to fill the gap in higher education for sustainable development research by studying the use of an online business simulation in a graduate business degree program in Thailand. The main objective of this empirical study is to assess the extent to which the Leading Change for Sustainability simulation, or LCS, impacts students' knowledge and attitude in the domains of change management and sustainability science.

This research will give insight into the impact of simulation-based learning on student understanding of the complex, systemic nature of sustainability challenges and solutions. More specifically, empirical evidence analyzed in this study will offer a summative assessment of the simulation's impact on student knowledge, attitudes, and skills in leading change for sustainability in organizations. Thus, the research addresses a gap in the literature on simulation-based learning and education for sustainable development.

This study uses a quasi-experimental research design to assess change in student knowledge, attitude, and skills related to managing change for sustainability. This study collected the data from classes using LCS simulation taught in a graduate school of management in Thailand. This study is the preliminary result of the data collected from three classes. The pre-test and post-test comprise the sustainability mindset test and the sustainability knowledge test. Half of the knowledge test assessed the sustainability knowledge, and the other half evaluated the knowledge in organizational change management. The attitude test consists of ten questions using a 5-point Likert scale.

From the analysis of the knowledge test, the skewness and the kurtosis of the data, both between -1 and 1. The author also tested the normality of the small sample of this data with Shapiro-Wilk. Both passed the normality test at a p-value of 0.05, reflecting that this knowledge test is normally distributed. The author tested for reliability with Cronbach's Alpha for the attitude test. From SPSS, Cronbach's Alpha for the attitude test is 0.602. It is relatively low but still moderately reliable and acceptable. However, if we took out the item with the lowest correlation, the Cronbach's Alpha improved to 0.632. Therefore, the attitude test of this study is moderately reliable. The paired t-test is used to see a significant difference between the pre-test and post-test in the knowledge and attitude tests. The paired t-tests for the knowledge test passed the t-test significantly. This means that there is a significant difference between the pre-test and post-test scores of the knowledge test. The author also used the paired t-test to assess a difference between the attitude pre-test and post-test and found that the attitude pre-test and post-test are also significantly different. The descriptive analysis of the pre-test and post-test of attitude and knowledge tests also confirmed statistical findings. With these descriptive and inferential analyses, the author can assert that students improve their knowledge and attitude in change management for sustainability from simulation-based learning.

Track
Track 2b Educating for sustainability

Education for Sustainability: The teaching of skills to achieve the sustainable development goals of the 2030 Agenda

PhD Gabriela Garcez, PhD Renata Bonavides

Catholic University of Santos, Santos, Brazil

Abstract

The dissemination of knowledge is essential and a fundamental requirement for the transformation of society and for achieving sustainable development, based on the Sustainable Development Goals (SDGs), of the 2030 Agenda, of the United Nations (UN), with the objective of enabling all public and private agents to adopt practices that encourage the right to development and protection of the environment, so that it is possible to create multipliers with a positive meaning, organized to contribute to issues related to the right to sustainable development for future generations.

In this way, a profound transformation is required of society to create a world more engaged with issues related to the environment, as described in the SDGs, which must be implemented through the creation of knowledge, skills, values and attitudes that can enable them to contribute to sustainable development (enabled by capacity-building through education, promoted by means of international cooperation and governance).

This is because education is the fundamental instrument in achieving the SDGs, since a change in mentality is necessary about the role of education in the context of global development, as it has an essential impact on the well-being of individuals and on the future of the planet, with the ability to promote values, knowledge and skills that can lead to inclusive, resilient and peaceful growth (on a lasting basis), which promotes economic growth allied to environmental and social issues.

In this line of reasoning, this chapter (through an analysis of bibliographic references, made through a deductive-critical method) aims to discuss education for sustainable development, in order to contribute to the adoption of a new vision in favor of sustainability , in order to enable all interested agents and actors to make more responsible decisions towards the environment based on criteria of integrity, economic viability and fair society for the present and future generations, taking into account that actions already exist at the international level and Brazilian (in the areas of education, international cooperation, governance and the right to development), as well as important regulatory frameworks (such as Brazilian national legislation and international documents) for the promotion of an adequate global sustainable education.

Thus, this chapter is directly related to SDG 4, of the 2030 Agenda, especially with regard to goal 4.7, which, on the other hand, is directly related to the global theme of the conference ("SUSTAINABLE DEVELOPMENT AND COURAGE: CULTURE, ART AND HUMAN RIGHTS"), since it is only through the implementation of adequate knowledge and skills for sustainable development that other human rights can be guaranteed (such as gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation cultural diversity and the contribution of culture to sustainable development).

Track

Track 2b Educating for sustainability

Energy: A philosophy of practice

Prof. Natasha Lushetich

University of Dundee, Dundee, United Kingdom

Abstract

Today, 'energy' is most often associated with the global North's – and increasingly the global South's – vital dependence on the combustion of fossil fuels needed for transportation, the production of food, and an ever-increasing variety of commodities. Although there is no shortage of 'green' energy innovations, many cause more problems than they solve, as the example of wind farms in Oaxaca, which caused aridification while reinstating colonial relationships, shows (Dunlap 2018). One reason for this is the sheer volume of energy extraction. The other is the conceptual framework that underpins this activity: this is a source-conversion-end-use concept of energy that is embedded in the Greco-monotheistic-scientific tradition. This conception views the world as composed of individual phenomena, separates animate from inanimate existents, privileges solids over vapours, and teleological developmental trajectories over complexity (Stengers 2018).

Despite the fact that an unbroken line of inquiry can be traced from Aristotle to Einstein, taking in, for instance, Aristotle's notion energy as energeia, entelecheia, and invariance amidst change, the passage from pondering the functioning of levers and pulleys to the discovery of mass-energy equivalence in the 20th century wedded energy irrevocably to technology. Potentiality, which, alongside flux, is one of energy's main 'aggregate states', was reduced to entelecheic end-use. This further gave rise to a 'standing-reserve' view of energy where the actual is 'enframed' within the usable (Heidegger 1977) and where the 'exigencies of planning' entice humans to behave in accordance with what they perceive to be the 'technological imperative' (Glazenbrook 2001). If Heidegger's notion of enframing seems dated, a quick glance at synthetic biology – which modifies biological materials and entities – shows living entities to be a standing-reserve of function (Schyfter 2021).

In the past thirteen years, the post-disciplinary configuration of Energy Humanities has usefully mobilised new-materialist concepts to argue for the relevance of energopolitics to the survival of the planet (Szeman and Boyer 2017). However, Energy Humanities has focused largely on the ethics of energy consumption, which, though useful, does not solve the problem of the crisis of the concept of energy, where the same logic of energy extraction is merely moved to another field, such as datification, which uses unsustainable sources to power data farms.

This paper focuses on reticular (rather than linear) causality in the flux-potentiality continuum. Acknowledging energy's dynamic nature, it proposes a non-dualistic analysis where content (the source of energy) is not separate from method (its technology of transformation). The paper's conceptualisation of energy as a flux-potentiality continuum, and of nature-culture as nature-culture-technology enables an articulation of the full spectrum of energies (not only of primary or secondary energy sources, such as biomass or batteries) that constantly transform our world, through trans-temporal interpenetration of phenomena such as encrustment, encoding, multiplying and re-assembling. The philosophy of practice the paper formulates has three axes: 1. resonance, which comprises physical, spatio-temporal and animal energies; 2. aura, which includes cultural-virtual energies; and 3. assemblage, which consists of the energies produced by arrangements and contraptions.

Track
Track 2b Educating for sustainability

EUSTEPs MOOC: Leveraging ecological footprint for lifelong sustainability learning

Mahsa Mapar[1,2], Sandra Caeiro[1,2], Paula Bacelar Nicolau[1], Antonio Teixeira[3], Alessandro Galli[4], Sara Moreno Pires[5], Nicoletta Patrizi[6], Federico M. Pulselli[6], Georgios Malandrakis[7]

[1]Department of Science and Technology, Universidade Aberta, Lisbon, Portugal. [2]CENSE, Center for

Geneva, Switzerland. [5]Department of Social, Political and Territorial Sciences, University of Aveiro, Aveiro, Portugal. [6]Ecodynamics Group, Department of Physical Sciences, Earth and Environment, University of Siena, Siena, Italy. [7]Department of Primary Education, Aristotle University of Thessaloniki, Thessaloniki, Greece

Abstract

Massive Open Online Courses (MOOCs) are being increasingly used across all areas of knowledge, including sustainable development. Higher Education Institutions (HEIs) in particular are increasingly adopting MOOCs not just to improve learners' experience, but also to promote lifelong learning for multiple audiences. Given the critical role of HEIs in the transformative shift of values and actions towards sustainability, it is paramount that sustainability education is not only provided to students through formal education but also, in line with SDG 4.7, to the whole university community and the general public within a lifelong context. However, the development of educational tools as MOOCs that can interlink topics such as sustainable development and Ecological Footprint (EF) is still lacking.

Being aware of this lacking, a MOOC entitled “Sustainability and Ecological Footprint: From Theory to Practice” was developed within the scope of the ERASMUS+ project ‘Enhancing Universities’ Sustainability Teaching and Practices through Ecological Footprint- EUSTEPs’; a strategic partnership among four European universities and an international Non-Governmental Organization; to assure the consistency of the project outcomes after the formal end. This paper aims to present and discuss the contribution of the EUSTEPs MOOC on sustainability and Ecological Footprint education as an open resource for lifelong learning. The MOOC is freely available online to all interested target audiences including students, educators, administrative staff, and the general public from within and outside the EU.

This MOOC was made of 50 academic hours and designed according to a hybrid pedagogical model (iMOOC), merging elements from existing xMOOCs and cMOOCs with new collaborative features drawn from UAb's experience with online learning. Based on the outcomes of the previously taught EUSTEPs modules in 2020 and 2021 for the whole HEIs community, this MOOC consists of three micro-credential lessons: i) Ecological overshoot, Sustainability, and SDGs, ii) The concept of EF to promote the knowledge-awareness-action journey towards sustainability in daily life, and iii) The sustainability aspects in HEIs to help the HEIs community to incorporate the sustainability values in all HEI’s missions and practices. Two learning tools are provided for the MOOC: 1) a "Learning Guide" containing the MOOC objectives, syllabus, and learning materials guidelines, and 2) a forum moderated by the facilitators and social media channels to centralize interactions between participants. Universidade Aberta serves as a pilot within the project to test the developed MOOC with their audiences in 2022. Two sets of questionnaires are developed i) a pre-questionnaire to evaluate the expectations before receiving the MOOC, and ii) a post-questionnaire to evaluate participants' perceptions on the MOOC aspects, learning materials, and intentions towards sustainability.

It is expected that by the end of the MOOC, participants will be able to recognize how sustainability and SDGs link with the Footprint concept, and how to promote a sustainable lifestyle, compatible with the one-planet living concept. The revised version of the EUSTEPs MOOC will be made freely available to all interested users, other HEIs, and stakeholder groups as a significant way of disseminating the EUSTEPs rationale and outputs.

Keywords: MOOC, Sustainability, Ecological Footprint

Track
Track 2b Educating for sustainability

Expanded Learning: Examples of embodied sustainability education practices

Dr Giulia Sonetti[1], Mr Andrea Gerbaudo[2], Mr Andrea Caretto[3], Dr Marco Tonon[2]

[1]CENSE, Lisbon, Portugal. [2]Università di Torino, Torino, Italy. [3]Esculenta, Torino, Italy

Abstract

INTRODUCTION: The current, progressive momentum of environmental sciences, due to the increased attention to climate change does not seem to ground into a significant shift of individual practices, that are sought to be at the root of a new, real change. The so-called 'ecological crisis' is seen by many scientists as primarily an aesthetic one (from the Greek root aisthēsis, that means 'perception'): a sort of inability to perceive what is happening to the Earth as something that deeply affects each of us. More than a question about knowledge, it relates to our feeling and epistemological worldview of westernized humans living in a state of anaesthesia, alienated from the world and disconnected from the interdependent and continually corresponding elements around us, in space and time. Education plays, of course, a crucial role in shaping a new form of Human-Nature-Relationship that perceive humans as Nature, not part of or just connected. GOALS OF THE PROGRAM: Transformative learning, to this respect, aims exactly at shifting from a transmissive to a transformative experience, developing critical and creative abilities, attentive to the different forms of intelligence (human and non-human) and committed to unveiling the complexity and interdependence of the world. This work presents an educational project designed to overcome the division between theory and practice by experiencing the world from an eco-ontological perspective so that participants may develop effective individual and collective thoughts and actions.

PROGRAM DESCRIPTION: The project encompassed three days at the Research Centre for Arts and Science Pianpicollo Selvatico, located in Levice (CN - Piedmont, Italy). The selection of such a place, small and immersed in nature, encouraged free art-making, scientific and philosophical trajectories of thoughts in all forms. Participants were 20 future teachers, either future Primary school ones or Natural Science teachers. We experienced a sustainable style of life, sleeping in tents and eating local food.

EXPERIENCE AND EVALUATION: Through the direct experience of the environment of Pianpicollo, participants perceived a profound relationship with places and communities made of living and non-living beings, in an authentically transdisciplinary ecological perspective. Proposed activities were generative walks, observing and describing the biodiversity of the place, collecting and transforming natural elements and building different handicrafts, from musical instruments to artistic assemblages. Data were collected via a questionnaire before the workshop and via in-depth interviews with all participants. A qualitative analysis, using Grounded Theory methodologies, was then performed to the evaluation of collected materials.

CONCLUSION & RECOMMENDATIONS FOR THEORY AND PRACTICE: Results showed that the majority of participants changed the way of perceiving their connection with living and non-living elements, developing a greater sensitivity towards an alternative way of teaching and learning, experiencing the potential of the place-based and aesthetic-based practices. Education, in this sense, should not only have to do with acquiring specific knowledge but rather by helping each mind and body to be truly present and engaged in our beautiful world.

Track
Track 2b Educating for sustainability

Exploring Accounting Educators' Perspectives on Sustainability: A Freirean critical pedagogic perspective

Dr Olga Cam[1], Prof. Joan Ballantine[2]

[1]University of Sheffield, Sheffield, United Kingdom. [2]Ulster University, Belfast, United Kingdom

Abstract

Sustainability is a philosophy that is supported by large-scale societal movements. Accounting as a communicative practice, central to organisational decision-making, has the potential to support sustainability agenda. Still in its emerging state, sustainability demands a dialogical learning approach facilitated by educators with a fully awakened critical consciousness and thus can be the force for change. However, the ability of educators to drive the sustainability agenda in accounting education is often taken for granted, which limits opportunities for engagement in critical reflexivity necessary for the critical consciousness awakening. To enable such an engagement requires building the initial knowledge base for learning to understand the view of others (i.e. dealing with relational issues).

This study adopts a Freirean critical pedagogy lens aiming to explore educators' views on the relation of sustainability to accounting (and accounting education). The interview data with twenty accounting educators for UK universities demonstrate that the perspectives of those who teach accounting vary. We map these views that range from the dismissal of sustainability to seeing it as a foundation philosophy for accounting and accounting education along the epochal change continuum. The mapping shows that while change is occurring, sustainability remains of a secondary value to the currently adopted use of accounting techniques as a tool for reporting financial profitability.

The contribution of our study is twofold. Firstly, it explains the evident disengagement with dialogical approaches in accounting teaching. Many educators are confined to a dominant narrow view on the matter and may not yet have an awakened critical consciousness. Secondly, our findings facilitate an opportunity to deal with relational issues for those wishing to engage in self-reflexivity. It enables educators to see the existence of realities alternative to theirs as a firth step to becoming critically awakening educational professionals.

Track
Track 2b Educating for sustainability

How to Achieve Reduction of Excessive Consumption? An educative approach with middle school students and their families

Fátima Carvalheiro[1], Prof. Sandra Caeiro[2]

[1]Universidade Aberta, Lisboa, Portugal. [2]Universidade Aberta, Lisbon, Portugal

Abstract

The excessive consumption in the last decades is pointed out as one of the main factors of global warning. In order to reverse their consequences, or at least minimised them, it is essential to change the consumption practices. In order to change the consumption behaviours, according to the current standards, nothing better than to involve and motivate the young people So the work had as objective to develop a project about "awareness for the reduction of excessive consumption" with students and their families from middle school, within the scope of education for Sustainability. The target population belong to a school in Palmela, Portugal and the project was developed during two scholar years, from 2020 to 2021. The project was based on an action research methodology that included activities carried out by the students and their families. The activities developed were carefully planned and included: practical and interactive activities, games, collaborative work and seminars. A statistical and content analysis was performed to evaluate the development of the students' knowledge, skills and critical thinking, based on questionnaire surveys and observation grids. The different activities performed with the students allowed them to develop the critical thinking and awareness of unnecessary consumption and its implications. One of the activities consisted in the identification of all the new materials that the students had in their backpacks, recognizing if they had been purchased because they needed them or simply wanted to buy them. By the video visualisation, the students develop knowledge about circular economy, sustainable development, and the evolution of consumption. Moreover, the students carried out individual and group research which allowed them to reflect on topics such as food waste, reuse of materials, sustainable consumption and sales. The final activity consisted in the development of a Strategic Plans for a Sustainable Lifestyle, in the family, at school and in the municipality. Most of all the proposals presented showed that the students were able to reduce their consumption and, at the same time, as well as to be active citizens in the essential community actions. 51% of students and their families were not performing a sustainable lifestyle, however, 37% indicated that they intended to change their behaviour. At the end of the project, 87.5% of the students were willing to change their consumption habits and none indicated "not being available". In last survey it was observed an improvement on the students' knowledge and behaviours. of the most important achievement of this work was the interest of Palmela Municipality to carry out a protocol with the school to develop a project in the same area with the involvement of the students and their families. The results shown the importance of a careful project plan, use of approaches based on system thinking, duration of at least one year, involvement of not only students, but families, school and municipality, and assessment using different tools to allow the achieving of change of behaviours towards a more sustainable patterns of consumption. SDG 4.7; 12.2; 12.5 e 12.8.

Track

Track 2b Educating for sustainability

In Search of a Sustainable University: Lessons from a Brazilian case study

Ms. Jaqueline Silva Melo, Mr. Eugênio Batista Leite, Mr. Armindo dos Santos de Sousa Teodósio

Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil

Abstract

The technological advance of recent times has changed the modes of production and, consequently, consumption. In order to adapt to this new context, an educational intervention became necessary in order to make human beings aware of the importance of preserving nature to guarantee the future, incorporating exemplary practices of sustainable actions in their work processes.

Higher Education Institutions (HEI) can support the construction of sustainability, having the mission of teaching and training decision-makers for the future, they must assume an essential role in the construction of a sustainability project. Based on this premise, PUC Minas defends, in its Institutional Development Project (PDI), shared, participatory and sustainable management. In accordance with the PDI, its Institutional Pedagogical Project (PPI) foresees, as part of its premises, responsibilities for environmental preservation and the need for curricular practices conducive to the sustainable development of the country. Its PDI has a specific chapter for the implementation of practices of sustainability with the proposal of an Environmental Responsibility Program, explaining the theme as an item of its social commitment.

The present study analyzes the actions developed by the Sustainability Commission of a Brazilian university, seeking to achieve the aforementioned goals in the quest to become increasingly a sustainable university, articulating four levels of intervention that are: the education of decision-makers for a future sustainable; the investigation of solutions, paradigms, and values that serve a sustainable society; the operation of university campuses as models and practical examples of sustainability at the local scale and the coordination and communication between all these levels, in addition to engagement with society. The results indicate that the benefits arising from these actions are numerous, highlighting the savings arising from productivity improvements and reduced consumption of inputs; due to compliance with environmental legislation; the generation of opportunities for extension and research, and the expansion of research fields for the university community and, finally, a benefit related to positive gains in the image of the HEI, linked to the challenges of an agenda committed to our own survival.

Track

Track 2b Educating for sustainability

Marine Litter: Design, implementation, and evaluation of an educational intervention for young people to raise awareness and stimulate co-responsibility and sustainable behaviors

Sara Bettencourt[1,2,3], Carlos Lucas[4], Sónia Costa[3,4], Sandra Caeiro[1,2]

[1]Department of Science and Technology, Portuguese Distance Learning University, Lisbon, Portugal. [2]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. [3]MARE - Marine and Environmental Sciences Centre, ARDITI – Regional Agency for the Development of Research, Technology and Innovation, Funchal, Portugal. [4]OOM - Oceanic Observatory of Madeira, ARDITI – Regional Agency for the Development of Research, Technology and Innovation, Funchal, Portugal

Abstract

Ocean pollution is a global challenge with noteworthy impacts. One of the most worrying sources of pollution is associated with the presence of solid waste in the marine and coastal environment, commonly called 'marine litter'. The recognition of marine litter as an urgent issue to be tackled has been increasing over the years. The problem is indubitably attributed to human activities and behaviors. Therefore, research in education and raise-awareness campaigns has been gaining relevance. The aim of this communication is to present the development, implementation, and assessment of an educational intervention. The intervention's goal is the promotion of sustainable attitudes and behaviors, increasing ocean literacy and awareness among schoolchildren of a small island, Madeira, Portugal, where tourism is the main economic activity. The educational interventions were designed gathering different insights: literature review and gaps identified in pilot interventions. A set of three sessions were implemented and adapted for each class. The sessions include expository presentations, videos discussion, word clouds formation, interactive games, visualization of marine litter objects found in Madeira's beaches, case studies, and practical activities (sampling of microplastics and/or reuse of materials for manual works), according to a reflecting and co-creation learning. Different topics are addressed in each: 1) marine litter definition and impacts; 2) marine litter in numbers; 3) microplastics sampling and individual actions that can be adopted to curb marine litter raise. A fourth session is a beach clean-up action and is optional. Students aged between 8 and 16 years old (third to tenth grade) participate in the actions and fill a questionnaire in the first session (pre-questionnaire) and one in the last (post-questionnaire) to assess changes in knowledge, perceptions, and attitudes. Interventions are being run and by the end of the intervention (April 2022), more than 250 students are expected to have joined. Interventions are evaluated by comparison of the answers obtained in the pre- and post-questionnaires. Altogether, the results indicate that interventions are having positive outputs. Students become engaged with the topic and concerned with the the problem. When data is presented and objects collected in the island beaches shown (e.g. cigarette butts, metal items, balloons) they become worried and perceive that streams, wind, and rain contribute to litter deposition in the marine environment. Students understand that the problem is 'real' in the place where they live and that can impact tourism, economy, and human health, a fact that was not known for much of them (environmental consequences are the leading causes identified). The participants became more aware and understand that human behaviors can contribute to tackling the marine litter issue. The holistic, teamwork, and reflection on action approach that is being used shows to be effective compared to the traditional learning by listening. Future work will consist of adapting the educational actions to other target audiences beyond school students, as marine litter is a global problem that requires an all-inclusive approach.

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Track
Track 2b Educating for sustainability

Philosophy in Nature. Walkshops as a pedagogical-didactical tool for planet proof education

dr Floris van den Berg
Utrecht University, Utrecht, Netherlands

Abstract

'Walkshops' are a new educational tool to enhance teaching in environmental philosophy by taking students outdoors into nature. This paper describes positive experiences with walkshops and how these could be implemented in education in general as a concrete tool towards SDG 4 about education and especially teaching about sustainability or, what philosopher David Orr call 'planet proof education'.

Track

Track 2b Educating for sustainability

Public Institutions for SDGs: Between didactic (participation teaching method) and social impact assessment

dr Katarzyna Cichos

Cardinal Stefan Wyszynski University in Warsaw, Warsaw, Poland

Abstract

The paper presents the didactic method in the context of organization studies. It presents the new participation teaching method to complement Social Impact Assessment Process in a situation when the organization or public institution (university, local government, etc.) is not aware of either the management of social change, development management methodology, etc. or even the scope of SDGs.

Lack of knowledge and awareness of both SDGs and methodology makes impossible to implement even the simplest solutions from the field of sustainable development within any public institution. Very often, people holding public functions are reluctant to study. Including didactic elements in the SIA process will allow the organizations' representatives (responsible for the preparation and implementation of the sustainable development strategies) to study during the process of development of specific solutions in the area of SDG implementation. Combining the methodology of process of research, planning and the management of social change or consequences with the educational process may contribute to increased public authorities activities and interest in the process of implementing solutions. The research are based on teaching experiment at Cardinal Stefan Wyszynski University

Track
Track 2b Educating for sustainability

Relations between Universities and Recyclable Material Collectors: An analysis of the production of knowledge in action research

Ms. Jaqueline Silva Melo[1], Ms. Dijana Helena Diniz Costa Vieira[1], Ms. Laísa Santos Magalhães[1], Ms. Aline Rodrigues da Fonseca[2], Mr. Armindo dos Santos de Sousa Teodósio[1]

[1]Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil. [2]State University of Minas Gerais, Belo Horizonte, Brazil

Abstract

The actions of universities with the communities, together with teaching and research, make up the principle of inseparability that governs universities, highlighted in Article 207 of the Brazilian Federal Constitution of 1988. The articulation of these three areas enables the transforming relationship that links the University the society.

Our article analyzes the production of knowledge in a university project with cooperatives of recyclable material collectors. The project tries to combine teaching and research in an attempt to mitigate or mitigate the effects of these conditions in order to provide more citizenship, dignity, and safety in the work of recyclable material collectors, professionals so important to society. In addition, we sought to contribute to greater professionalization of the activities of the cooperatives, as well as the promotion of the health of their members.

As urban solid waste can contain valuable materials, people in poverty are involved in the activity, often informal and under precarious working conditions, aimed at collecting recyclable material. Waste pickers constitute a community at risk, not only for their own physical and health integrity but are also subjected to a condition of social and economic marginality, which is often confused with the very concept of garbage or waste.

During the years 2020 and 2021, as a result of the COVID-19 pandemic, the Solidarity and Inclusive Recycling extension project worked remotely in four recyclable materials cooperatives.

The project aims to develop actions that promote the emancipation of cooperatives and their respective members, both in terms of management and human development.

The management axis sought to act in order to assist in the development of the main activity of cooperatives. For this, a management consultancy was carried out, diagnosing the strengths and weaknesses through categories, which were related to financial and material resources, learning and growth, market management, partners and management of internal and operational processes. Based on this, the management axis developed some video classes with topics of interest and made them available weekly to the cooperatives.

The health axis donated face protection masks and basic food baskets to cooperatives, informative booklets for waste pickers with a focus on preventing the contamination of COVID-19. Surveys were carried out on the health and ergonomic profile of the collectors, food health, and zoonosis conditions in the cooperative. From this, videos were produced about men's and women's health.

The communication axis carried out a survey to analyze its communication profile. After this survey, a communication plan was developed, and a project page was created on Instagram and YouTube, which made it possible for the actions carried out to be disseminated on social networks. In addition, the project held conversation circles on topics related to recycling, which made it possible to share knowledge between the academic public and the cooperative members.

This action is related to SDG 10 (Reducing inequalities), providing waste pickers with access to tools and techniques that can assist in their personal and professional growth, meeting target 10.2 whose objective is to empower and promote social, economic inclusion by 2030.

Track
Track 2b Educating for sustainability

Short-term and Long-term Impact of Education for Sustainability on the Behaviour of Students

Ágnes Zsóka, Katalin Ásványi

Corvinus University of Budapest, Budapest, Hungary

Abstract

Knowledge and recognition of sustainability issues are a prerequisite for changing society's mindset, attitudes and behaviour towards sustainability. Universities have a key role to play in developing sustainable culture and providing students with the knowledge they need to think and act in a more sustainable way, as set out in SDG 4.7. goal which also states that „all learners acquire the knowledge and skills needed to promote sustainable development and sustainable lifestyles". Recently, more and more universities have integrated a sustainability approach at the level of study programmes or courses that promotes the development of sustainable consciousness along knowledge, attitudes, and behaviours. Examining the impact of courses on some elements of sustainability consciousness or its complexity is a less researched field, and examining its long-term impact has appeared in few research so far. After exploring the literature on sustainability consciousness and the relationships among its elements, a specific course on sustainability was examined over four semesters (Fall 2019, Spring and Fall 2020, Spring 2021). A special feature of the project-based course is that students work with a community partner each semester. The aim of the course is in line with SDG 12.8. goal, that ensures that students „everywhere have the relevant information and awareness for the sustainable development and lifestyles in harmony with nature". The changes in the students' sustainability consciousness achieved by the course were examined by structured in-depth interviews, in two phases. The first measurement was taken at the end of the course (short-term impact), the second one was in the fall of 2021 (longer-term impact). At the end of the course, structured in-depth interviews were conducted with a total of 200 students over the four semesters, during which they reported on their own perceived knowledge, attitudes, and behaviour. In the phase of the longer-term measurement, 30 interviews were conducted. Findings show that at the end of the course, students clearly show a higher level of knowledge in sustainability issues, more positive attitudes, and more openness to developing sustainable behaviours. Different community partners had a different impact on students' consciousness: when students worked with a partner focusing on social problems, the shift towards social sustainability was stronger, while an environmental NGO as partner strengthened environmental consciousness more distinctively. The long-term impact of the course is less pronounced: students lost some of the acquired knowledge and some sustainable behaviours have worn off in their daily lives, while positive attitudes remained almost the same. Results suggest that one single sustainability course has a limited long-term impact. There is a need for continuous impulses and additional courses for students at the university, to encourage change in behaviour towards sustainability and deepen sustainability consciousness in the longer run.

Track
Track 2b Educating for sustainability

Teaching to Embrace Uncertainty – using SDGs as shared objects

Dr. Steffi Siegert, Dr. Malin Gawell, Dr. Paul Fuehrer, Dr. Ann-Sofie Köping

Södertörn University, Stockholm, Sweden

Abstract

In this paper we reflect on the development of an international, interdisciplinary master programme in the social sciences and on challenges related to teaching sustainability on an advanced level. Special focus is placed on how the sustainable development goals (SDGs) can be used as "shared objects" in both programme development and teaching. Our empirical material consists of interviews with involved academics, and notes/documentation from workshops and seminars with researchers and external partners before the start of the programme. We furthermore include an analysis of students' master theses and their understanding of sustainability shown in the texts. The main emphasis was put on differences in the definition and perception of sustainability, the recognition of SDG as shared objects and various ways to manage these challenges in higher education. The SDGs have been a useful tools to frame and start discussions on sustainable develop. Gradually, diverse and ambiguous views, perspectives and interpretations have been more noticeable. This has challenged the role of the SDGs as a shared object.

The students had, as expected, diverse views on sustainable development and varied knowledge of the SDGs. They also had very disparate experiences of different types of teaching. Not all were used to group work or to the student driven learning approach that has been implemented in the programme. Even if these pedagogical challenges had been discussed already during the planning process, it has been obvious that they have been underestimated – especially in relation to the need for support on what Vigotsky refers to as "zone of proximal development" of the understanding of the SDG and how they are related to sustainable development.

This leads to primarily two future tasks for the core team of teachers/researchers. Firstly, there is a need to further explore and develop the relations between SDGs as well as other views on sustainable development. This is pertinent in relation to social science perspectives on social and cultural aspects of sustainable development. Natural sciences' perspectives on environmentally sustainable development appear to be more well defiend and easier to operationalize, measure and apply to practical problems However, the social and cultural dimensions are as important for a transformation towards sustainability.

Secondly, there is a need to further develop the pedagogical approach to embrace uncertainty through attention to the diversity of students and their learning processes in the zone of proximal development so the SDGs can be given a clearer role not only as shared object, but as transitional object in line with Winnicott's ideas about objects of comfort as safety during challenging transitions. Our experience from the programme's first years is that the SDGs can be used as shared objects in order to frame collaboration and teaching for sustainable development. But the experiences also show that the focus on the SDGs as such, risk to encourage a rather shallow view on sustainable development. The focus on SDG does not automatically lead to a nuanced view on sustainable development.

3a) SDG+Target:4.7

3b) Teaching sustainable development from a social sciences perspective

Track
Track 2b Educating for sustainability

The Impact of Teaching Engineering for Sustainability on Students. A comparative study on different levels of sustainability integration in University of Technology

PhD student Claudine Gillot[1], PhD Student Lou Grimal[1], PhD Yacine Baouch[2]

[1]InSyTE, Creidd, Troyes, France. [2]Université de Technologie de Compiègne, Compiègne, France

Abstract

Engineering training has been transformed through the last decades for the integration of sustainability into engineering classes. Those evolutions are quite difficult as education for sustainable development is a real challenge to implement. Indeed, integrating sustainability requires new competencies (for instance critical thinking, systemic thinking, self-knowledge) and knowledge (technical, environmental, and social knowledge), attitudes, and values. More knowledge on how to teach those elements is required. In this paper, we focus only on the competencies for engineering education, as those competencies are well defined in the literature and as there is a lack of examples of implementation of those competencies. Thus, the goal of this paper is to better understand the impact of teaching sustainability to engineering students and to what extent the way we teach has an impact on the evolution of competencies of students for sustainability engineering.

Different forms of integration and ways to understand sustainability exist and are supposed to have different impacts on engineering students. To address our goal, we have explored three different forms of integration of sustainability, from weak to strong sustainability, and from a standalone class to a master's specialization on sustainability. We conducted a comparative analysis with three different classes which integrate sustainability differently in their engineering curricula, at different levels of class. This case study will be scrutinized thanks to an analysis of competencies of engineering for sustainability (qualitative and quantitative analysis). The competencies of students have been evaluated at three different moments in a class (at the beginning, at the middle, and at the end of the class) through self-assessements.

With this study, we yearn to better understand how to implement the teaching of engineering for sustainability competencies. There are two outcomes of our work: (1) a better understanding of the role of education in the improvement of competencies of engineering for sustainability and (2) a better understanding of possible ways to measure the improvement of those competencies among engineering students.

Track
Track 2b Educating for sustainability

The Regenerative Campus and Sustainable Wellbeing - an exploratory literature review on nature-based and transformative approaches in higher education institutions

MSc Carolina Silva[1], Dr. Antje Disterheft[1], Prof. Dr. Matthias Barth[2,3]

[1]CENSE—Center for Environmental and Sustainability Research, NOVA School of Science and Technology, NOVA University Lisbon, Campus de Caparica, Caparica, Portugal. [2]Institute for Sustainable Development and Learning, Leuphana University of Lüneburg, Lüneburg, Germany. [3]Presidency, Eberswalde University for Sustainable Development, City Campus, Eberswalde, Germany

Abstract

Education for Sustainable Development (ESD) in higher education institutions (HEI) plays a crucial role in the debate about sustainability and societal transformation to achieve the 2030 Agenda and the Paris Agreement. However, links between holistic learning and nature-based solutions in and for HEI are still under-researched topics. Learning in and with nature can contribute to people's overall wellbeing and lead to transformation on a personal and collective level. At the same time, such holistic learning approaches can provide innovative ways to mitigate and adapt to climate change. This research wishes to understand better how education in close contact with nature can transform people, as well as their perception of their existence and sustainability mindset. Embedded in a larger PhD project, this work presents the results of an exploratory literature review that shall serve to understand better the state of the art of concepts of nature-based solutions, transformative learning, nature connectedness and wellbeing in HEI, and to find out about already existing initiatives in HEI that follow holistic learning approaches and have implemented nature-based solutions on campus. The deep leverage points for transformation (Abson et al. 2017) will be used as selection criteria to map those HEI, namely (i) how the institutions are structured in comparison to other regular sustainable HEI (e.g. how HEI are overcoming disciplinary separations of faculties and departments, which are the notable differences in their curriculum, how are the fees' costs and means of access, etc.); (ii) how the HEI reconnect people to nature (e.g. the existence of outdoor spaces for classes and other extra activities, a campus garden, a campus forest, etc.); (iii) how knowledge is created and applied for sustainability (e.g. through the inclusion of embodied knowledge, indigenous wisdom, etc.). . The results will help to identify how nature-based and transformative approaches might differ from more conventional sustainability approaches, and invite actors in education towards taking more courageous steps for reaching the SDGs, namely SDG4, target 4.7, and SDG13, target 13.3. We perceive rethinking education and educational institutions as an act of love and courage, and we therefore regard our research well aligned with the conference topic: holistic educational approaches that connect people to nature and consider different aspects of the knowledge production in HEI, including arts, promote existential and philosophical changes that can contribute to the adoption of a more sustainable and harmonious way of life and hold the potential to transform our society effectively towards a more sustainable world.

Abson, D.J., Fischer, J., Leventon, J. et al. (2017). Leverage points for sustainability transformation. Ambio 46, 30–39. https://doi.org/10.1007/s13280-016-0800-y

Track

Track 2b Educating for sustainability

The Educational Worldview Journey. A transformative learning tool for exploring, exchanging, and expanding perspectives in a world in crisis.

Ph.D Annick de Witt[1], Ph.D Margien Bootsma[2], Ph.D Karin Rebel[2]

[1]Wageningen University, Wageningen, Netherlands. [2]Utrecht University, Utrecht, Netherlands

Abstract

As complex planetary challenges like climate change demonstrate, sustainability issues are often characterized by high degrees of public polarization and a politicization of scientific knowledge. Due to the planetary challenges and systemic crises the sustainability field is inherently focused on, calls for more transformative approaches are also common. Building on ideas and findings from systems thinking, transformative learning theory, and developmental psychology, transformation can be understood as a shift of perspective – i.e., a "mindshift", "paradigm change", or expansion of worldview. Engaging with our foundational paradigms or worldviews is therefore particularly potent, as it allows us to create more transformative forms of (sustainability) education, while also responding to the extreme cultural polarization that characterizes contemporary society more generally, and our sustainability issues in specific.

In this presentation, we aim to share our findings with respect to our project of designing transformative education in the context of sustainability education at a modern Higher Education Institution in the Netherlands, which we'll present here as case-study. As a diverse group of educators and researchers at Utrecht University, we've developed a continuous learning tool, the so-called Educational Worldview Journey (EWJ). The EWJ aims to put more emphasis on students' ability to take different perspectives, critically reflect on their own perspective, and understand the central role of perspectives in the understanding and 'framing' of sustainability issues and their solutions more generally. Moreover, the EWJ intends to invite for, and facilitate transformation, next to providing students with information.

In the EWJ, we use the concept of worldview as an entry-point for this exploration. That is, rather than just being embedded in their worldviews, students are supported to look at them. In a step by step process, students are invited to explore their own worldviews, constructively communicate with those of other worldviews, and reflect on their worldview in a world in crisis, aiming to clarify their role and purpose in the larger whole. About 1000 students completed the level 1 of the EWJ (level 2 and 3 are still being finalized). The experience was highly valued by a great majority, and their evaluations offer interesting insights into what higher (sustainability) education may derive from such an approach. Particularly noteworthy was students' willingness to reflect on, and acknowledge the inherent limitations of, their own perspectives, as well as their eagerness to learn about, and communicate with those of, other worldviews. As we will argue, a systematic exploration of our individual and collective worldviews could be a potent entry-point for starting to address some of our larger societal and sustainability challenges.

This contribution can be said to relate in particular to SDG's 4 (quality education); 16 (peace, justice, and strong institutions); and 17 (partnerships for the goals), and speaks strongly to the conference topic, by focusing on the cultural dimensions of our sustainability issues as well as cultivating the kinds of courage, cultural exchange, and collaboration that are essential to addressing them.

Track
Track 2b Educating for sustainability

Universities Driving Sustainability: Exploring cross-cultural pathways to a circular economy of plastics on campus

Jana Busch[1], Prof. Pauline Deutz[1], Dr Felix Why[1], JProf. Julia Affolderbach[2], Prof. Hồng Quân Nguyễn[3], Phúc Trần Thị Diễm[3], Asst. Prof. Niwat Srisawasdi[4], Chawadol Sriboonpimsuay[4]

[1]University of Hull, Hull, United Kingdom. [2]Trier University, Trier, Germany. [3]Vietnam National University, Ho Chi Minh City, Vietnam. [4]Khon Kaen University, Khon Kaen, Thailand

Abstract

In recent years, the problem of extensive waste generation, especially plastic waste, has been placed at centre stage in environmental debates. Consequently, universities, whose various complex activities facilitated on campus (space of working, studying, socializing, consumption and living) result in significant material consumption and waste generation, are interested to improve their environmental performance by tapping into Circular Economy approaches. Existing research findings, predominantly focusing on universities located in the global north, have shown successes of reducing waste on campus by universities implementing, testing, and bringing forward circular economy approaches. But how much does that depend on local context and cultural habits on university campuses? The study explores findings of ongoing cross-cultural research conducted at universities in four countries: the UK (University of Hull), Vietnam (National University Vietnam), Germany (Trier University) and Thailand (Khon Kaen University). Ethnographic research methods are applied to back the practice theoretical approach of the research project. Observation methods on campus, interviews and surveys conducted with the university populations and experts and affiliated stakeholders of the university are included in the data collection. Research methods were designed and trialled at the University of Hull and adapted to the context of the other universities where needed. The four case studies draw a picture of a cross-cultural comparisons of the constitutions, drivers, and challenges of a circular transition on campus. The research project relates to the implementation of SDG Target 11.6 'By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management', Target 12.5 'By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse and Target 17.17 'Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships Data, monitoring and accountability'. The research project relates to the Conference's theme by exploring courageous progress towards sustainable development in times of global crises in the context of university campuses across international cultures.

Track

Track 2b Educating for sustainability

Walkshops towards a Sustainable World. Teaching environmental philosophy in the woods

Dr. Floris van den Berg

Utrecht University, Utrecht, Netherlands

Abstract

Most of school and university education takes place inside artificially lit classrooms where students sit on chairs and listen to their teacher. Especially when teaching environmental philosophy, it seems awkward to teach *about* nature, but not *in* nature. Is it possible to gain a deep understanding of our alienation from nature by remaining indoors? For the last ten years I have been experimenting with different kind of outdoor education with students. I have developed the concept of a walkshop (from 'workshop' and 'walking') where I take students out in the woods for a diverse program of doing philosophy while walking. Based on topics related to environmental philosophy (e.g. deep ecology, the SDG's, the concept of nature, intrinsic value, natural beauty) students walk in pairs and have conversations about these topics. Pairs are changed several times. In order to create more awareness of nature, there are periods of silent walking. One of the highlights (according to students) is a session of tree hugging. Most students have heart of tree hugging but never actually hugged a tree. Doing that for 20 minutes changes the awareness of what a tree is, but also of yourself. Blindfold walking, where one is guided by a fellow student (and only the blindfolded person is allowed to talk) creates a quite different experience in raising the awareness of hearing and building trust. Yet another aspect of the walkshop is to create in a team **land art**, that is playfully arranging things in nature without destroying anything. The sheer joy of seeing adults play like small children is amazing.

Walkshops are active and interactive and involve much more than cognitive skills. From students evaluations it has become clear that even a one day walkshop in the woods can have profound influence on a person's perception of nature and life stance. Solutions for sustainability cannot only be technological fixes, but also require a different attitude toward nature. Outdoor philosophy education seems a promising way to help change the attitude towards a more deeply felt connection with nature, and reflecting on how being outdoors in the woods, walking and reflecting can help to build a meaningful life. Walkshops seem very well suited for Education for Sustainable Development. These wonderful experiences raise the question if walkshops can be implemented in education on a broader scale.

The topic of outdoor education in environmental philosophy is relevant for SDG 4 (Education), target 4.7: Education for Sustainable Development. In order to change mainstream class room education to include outdoor education, it takes **courage** from teachers and staff from standard educational practices. Walkshops are about changing the mainstream cultural paradigm of materialism to a meaningful playfulness of being outdoors in nature: not buying stuff, but walking. Not facing a screen, but facing the sky. Not sitting passively indoors, but actively walking outdoors. Not thinking about nature, but thinking about nature *in* nature.

Track

Track 2b Educating for sustainability

Full papers

Creativity, Leadership and Education for Sustainability

A *Creativity in Action Project* to support student learning, action and impact for sustainability change

Jayne Bryant[1,2]

[1]*Blekinge Institute of Technology, Sweden, jayne.bryant@bth.se*
[2]*Curtin University, Australia*

Abstract

The sustainability challenges of our time require engagement from all, and the potential for the arts and humanities to contribute has been undervalued and underutilized within sustainability science approaches. UNESCO sees education is seen as a key leverage point to shift society towards sustainability transformations however as with sustainability approaches in general, the potential of creativity and the arts remains untapped as a tool, topic, process, pedagogy and way of thinking. Inspired by a creativity assignment delivered in a Leadership in Sustainability course at Curtin University in Western Australia, this paper describes a Creativity in Action Project which was an assignment within the Advanced Leadership for Sustainability course at Blekinge Institute of Technology in Sweden. It was a year long course that ran through 2021. This paper articulates the purpose, design, pedagogy, content and learning process of the Creativity in Action Project and how it integrates the whole course. In brief, the students were invited to: "...explore the role creativity and/or the arts play, or could play, in expanding your thinking and in shifting paradigms that move people towards sustainability" and the intention of the project was to "...explore creative ways to enact change for sustainability in your lives or communities" through taking inspiration from artistic practices and processes. Through a feedback survey from the students, this study evaluates the project as a whole and identifies the key pedagogical elements that supported the students learning; what provided value and impact for the students; as well as discussing the challenges in doing such work. With permission from the students, this paper showcases some of the artistic and creative projects that the students completed. The intention of this paper is to provide educators and learning designers with inspiration and a practical, adaptable, and impactful creativity-based pedagogy for the development of sustainability leadership and key sustainability competencies that could be used and adapted to various contexts. It is hoped this will in turn support societal transition towards sustainability through empowering students to be sustainability change agents by applying their creativity to solve a sustainability challenge in real life.

Keywords: Creativity, Key Sustainability Competencies, ESD, Leadership, Sustainability

1. Introduction

The sustainability challenges of our time call for new ways of education that produces graduates capable of creatively approaching the many problems we face (UNESCO et al., 2020). It will require engagement from all, and the potential for the arts and humanities to contribute has been undervalued and underutilized within sustainability science approaches (Palsson et al., 2013). To move towards a more sustainable society will require large scale transformations of our structures and systems and human agency, or leadership, is a key leverage point to do this (Abson et al., 2017; Bryant & Thomson, 2021). The change required within society will be one of social learning in its broadest sense (Barth & Michelsen, 2013) and with education as a key leverage point, much research has been produced to guide educators and practitioners on the key sustainability competencies required by graduates of sustainability education (Wiek, Withycombe, & Redman, 2011). More recent additions to this work introduce two newer competencies: the Implementation Competence (the ability to enact change for sustainability in the world), and the Intra-personal Competence (the ability to avoid burnout in implementing sustainability transformations through resilience-oriented self-care) (Redman & Wiek, 2021). Further research on the best ways to support the development of all of these competencies is still needed (Brundiers et al., 2021). As with sustainability approaches in general, the potential of creativity and the arts remains untapped as a tool, topic, process, pedagogy and way of thinking in Education for Sustainable Development (ESD) (Newman-Storen, 2014; Sandri, 2013).

The Cambridge Dictionary online defines 'creativity' as: "the ability to produce or use original and unusual ideas" (UK) and adds the phrase "...or to make something new or imaginative" to the US version. Creativity has clear benefits for individuals and society and does not just play a role in the arts, invention and innovation but in our everyday lives (Runco, 2004). Research into creativity can be grouped into four main areas: the creative *person*; the creative *process*; the *product* that is the result; or *press* – which refers to the situational influences or environmental support for creativity (Runco, 2004, p. 664). This paper presents a pedagogy – a Creativity in Action Project (CAP) - which invited students to participate with the foundational assumption that all *persons* are creative in various ways and forms, and all have the ability to produce a creative *product* through a creative *process*. The *press* – the situational or environmental influences that often support creativity are "freedom, autonomy, good role models, resources (including time), encouragement for originality, freedom from criticism and norms in which innovation is prized and failure not fatal" (Witt & Beorkrem, 1989, pp. 31–32). These reflect the conditions that we attempted to create to support student learning about themselves, the role and value creativity can play in addressing sustainability issues in their lives and work, and as a pedagogy to support the development of key sustainability competencies in the participants.

1.1 Context and Background

The Creativity in Action Project (CAP) was an assignment within the Advanced Leadership for Sustainability (ALfS) course at Blekinge Institute of Technology (BTH) in Sweden which ran through 2021. All students were required to be graduates of the Master's in Strategic Leadership towards Sustainability (MSLS) to participate, and the ALfS course built on concepts and relationships that are incorporated in that program (see e.g., Bryant, Ayers, Missimer, & Broman, 2021). It was a stand-alone course delivered online and was worth 15 credit points. The CAP was worth 2.5 points of the total course and the other assignments were two "Written Portfolio" deliverables (10 credits), and a "Learner Led Session" (2.5 credits) where they researched and then taught in groups topics they were interested in, to the class.

1.2 The CAP Assignment

For this assignment students were invited to explore the role creativity and/or the arts play, or could play, in expanding their thinking, and shifting paradigms that move people towards sustainability. It encouraged them to play with new ways of enacting change using creativity and the arts for inspiration. The CAP was inspired by a similar creativity project conducted in a Leadership in Sustainability course which I have also been involved in co-designing and teaching at Curtin University in Western Australia (see: Mouritz et al., 2022; Newman-Storen, 2014).

The deliverables for the CAP assignment were:

- The CAP project itself
- An individual Reflection Essay (500 words) on the lessons learnt in doing the CAP

The CAP could be done individually or in small groups and could be: "a process or product or thing or event that you must be able to present/show/demonstrate to others". In this project students were asked to use a unique and creative method to enact change for sustainability in some way:

"...to play, learn, dance, prototype, paint, sing or just take inspiration from these artistic practices to enact change in a way that is unique, novel and untried thus far for you. The intention of the project is to explore creative ways to enact change for sustainability in your lives or communities. Think of the output of this project as an exhibition which will be captured on a webpage on Canvas where you share your project and other students can read/see/experience your work."

Students were encouraged to stretch towards new ways of thinking, being and doing rather than producing an intervention or creative work of the utmost 'quality', 'beauty' or 'success'.

The pedagogical elements of delivering the project were:

- The online learning platform used at BTH is 'Canvas' which is used for all teaching – both distance education (online learning) and face-to-face. BTH changed to Canvas in 2018 as it has been designed to support education both in person and at a distance.
- The CAP content on Canvas included:
    - Introduction Video explaining assignment
    - One Required Reading (Newman-Storen, 2014)
    - Recommended Readings (Cameron, 1992; Jaworski & Flowers, 1996; Kagan & Kirchberg, 2016; Kajzer Mitchell & Walinga, 2017; Lozano, 2014; Molderez & Ceulemans, 2018; Palsson et al., 2013; Runco, 2004; Sandri, 2013)
    - Videos such as 'Do Schools Kill Creativity?' by Sir Ken Robinson; and 'Your Elusive Creative Genius' by Elizabeth Gilbert
- Creativity in Action 2-hour online class sessions (March and September 2021)
- One-on-one coaching sessions (offered at various times throughout the year)
- An 'Exhibition Space' on Canvas where students shared their project and work
- An 'Exhibition/Showcasing Event' at the end where students shared their projects and shared their lessons learned through doing the project.

Grading was pass/fail and participation in the project (and presentation through images, a weblink or description of what they did on the Canvas webpage), and submission of a Reflection Essay were the criteria to pass.

2. Research Methods

As a teacher and designer of this course and the CAP I identify as a 'Reflective Practitioner' (Schön, 2003). A primary goal of this study is to reflect on the work and course, to gather insight from participants and to offer the learnings for other educators of ESD. The primary data gathered include my own reflections from the experience of designing and teaching on the course; a 10-question survey which 21 out of 24 students responded to; and the artifacts of the creativity project shared predominantly as images. In this section I describe my own reflections which shaped the survey development so I will use the first person.

Through facilitating the final Showcase/Exhibition and reading the Individual Reflection Essays which the students were required to reflect on their CAP, I noticed the joy and pride at overcoming challenges and stretching comfort zones. I observed courage in their actions and found it interesting how some focussed on 'inner change' (of themselves) and others focussed on trying to create change for sustainability outside themselves. A further deliverable for the course was for students to provided "Written Portfolios" which are also a reflective pedagogy (Ayers, Bryant, & Missimer, 2020), some other teachers who were also teaching on the course told me how some of the students shared how important the creativity project was for them. This initial sense-making involving my own reflections on the CAP informed the design of the survey. The Survey consisted of 10 questions, predominantly open-ended questions with two quantitative questions. The 24 students who completed the CAP were emailed and invited to participate and 21 responded. Information about the study was provided in the email and at the beginning of the survey and the first questions were regarding consent. Students were invited to share the images of their creativity projects for which they could choose to remain anonymous or be credited for their creative work.

The main (open-ended) questions centred around:

- *Key Learnings*: (e.g., 'What were your key learnings from doing this Creativity in Action Project? Was it as you expected or were there unexpected learnings for you? How was your experience of making change for sustainability? What did you learn about it through this project?')
- *Impact of the CAP*: (e.g., 'Could you describe your impact (or change) for sustainability through this Creativity in Action Project?')

There was one question which sought the participants' evaluation of the pedagogical elements of the CAP project. It asked them to rate on a scale of 1-5 the extent to which they found the various pedagogical elements useful to (1 = not useful, 5 = extremely useful) and also asked an open-ended question inviting further comments and suggestions.

The other quantitative question asked the students for their reflection on the possibility for the CAP to develop key sustainability competencies (Brundiers et al., 2021; Redman & Wiek, 2021). I had my own theories about what the project might support the development of, but I was curious to see the students' perspectives as they are also professionals, and many of them familiar with the key sustainability competencies through MSLS and/or working in education for sustainability. This question was:

"To what degree to you think the Creativity in Action Project is useful for the development of the following key sustainability competencies (e.g.: knowledge, skills, attitudes)? Please rate from 1 - 5 (1 = not useful, 5 = extremely useful)

And in the question defined the competencies as:

Systems-Thinking: Ability to analyse complex systems and the impacts of sustainability action plans (strategies) and interventions (how they change systems and problems)

1. *Futures-Thinking:* Ability to anticipate future states and dynamics of complex systems and sustainability problems and how sustainability action plans (and strategies) might play out in the future if implemented.
2. *Values-Thinking:* Ability to apply sustainability values, principles, and goals to assess the sustainability of current and/or future states
3. *Strategic-Thinking:* Ability to construct and test viable strategies (action plans) for interventions, transitions, and transformations toward sustainability.
4. *Implementation:* Ability to put into action sustainability strategies and action plans, including implementation, adaptation, transfer and scaling, in effective and efficient ways.
5. *Inter-personal:* Ability to collaborate successfully in inter-disciplinary and professional teams; and to involve diverse stakeholders, in meaningful and effective ways, in advancing sustainability transformations.
6. *Intra-personal:* Ability to avoid personal health challenges and burnout in advancing sustainability transformations through resilience-oriented self-care (awareness and self-regulation).
7. *Integration:* Ability to apply collective problem-solving procedures to complex sustainability problems to develop strategies and successfully implement them, in collaborative and self-caring ways." (Adapted from Redman and Wiek, 2021, p. 6)

Participants were also asked for any further comments or thoughts on their choices in an open-ended format.

As the majority of the data collected was qualitative (open-ended survey responses) the analysis was primarily done using thematic analysis - a method where the researcher can "get a feel for the whole text by living with it" and allows for "intuition and sensing, rather than being bound by hard and fast rules of analysis" (Savin-Baden & Major, 2013, p. 440). This sense-making was first done with initial or open coding – whereby the researcher reads through the data line by line and makes codes or notes in the margin, followed by a second read through of the data with preconceived codes which the data is related to – a version of axial coding (Savin-Baden & Major, 2013). With constant connection of the codes back to the literature themes were developed. A theme is a "unifying or dominant idea in the data and finding themes is the heart of the data analysis process" (Savin-Baden & Major, 2013, p. 427). The themes that were identified in this study are presented in the Results and Discussion section.

3. Results and Discussion

In this section some reflections on the course as a whole are presented, followed by a description of the key learnings that the students identified through their survey responses. After this will follow a discussion and

CAP; and finally, recommendations for educators interested in applying the CAP in their own context. Direct quotes from participants are used to better illustrate findings in this study and are represented in italics and quotation marks.

Reflections from participants on the project were extremely positive. The final question in the survey asked for any other reflections not shared already, and the vast majority of them said variations of *"thank you",* and that this project gave them the *"mandate"* to do or complete something they had wanted to do but would not have otherwise taken the time. One response: *"This was my favourite project of the year. I loved it so much. I learnt so much"* and another who had struggled with the project along the way, described how life changing the CAP was for her, discovering the many ways to approach sustainability that were more creative than her current life path: *"I have started studying something new and completely different... thank you for helping me on this path!"* Some described the challenges of doing the project – of stretching their comfort zones – and some had suggestions for improvements for future iterations. These will be discussed further below.

3.1 Themes of Key Learnings through the CAP

The key learnings identified by participants through the CAP can be summed up in four themes:

- *Communication* - the value of artistic and creative expressions to communicate sustainability, and that communication is two-way (speaking and listening)
- *Concrete* - the empowerment of 'being embodied' and creating something 'concrete'
- *Courage* - the challenge of expanding comfort zones and the courage that requires
- *Creative thinking* - the revelation of how many creative ways sustainability issues can be tackled.

The benefit of creativity and the arts in improving communication for sustainability was mentioned by many respondents. Some described how they felt understood by others in ways they had not before: *"others around me seemed to understand me and my vision more clearly"* and *"I learnt that making change for sustainability can be effectively achieved through creative means and sometimes it can be more impactful or it can resonate with a broader population than technical or academic language/theory".* One suggested that *"...arts are a powerful language that speaks directly to the heart,*
not being so questioned by the rational mind". Another responded that they learnt to talk about this dark and difficult topic of sustainability through engaging humour and laughter through in stand-up comedy training *"...made me think a lot of how to talk about something that you love and believe in a different way".* Communication is of course two-way. There were other students who realized through the CAP of their need to listen more to others in their communication, to understand the perspective of others who they were hoping to influence and relax *"... like I never relaxed in my life and abandon completely the selfish hope to change a system the way I want it",* to invite others in, and this realization *"changed me a lot in terms of how I approach my change-maker role in the world".* Communication at its best requires the mouth and the ears, and of course only existing in relationship. The ability to both speak in mediums or *"languages"*

create a sustainable future are qualities much needed in us all.

Many students used the word *"concrete"* to describe their key learnings through the CAP and how *"grounding"* it was to be *"... using my hands, moving my body and using my creativity in something more concrete and tangible..."*, and *"...I believe these activities will support me doing my sustainability consultant work"*. Another described it as empowering *"... to see concretely things emerging that I have created myself. I felt my potentials as a human being/sustainability leader got nurtured"*. The creation of something real and tangible in the world – a product – was a *"mandate"* through the assignment, but the realization of many students was around the intangible benefits and learnings of engaging in the process of creating a thing, and the application of this into their everyday lives and work.

There are challenges of inviting students to stretch their comfort zones and engage in creativity and the arts and this requires courage. It became obvious that many have had bad experiences with this in the past – for example of being told by art teachers that they were not good at art or judged on the product, not encouraged in the process of creating. Others spoke of *"not being particularly creative"* and or not knowing where or how to start. In the class sessions, the one-on-one coaching sessions, in the CAP assignment description, the focus was on process, on expanding comfort zones with a playful attitude of trying something you have always wanted to, encouraging students to "stretch yourself towards new ways of thinking, being and doing rather than producing an intervention or creative work of the utmost 'quality', 'beauty' or 'success'". Many mentioned the fact that assigning the project as a requirement was a way for them to push beyond their inhibitions, and then the realization that *"creativity does not have to be perfect or good, it is just about starting it"*. The lessons and the benefits of doing the work then opened up, mainly that there are many creative ways to tackle sustainability. Courage is an essential quality for sustainability change agents (Ayers, Missimer, & Bryant, n.d.; Mouritz et al., 2022), and 'building this muscle' through the CAP is an additional benefit.

Creative thinking about sustainability challenges is an essential quality moving forward (Newman- Storen, 2014; Patton, 2018). For many students an outcome of the CAP was the realization of the variety of ways that they can address sustainability challenges in their lives and work. One student said:
"By the end of the course, not only was I able to see the possibility of approaching sustainability in a different way as I was doing it, but also I saw the great potential for impact that a creative intervention can have when it is set in the direction of sustainability efforts. And at a personal level but connected to what I was saying before the course broadened my perspective of what a creative endeavor is."
The CAP provided an opportunity to practice creativity and think creatively, expand their comfort zones though building courage, and produce a concrete intervention in their lives for sustainability.

3.2 The Creativity Projects and their Impact

There was a large variety of initiatives undertaken through the CAP, and the sheer diversity of approaches to solving sustainability challenges creatively was inspiring for many. To quote one survey participant the course " made me see the possibility of approaching sustainability from other fields

children, roommates, workplaces and neighbourhood and/or online communities. Examples of some of the projects include:

- Making seasonal decorations with the family from things that come from nature and can go back to nature, reducing waste and increasing connection to and time spent out in nature (instead of buying them from the shops, often made far away and in plastic)
- Crafting a compost bin out of recycled wood with the children in the hopes of teaching the family a *"new normality"* in which *". waste is a human concept and doesn't exist in nature and shouldn't exist in society"*
- Drawing and painting an image of an alternative future vison for an international environmentally and socially sustainable tourism facility in Zambia's with this as a main economic force as opposed to the destructive copper mining that currently exists
- Making handmade soaps and giving them away as presents with a sustainability message: "not having to buy plastic, knowing what is in it and not having micro plastics"
- Cooking a *"Carrot Greens Pesto"* dinner for a group of diverse friends and discussing cultural differences around which parts of the vegetables you can eat, buying vegetables in plastic, and ways to reduce food waste.

The images below showcase some of the projects. Figure 1 demonstrates the reuse of old clothes to give life to them with the hope to inspire others to make children's clothes out of ones that are old and broken. Figure 2 shows a children's book co-created with the family in an attempt to communicate what can be very complex sustainability concepts to children, with the hope of publishing the book and thus increasing its impact. Figure 3 shows a neighborhood engagement installation inspired by the story of the Hummingbird which does its part to put out a fire... or, make its world a little bit better. This project invited others in, to reflect and share, their hopes and *"fires"* as well as bringing beauty to some particularly *"ugly and dirty parts of the neighbourhood".* Figure 4 presents a CAP using non-fungible tokens (NFTs) to register images of nature. This student was curious to learn more about *"blockchain technology, decentralized finances, gamification and how we can hack this future tech world and use it for creating more positive impact for a more sustainable and just society*". The aim was to hack this new technology and connect people to nature this becoming more conscious of it and how it is constantly transforming before our eyes.

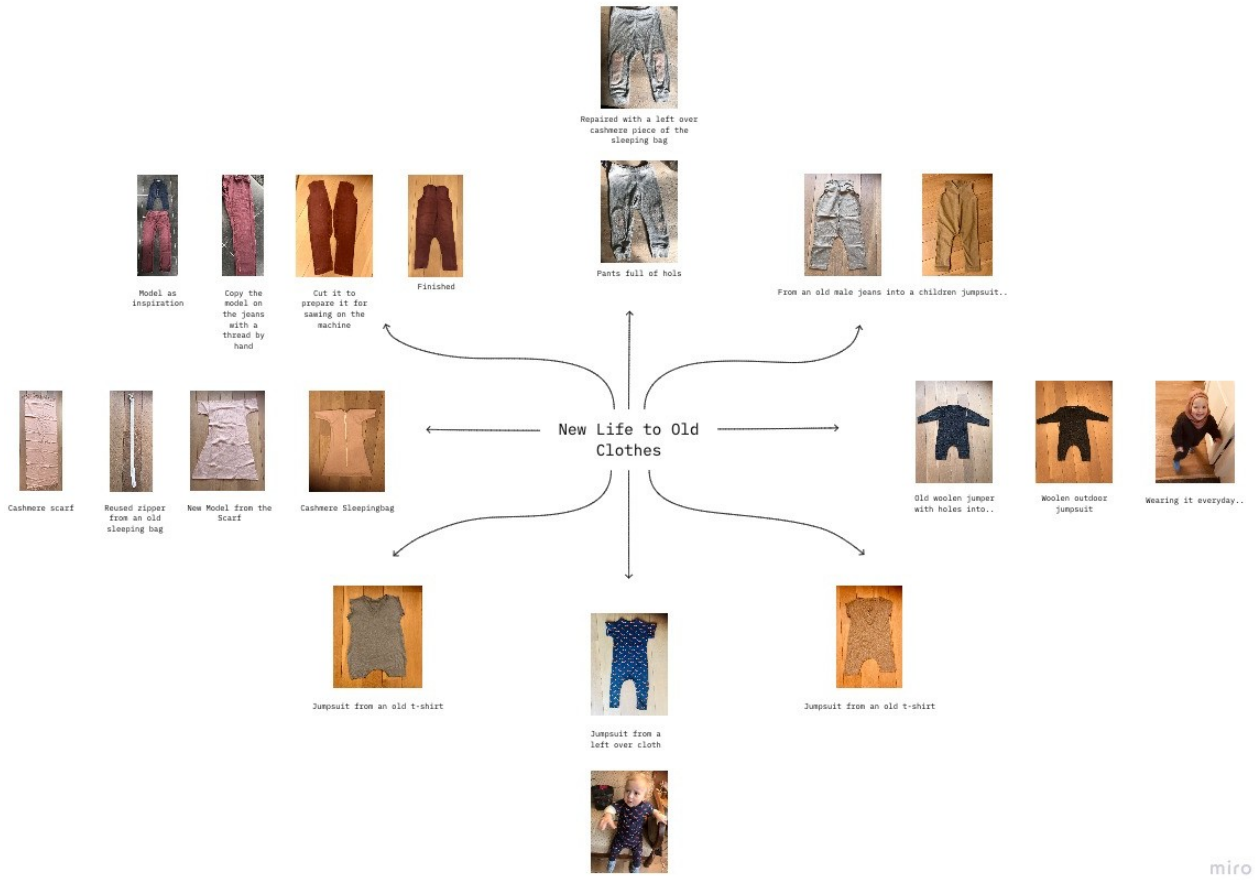

Figure 1. *New Life to Old Clothes by Sophie Vrolijk.*

Figure 2. *Children's Book '1,2,3 Yeah for Sustainability!' co-created with family (A. Jannink)*

Figure 3*. 'We can all be Hummingbirds' a neighbourhood engagement and visioning installation by Carlotta Cataldi.*

Figure 4. *Nature Collection NFTs by Telma Gomes.*

In describing the impact many of the students answered that what they had done was *"not enough"* or that they had hoped to have made more impact for sustainability on more people. One participant said: *"I am unsure if I actually made much of a change but sometimes you can only see the effect of that later on".* But many of them also talked about the *"little seeds planted"* by their work, that it felt like a beginning of something new and their desire now to do more.

3.3 Key Sustainability Competencies and the CAP

Much academic literature has described and defined the Key Sustainability Competencies desirable for sustainability graduates and the most recent and well known and cited work describes 8 competencies (Brundiers et al., 2021; Redman & Wiek, 2021, 2021) which are articulated previously in the Methods section. In designing this project an intention held by the staff was to encourage the students to "go out and make change in the world". An assumption I held was that students would find it beneficial support for Implementation competence – the ability to put into action sustainability strategies and action plans, including implementation, adaptation, transfer and scaling, in effective and efficient ways. The results which can be seen in Figure 5 show that most students did find the CAP supported the development of this competence, and indeed all the competences but particularly that the CAP assignment supported the development of their Intra-personal competence – one of the newer identified competences which speaks to the ability to avoid personal health challenges and burnout in advancing sustainability transitions; and Values thinking competence.

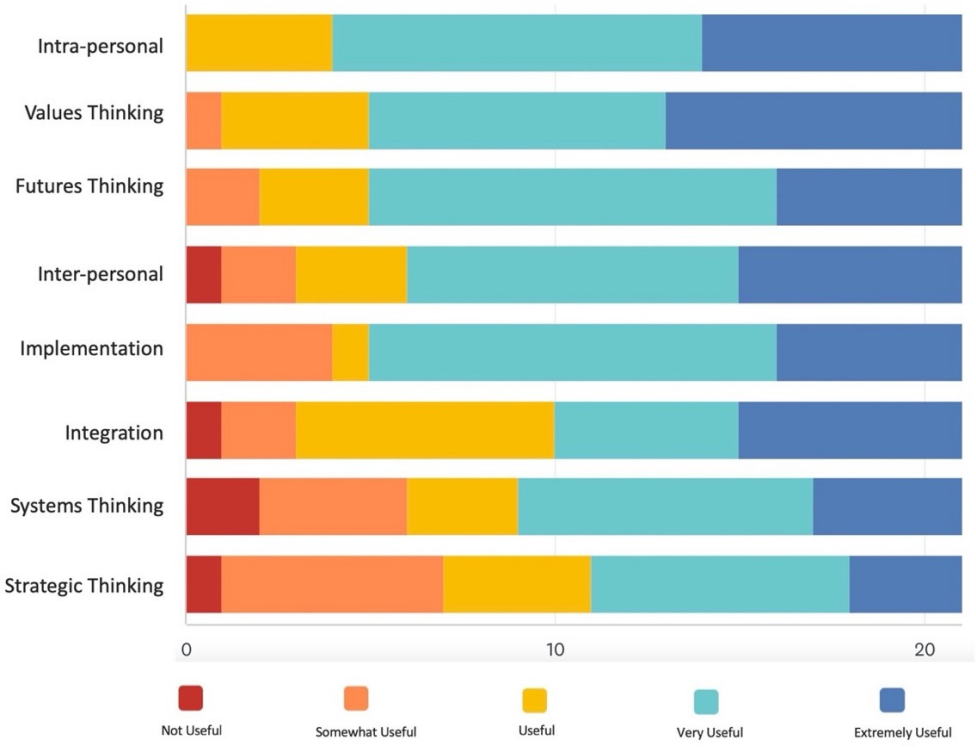

Figure 5. *The Creativity in Action Project's Support in Developing Key Sustainability Competencies According to Respondents.*

All 21 indicated they thought the CAP was "Useful", "Very Useful", or "Extremely Useful" to support development of the Intra-personal competence. As one of the 'newest' Key Sustainability Competencies, researchers still grapple with what the Intra-personal competence actually consists of (Brundiers et al., 2021; Redman & Wiek, 2021). A recent paper currently under review by Ayers, Missimer and Bryant called "The Dark Matter of Sustainability Leadership—Intrapersonal Competence for Sustainability" describes in more detail what these may be. Many of the key learnings identified by participants in the CAP are similar e.g.: Courage, flexibility and open-mindedness, the ability to let go, humility, to honour diverse perspectives, to cultivate optimism and hope are all elements represented in both, suggesting that the CAP is a useful pedagogy to support Intra-personal Competence development.

Values thinking is the ability to apply sustainability values, principles, and goals to assess the sustainability of current and/or future states, and is suggested by some as a pre-curser to all the other sustainability competencies (Brundiers et al., 2021). One participant's quote describes this exactly: *"developing a creative project that is out of your comfort zone, contributes a great deal to knowing ourselves, knowing the values we hold, what we care about, what moves our hearts and inspires us.*
This clarity can then be expressed in many activities or tasks that we do within the sustainability realm (strategies, planning, connecting to others, etc.)". Figure 5 shows respondents also see the CAP as a supportive pedagogy to develop this competence also.

Brundiers et al. (2021) suggest learning objectives for educators to use that can support the development of the Key Sustainability Competencies. The results, impact and feedback of the participants in this study

into scientific inquiry to counter the positivistic perception that values are outside of science. Achieving this desired learning objective to develop the values thinking competence can be seen in the CAP, with the integration of values into creatively solving sustainability problems. This can be seen from the results in Figure 5, and some of the quotes from the participants that have already been shared, who discuss the realization that they needed to clarify their own values, as well as engage with and listen to others to create a more sustainable world (in particular, see the section 3.1 above on Communication). A further learning objective that is recommended is that sustainability is a solution- oriented field, and that it must be done with stakeholder engagement (Brundiers et al., 2021). The CAP scaffolds the learning of both of these objectives as it requires students to initiate a creative solution to a sustainability problem in their own lives and world. Although not essential to engage others in the creative process, the intended impact is on creative change on others. A learning for many through doing this project was of the need to invite others into the project or process, as the realization that the "*selfish hope to change a system the way I want it"* is not the way to make change in the world and was the inspiration for the beautiful community engagement 'We can all be Hummingbirds' creativity project.

Results indicate that the CAP was experienced by most of the students as a useful assignment to develop the Key Sustainability Competencies, but it will of course depend on how people approach the project. As some students reflected, if the intention is to build these competencies, then framing the CAP with these in mind would allow the students to craft their projects accordingly.

3.4 Pedagogical Elements of the CAP

The feedback from the students suggests that doing the project, sharing the project with others and witnessing their projects were the most important parts for most respondents. Figure 6 outlines the responses in the order of the elements of the delivery of the CAP.

The main two recommendations for future iterations of the CAP are to have a more ongoing presence of the project throughout the year and to have "Creativity Coaching Buddies". The course was year long (Jan 2021 – Jan 2022). The CAP was introduced at the beginning of the course through an introduction video, and the webpage. There were two 2-hour class sessions focussing on the CAP in March and September 2021. The option to complete and submit the CAP was available the whole year, however there was only one final Showcase/Exhibition Event (online) which was at the end of the year coinciding with the due date for the CAP. This was mainly due to staff availability, and the fact that the project was a small part (2.5 credits) of a larger course (15 credits). One suggestion to provide a more ongoing presence of the CAP might be to have a mid-year Exhibition event where half or some students present. The class could be split into *"batches",* one at the midway point and one at the end. Alternatively, prototypes could be shared at various points along the year. Making sure to remind students of the CAP in every online session (these happened once every fortnight) would also help.

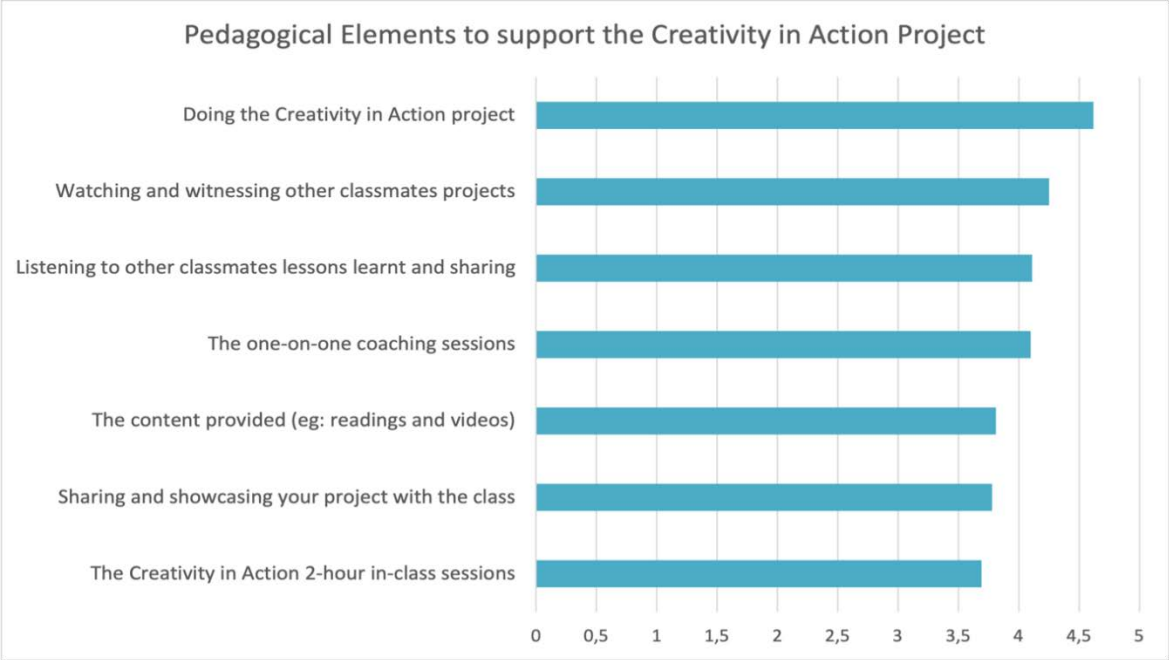

***Figure 6**. Pedagogical Elements to support student learning in the Creativity in Action Project and their 'usefulness'.*

The *"Creativity Coaching Buddies"* or peer support structure is another way to help students keep each other motivated and moving towards something that for many will stretch them out of their comfort zones and require courage. As many expressed finding inspiration and learning from witnessing each other present their projects this sharing of those earlier in the year could help inspire those still stuck on what to do. As the key learning is doing the project this might also support students who may not have made it to the end of the course and complete the CAP in case this was a factor in them not completing the course.

This study looks at the CAP within a distance learning course, and it is worth noting that in the course which provided the inspiration is taught both face-to-face and online suggesting the pedagogy can be adapted to distance, face-to-face or hybrid settings (see: Mouritz et al., 2022; Newman-Storen, 2014).

3.5 For Educators of Sustainability

Creativity and sustainability as essentials for global and economic survival and for individual wellbeing (Jones, 2013) and the future of higher education requires educators across all disciplines to develop capacity in teaching sustainability ('DECODE Sustainability – European Deans Council for Sustainable Development', n.d.; GUNi Network, 2022). This paper presents a creativity-based assignment as a valuable pedagogy for educators for sustainability. The CAP is an assignment that could be used in many fields and disciplines with simple elements. From personal experience I can say that it is a pedagogy that can be used even if you don't identify or feel 'creative' yourself. Two students implemented a similar project for their own students to do which gave them courage to do more themselves! One responded that when watching their students in Russia and *"how brave they were"* in their

project as a chance to do something that you maybe would never do..." the teacher's courage grew. Thinking and literature around creativity proposes that the product must be something of value (Wreen, 2015) which brings up the questions of value to whom and evaluated by whom? This paper argues that the experience of engaging in creative work provides impact and benefits in both the inner and outer realm that are impossible to measure, and the process and press of challenging oneself to step outside one's comfort zone and 'get creative' can be the gift in and of itself.

4. Conclusions

Education is seen as a key leverage point to shift society towards sustainability transformations however as with sustainability approaches in general, the potential of creativity and the arts remains untapped as a tool, topic, process, pedagogy and way of thinking in ESD. This paper presents a creativity-based assignment as a valuable pedagogy for educators, and findings demonstrate realization of the students of the value of creative expressions as a tool for communicating sustainability; the empowerment of creating something 'concrete' and tangible; the courage of expanding comfort zones and the benefits of doing so; and the practice of creative thinking and the revelation of how many creative ways sustainability issues can be tackled. Descriptions and images of the projects are shared to provide concrete examples for inspiration and future iterations. The potential value of the CAP to build key sustainability competencies – particularly the newly identified Intra-personal competence is discussed. The intention of this study is to provide educators and learning designers with inspiration and a practical, adaptable, and impactful pedagogy for the development of sustainability leadership that could be used and adapted to various contexts and recommendations for educators interested in applying the CAP in their own context. It is hoped this will in turn support societal transition towards sustainability through empowering students to be sustainability change agents by applying their creativity to solve a sustainability challenge in real life.

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Developing Social Sustainability with Circus-based Methods

Emma Stenström[1], Andreas Skjönberg[2],

[1]*Stockholm School of Economics, emma.stenstrom@hhs.se*
[2]*Hyper Island, andreas.skjonberg@hyperisland.se*

Abstract

Can circus-based methods develop trust between people in organizations? If so, how? This paper reports the results of a one-year-long research project in collaboration with the Swedish circus company Cirkus Cirkör, the Center for Arts, Business, and Culture at the Stockholm School of Economics Institute Research, and the educational organization Hyper Island.

The project aimed to explore if circus-based methods could be used to develop trust between people in different environments. Different methods were already in use, and new methods were invented in several interdisciplinary laboratories. Special attention was given to developing digital methods due to the pandemic. The result was a series of performance workshops.

As a next step, the performance workshops were tested in five different environments, covering various sectors: a government agency, a private corporation, higher education, a municipality, and a not-for-profit organization.

Interviews and surveys were conducted in all these different environments, and at the university, randomized control groups were used to measure and compare the effects.

The results are fascinating. Circus-based methods and performance workshops add imagination and creativity, hope and surprise, embodiment and entertainment. They can contribute to increasing trust and extending the mind. We conclude that the experiences indicate that trust can be fostered in the short term. Increased trust can potentially enhance social cohesion and sustainability.

Trust is experienced in different dimensions: physical, emotional, interpersonal, self-trust, cognitive- and affect-based. Circus becomes a method, a metaphor, and a mindset, an area of projection and enchantment. The performance workshops allow for embodied learning.

Previous studies have emphasized the psychological skills that can be enhanced: the ability to learn from failures, collaboration, vulnerability, focus, and attention, but we can also see the philosophical aspects. These kinds of circus-based performance workshops can shift how we relate to the world, create new horizons of knowledge, build communities, and, potentially, cultivate social change.

The project addresses several goals and targets. In general, it is goal 16 that is of particular interest. The paper builds on several theoretical strands, particularly circus-based methods and trust and quantitative and qualitative methods.

Keywords: Circus-based methods, Trust, Embodied learning, Resonance

1. Introduction

Trust is a topic that has been studied from a multitude of perspectives, including sociology, philosophy, economics, psychology, management, international relations, automation & computing, to name only a few. Most definitions revolve around expectations in a relationship (James, 2005; Mayer et al., 1995; Kydd, 2005; Rotter, 1980). According to Luhmann (2014), trust reduces the complexity of social systems, which is needed for people to function efficiently despite a very high amount of information regarding social cues and risks regarding personal stakes.

In this paper, trust is defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action necessary to the trustor, irrespective of the ability to monitor or control the party" (Mayer et al., 1995, p 712). According to the authors, trust has a complex foundation and is not to be regarded solely as an emotional state or tendency.

Trust is also a prerequisite for societies to function well in general. Robert Putnam (2000) wrote: "A society that relies on generalized reciprocity is more efficient than a distrustful society because money is more efficient than barter. Honesty and trust lubricate the inevitable frictions of social life (p. 135)." This is also the case within organizations. In Sweden, "trust- based governance" is proposed as the alternative to "new public management" in the public sector (Bringselius, 2017). Instead of relying on measurement and control, trust and judgment become cornerstones in this philosophy.

Trust is one of the critical capabilities and skills that must be developed on an individual, collective, and system level (Wamsler et al., 2020). Further, trust is linked to sustainability. It is a critical component in creating social cohesion, and social sustainability is essential to reaching the global goals for sustainable development, 2020).

Some argue that trust might be on the decline. The global communication firm Edelman has studied trust for over 20 years. Their latest publication, "Edelman Trust Barometer 2022," claims that the "world is ensnared in a vicious cycle of distrust, fueled by a growing lack of faith in media and government." A growing crisis of trust in governments and institutions is also supported by, among many, the World Economic Forum (Mantashyan, 2022) and the United Nations Department of Economic and Social Affairs (Perry, 2022). Flew (2019) argues that "the rise of populism worldwide can be seen as arising from a more general crisis of trust in social institutions" (p. 1).

In circus training, trust is a crucial factor. Several studies show the critical role of trust, how trust is one of the qualities often developed through circus training, and how that, in turn, can enhance social cohesion (Dubois et al., 2014). The pedagogical effectiveness is not limited to specific techniques but includes the development of an array of personal and social capabilities. Essential among these is the ability of participants to trust themselves and others (Bessone, 2017).

According to several scholars, participants will develop an array of personal, interpersonal, and social skills." Chief among these skills is that of trust: trusting oneself and trusting others are vital components of the personal, interpersonal and social skills that develop through the practice" (Cadwell, 2018, p 24).

Circus has a long tradition of working with communities and training non-professionals in basic circus skills. There is a growing body of research on using those circus-based methods outside the artistic practice. Many studies focus on youth or social circuses. A social circus is a" form of non-professional circus education where the focus is on personal development, social inclusion and self-expression as opposed to the achievement of a high level of artistic technique" (Cadwell, 2018, p 22).

The findings from these studies can be used to help interpret our results, but we also notice a gap. Few studies focus on how circus-based methods can be used in settings other than among youth and underprivileged groups. This paper explores the effects of circus-based methods on organizational and professional development, particularly on trust and sustainability.

2. Research Process

For the research process, design thinking principles have been used. The process was divided into four phases.

The first phase identified current challenges in different workplaces through interviews and a literature review.

In the second phase, the focus was turned toward the circus practice. Qualitative interviews were conducted with circus artists and circus pedagogues. A semi-structured discussion guide was set up, which

(Britten, 95; Potter & Hepburn, 2005). The data from the qualitative interviews were analyzed through thematic analysis by systematically identifying, organizing, and clustering patterns of meaning (themes) across the data set. Additional interviews were conducted with organizations that have used circus-based methods and an invention of methods that circus artists had used.

Insights from the research were then processed in a series of co-creation sessions, with the working group containing artists, pedagogues, an administrator from the circus, representatives from education, foreign affairs, and a corporate organization. These workshops were held iteratively throughout the process. The outcomes were mainly physical exercises on developing trust and creating performance workshops for different settings.

The fourth and final step was the workshops conducted in a series of iterations between November 19, 2021, and May 8, 2022. After each workshop iteration, participants' feedback was captured in qualitative and quantitative data. The data were analyzed in the following co- creation workshops with the working group and concerning theories. 190 people participated in five settings: a government agency, a private corporation, an educational institution, a municipality, and a not-for-profit organization. The aim was not to compare the different settings but to test the workshop in different environments. In the educational background, a randomized control group was used so that half of the students participated in the circus workshop and half in a more ordinary cognitive-based seminar on trust, addressing the same topics, but not through circus-based methods.

Ethics

All participants were asked to sign a consent form where they agreed for the authors to use their input following these critical regulations:

- All data were to be anonymized
- All were asked to read and agree to a privacy note
- All were informed that they have the right to change their mind about what the author does with their information and to withdraw from the research entirely at any point and for any reason.

Table 1: Research process

First step: Understanding the Problem	Second step: Discover	Third step: Define	Fourth step: Develop & Analyze
Aim			
To understand the problem, primary research was conducted together with a literature review.	To understand what makes trust building in circus an integrated part of working together, primary research was conducted with respondents who have 'circus' as their profession or have had connections to the circus in their professions.	To create solutions to build trust, insights from interviews, literature reviews, and workshops were integrated into a series of co-creation workshops.	To understand the solution's potential, shortcomings, and areas for further development, a series of workshops were developed and tested in iterative sessions with different target groups. Quantitative and qualitative surveys were conducted with all external participants in order to explore how trust can be created through circus-based methods.
Method			
Qualitative Interviews & Literature Review	Qualitative Interviews	Co-Creation Workshops	Online and Physical Workshops Quantitative & Qualitative Surveys
Number of participants			
N=14	N=16	N=14	N= 190
Guiding Focus Areas and Participants			
Challenges to trust in a business context: • 6 employees on different levels Challenges to trust on a societal level: • 8 local employees at embassies across Europe	Insights on the process of trust among circus acrobats: • 7 acrobats. All working professionally for more than 4 years Gather already developed methods for trust: • 4 circus pedagogues. All with at least 5 years' experience as pedagogues and some professional experience working as performing artists Understanding what makes the circus methods and its approach unique to actors from other fields: • 5 people who are working in organizations, municipalities and companies who have used circus in workshops	Assuring a circus perspective: • 4 circus pedagogues • 3 circus artists • 1 CC employee Assuring relevance to other fields: • 2 participants from the Swedish Ministry for Foreign Affairs • 2 participants from the agency Futurniture Facilitation and transfer of knowledge: • 2 members of the core group	From a government agency: • 10 participants from the Swedish Ministry for Foreign Affairs From business: • 82 participants from Allianz, a mix of team members and managers From education: • 68 participants from a global master program at Stockholm School of Economics From a municipality: • 22 participants from the municipality of Malmö in Sweden From a non-profit organization: • 8 participants from a community sewing atelier which offers educational opportunities to tailors with refugee backgrounds.

3. Results and Discussion

From the first iteration, with participants working in a government agency, there were indications of the workshops' ability to transfer the circus' approach to trust in a playful setting and through embodied learning. The potential was identified for examples from the circus to work as a projection tool for the participants to discuss sensitive topics often not addressed with colleagues. Especially the circus approach to failure, as an acknowledged part of the creation process, served as an effective tool for a mind shift in the perception of failure.

Several iterations were then conducted at the company Allianz Suisse. During these iterations, perceptions of personal connection, level of trust, and readiness to share concerning the other participants before and after the workshop were gathered.

and personal connection among the participants.

- 85.7% of the participants either agree or strongly agree with the statement that the workshop increased their trust in the other participants.
- 85.6% of the participants either agree or strongly agree with the statement that the workshop increased their readiness to express themselves more openly with the other participants.

The qualitative feedback indicates that the Circus' perspective on trust and collaboration served as the basis for discussions among colleagues.

Two workshops were carried out with master's students at the Stockholm School of Economics. Half the students were randomly assigned to an online circus workshop, and the other half to a cognitive, more traditional workshop. All students answered a survey before and after the workshops to measure if a sense of trust was increased.

Also, here the findings were validated.

- 69.4% either somewhat agree or strongly agree with the statement that the circus workshop increased their trust in the other participants.
- 57.3% either somewhat agree or strongly agree that the circus workshop increased their readiness to express themselves more openly with the other participants.

However, and this is important to notice, the other non-circus workshop received similar ratings, which indicates that development could also be a critical topic. When assessing the qualitative feedback, the circus' methods and approaches are perceived to give new learnings regarding trust. The last workshops have not been evaluated yet. Therefore we only have the (very positive) qualitative feedback to rely upon, not the quantitative. To sum up, most of the participants in the performance workshops experienced an increased trust in the other participants.

Therefore, it seems like circus-based methods can increase the experience of trust. We discuss how in the following, using theories from previous studies of circus-based methods and trust.

Through an iterative, interdisciplinary process, we created performance workshops using circus as a method, a metaphor, and a mindset. Circus training can enhance trust-building in a physical, embodied way, for example, when participants collaborate and guide each other blindfolded. An example is a participant who said:

"The "blind" test and trusting the other to direct your way made the most impression on me."

Previous studies have also shown that training circus skills can change the modes of encountering others, fostering trust, collaboration, bodily knowledge, and interactions (Bolton 2004; Dubois et al. 2014; Spiegel et al. 2014; Wilson 2016).

solid and authentic and act as successful accelerators for authentic discussions among the participants. As a metaphor, the circus becomes an area for projection. A natural connection between trust and circus acrobats creates curiosity for the participants to engage in the workshop. Here is a voice from a participating student:

"Focusing on a non-business area and projecting it into our studies made the most impression on me.

Previous studies support this. Several scholars emphasize the "enchantment" element connected with the circus. Enchantment is" a state that embraces the potential to become otherwise" (Wilson 2016, p 2). Circus is a sort of 'enchantment' and surprise, unveiling meaning in" new forms of attachment to the world" (Bessone, 2017, p 656).

As a mindset, the participants picked up many different things from the circus: the importance of trust, learning from failures, deliberate practice, playfulness, etcetera. These could be transferred to their settings, or as one participant expressed it:

"Working together (well) is about collaboration, practice, practice. Practice and patience. More playfulness would be very good also in a formal context as you actually "perform" better because you have fun and try out new things."

Circus teaches participants 'that nothing is impossible, and that doubt and fear are to be examined and absorbed into positive action' (Bolton, 2004, p. 193). Circus techniques and performances can be used as resources for interpersonal trust instead of achieving a high level of artistic technique (Cadwell, 2018). The aim is to create a space 'where ideas can be shared without fear, opinions, and attitudes can be openly stated, and fruitful conversation can flourish and grow' (Bolton, 2004, p 204).

Digging deeper into the topic of trust, previous studies of circus training have noted that trust is developed physically and emotionally between each other and oneself. Even if it is not a risk to life, losing face is seen as a threat – and needs trust. Participants had to trust each other physically and emotionally - and trust themselves. One expressed it:

"Yes, I experienced trust in the sense that because they would make fun of me or judge me while balancing badly. ;) So I felt very comfortable and therefore trusted myself."

Trusting those around you and trusting in the safety of the situation is crucial, but until trust in

t. Still, until you take that first step, the participants cannot truly participate. There genuinely trust becomes about trusting oneself, trusting others, and others, and as several scholars have pointed out how circus training can enhance psychological skills in participants, for example:

"Results showed that mental skills such as confidence, concentration, energy management, and emotional management are considered integral to success in circus also reflected differences that exist between sports domains, such ability to embody emotions and connect with the audience." (Ross & Shapiro, 2017).

Others emphasize the ability to focus. "Circus is a continuous dialogue with the audience and the viewers need to feel that the performer is "in the moment". Indeed, that ability to remain focused while allocating

movement sciences and sports psychology. (Filho et al., 2016). Attention was also a key feature in an earlier study we conducted on what circus training could bring to business students (Stenström, 2016).

Other psychological benefits include the ability to relate to others (Cadwell, 2018) and a reduction in emotional problems such as worry, nervousness, lack of confidence, and fearfulness. (Neave et al., 2020). Welby Altidor, former Executive Creative Director of Creations at Cirque du Soleil, further describes how circus skills can enhance creativity and courage (Altidor, 2017).

Circus builds on risk as a key component. Without something to risk, the trust would not be needed (Coleman, 1990; Deutsch, 1958; Jøsang and Presti, 2004; Molm, Takahashi & Peterson, 2000; Szerszynski, 1999). The link between risk and trust becomes even clearer through Robbins' (2016) reasoning that trust emerges under conditions of risk and uncertainty – conditions in which the outcome of matter 'Y' is unknown. Thus, risk and uncertainty are necessary conditions for trust. Or, to rephrase it, trust is a way to calculate how to deal with uncertainty and risk logically.

Risk in the circus plays a central part in the performance of the act, the performed danger, as performative risk. The audience's perceived risk in the performed circus act is what draws an audience to be amazed by "death-defying" acts.

Circus also has a history of embracing failures and learning from them. Ibañez (2018) argues that trying out something new offers us opportunities for growth and change, "but with those opportunities comes the risk of failure. While we intellectually understand that to grow, we must take chances and try things we cannot accomplish until the skill has been learned, it doesn't seem to help how we feel about failing." Failure can offer an opportunity for building trust through vulnerability when acknowledging failure. Failures also provide chances for development and learning new things if you learn from your mistakes. As two participants noted, independently:

"I was reminded that failure is necessary and good."

"Failure should be celebrated, as it offers the opportunity for something new."

The approach to failure in the circus plays a central role in trust building. Between acrobats, failure is the very start of each new learning curve. When an acrobat starts training a new trick with a partner or alone, failure is assumed. The process has similarities with reward-based learning (Palminteri et al., 2015), as, among acrobats, the failure is acknowledged and owned, thus not an indication of a breach of trust. This enables a more accurate reflection detached from the influences of emotions. Using this circus approach in training did not only support a mind shift regarding failure but also as an enabler for vulnerable and authentic conversations.

These conversations contributed to perceived reliability among the participants and fostered sustainable relationships built on interpersonal trust.

The notion of choosing trust as a mindset made an impact and the circus perspective on failure. One

"What I take from the workshop is to give initial trust instead of being suspicious. Take a leap of faith, communicate, express doubts, and collaborate on the best solution together".

Among acrobats, acknowledging the failure, analyzing it, owning it, taking responsibility, and showing a change in the next training session builds trust. When acrobats examine the loss in several small steps, each involved party learns how the other(s) behave in situations of danger and stress. And, through the event of failure, each party learns about the other's (and own's) ability, benevolence, and integrity, resonating with Mayer, Davis & Schoorman's model (1995).

Faith in judgment and competence is also built by affect-based- and cognition-based trust elements. Affect-based trust plays a significant role as a starting point as the connection between the acrobats needs to be personal and authentic to withstand the challenges of training, failure, pain, and exhaustion. The characteristics of affect-based trust resonate with other researchers' findings (Lewicki & Bunker, 1995), involving individuals creating a common ground by understanding expectations on responsibilities. When affect-based trust is established, cognitive-based trust plays a prominent role. When there is a high stake (life or death/injury) investment, a person's actions play a more prominent role than the emotional connection.

A significant discussion in the co-creation workshops was what characterizes the circus, or as it was expressed:

"How do you "circusfy" a workshop?"

Is it the skills that characterize the circus? The objects? The aesthetics? The ethics? The attitude? Or, perhaps, a combination of all and more.

From the outside, an essential element was the instructors, who all came from the circus and acted as role models, showcasing the circus mindset. Capturing this circus mindset is not easy, but it has elements of an inclusive attitude, creativity, presence, physical intelligence, humor, surprises, social awareness, and care. During the co-creation workshops, it was, for example, often pointed out how important it is that everyone can participate and that nobody feels too uncomfortable or excluded.

In earlier studies, the role of the instructors has been pointed out. "The presence of soft skills among circus tutors essentially goes unnoticed. Much like plumbing, it only becomes a problem when it stops working. However, when a tutor lacks that ability, or when insufficient time is given to trust-building within the class setting, the efficacy of circus as a strategy for personal development falters." (Cadwell, 2018, p 28).

Another aspect that turned out to be important in co-creation was the space. After a few iterations, one of the artists came up with the idea to build boxes showing the different topics in the workshop: trust, failure, collaboration, etc. These boxes could then be used in different ways: to play with, to co-create a workshop around, to introduce oneself, to build a physical space, etc. The boxes created an experience and made the circus element stronger.

Space is also vital in a metaphorical sense. The space blocks everyday life out of the 'circus bubble.' It

educational or business settings – towards the 'new' rules and goals of the game. This opens opportunities for new experiences, perspectives, and relationships.

Space is not only physical but also emotional. The principles of the circus inspire a space where ideas, opinions, and attitudes can be openly stated, and fruitful conversation can flourish and grow, according to Bolton (2004). This was also incorporated in the performance workshops, where attention was given to designing workshops where participants would feel safe. Just like a trapeze artist need to ensure that the trapeze and crash mat is functional for them to feel secure enough to train, it is essential to assure that all participants are familiar with the used technology and the anchor points. It is necessary to set a transparent frame for open and honest conversations.

Objects, and the manipulation of objects, are other key features of the circus. According to research, incorporating objects can be one way to extend the mind (Paul Murphy, 2021). The workshops included everyday objects, apart from boxes, plastic bags or newspapers, feathers, and balls.

Others include movement and the body (Paul Murphy, 2021), which might be the most apparent element when using circus-based methods. "It is the physicalities, and corporeal relationship experienced rather than the narratives illustrated [in the creation process] that become the locus of transformation' (Spiegel, 2016, p 55). Those comparing circus with sports emphasize how circus arts are non-competitive and open up physical experiences for those who do not like to compete (Ross & Shapiro, 2017). Embodied learning is a crucial feature of circus training. Or, as one of the participants writes:

"I've learned a new thing, played, and had fun. I felt my body. Experienced focus (inner and out)."

This is in alignment with the sociologist Hartmut Rosa's concept of resonance. Circus art can support the participants' experiences of resonance, which in turn can help them restore their relationship with the world. Instead of appropriating the world, as is often taught in management education, art opens up for *experiencing* it in an unpredictable, uncontrollable way. The experience is embodied through the skin, breath, voice, gaze, and other bodily organs and senses (Rosa, 2019).

Many studies have observed the psychological effects of circus training, but as important are the philosophical ones of changing the relationship and becoming more responsive to the world. "Undermining bodily and emotional labeling and expanding empathy, the social circus has the potential to affect subjectivities and communities beyond the time and space of the workshop, to foster an 'ethics of becoming "more responsive" to the world' (Wilson 2016: 10).

The specificities of the circus foster" a challenge to habitual modes of relating, one that breaks with habits of thought and interaction, to open up new individual and collective horizons for future social and cultural development" (Spiegel 2016, p 64).

This is true for bringing in arts-based methods in general. Art can be used as a sensitizing experience, bringing unexplored bodily senses such as tactile and taste to the educational setting (cf. Küpers 2017, Gallos 2020). Artistic interventions, such as our circus workshops, can help to destabilize the participants' bodily positions and provide them with a sanctuary in the form of an alternative discourse or a new vista

Bessone (2017) shows, for example, how circus training enhances the opportunities to be surprised by 'others' and encounter them in ways that undermine reductive representations, and Wilson (2016) continues: "Emphasis on creativity also implies accepting failure and ambivalence, remaining attentive to unknown outcomes and unpredictable solutions – that is, working towards an 'ethics of attunement'" (Wilson 2016: 15). This is in line with Hartmut Rosa's idea of resonance. One participant expressed:

"The circus interlude was simply "refreshing" and "something different": in other words: "Sau gut ;-)." The topic "trust" is so enormously important, and also every partnership/marriage/etc. is based on trust. This feeling of trust releases enormous energies: you feel protected, sheltered, supported, and caught if something does not work out as desired".

An earlier study explores how circus skills can be integrated into academic subjects. The authors conclude that "three common ways students experience agency through the integration of circus practice and academic knowledge. First, students can build new knowledge from their domains of comfort into domains of discomfort. Second, combining embodied and academic knowledge expands student access to creative solutions, thereby expanding their knowledge horizons. Third, we notice that the collaboration inherent in the practice of circus arts enables community building, which, in turn, elicits the development of trust in new situations. We see each of these elements as foundational for social change." (Hoak, Funk, & Berkley, 2021, p 147)

Therefore, three elements might contribute to enhancing sustainability through circus training: entering domains of discomfort, combining different knowledge forms, including embodied learning, and the development of trust.

We are not the first ones to recognize the potential for the circus to become a site of pedagogy. Through a similar path, Wilson (2016) concludes:

"The peculiar meanings and roles acquired by trust in circus practices, where learning entails placing one's integrity and sometimes life in the hands of someone else, and where creation and performing rely on skills of 'bodily listening' and non-verbal communication; and an emphasis on creativity which praises and values the unexpected character of the outcomes of learning or creative processes, and enables to reframe behaviors otherwise classified as marginal, deviant, or pathological, as factors of diversity 'without the minus,' and even as resources for artistry and inventiveness. These features normalize destabilization within social circus spaces, turning them into significant sites of 'politics and pedagogy'" (Wilson 2016, p 6).

Circus performance workshops as "significant sites of politics and pedagogy." Now, that is an exciting thought – and a tentative conclusion.

4. Limitations

Although the findings are inspiring, there are some limitations regarding reaching the same engagement

1. The study aimed to create and explore circus-based methods to build trust. As the format only has been tested with temporary groups of people, no findings are made on long terms implications on established teams.

2. Speaking openly about failure seems to strike different nerves among different targets. A senior target can connect it to experiences at work. These issues might not occur as frequently among a younger generation as there are indications that reflecting on failure is more common.

3. The workshop has shown limitations in terms of time; a workshop of 90-120 min can serve as an initial introduction to the topics. A continuous critique has been the workshop's short length, which ties in with the findings that time is needed to build trust.

5. Conclusions

After having created, through an interdisciplinary, iterative process, and tested a series of circus-based performance workshops in different environments, we can conclude that the experiences point to that trust can be fostered, at least in the short term. Increased trust can potentially enhance social cohesion and sustainability.

Trust is experienced in different dimensions: physical, emotional, interpersonal, self-trust, cognitive- and affect-based. Circus becomes a method, a metaphor, and a mindset, an area of projection and enchantment where we can become otherwise.

Many previous studies have emphasized the psychological skills that can be enhanced: the ability to learn from failures, collaboration, vulnerability, focus, and attention – and we note the same.

Among the crucial factors are the instructors, the physical and emotional space, and the objects used. Of particular importance is the fact that the performance workshops allow for embodied learning.

Finally, the philosophical aspects are at least as important as psychological skills. These kinds of performance workshops can, in the best of worlds, shift how we relate to the world, create new horizons of knowledge, build communities, and cultivate social change.

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Embedding Enterprise Focused Education for Sustainable Development: Lessons from undergraduate student experiences in product design

Dr. Francesco Luke Siena[1], Dr. Ana Rita Domingues[2], Prof. Richard Bull[3], Mr. Peter Jensen[4], Mr. Allan Cutts[5], Mr. Oliver Price[6], Mr. Christopher Forbes[7]

[1]Product Design Department, School of Architecture Design and The Built Environment, luke.siena@ntu.ac.uk
[2]School of Architecture Design and The Built Environment, rita.domingues@ntu.ac.uk
[3]School of Architecture Design and The Built Environment, Richard.bull@ntu.ac.uk
[4]Department of Architecture, Design & Media Technology, Aalborg University, pbjen@create.aau.dk
[5]Product Design Department, School of Architecture Design and The Built Environment, allan.cutts@ntu.ac.uk
[6]Product Design Department, School of Architecture Design and The Built Environment, oliver.price@ntu.ac.uk
[7]School of Architecture Design and The Built Environment, christopher.forbes@ntu.ac.uk

Abstract

As the world begins to grapple with numerous sustainability challenges such as zero waste, de-materialisation, sustainable consumption, zero emissions and a fair society, product design students must be educated on these key sustainability concepts. In industry, product designers are embedding sustainable values and processes within their everyday design practice when developing new products and services. The Nottingham Trent University (NTU) Sustainability in Enterprise (SiE) project is working to support local businesses within the Greater Nottingham area to help improve their environmental performance across four key areas: People, Products, Processes and Premises. We present a case study whereby for the first time, first-year BSc Product Design students at NTU act as design consultants during a focussed "Sustainability Week" to support local enterprises. During Sustainability Week, teams of BSc Product Design students undertook a project alongside a Nottingham, UK, based chocolate shop and bakery by reviewing their existing product line and packaging solutions. Students selected an existing packaging solution and designed new solutions associated with less and alternative materials for their products. Students learnt through discovery, experience, experimentation, research, practical doing, and other forms of experiential learning. During sustainability week, qualitative data through observation was collected to analyse the development of the sustainability week. Data from students was gathered at the end of sustainability week to gain insight into their learning experience. We collected quantitative and qualitative data to assess the students' experience and the project through a survey questionnaire. A mixed-methods approach was used to analyse the data. The development of Sustainability Week has improved student knowledge on sustainable product development. Delivered sessions promoted knowledge acquisition, skills development, and improved attitudes towards global issues, i.e., Responsible Consumption &

Production (SDG12). Having attended Sustainability Week, a large proportion of the student cohort suggested that this helped improve their understanding of sustainable concepts within product design. Students submitted a physical model and two presentation boards to communicate their proposed new solutions demonstrating through their project outputs and vocational taught sessions improved knowledge on life cycle assessment, methods of communicating sustainable product solutions through design

their basic knowledge of designing for longevity, sustainable design considerations and material selection using material databases. Based on the developed Sustainability Week, the success and positive feedback from students resulted in its integration into the BSc Product Design curriculum, with further improvements planned to enhance Sustainability Week in the future. The implementation of sustainability week in the BSc Product Design curriculum will shape new sustainability-conscious product designers and professionals who have insight into sustainable product development whilst being equipped with dedicated tools/learnings to enhance their professional expertise.

Keywords: University-industry collaboration, Higher education institutions, Eco-design, Undergraduate teaching, Sustainability education, Curricular innovation.

1. Introduction

In recent years the demand for sustainability to be fully integrated as a core concept/topic within product design and design engineering education has continued to grow globally (Ramirez, 2006; Ramirez, 2007; Watkins & Lofthouse, 2010; Seay, 2015; Ashour, 2020). It has been recognised that sustainable product designers require additional knowledge and skills beyond traditional design education, thus highlighting that sustainable product design education should be fully integrated into the core design curriculum to have an impact (Watkins et al., 2021). Sustainable product design is an essential topic that needs to be taught across the product design and design engineering sector; however, it requires specialist knowledge and an in-depth understanding to deliver this successfully/effectively. Future designers and engineers must learn how to address sustainability's triple bottom line, i.e., addressing financial, environmental, and social goals (Oehlberg, 2010). Teaching sustainability alongside enterprise and entrepreneurship also offers a unique opportunity to provide an enhanced educational experience to students across the sector, thus enriching their educational experience.

Education for sustainable development has been addressed in scientific and grey literature in the last years. In a recent study, (Lozano et al., 2017) conducted a literature review to link pedagogical approaches adopted in Higher Education Institutions (HEI) and how they may affect sustainability competencies. For instance, systems thinking is a competence that underpins understanding the interlinkage issues that underpin sustainability problems. According to the framework by Lozano et al (2017), system thinking could be fostered by universal approaches such as case studies, mind and concept maps and project and/or problem-based learning. At the same time, these authors highlight that systems thinking can be nurtured through environmental education, e.g., eco-justice and community and place-based environmental education.

With a topic such as sustainability, it is important that students learn in an environment conducive to exploring their beliefs and values in relation to the topic. This type of learning is best conceived through experiential learning and is best facilitated by a process that allows students to draw out their beliefs and ideas to be examined, tested, and integrated with new, more refined ideas (Passarelli and Kolb, 2012). Teaching sustainability through project-based learning and in the context of experiential learning has also

when considering new product development (Zancul et al., 2017). Embedding sustainability into design/engineering education has been a topic of discussion in recent years (Humphries-Smith, 2007; O'Rafferty, 2008; Watkins & Lofthouse, 2010; Watkins et al., 2021), with academics identifying that more sustainability focussed education should be embedded within the curriculum.

NTU's vision is to create the university of the future, as such one of the six key strategies is to "Embrace Sustainability" (NTU, 2022a). This is also a core research theme which aims to bring academics and industry together to explore/influence low carbon technologies, sustainable consumption, green mobility, and government policy to improve the future of our planet (NTU, 2022b).

Although sustainability is a key strategic theme at NTU, it is important to recognise that within many of NTU's themes, creating links and connecting with industry/enterprise is critical, especially within the education context. 'Therefore, moving forward in today's economic climate, students must engage with industry and enterprise as early as possible in their education in the higher education setting. By engaging with stakeholders and industrial sector experts, enterprise focussed education enables students to experience life beyond the traditional learning setting. At the same time, previous studies have shown the valuable benefits of students' insights into industrial practices (Piekarski et al., 2019). Following the UK QAA 2018 guidance, NTU has identified that all students should have an opportunity to engage with enterprise and entrepreneurship within their subject of choice (Advance HE, 2019).

The 2018 European Entrepreneurial Competence Framework, which also informs the QAA guidance, encourages embedding enterprise within the curriculum. McCallum et al (2018) has also identified that entrepreneurship capability is a core competence for life. It is relevant to personal development and fulfilment whilst also contributing to progression in employment and initiating new ventures ranging from community campaigns and social enterprises to new start-up businesses. Jones (2018) also identifies an increasing demand for entrepreneurship education across all levels of education globally, thus suggesting a need for pedagogy for entrepreneurship across all teaching and learning contexts.

At NTU, the Sustainability in Enterprise (SiE) project partly funded by the European Regional Development Fund (ERDF) aims to combine sustainability and enterprise together. The SiE project supports small and medium-sized enterprises (SMEs) in Greater Nottingham to reduce their carbon emissions. The SiE project blends sustainability and enterprise/entrepreneurship to provide specialist knowledge and skills in sustainable business operations, building management, product design, and employee engagement. The SiE project also provides support in multiple ways, including offering a student sustainability consultancy from two schools at NTU: the School of Architecture, Design, and the Built Environment (ADBE) and Nottingham Business School (NBS). While NBS has a specific module related to the SiE project that students can opt into to support SMEs, ADBE is still in the early stages of integrating sustainability-related skills into its curriculum.

Sustainability-related skills are currently still added in a non-systematic way within ADBE. Thus, the SiE project provided funding from NTU and the ERDF to support ADBE's journey into integrating sustainability education more systematically into the curriculum. This paper shows how sustainability-

undergraduate education). Students supported an SME in reducing its carbon emissions by offering alternative packaging alternatives. It enhanced students' education on sustainability and allowed first- year students to gain experience in a work-related project, offering the opportunity of a site visit and interaction with a business. The project was set up to help businesses fully understand their current carbon emissions and identify effective carbon reduction measures. Subsequently, the project also offers financial support to help businesses act on carbon after enrolling in the scheme and conducting a project (NTU, 2022c).

Within the product design sector, the SiE project also offers a product design consultancy whereby commercial product design consultants offer a wealth of design experience to help reduce the carbon impact associated with products or packaging. Services available include an independent carbon footprint of a company's existing products via a lifecycle analysis, initial research into the design challenges within a business and market context, design consultancy focused on waste reduction and a second lifecycle analysis of a redesigned product to quantify the associated carbon reduction (NTU, 2022c). The product design consultancy resources are also delivered in collaboration with students from ADBE, with concepts taught within specialist sessions.

Collaborating with the SiE project has allowed students to gain their first experience of working with a real-life client in an enterprise setting, whilst also embracing sustainability and sustainable design principles. Throughout this paper, insights are provided on the development of sustainability week, providing understanding, reflection, and student feedback from an end-of-project survey. Finally, recommendations are presented on how to adopt further sustainability-related product design education informed by enterprise for other courses and institutions across the design and built environment sector.

2. Methods

Thirty-seven students split into ten groups of three to five. Each group was set the design challenge of redesigning an existing packaging solution for a female-led chocolate shop and bakery in Nottingham, UK. The outcome needed to be a packaging solution associated with the use of less materials or materials with less environmental impact. The student groups were required to explore the materials used for the existing packaging solutions and the ease of use and assembly of the packaging. It was also crucial that the capabilities of the mass manufacturability of the current and future packaging solutions were reviewed.

A key aspect of the design challenge was adjusting the packaging design and materials whilst maintaining the company's identity. 'Students were required to seamlessly implement the brand values of the female-led chocolate shop and bakery into any designed packaging solution, especially considering the product range focusses on lovingly hand-painted artisan chocolates and deliciously indulgent bakery treats. The brand's personalisation needed to be conveyed through any redesigned

packaging whilst balancing the sustainability aspirations. Critically, the students were required to ensure any product solution adhered to a more sustainable solution, when compared to the original product.

A traditional design sprint methodology approach typically used in industry was adapted which to tackle the business problems allowing the students to complete the design challenge within the sustainability week time scale. In this case, the student cohort were taken through a streamlined design thinking-based

design framework which is often used by design teams to improve the likelihood of producing a successful solution; this is often a product or service (Banfield et., 2015).

Design sprints are used to solve big problems and test new ideas. For this to be successful, a range of elements from the design process are utilised; scientific methods are combined with design activities in combination with philosophical viewpoints and perspectives. Knapp et al (2016) presents a structure/framework whereby a range of focussed activities are utilised to allow successful design sprints to be completed within just five days. Integrating design sprints into the classroom or a design studio is a significant challenge, especially for first-year product design students who have only just started their design education journey and therefore have only begun to embrace the design studio culture and compliance with structured design processes.

Integrating design sprints into classrooms as well as exploring new active learning tools for project- based learning has been successfully utilised in various sectors ranging from human computing, UX/UI design, engineering, and industrial design (Knapp et al., 2015; Ferreria & Canedo, 2020; Ferreria & Canedo, 2019). Many researchers have identified that design sprint activities must be run in a timely manner in order to rapidly focus product innovation to drive more valuable outcomes (Ferreria & Canedo, 2019). The sustainability week design sprint activity schedule is presented in Figure 1.

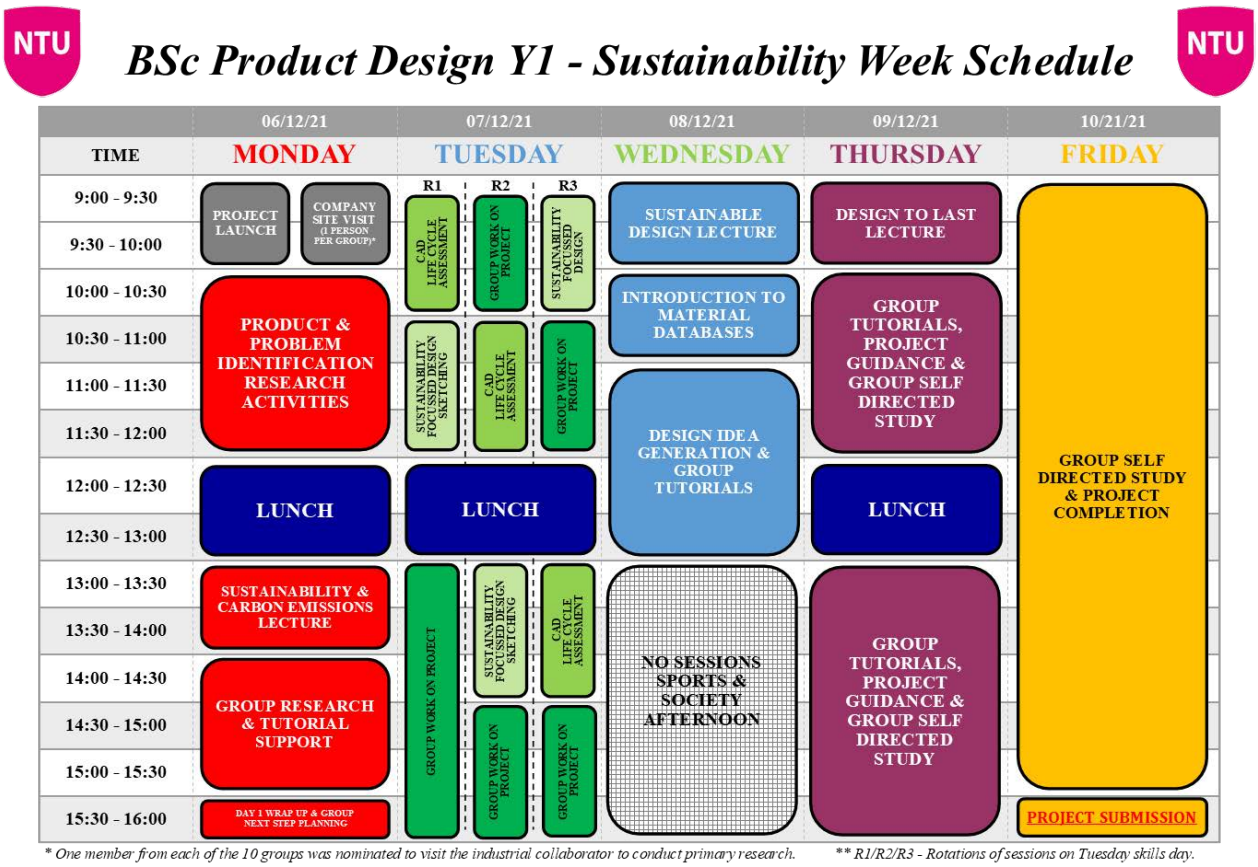

***Figure 1**. Sustainability Week Overview Schedule.*

In the adapted design sprint approach, a variety of lectures, workshops, and short research and design activities were integrated into a structured week whereby the students' groups were able to redesign an

structured set of activities; throughout the week research, design sketching, computer-aided design (CAD), material database exploration, product development and modelling and final design realisation/presentation was completed (Figure 1).

Following the completion of sustainability week, an online survey with open and close-ended questions was created based on previous work on learning and teaching sustainability in higher education (Sandri, 2014). The survey was distributed using Microsoft Forms. It was also designed to collect student demographic data for suitable results analysis. Participation in the survey was entirely voluntary and was sent to the student cohort to ascertain their understanding of the topic and their experience of sustainability week. All quantitative questions utilised within the survey were measured using a 5-point Likert scale. The survey comprising of twenty-one questions aimed to establish the following:

- Student interest on the topic of sustainability prior to the commencement of sustainability week.
- Student prior experience with sustainability/sustainable design principles.
- An understanding of the importance of the topics learnt and activities that were undertaken during sustainability week.
- The students' successes and challenges during sustainability week whilst completing the design challenge.
- Student perception of their thinking on sustainable design after the completion of sustainability week.
- Overall satisfaction with sustainability week and the learning completed.
- Understanding the importance of sustainability in future professional practice and career development.

3. Sustainability Week

Sustainability week aimed to improve student knowledge on sustainable product development whilst promoting knowledge acquisition, skills development, and improved attitudes towards global issues. The topic of sustainable product design/development refers to the design process that considers the source of natural resources as part of the design. Fundamentally sustainable design seeks to reduce negative impacts on the environment. As young aspiring designers, students were asked to consider their role as they move toward living in a sustainable world. Part of their journey throughout sustainability week was to consider their impact on the environment when creating products and services, including reflecting upon environmental, social, and economic impacts whether this is at the initial phase of product development or at product end life. As such, the following session types/activities were conducted throughout the week:

Product Design Studio Sessions

Throughout the week, design studio sessions were integrated to facilitate project development and student group work. Students were briefed at the start of the day with the program of activities which included

methodology, the design studio sessions were broken down into short individual activities whereby the students were empowered to complete specific rapid research activities, utilise tools such as Miro (a visual collaboration platform) to share work, conduct ideation activities based upon previously taught ideation methods from ideation workshops, complete product modelling and experimentation, produce product visualisations for the submission of client-ready presentation boards and finally produce a functional presentation worthy prototype/model.

The design studio sessions also allowed the students to work collectively and as individuals on elements of the project to meet the final deliverables. Throughout the design studio sessions, the supporting academic staff and guest speakers/experts provided group tutorials while also encouraging self-directed group study. The daily ordering of activities (Figure 1) was set out to facilitate the projects progression- Guest speakers introduced key topics throughout the week at timely checkpoints providing key reminders of the sustainability topic which needed to be fully considered. Each design studio session was also linked to the lectures provided, or skills focussed sessions delivered during the week.

Sustainability & Carbon Emissions Lecture

This session aimed to make students reflect on their values, perceptions, and actions (critical thinking and analysis) and understand design decisions' connectivity and cause-effect relationships (system thinking). Students were given an overview of sustainability concepts related to life cycle thinking and the importance of calculating carbon equivalent emissions to quantify the impact. Food production and packaging were used as case studies to highlight how decisions on material use can affect emissions. Case studies are among the pedagogies with a high likelihood of addressing critical thinking, analysis, and systems thinking competencies (Lozano et al., 2017).

Students were also given multiple examples of how design-related decisions often have irreversible effects that can potentially increase social inequalities, environmental degradation, and economic disparities. Students were taught about greenhouse gas (GHG) emissions, their different impacts, and sources. Lastly, a preliminary overview of circular economy principles compared to a linear economy introduced the first discussion into future design approaches, using the waste hierarchy pyramid (DEFRA, 2011) and the 5R's Refuse, Reduce, Reuse, Repurpose, Recycle as the lens.

Sustainability Focussed Design Sketching Session

This session aimed to inform students on how to effectively communicate key sustainable principles regarding their designs in sketch format. This session focussed on communicating packaging products via storyboards. Storyboards are a traditional method of communicating a written story, screenplay, scene, or scenario in many different industries. However, they are a very useful tool in communicating design concepts. Storyboards can be used to stimulate creative thinking, planning projects, collecting ideas, communicating concepts, illustrating key aspects of a design, or presenting the understanding of the big picture (Birchman & Sadowski, 2006).

storyboarding, including movements/actions such as unfolding, assembly/disassembly, deconstruction etc. This session ultimately allowed the students to visually communicate and sketch packaging solutions with each other and potential clients frame by frame, whilst communicating the sustainability story behind their ideas.

Computer Aided Design – Life Cycle Assessment Session

In this session, students were introduced to the basics of conducting a life cycle assessment (LCA) using SolidWorks. SolidWorks is an industry-standard solid modelling computer-aided design and computer-aided engineering application published by Dassault Systèmes. SolidWorks is designed to help designers and engineers conceptualise, create, validate, communicate, manage, and transform innovative ideas into great product designs (SolidWorks, 2022). Within this session, students were taught step by step how to complete a LCA using the software, thus providing them with information on how to make the most environmentally friendly decisions throughout the design process of a product.

The SolidWorks Sustainability plugin/feature integrates LCA directly into the engineering design process, providing insight into a product's social, environmental, and economic conditions, thus allowing designers to be environmentally conscious about their designs. Within this session, students were taught how to model a piece of packaging and its multiple components, apply material settings to the components and then fully assess the sustainability of the packaging solution by completing their first LCA.

Sustainable Design & Material Selection Session

In this session, students were introduced to a wider range of sustainable design principles and topics. Critically, the student cohort were introduced to the social implications of sustainable design, such as social equity and fairness, as well as designing for the needs of people and communities affected by the production, mining, and extraction of raw materials. Students were further reminded about approaches to design using the concepts of the waste hierarchy pyramid (DEFRA, 2011) and the 5R's Refuse, Reduce, Reuse, Repurpose, Recycle, as well as being introduced to key concepts and sustainable design considerations such as The Waste Electric and Electronic Equipment (WEEE) Regulations (Health & Safety Executive, 2022), Restriction of Certain Hazardous Substances (RoHS) Directive (European Commission, 2011), design for sustainable behaviour (Selvefors et al., 2014), design for disassembly and design for modularity.

Furthermore, the student cohort were introduced to Ansys Granta EduPack (Ansys, n.d.) a piece of software that provides and enhances undergraduate materials education and includes a database of materials and process information, materials selection tools and a range of supporting resources. This software helps teach appropriate material selection based on the work completed by Ashby and Cebon (1993) which focusses on material selection in mechanical design. Material selection in relation to product design is fundamental (Ashby & Johnson, 2013), and ultimately directly impacts the perceived sustainability of a product from a material selection standpoint, design for modularity, design for disposal and energy consumption standpoint. An introduction to material selection was presented, including the

principles. Within the software, students were able to access the sustainability package and explore how to generate charts that compare materials and the properties of the different materials to justify their selection and implementation into products. Additionally, students received demonstrations and step-by-step guides on how to critically evaluate a product's environmental impact through the eco audit tool.

Designed To Last Lecture

The session focussed on "Designed To Last" was centred around recent research on product longevity and how to increase this as a part of the circular economy discussion. Product longevity function is an important element of environmental sustainability by slowing the rate of consumption. When discussing product longevity in the design context, physical durability is an important deciding factor for the actual product life. Also, the user's attachment, the ability to repair and maintain a product and the business supporting the product will all influence the longevity of the product.

Working with product longevity and being presented with these opportunities can hopefully enable students to be more cautious in their design process. The students were firstly presented with 14 barriers that designers, companies, and users need to overcome to produce products with high longevity (Jensen et al. 2021a). These barriers form insights into obstacles for the students that might not have been considered previously. Based on a discussion of these barriers and their relevance to the student's current projects, they were then presented with real-life cases from 18 producing companies and their solution principles to the barriers (Jensen et al. 2021b). As the cases differed significantly in both marked solutions and aim, the students could select and adopt the most appropriate solution principle for their own project. Based on the presented barriers and solution principles, the students worked to incorporate considerations regarding the product longevity, ranging from limiting the number of parts needed or increasing the modularity of the product to creating a more personal experience between product and user to improve the user's experienced attachment towards the product.

4. Results and Discussion

Thirty-seven students took part in sustainability week, of which twenty-two students voluntarily completed the anonymous end-of-week survey representing a 59% response rate. The male to female response rate was 91% male to 9% female; however, it is worth noting that the student demographic for the 2021/22 academic year for BSc Product Design first year cohort is predominantly male, representing 84% of the student cohort. The average age of respondents was 20.3 years old, with the student cohort age range consisting of students aged 18 – 30.

Results show that the higher the student age, the more interested they are in learning about sustainability/sustainable design. Students more interested in learning about sustainability/sustainable design typically haven't studied or had previous experience with sustainability/sustainable design before sustainability week. The overall satisfaction with sustainability week was positive; 15 out of 22 students who completed the feedback survey were satisfied or extremely satisfied with sustainability week in understanding sustainable development principles. 19 out of 22 students agreed or strongly agreed that

product design.

Student feedback also showed that the different sessions were important or extremely important (Figure 2). While discussing ideas with lecturers and guest speakers was the session considered most important, students felt the design sketching session was only moderately or somewhat important. The perception of the design sketching session may have been deemed less important by the students as they receive weekly design sketching classes throughout the entire first-year curriculum. Conversely, this might also be explained by the fact that product design students often prefer to "learn by doing" (Lawson, 2006, p.7). Therefore, in this situation, had the design sketching classes allowed the students to focus on the communication of their specific designs through the storyboarding sustainability focussed activity, rather than just teaching the fundamental skills, this session may have been better received by the students. It is also recognised that product design students prefer to "learn by doing" and through experiential learning experiences, whether this is by experiencing handling materials (Parisi et al., 2017) or through hands-on project-based learning in a design studio setting (Gomes et al., 2018).

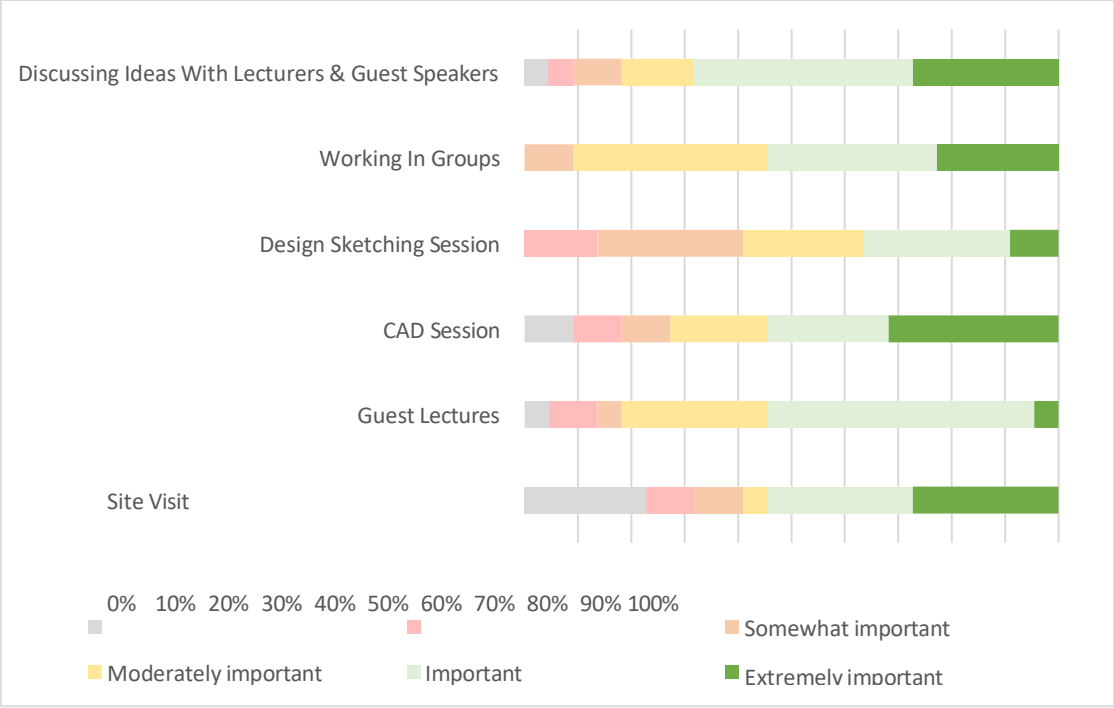

***Figure 2**. Level of important of the different Sustainability Week sessions.*

Sustainability week was the first experience for most students to integrate sustainability-related concepts into the design phase of a project. At the end of the experience, 11 out of 22 students stated they were very or extremely confident in applying sustainability principles/ideas/theory in their professional careers. From the survey results, additional key findings concerning the student experience and future sustainable practices were as follows:

- 15 out of 22 students identified it was either very relevant or extremely relevant for them to work on a project brief based on a product from a company/enterprise.
- 19 out of 22 students identified that sustainability week was very relevant or extremely relevant

- 18 out of 22 students agreed or strongly agreed that they believe sustainability is relevant to them personally.
- 19 out of 22 students agreed or strongly agreed that sustainability week should continue to be part of the product design degree program.
- 18 out of 22 students agreed or strongly agreed with the statement that "they would engage in more initiatives like sustainability week in the future".

Students reflected upon the activities conducted throughout sustainability week, identifying the sessions they felt helped them learn the most about sustainability and the related principles and ideas; key quotes from the survey results included:

"Session with [Guest Speaker 2] about product lifecycle, as this made me more aware that the products we design could have a secondary use to prolong the life of the product". (P1)

"Thinking about the whole supply chain as a whole rather than just the finished product and that some sustainable materials are in fact not as sustainable as they claim to be". (P3)

"The presentations from the guest lecturers were insightful, and the sustainability week project was beneficial as it improved knowledge on sustainable materials through research". (P4)

"The CAD session was very interesting; learnt about the sustainability features in SolidWorks as well as interesting information presented…" (P6)

"The CES [materials database] session because it's such an important and useful piece of equipment. Also, the storyboards because they are also applicable to other projects we do. The talks given by guests were interesting to give an insight into what they do". (P12)

"The CAD session gave a practical way to learn about sustainability and how to achieve it in modelling". (P14)

Students were asked if they found any of the sustainability concepts or theories challenging to understand during sustainability week. A variety of topics were taught in a short space of time during the sprint-inspired project, thus reinforcing some topics that may be needed in future projects. Responses to this question provided little insight as most students found aspects of the design task challenging and not necessarily the sustainability concepts/tools taught:

"Trying to come up with a design that used a single material and not using any glue or other fixings, developing the net became the biggest challenge, and researching existing products that do similar things and taking them apart really cleared up the methods they use". (P3)

"The most challenging theory was trying to make a universal packaging [product] that could be increased and decreased in size whilst also saving packaging". (P12)

Students were also asked if there were any 'light bulb moments' that helped them learn about sustainability during the week. Interestingly a variety of topics were raised based on the guest lectures delivered and the self-directed research conducted in groups:

"Yes, when further research was done into what is sustainable, because it was confusing at first, once the processes of how long something takes to decay was researched, and what conditions it needed, it was easier to find materials that met the needs of the company as well as being sustainable". (P5)

"During the [guest] lectures and a presentation where some examples have been shown and how the product can be used for different things". (P7)

"Price of material production changed our outlook on what our design was made of". (P17)

Over the course of sustainability week, students identified that finding the balance between design creativity and realism in combination with suitable sustainable design considerations was a big challenge. The survey asked students to reflect on any aspect of the project brief they found challenging:

"The biggest challenge was finding the balance between design and sustainability, as the client relies heavily on presentation. We found an abundance of choice when it came to choosing sustainable materials though". (P4)

"Finding a material that's suited what the company wanted as well as being sustainable". (P5)

"Producing a packaging product that is creative and different but also viable as a real-world option". (P10)

"Trying to make our design more sustainable than the original. It took a while for us to make something worth producing, by making it reusable". (P15)

The integration of sustainability week into the BSc (Hons) Product Design first-year curriculum has been successful and has addressed some challenges that Watkins et al (2021) identified. Although it was not possible to overcome all of the challenges Watkins et al (2021) identified, the integration of sustainability week has addressed factors such as integrating sustainable product design into the core curriculum as a standard and not as an elective subject. Sustainability week has also ensured the topic was covered thoroughly and not in the discipline's broad, holistic nature. This is often the challenge in a culture of reducing contact hours and growing pressure from other aspects of the curriculum. Sustainability week also allowed focused teaching on specific aspects of the discipline by experts rather than taking a holistic approach by providing a general appreciation for sustainable product design within the broader discipline of design. Sustainability week also allowed students to obtain, comprehend and apply resources to project work which supported industrial partners/collaborators on a focused sustainable product design project/challenge.

Furthermore, the success of sustainability week and the SiE project has now led to the further development of more rapid sprint informed design projects within the Product Design Department at NTU with further

of the 2022/23 academic year. The drive to embrace sustainability and a net zero carbon strategy is an ethos NTU has embraced at an institutional level and continues to develop. It is an important driver behind how students think and their decision-making. This is demonstrated in the survey results feedback. A selection quotes from the survey demonstrate how students perceived sustainability concerning the sectors professional practice and their own professional practice:

"It will most likely play a key part in any design sector that I'll choose to go into and will influence the outcome of many future projects to come in terms of materials, manufacturing, and societal impact." (P6)

"Minimising throwaway items such as packaging, labels, stickers and trying to use reusable methods of packaging or schemes to reduce throwaway and offer bring back pay back schemes." (P18)

"In a design setting, I expect that sustainability reports will have to be produced for every product you design." (P19)

"Designing in a smarter manner to extend a product lifespan. Also, the removal of planned obsolescence." (P21)

Moving forward other methods of integrating and assessing education for sustainable development within the curriculum are to be explored. It is strongly recommended that institutions globally do so too. In addition, based on the survey results collected, these demonstrate that there is a demand from students to learn more about sustainable product design and sustainability in enterprise. The students identified that they learnt many new skills throughout sustainability week as demonstrated by the survey feedback:

[Improved skills include:] "Material science, working with a client, being more conscious of sustainability." (P1)

[Improved skills include:] "How to use material databases, how to explore multifunctionality, how to use CAD [Computer Aided Design] to better understand the impact of production." (P13)

[Improved skills include:] "How to look at sustainable materials i.e., effect and function." (P18)

[Improved skills include:] "How to be more sustainable in CAD [Computer Aided Design], how to work faster as a team and effectively manage time." (P22)

This recommendation does present its challenges; Watkins et al., (2021) also identifies many of the same challenges faced throughout the sustainability week project. There is a growing demand from industry for graduates to have not only an appreciation of the topic, but to have a detailed understanding and awareness of sustainability in addition to possessing sustainability focussed skills. Academics and academic institutions globally would benefit from continually investing in sustainability driven education. To enhance sustainability projects moving forward, it is necessary to invest further in developing or redeveloping classes whilst also further supporting research into sustainable product design/development to ensure the latest knowledge generated is disseminated at the undergraduate level.

There is also a need to promote the demand for sustainability skills in graduates in industry and ensure students are aware of this demand. Professional institutions and course accreditors are also demanding this as part of their code of practice. If sustainability is taught in the correct setting, and supported by sustainability focussed projects, students have proven they are prepared to embrace this much quicker

and subsequently they recognise the importance of this much quicker. The drive by ADBE and the SiE project team has also helped promote and involve academic staff and students in sustainability initiatives and strategic sustainability plans. Sustainability week is a clear example of this, and similar initiatives should be promoted institutionally and sector wide; this is another recommendation highlighted by Watkins (2010) in earlier work conducted on the integration of sustainable product design knowledge and practices in HE.

Despite the challenges identified, integrating the design sprint into the first year is a valuable first step in students' education for sustainability. It represents the first overview of concepts that will be used and experienced in more detail throughout the course. Previous research has discussed the benefits of integrating first-year sustainability-focused content (see, e.g. Coops et al., 2015). Particularly, to create a sense of community between students and staff and expose students to an interdisciplinary teaching team from the beginning of their course.

From the feedback collected, it is evident that students have found the experience of engaging with sustainability week challenging and rewarding whilst also enriching their educational experience. The mixture of activities and session types embedded through a sprint approach has allowed a variety of key concepts and skills to be taught in a short space of time. Although the key concepts have been taught and communicated to a good standard, it is evident that some of the more complex skills, such as LCA, material selection need further integrating into future projects throughout the academic year to reinforce and reapply the taught skills, whilst also interrogating the topic to a deeper level. Students appear to have embraced sustainable design principles within the packaging sector, therefore, it will be interesting to see in future projects whether they can apply the skills and teaching knowledge to a different product sector.

The present study did not assess specifically whether the approach undertaken were effective in behavioural change, but this will be addressed in the following academic year when the same cohort of students, now in year two, will go through another sprint sustainability project. Nevertheless, even though only a minority of students stated being interested or extremely interested in learning about sustainability/sustainable design, the majority confirmed their thinking had changed due to the sustainability week. This cohort of students will go through the next stages of a more in-depth understanding of sustainability concepts and their application to product design, including circular economy principles such as designing to regenerate in year two which forms the next stages of developments of embedding enterprise focussed sustainable design principles into the curriculum.

Embracing Sustainable Principles – Student Outcomes

Throughout the week, students were encouraged to embrace a number of different sustainable design

product. Many students considered how to make the current packaging solution more sustainable, especially when considering the existing materials and manufacturing methods, whilst exploring other options. Students also explored other options regarding materials which could open up new packaging solutions and how the product net could be manufactured and subsequently tessellated to minimise waste during production.

While exploring materials and manufacturing, the students also had to consider the elegance of the brand and the product range, as the texture of the material significantly impacts the perception of the product's elegance to both the client and the customer. Furthermore, suitability and adherence to sustainability values and principles were consistently considered by examining the packaging life cycle and sustainable packaging considerations. The key design considerations the students reflected upon and implemented into their designed product focussed on the following questions posed:

- Is the solution beneficial, safe & healthy for individuals and communities throughout its lifecycle?
- Does the product solution meet the desired market criteria when factoring in the performance vs cost considerations?
- Are materials sourced, manufactured, transported, and recycled effectively when considering renewable energy sources?
- Are product solutions optimised when considering the use of renewable or recycled source materials?
- Can the designed solution be manufactured using clean production technologies and best practices?
- Can the designed product be recovered and utilised in biological and/or industrial closed-loop cycles?
- Does the product solution minimise the mixture of different materials?
- Could compostable and biodegradable alternatives be utilised?
- Has the designed product minimised over-packaging, which can reduce the impact on the supply chain?
- Are there any secondary uses or reuses for the designed solution?

The posed questions consider many of the total life cycle considerations when designing products where both closed loop and open loop life cycle systems are considered (Jawahir et al., 2006). In addition, students are often influenced by the design thinking approaches linked to the circular economy and design guides developed by IDEO and the Ellen MacArthur Foundation (The Circular Design Guide, 2018). Furthermore, the questions posed were also influenced by the 5R's Refuse, Reduce, Reuse, Repurpose, Recycle and DEFRA’s (2011) waste hierarchy pyramid. Based on these taught principles, the student groups were challenged to approach their packaging redesign with these in mind.

Each student group picked an existing packaging solution and thoroughly examined every aspect. Figure

presents a student-designed output demonstrating how an existing product has been redesigned to be manufactured out of a single type of material whilst still being easily manufactured and assembled yet conversely also reducing the number of components needed and variety of materials used.

***Figure 3**. Existing Chocolate Bonbon Packaging*

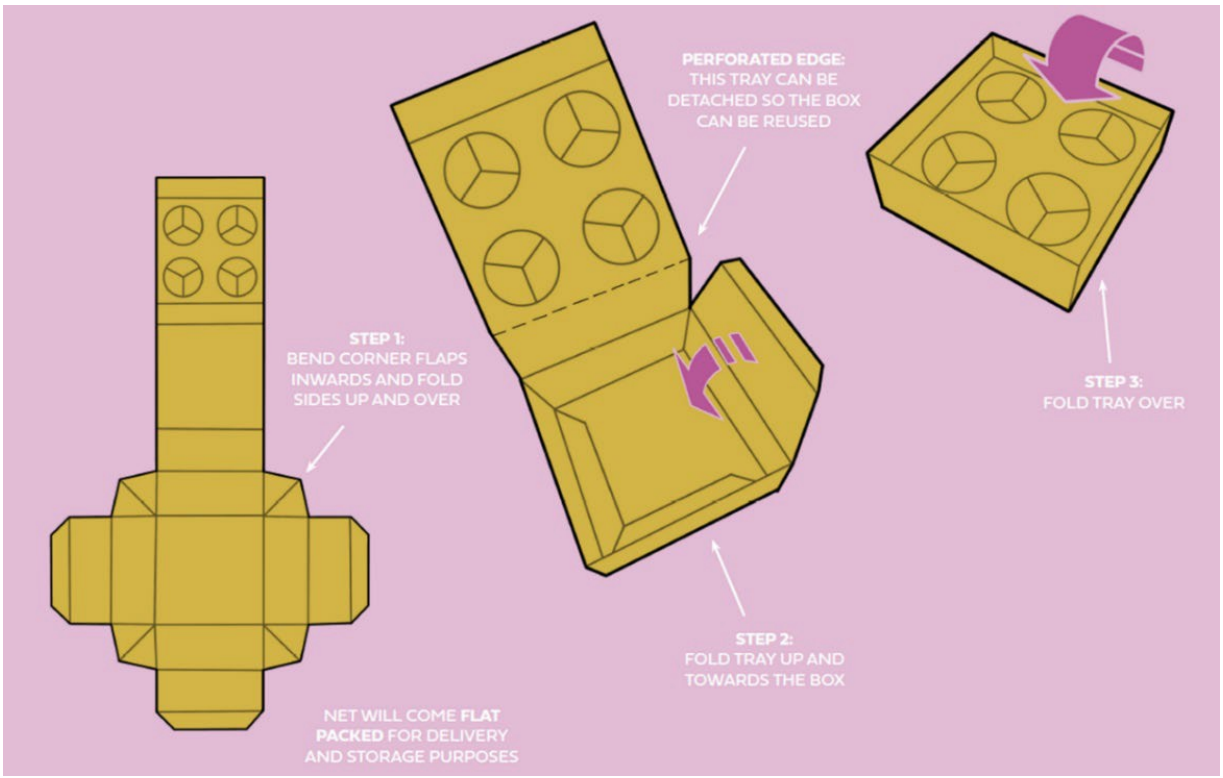

***Figure 4.** Redesigned Chocolate Bonbon Packaging*

(Credit: Student Group 4 - J. Cecil, I. Gilbert, J. Gore, J. Inglis & B. Randall)

A key aspect moving forward that needs to be further integrated into any further sustainability week, is the

calculators and templates exist online and within software packages taught within higher education. Introducing this concept earlier within the product design / sustainable education curriculum would allow students to make more valuable and quantifiable comparisons of their design decisions, providing further value to the project partners.

When considering the topic of "designed to last" (Jensen et al. 2021a; Jensen et al. 2021b), to further improve the integration of this consideration regarding product longevity into the student projects, a second "sustainability week" is recommended within the curriculum; as previously discussed, the same cohort of students will experience this in the second year of their studies. In sessions delivered, students should be provided with the opportunity to integrate product longevity considerations in an earlier phase of their project, such as the idea generation process. Further insight on the topic could lead to further co-development of products alongside product longevity considerations, which could help create a more integrated result and improve the total sustainable footprint of products. Furthermore, sessions on the considerations between different sustainable choices in the design process would help improve the students understanding of environmental sustainability and help make them consciously select their solutions.

5. Conclusions

In conclusion, sustainability week has provided an initial platform for enterprise-driven sustainability focused projects to be embedded into the ADBE curriculum at NTU. Using the design sprint methodology allowed the students to focus on sustainability for a week whilst being guided through specific activities and taught sessions. It has allowed the students to become self-supportive and present sustainable solutions to real-life clients. This project has further unlocked the potential for adopting sustainability and enterprise focussed teaching across different settings and has demonstrated how an institutionally driven ethos/approach can benefit academics, students, and industry partners alike to work collaboratively regardless of the setting.

The development and integration of sustainability week is just the start of the wider adoption and focus on sustainable development teaching. As a direct result of the success of sustainability week, further sustainability weeks are planned with consideration on how this model could be adopted across a wider range of year groups and courses across the product design department and also the school. Developing on from the success of sustainability week, the student group were then able to work on numerous projects for the rest of the academic year with a great deal of success. Design competition projects later in the academic year focussed on upcycling and developing products based around the process of sustainable aluminium extrusion design, this allowed further sustainable design principles to be taught and embedded into the student’s design practice. This has now allowed academics to develop longer sustainability focussed projects for the same year group to experience in their second year within the 2022/23 academic year; this would have not been possible had the student group not had this initial intense introduction on the topic.

wider integration of circular economy principles being integrated into the student's daily design habits and model making experience. Schemes are currently in development whereby the actual product making experience in the university's workshops are influenced by these principles from the ground up, whether this be designing and model making at year one or whether this be final year degree show exhibition development.

Finally, one of the most exciting aspects for future development is the possible 'vertical integration' of sustainability weeks, months, or projects across the different levels of degree programs which will lead up to degree shows to showcase the most sustainably conscious products and designers. Sector wide design competitions are demanding students to be sustainably conscious and the success of failure of projects can be defined by the correct application and adoption of these principles. By developing a deeper understanding of sustainable design principles, circular economy understanding etc., this will allow students to also gain a deeper understanding of sustainable or circular design business models which is needed to allow students to know how to make a business case for sustainable products.

Cross course collaboration could help further influence and leverage staff knowledge bases ensuring students hear from experts across numerous subject fields. An initial trial of cross course collaboration is planned with the Engineers Without Borders (EWB) project for 2nd year product design and civil engineering students. The EWB project provides the opportunity for students to build up on their acquired knowledge from sustainability week and apply this to a design challenge that will broaden their awareness of the social, environmental, and economic implications of engineering and design solutions. By sharing the resources required to deliver this complex subject fully and comprehensively this will not only benefit the student cohort, but this will also enable all product design educators to upgrade their knowledge and skills to be able to teach and assess this subject by increasing literacy and expertise in this area both from a design, business, and entrepreneurship perspective.

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'Leading Change for Sustainability in Schools' Simulation: The training tool for educators in Vietnam

Vien-Thong Nguyen[1,2], Philip Hallinger[2,3]

[1]*University of Social Sciences and Humanities, Vietnam National University Hochiminh city,* *thong.nguyen@hcmussh.edu.vn*

[2] *ASEAN Center for Sustainable Development Studies and Dialogue, College of Management, Mahidol University*

[3]*University of Johannesburg, hallinger@gmail.com*

Abstract

Educators play a critical role while implementing Education for Sustainable Development. Therefore, there is a need for innovative and more powerful tools to prepare educators in making the change to sustainability happen in their schools. This paper introduces the simulation 'Leading change to sustainability in schools', a product of a research & development (R&D) project, which sought to create an online-based simulation to prepare Vietnamese educators for the challenge of implementing more sustainable practices into K-12 schools. This paper aims to present the initial evaluation of simulation in changing knowledge, attitudes related to managing the change for sustainability. The authors conducted a quasi-experiment during four- week teaching session with 32 graduate students in Faculty of Education. As a result, the participants show the significant differences on before and after learning with simulation for their knowledge about sustainability and change management to sustainability, as well as their attitude towards sustainability.

Keywords: education for sustainable development, simulation-based learning, Vietnam

1. Introduction

Transformation to sustainable development requires complex, systemic changes to take place from the individual to the social system levels. Undeniably, traditional teaching methods will lead to missing many connections and interactions which can be explored to solve sustainability-related problems. This would suggest a requirement for innovative and more powerful tools to prepare educators in making the change to sustainability happen in their schools.

In recent years, simulation and serious games focusing on teaching sustainability have been proliferating because of their superior ability to capture the complexity of sustainability problems. In concert with

advancements in simulation technology, this study represents project the 'Leading Change for Sustainability in Schools' simulation for the Vietnamese version. Based on the existing Leading Change for Sustainability (business) simulation, the authors use Research and Development (R&D) to redesign sustainability-oriented online simulations for use in Vietnam's education sector. School leaders and teachers play vital roles in cultivating sustainability awareness and competencies among students, as well as preparing them with the decision-making values and skills needed to foster a sustainable society. Therefore, the 'Leading Change for Sustainability in Schools' (LCS in schools) simulation can be used with prospective and practicing educators to learn how to better lead the change towards sustainability in the Vietnamese K-12 education system.

2. Background

Several conceptual models of organizational change management and sustainability are embedded in the simulation. Change management theories include Concerns-based adoption (Hall & Hord, 2006), change adoption and diffusion (Crandall, Eiseman, & Louis, 1986; Rogers, Medina, Rivera, & Wiley, 2005), systems thinking and strategic change leadership (Senge, 1990; Senge, Hamilton, & Kania, 2015), and change model (Kotter, 1995; Kotter & Cohen, 2012). This model of leading change informed the decision rules and conceptualization of 'change strategies' that are built into the simulation.

The concept of simulation-based learning is derived from constructivist learning theories (Bruner, 1996), and experiential learning theories (Dewey, 1986; Kolb, 1984; Rogers, 1969). This method focuses on learner-centered approach, and active learning which help learners generate required knowledge and skills applicable to reality while those may take after several years' real time period (Salas, Wildman, & Piccolo, 2009; Sauvé, Renaud, Kaufman, & Marquis, 2007).

For sustainability, there are some concepts embedded from triple bottom line (Elkington, 2013), Education for sustainable development (UNESCO, 2002, 2020), whole school approach to sustainability (Tilbury & Wortman, 2005). Especially, the authors refer to Green school project in Vietnam. Because Green school project leans on environmental issues limited perspectives and asynchronously implemented from different regions in Vietnam, the authors also utilize the Sufficiency Economy Philosophy (SEP) model of sustainability which is bestowed by His Majesty King Bhumibol Adulyadej of Thailand over many decades. SEP has been widely adopted as a "people-centred approach to sustainable development" (Wedchayanon & Chorkaew, 2014; Wibulswasdi, Piboolsravut, & Pootrakool, 2011). The SEP was implicated in education and in Thailand there are the model of sustainable school, called Sufficiency-based school project, that make this research a vivid lesson for localizing ESD concept (Dharmapiya & Saratun, 2015). It makes the

authors learnt social and economic conceptions and inherited national and cultural adaptation during redesigning simulation for Vietnamese context.

To evaluate the effectiveness of learning with simulation, this study implements a learning assessment of the knowledge, attitude, and behaviour in sustainability education (Chappin, Bijvoet, & Oei, 2017; Salas- Zapata, Ríos-Osorio, & Cardona-Arias, 2018). The "LCS in schools' simulation sought an ESD-oriented pedagogy that requires all learning domain criteria. Increasing knowledge and attitudes towards sustainability through simulation-based learning can provoke the intent of sustainability behaviour and lead to future behavioural changes. Based on that framework for the learning assessment, in this paper, the authors present the evaluation of learners' knowledge of sustainability and change management and attitudes toward sustainability while learning with 'LCS in schools' simulation. Sustainable behavior reflects how learners understand and think about sustainability reveal through strategic skills achieved during the simulation learning. As the limit of the conference paper, this part will be introduced in further research.

3. Overview of simulation

'Leading Change to Sustainability for schools' (Vietnam) is a web-based simulation that addresses these management and leadership competencies in the context of a school district that is trying to apply 'whole school approach to sustainability' to some pilot schools. It was originated by simulation 'Leading change to sustainability' which is for business context. After revising and redesigning the simulation through R&D cycle, the simulation new version is for Vietnamese context and take places in education scenario (Nguyen & Hallinger, 2022).

Through the internet access, learners can play the simulation anytime from anywhere. The learning objectives for use of the simulation include the following: 1. To gain a deeper awareness of the range of sustainability challenges faced by schools and society; 2. To analyse, plan, and execute a change strategy for helping a school district transform for sustainability; 3. To understand key concepts related to triple bottom line, Education for sustainable development, and sustainable school; and assess their implications for management practice into school context.

The simulation scenario is that the Vietnam Ministry of Education has selected one of the pilot districts for implementing a new project focused on the implementation of sustainability in the education system. This project, so-called 'One Future Project', aims to educate future generation a capable of living in a sustainable society and a sustainable planet. The participants play a role as a member of the project team. During this 3-year assignment, they have responsible to transform educational organizations become models'

sustainable values and practices. This transformation should become evident in daily practices as well as in schools' contributions to the economic, environmental and social development of the society. They are able to lead the pilot implementation of One Future in our district education unit: The District Office, Primary School, Secondary School.

While playing the simulation, players interact with 24 stakeholders in various positions (e.g. head of education department, members of people committee, school principals, teachers, parent representative, trade union officers, etc.). the first goal for players is to reposition those stakeholders as possible from outside Gameboard (i.e., know nothing about sustainability) to the final stage (i.e. fully acknowledge and use sustainable practices in daily life and working) at the end of three years. In order to accomplish this 'change', players spend an annual budget on typical 18 activities that can be used to 'move people' through the five change stages towards sustainability (see Figure 1).

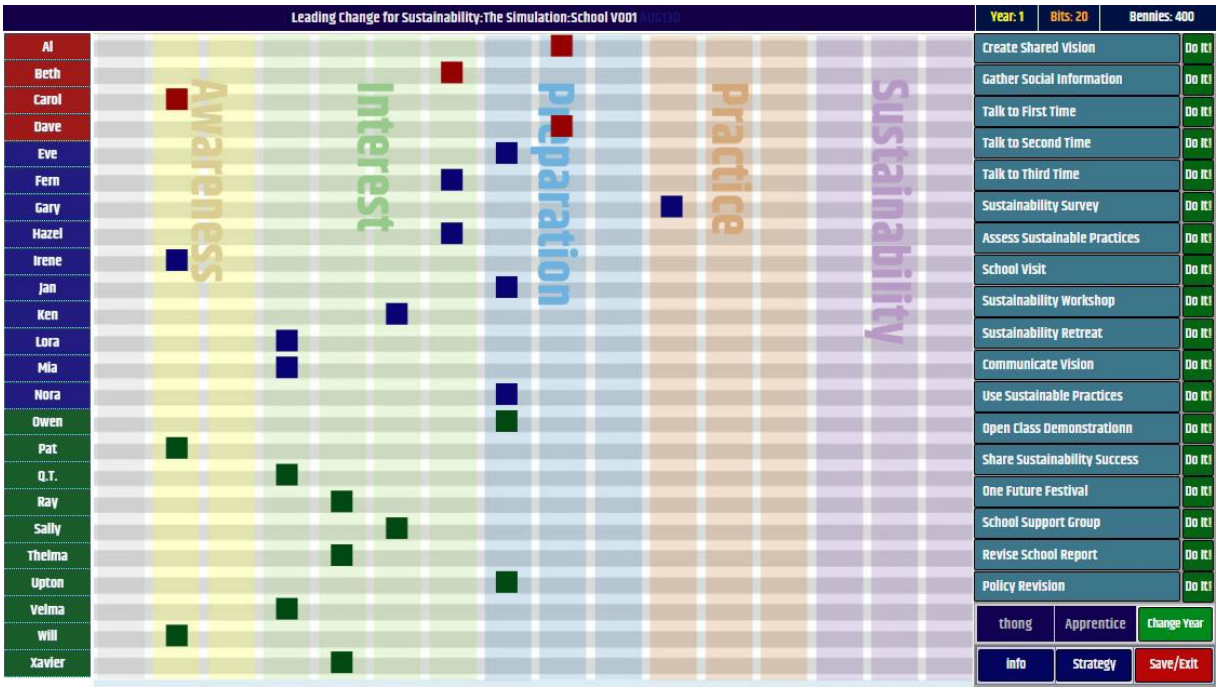


Figure 1. Leading Change for Sustainability in School simulation screen/gameboard (in English)

The second goal for players in this simulation is Bennies (sustainability benefits). Bennies are symbolized for positive impact on the triple bottom-line of the educational organizations as it leads changes towards achieving a balanced set of economic, environmental, and social outcomes. The conception of Bennies is aligned to the triple-bottom-line of social, environmental, and economic benefits (Elkington, 1994, 2013). Consequently, if learners can motivate the simulation's stakeholders to embrace sustainable practices that result in progress toward new social, environmental, and economic goals, they could win a lot of Bennies.

Players interact in this simulation within a three-year simulated timeframe. When starting each year, players receive a new budget to implement activities designed to move the project forward (see activities on the right side of Figure 1). Each of these acts has a cost as well as an underlying purpose.

sustainability, education for sustainable development, sustainable school and the purpose of the project (e.g., Sustainability Survey, Assess Sustainability Practices, Talk with People). Other activities are used to motivate and inspire stakeholders to engage with the change in schools (e.g., Create Shared Vision, Communicate Vision, and School Visit). Some activities are used to prepare stakeholders for the implementation of new whole school approach to sustainability (e.g., Sustainability Workshop, Sustainability Training, Open Class Demonstration). Other practices focus on supporting the practical use of sustainable practice (e.g., Use Sustainable Practices, Share Sustainability Success, and School Support Group). Finally, various activities are utilized to incorporate sustainability into the educational policy structure and school culture (e.g., Revise School Report, Policy Revision, School Festival).

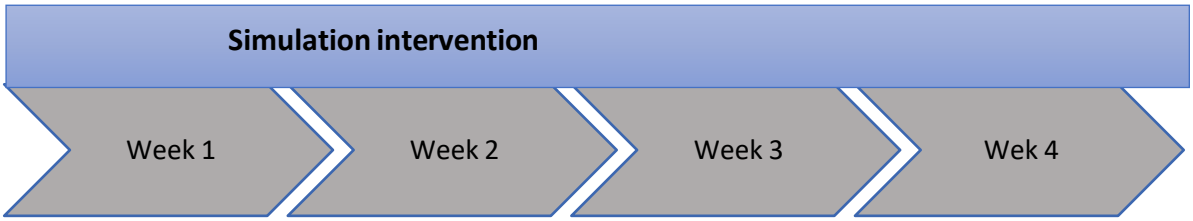
Both during and at the end of each play, participants can observe the rate and patterns of changes in the stakeholder's positions on the playing field as well as the accumulation of Bennies. As the players conduct the activity, a change takes place (i.e. stakeholders will move or not). As Bennies increases, players can observe the effects of new practices on the triple bottom line. Their results are reflected and evaluated in six levels of management from apprentice to master change. The evaluation is measured by two main objectives: 1) how many stakeholders have reached the sustainability stage; and 2) how many Bennies have earned (i.e. impacted Triple Bottom-Line). When players reach the higher levels (e.g. Expert and Change Master), it reflects the use of a 'Stronger Change Strategy' based on the change theories embedded in the simulation.

4. Methods

Research design

This research adopts a quasi-experimental design without a control group. This single-group pretest-posttest design plays an important role in education as it can prove an intervention promise during the development phase (Marsden & Torgerson, 2012). Pre-test and post-test design without a control group faces threats of validity (Campbell & Stanley, 1963; Shadish, Cook, & Campbell, 2002). However, much research in the education field did not include a control group because implementing stages usually carry on a semester or a specific number of teaching lessons, and depend on the simulation complexity (Gatti, Ulrich, & Seele, 2019).

Though the project uses mixed method design with both formative and summative measurements to evaluate the simulation effectiveness, this paper presents summative evaluations which combine pre-post- test on learners' knowledge, attitude for change to sustainability.



- pretest 1: knowledge about sustainability and change management to sustainability, and attitude on sustainability
- posttest 1: knowledge about sustainability and change management to sustainability, and attitude on sustainability

Figure 2. Summative Evaluation Scheme during 4 weeks

Sample size

This study uses the convenience sampling method. Because it is difficult to create a randomized sample and control group with the teaching and learning process. The quasi-experiment is held during four-week teaching sections with 32 participants. Those people are graduate students at Faculty of Education, University of Social Sciences and Humanities, Vietnam National University, Hochiminh city. Though, their work varied from teachers, school leaders, educators, staff in schools and university in Vietnam. Participants consist of 11 male and 21 female graduate students.

Instruments

Inspired and adopted others scholars' learning assessments (Chappin et al., 2017; Salas-Zapata et al., 2018), the authors designed a pre-test & post-test for the learning assessment regardless of two domains knowledge and attitude. The pre-test questionnaire was distributed in week one before class started, and the post-test questionnaire was distributed in week four when students took the simulation examination. These identical pre-test and post-test comprise the sustainability knowledge test, and sustainability attitude (mindset). The sustainability attitude test consists of 15 questions using a 5- point Likert scale (from total disagree to total agree). Plus, the participants self-evaluate their knowledge on sustainability issues, including sustainable development goals, circular economy, education for sustainable development, environmental education, global citizenship, social sustainability, triple bottom-line, social responsibility, sustainable school. The participants choose one from four statements which is self-rated their knowledge. i.e. 1= "I don't know about it", 2 = "I've heard of it but don't know much about it", 3 = "I could explain this but only in general terms", and 4 = "I could explain it well". The knowledge about change management to sustainability focuses on how participants involve change to sustainability in schools in particular situation. It is the 12 multiple-choice questions.

Data analyses

The data from participants were collected and recoded for identification protection. After that, the

evaluated the participants' knowledge on sustainability and change management, as well as attitude on sustainability. The difference of mean score before and after learning with simulation. As small sample size (N = 32), the normality test was conducted by Shapiro-Wilk test. Plus, the Cronbach Alpha score is also reported to check the validity of knowledge on sustainability test, and attitude on sustainability test.

5. Results and Discussion

Demographic information

Among 32 participants, there are 11 male and 21 female graduate students. They are from various education working places such as teachers, vice-principals, staff in universities and schools, NGO officers, etc. Theirs working experiences in education sectors were varied. There were 14 participants (43.75%) who has from 1 to less than 5 years of experience; 11 participants (34.37%) from 5 to less than 10 years of experiences, and 7 participants (21.87%) had more than 10 years of experience in education sectors. For digital capacity, participants rated them self through four statements from limited to proficient. As a result, 22 of participants have moderate digital capacity (68.8%). Seven participants have advanced digital capacity (21.9%); and only three people have struggles with modern teaching and learning approach (9.4%). The authors also checked their experience of learning and teaching with simulation to estimate the difficulty which participants might have. There were only nine participants who have experiences with learning or teaching with simulation (28.1%). In short, the participants have little experiences on learning with simulation.

Knowledge on sustainability

Knowledge on sustainability were compared before and after learning with simulation "LCS in schools". The range for scale was from 1 to 4. On average, participants understand more knowledge (M = 3.16, SD = 0.46) than before taking the learning session with simulation (M = 2.33, SD = 0.54). This improvement, 0.83, 95%CI [0.61, 1.06], was statistically, t (31) = 7.49, p<.001.

Knowledge on change management for sustainability

Knowledge on change management for sustainability were compared before and after learning with simulation "LCS in schools". Maximum score for change management knowledge test was 12. On average, participants gained more knowledge (M = 8.13, SD = 1.6) than before taking the learning with simulation (M = 6.22, SD = 2.72). This improvement, 1.91, 95%CI [0.89, 2.93], was statistically, t (31) = 3.81, p<.001.

Attitude towards sustainability

Attitude towards sustainability were compared before and after learning with simulation "LCS in schools". The range for attitude scale was from 1 to 5. On average, participants increased their attitude to sustainability (M = 4.05, SD= 0.37) than before taking the learning with simulation (M = 3.74, SD = 0.46). This improvement, 0.31, 95%CI [0.16, 0.47], was statistically, t (31) = 4.03, p<.001.

Table 1. *Paired sample Test.*

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	sus knowledge_post - sus knowledge_pre	.83	.63	.11	.61	1.06	7.49	31	.000
Pair 2	change knowledge_post - change knowledge_pre	1.91	2.83	.50	.89	2.93	3.81	31	.001
Pair 3	sus attitude_post - sus attitude_pre	.31	.44	.08	.16	.47	4.03	31	.000

Table 2. *Descriptives.*

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	sus knowledge_post	3.16	32	.46	.08
	sus knowledge_pre	2.33	32	.54	.10
Pair 2	change knowledge_post	8.13	32	1.60	.28
	change knowledge_pre	6.22	32	2.72	.48
Pair 3	sus attitude_post	4.05	32	.37	.07
	sus attitude_pre	3.74	32	.46	.08

Assumption

As the small sample size (N=32), the authors conducted normality distribution test with Shapiro-Wilk test. Only the p-value of the Shapiro-Wilk of the knowledge on sustainability test was .508 > .05, reflecting that this knowledge on sustainability test was normally distributed. It is assumed that After minus Before learning with simulation did not follow the normal distribution for knowledge on change management (p- value is .007), and attitude to sustainability (p<.001). So, those testes were considered robust for moderate violation of the normality assumption. Thus, in further research the authors would use larger sample size or replace with Paired Wilcoxon Sign Rank Test for knowledge on change management and attitude to sustainability.

Table 3. *Normality Test.*

		W	p
sus knowledge_post	- sus knowledge_pre	.970	.508
change knowledge_post	- change knowledge_pre	.902	.007
sus attitude_post	- sus attitude_pre	.8333	< .001

Note. Significant results suggest a deviation from normality.

For the reliability test, the knowledge on sustainability and attitude to sustainability construct were estimated the internal consistency with Cronbach's alpha value. The results showed Cronbach's Alpha for knowledge on sustainability consisted of 9 items (α pre-test = .884, α post-test =.828), attitude to sustainability consisted of 15 items (α pre-test =.791, α post-test=.657). Those number were acceptable as the accepted value of Cronbach's alpha normally is 0.7; nevertheless, values above 0.6 are also accepted (Taber, 2018). The values between pre and post-tests are different because the effectiveness of simulation intervention changed participants' knowledge and attitude. In short, the knowledge test on sustainability is reliable, and the attitude test on sustainability is moderately acceptable.

6. Conclusions

This paper has described a simulation as a learning tool to cultivate knowledge and attitude to sustainability. With the quasi-experiment and pre-posttest one shot design, the group of 32 participants that completed the 4-week learning course with 'LCS in schools' simulation. At the end of course, it showed statistically significant increase in participants' knowledge on sustainability, change management to sustainability. Besides, their attitude to sustainability also grew after the course, implying the simulation is a potential training tool to cultivate sustainability mindset and awareness. Thanks to the simulation, educator learners perceived increased awareness and attitude towards sustainability, became more confident in the potential of pro-sustainability behaviours, and felt urgent for immediate action. The research has limit of small sample size. In further research, the authors would conduct more research in other courses to generalize the reliability and validity of simulation.

The 'Leading Change to Sustainability to schools' (Vietnam) might suppose that educators, teachers, school leaders are the target audiences for the simulation. However, the utility of this simulation as a training tool is quite extendable. The potential audience for the 'LCS in schools' simulation is indeed much broader. For example, people who are interested in sustainability, education for sustainable development would necessarily be equipped and supported the sustainability knowledge. Plus, the simulation also raises the attitude of participants as it seeks to cultivate sustainability mindset, and embrace sustainable practices provided in simulation. Thus, the simulation could be used with

it could also be accessed and integrated with modern teaching and learning methods such as eLearning, or hybrid learning.

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Socio-environmental Citizenship from the Perspective of University Social Responsibility

Maria de Lourdes Borges[1], Ingridi Vargas Bortolaso[2], Gladys Jiménez Alvarado[3], Maite Ines Jiménez Peralta[4]

[1]*La Salle University - Brazil, prof.marialborges@gmail.com*
[2]*La Salle University - Brazil, ingridi.bortolaso@unilasalle.edu.br*
[3] *Pontific Catholic University Valparaiso - Chile, gladys.jimenez@pucv.cl*
[4] *Pontific Catholic University Valparaiso - Chile, maite.jimenez@pucv.cl*

Abstract

Universities play an important role in building a fairer society, within the principles of University Social Responsibility (USR), via the socio-environmental training of citizens. USR can be understood as an important strategy for the model of building a sustainable and fair society and involves a commitment to citizenship (Cruz-Ayuso and Santos, 2008) and also to its formation. Socio-environmental citizenship is about including the environmental field in the political sphere as a common good in order to form "ecological citizens", acting in favor of sustainable consumption, through the respect for the environment as a space for sociability (Costa and Theodosio, 2011). The objective of this article is to analyze the challenges of training for socio-environmental citizenship from the perspective of the university social responsibility in a Brazilian higher education institution of confessional origin. The methodology used was exploratory and descriptive in a case study, where documentary analyses were carried out in the La Salle University, a Catholic and private institution, of community and philanthropic nature, whose sponsor is a religious order called the Lasallian Brothers. The results of the analyses point to (i) evidence of practices where students need to act in favor of solutions to socio-environmental problems. It is evident that La Salle University provides opportunities for citizen education through practices in which knowledge from different areas finds challenges for its applicability in favor of socio-environmental solutions, especially in environments of scarcity; and (ii) the need to learn about democratic institutions in an integrated way with the curriculum as one of the ways to exercise socio-environmental citizenship, as well as the development of a critical and reflective capacity regarding the contradictions of society. Challenges were also highlighted to increase the number of extra-curricular projects where socio-environmental learning spaces deepen citizen education through the practice of finding solutions to contextualized socio-environmental problems. Universities play an important role in encouraging young people towards sustainable development through practical experiences of socio-environmental citizenship. "SDG+Target: 13.3".

Keywords: university social responsibility; education; socio-environmental citizenship

1. Introduction

The UN has established 17 Sustainable Development Goals (SDGs) within the 2030 Agenda, in order for all stakeholders to work towards socio-environmental issues and humanity's biggest problems (issues focusing on the planet, people, prosperity, peace and partnerships). Universities play an important role

socio-environmental training of citizens. USR can be understood as an important strategy for the model of building a sustainable and fair society and involves a commitment to citizenship (Cruz- Ayuso, Santos, 2008) and also to its formation. Socio-environmental citizenship is about including the environmental field in the political sphere as a common good in order to form "ecological citizens", acting in favor of sustainable consumption, through the respect for the environment as a space for sociability (Costa and Theodosio, 2011).Social responsibility must be based on the tripod people, community and common good. The relationship between these three key elements becomes essential to understand the concept of social responsibility (Lombardo-Bertolini, 2014). Solidarity is presented as a principle of Social Responsibility, because it deepens the interdependence between people and communities, contemplating socially ethical actions. Solidarity is a way of living, taking responsibility for interdependence with the Other, the Community and, finally, the Planet. The principle of subsidiarity focuses on the principle of aid, support, promotion, and development. Then it becomes necessary to recognize the social function of the private sector and the citizen, which is called to become an active part of the political and social reality of each country. (Lombardo-Bertolini, 2014).

University Social Responsibility (USC) can be understood as an important strategy for the model of building a sustainable and fair society and involves the commitment to citizenship (Cruz-Ayuso, Santos, 2008) and also with its formation. For Cruz-Ayuso and Santos (2008) the RSU must go beyond forming responsible citizens, contributing to economic, social, and cultural development and generating new knowledge and knowledge. The UW should be focused on a transformative orientation of society in the search for social justice, through the fight against social and economic vulnerability. This orientation is because universities are (or should be) interlocutors for a social dialogue, given their great capacity to create social capital networks. Cruz-Ayuso and Santos (2008) also criticize the quantitativeway in which universities are evaluated, favoring a competitive perspective. It is up to universities to take care not to depart from their social attribution through the search for a practical citizenship, whichconsists in the rescue of citizen protagonism in society, in its public sphere, which can occur through social re-institutionalization.

University social responsibility is involved in an education focused on socio-environmental citizenship in a critical and transformative way, through the articulation between theory and practice in favor of the transformation of the socio-environmental reality for the sustainability of life on the planet (Freire, 2004; Casanova, 2012).

The study of the agenda of socio-environmental citizenship is urgent due to the breaking of the interdependence between human beings and nature (Souza Santos, B., 2005). This is a reductionist conception of the world that can be transformed from an education aimed at a reflexive construction of an identity in order to provoke a transformation in society (Santos, M., 2005).

2. Methods

design in the context studied, providing an insight into the problem (Prodanov, Freitas, 2013). The empirical data refer to documentary research, consisting of internal archives to the institution as PDI (Institutional Development Plan), PPI (Institutional Pedagogical Project) and PPC (Pedagogical Project of Course) of two undergraduate courses (Administration and Psychology). Therefore, institutional documents from La Salle University were analyzed as analysis data for this case study. The case study is understood as an investigation that seeks a greater understanding of the phenomenon studied in a given specific context (Yin, 2001). The case investigated refers to La Salle University, Catholic, private, community like and philanthropic HEIs, whose maintainer consists of religious named Lassalist Brothers. In Brazil, the maintainer was founded in 1908, undergoing experience at various educational levels, becoming a University in 2017. The perspective focused on citizen education has always been based on lassalist educational philosophy.

At the end of the 19th century the first lassalist brothers arrived in Brazil. They have brought in important elements of citizenship training, as The RSU has been in the DNA of lassalist education since the founding of the first schools 300 years ago. St. John the Baptist of La Salle (1651 - 1719, France) not only taught by example, but left compendiums on how to structure, manage, teach, act in education for all, being declared the patron of all educators by Pope Pius XII. The mission of La Salle University is: to promote the integral and continuous formation of the person through teaching, of research and extension with innovation, excellence, for the sustainable development of society, according to Christian-Lassalist principles. Thus, the educational identity of La Salle University is marked in institutional culture with the characteristics of being a Catholic and Lassalist institution.

3. Results and Discussion

The principles and values of the Lassalist Educational Proposal are condensed into the expression "teaching well to live". In this maxim is that the citizen formation of La Salle University is expressed, because the good to live contemplates the ethical aspect and the practice of human and Christian virtues, since it encompasses the globality of the human being to be educated.

For the educational model, the University considers the following dimensions and competencies: anthropological (living between and with others), theological (transcending one's own existence), epistemological (creatively applying knowledge in interaction with oneself, with others and with reality), pedagogical (continuous educational process), ethical-moral (ethical conduct that guides actions to the well to live, acting with social responsibility and fraternal coexistence, fair and supportive), pastoral (experience of the evangelizing perspective, welcoming plurality and promoting interreligious, interracial and intercultural dialogue), politics (formation of people for the exercise of democratic citizenship, with critical and reflective capacity to interact significantly for the construction of a better society), ecological (awareness of the limits of the planet's natural resources), aesthetics (sensitivity to appreciate and transform the environment in which administrative (participation in the life and management of the Institution).

The following are evidence of citizen education in the Institutional Development Plan (PDI) and the

(2020-2025) and their Interpretation.

Table 1: Evidence of citizen training in documents at La Salle University

Excerpts	Docum.	Analysis
In accordance with the principles of St. John the Baptist of La Salle and the Institute of the Brothers of the Christian Schools, the Unilasalle assumes social responsibility to offer excellent teaching for professional training and for the construction of a humanizing society and ethical values, focusing on environmental education, the valorization of human rights and the ethnic-racial and indigenous conception.	PDI, p. 20	The pedagogical didactic organization of the University is socially responsible for offering teaching aimed at the transformation of society. One of the focuses of social responsibility is on environmental education, one of the bases for citizen education. It is analyzed that socio-environmental citizenship is envisioned in the document, as it provides for an articulation between theory and practice in favor of the transformation of the socio-environmental **reality (Freire, 2004; Casanova, 2012),** but not directly.
"provide the student with the knowledge, knowledge and professional **skills necessary for professional practice and citizenship**, based on scientific-technological, socio- historical and cultural foundations; [...] **promote the citizen education of students**, marked and constituted by the **experience of their knowledge in an interdisciplinary, valued and** integrated **way to the curriculum**; promote entrepreneurship and innovation to express the commitment to the socioeconomic development of the region; **propose actions of social and pastoral** responsibility, to assist and assist students and society, in unfavorable	PDI, p. 35	Policies guide that citizen education is inserted in the aspects of theoretical skills (knowledge and knowledge), as well as in the experience of this knowledge through practical actions. In this sense, it is analyzed that citizen education, from the formal point of view and as it is in policies (documentary evidence) points to learning aspects related to democratic institutions and also to learning for the effective exercise of citizenship **(Cruz-Ayuso, 2008).**
"The **political *dimension*** is sociocultural and aims at promoting an education committed to the formation of people for the **exercise of democratic citizenship**, with a cytic **and** reflective capacity to interact significantly and interpret messages, with a sense of building a better society.	PPI, p. 54	Consistent with the understanding of Gasca-Pliego and Olvera-García (2011), the political dimension is fostered at La Salle University, through the commitment to the exercise of democratic citizenship, where it aims to "build an informed, responsible and participatory citizenship that responds to injustice, unsustainability, violence and corruption" **(Gasca-Pliego; Olvera- García, 2011),** through critical and reflective capacity for a better society.
The humanistic perspective considers the values and principles that underlie the person's life, based on **Christian-lassalist references,** with emphasis on ethics, morals, otherness, compassion, solidarity, respect, charity and empathy.	PPI, p.55	The Christian-Lasallists references consider values that are consistent with the **understanding of Gasca-Pliego and Olvera-García (2011)**, in the sense of focusing on the university's primary objectives in function of social and human development.
The Pedagogical Course Project (PPC) [should also] highlight [...] concern about issues of **citizenship, ethics,** sociocultural diversity and human rights and ethnic-racial relations and environmental education.	PPI, p.60	All courses should show 'concern with the issues of citizenship, ethics [among others'. In this regard, it is questioned **how and** if citizen education really "systematically and rigorously incorporates situations of ethical learning and citizen education" **(Martínez-Martin, 2006),** as clarified by formal institutional documents.

By systematizing different university extension actions, which concern citizen education and USC, we perceive a profusion of actions that occur in different projects and formats and reach all our students. The actions involve students from different courses, teachers, technicians, political, religious, public and student organizations. Because of this myriad, we present them in a picture:

Table 2: Evidence of Citizen Training in Extension at La Salle University

	Share	***What***	***Observações***

1	Technosocial	It contains the Incubator of Solidarity Enterprises where it advises 4 recycling cooperatives (environments of scarcity and pooverty) to improve their management and emotional intelligence of the groups. Students carry out work on environmental education and social and environmental education.	120 garbage pickers 480 indirect beneficiaries 15 classes involved
2	University Pastoral	Solidarity, volunteering and food collection campaigns	231 Volunteers 300 people benefited 30 courses involved
3	La Salle University Project Includes	Letter course volunteers teach Portuguese Haitian and Colombian immigrants	Several immigrants benefited 47 students involved
4	University of Direction	Action of Pope Francis - team and 40 volunteers who do social actions	Various social actions 40 students involved
5	Bachelor's degree courses (4 to 6 years) have 120 hours of complementary hours	Students apply RSU projects and activities to prove hours	Technosocial, community service, extension courses, etc.
6	Extension Curricularization and Integrative Project - Bachelor's degree courses (4 to 6 years)	Extension projects are included in the curriculum of undergraduate courses, opportunistic when educating contact and intervention in needy communities, programs and social projects.	Teacher of each discipline guides students on actions that are consistent with the discipline. 67 disciplines
7	Free Legal Service	allow the population of the region access to legal guidance	Law students make an average of 430 annual visits to the community
8	Open University of the Third Age (UNATI)	Inclusive, adapted education, with emphasis on self-care, autonomy, health promotion and citizenship for the old.	254 elderly who benefited from 6900 annual activities (Data prior to the pandemic)
9	Assistance to undergraduate students	scholarships of studies in undergraduate courses of the Ministry of Educationand scholarships of Unilasalle	+ 1000 government grants + 200 health care grants
10	Psychopedagogical care	Rehabilitation, reeducation and social reintegration for People with Disabilities	+2900 calls
11	Inclusion of students with disabilities	Adequacy of classes, environment, monitoring for PCDs	+ 60 STUDENTS PCDs (People with Disabilities)
12	Follow-up for entry into the labor market	Students are informed of effective vacancies and internship vacancies and accompanied	+1500 contracts and + 110 companies
13	La Salle Health	-Psychological care at social prices - Psychological care to aggressors and victims of domestic violence (agreement with the forum) - Physiotherapy care - Nutrition care	Social and even free care to the community in different areas of health.
14	Program to Promote Access to the World of Work (Access to	systematic follow-up and workshops with content that can enhance the	900 visits to users in social vulnerability

15	SINE Project	Psychology trainees serve unemployed individually and collectively in internship	Group and individual care for the unemployed

In the 15 practical and/or extension actions evidenced in Chart 2, which refer to the USR actions of La Salle University, where there are learning spaces for socio-environmental citizen education to occur through practice.

The results of the analyses point to (i) evidence of practices where students need to act in favor of solutions to socio-environmental problems. It is evident that La Salle University provides opportunities for citizen education through practices in which knowledge from different areas finds challenges for its applicability in favor of socio-environmental solutions, especially in environments of scarcity; and (ii) the need to learn about democratic institutions in an integrated way with the curriculum as one of the ways to exercise socio-environmental citizenship, as well as the development of a critical and reflective capacity regarding the contradictions of society. Challenges were also highlighted to increase the number of extra-curricular projects where socio-environmental learning spaces deepen citizen education through the practice of finding solutions to contextualized socio-environmental problems. Universities play an important role in encouraging young people towards sustainable development through practical experiences of socio-environmental citizenship.

In the actions mentioned, socio-environmental citizen education meets the social realities where students need to act in favor of solving social problems. In this myriad of evidences, it is understood that La Salle University provides opportunities for citizen education through practice, where the specific knowledge of each area encounters challenges for its applicability in favor of solutions for the individual and collective, in environments of scarcity, agreeing with Cruz-Ayuso (2008).

In interpreting Martínez-Martin's (2006) understanding of actions in terms of citizen education, we understand that students are opportunistic to mobilize three types of training: deontological, because they can apply technical knowledge in real environments, with real people; citizen and civic education, learning in practice and human, personal and social formation by contacting with different situations and needs of society.

According to Martínez-Martin (2006), it is more common to find deontological training in universities, progressively commissioned by the formation of citizenship and civics and rarely, human, personal and social formation. The evidence indicates that, at La Salle University, human, personal and social education has the opportunity to be put into practice due to extension projects.

4. Conclusions

The objective of this article was to analyze the challenges of training for socio-environmental citizenship from the perspective of the university social responsibility in a Brazilian higher education institution of

act in favor of solutions to socio-environmental problems. It is evident that La Salle University provides opportunities for citizen education through practices in which knowledge from different areas finds challenges for its applicability in favor of socio-environmental solutions, especially in environments of scarcity; and (ii) the need to learn about democratic institutions in an integrated way with the curriculum as one of the ways to exercise socio-environmental citizenship, as well as the development of a critical and reflective capacity regarding the contradictions of society. Challenges were also highlighted to increase the number of extra-curricular projects where socio-environmental learning spaces deepen citizen education through the practice of finding solutions to contextualized socio-environmental problems. Universities play an important role in encouraging young people towards sustainable development through practical experiences of socio-environmental citizenship.

The analyses also indicated the importance of a context that welcomes and develops the critical and reflective capacity regarding the contradictions of society. Moreover, the humanistic perspective can provide opportunities for learning aimed at the search for social and human development. It is also observed the need to put into practice actions for citizenship, ethics, sociocultural diversity and human rights and ethnic-racial relations and environmental education.

When analyzing evidence of extensionist projects, it is observed that in the actions of USc there are learning spaces for socio-environmental citizen education through practice. In them, students know and deal with social realities, putting into practice the development of citizen education where the specific knowledge of each area encounters challenges for its applicability in favor of solutions for the individual and collective, in environments of scarcity. In this sense, the challenge is to maintain the projects in activity, in view of less support from public policies.

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Developing social sustainability with circus-based methods

Emma Stenström[1], Andreas Skjönberg[2],

[1]*Stockholm School of Economics, emma.stenstrom@hhs.se*

[2]*Hyper Island, andreas.skjonberg@hyperisland.se*

Abstract

Can circus-based methods develop trust between people in organizations? If so, how? This paper reports the results of a one-year-long research project in collaboration with the Swedish circus company Cirkus Cirkör, the Center for Arts, Business, and Culture at the Stockholm School of Economics Institute Research, and the educational organization Hyper Island.

The project aimed to explore if circus-based methods could be used to develop trust between people in different environments. Different methods were already in use, and new methods were invented in several interdisciplinary laboratories. Special attention was given to developing digital methods due to the pandemic. The result was a series of performance workshops.

As a next step, the performance workshops were tested in five different environments, covering various sectors: a government agency, a private corporation, higher education, a municipality, and a not-for-profit organization.

Interviews and surveys were conducted in all these different environments, and at the university, randomized control groups were used to measure and compare the effects.

The results are fascinating. Circus-based methods and performance workshops add imagination and creativity, hope and surprise, embodiment and entertainment. They can contribute to increasing trust and extending the mind. We conclude that the experiences indicate that trust can be fostered in the short term. Increased trust can potentially enhance social cohesion and sustainability.

Trust is experienced in different dimensions: physical, emotional, interpersonal, self-trust, cognitive- and affect-based. Circus becomes a method, a metaphor, and a mindset, an area of projection and enchantment. The performance workshops allow for embodied learning.

Previous studies have emphasized the psychological skills that can be enhanced: the ability to learn from failures, collaboration, vulnerability, focus, and attention, but we can also see the philosophical aspects. These kinds of circus-based performance workshops can shift how we relate to the world, create new horizons of knowledge, build communities, and, potentially, cultivate social change.

The project addresses several goals and targets. In general, it is goal 16 that is of particular interest. The paper builds on several theoretical strands, particularly circus-based methods and trust and quantitative

Keywords: Circus-based methods, Trust, Embodied learning, Resonance

1. Introduction

Trust is a topic that has been studied from a multitude of perspectives, including sociology, philosophy, economics, psychology, management, international relations, automation & computing, to name only a few. Most definitions revolve around expectations in a relationship (James, 2005; Mayer et al., 1995; Kydd, 2005; Rotter, 1980). According to Luhmann (2014), trust reduces the complexity of social systems, which is needed for people to function efficiently despite a very high amount of information regarding social cues and risks regarding personal stakes.

In this paper, trust is defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action necessary to the trustor, irrespective of the ability to monitor or control the party" (Mayer et al., 1995, p 712). According to the authors, trust has a complex foundation and is not to be regarded solely as an emotional state or tendency.

Trust is also a prerequisite for societies to function well in general. Robert Putnam (2000) wrote: "A society that relies on generalized reciprocity is more efficient than a distrustful society because money is more efficient than barter. Honesty and trust lubricate the inevitable frictions of social life (p. 135)." This is also the case within organizations. In Sweden, "trust- based governance" is proposed as the alternative to "new public management" in the public sector (Bringselius, 2017). Instead of relying on measurement and control, trust and judgment become cornerstones in this philosophy.

Trust is one of the critical capabilities and skills that must be developed on an individual, collective, and system level (Wamsler et al., 2020). Further, trust is linked to sustainability. It is a critical component in creating social cohesion, and social sustainability is essential to reaching the global goals for sustainable development, 2020).

Some argue that trust might be on the decline. The global communication firm Edelman has studied trust for over 20 years. Their latest publication, "Edelman Trust Barometer 2022," claims that the "world is ensnared in a vicious cycle of distrust, fueled by a growing lack of faith in media and government." A growing crisis of trust in governments and institutions is also supported by, among many, the World Economic Forum (Mantashyan, 2022) and the United Nations Department of Economic and Social Affairs (Perry, 2022). Flew (2019) argues that "the rise of populism worldwide can be seen as arising from a more general crisis of trust in social institutions" (p. 1).

In circus training, trust is a crucial factor. Several studies show the critical role of trust, how trust is one of the qualities often developed through circus training, and how that, in turn, can enhance social cohesion (Dubois et al., 2014). The pedagogical effectiveness is not limited to specific techniques but includes the development of an array of personal and social capabilities. Essential among these is the ability of participants to trust themselves and others (Bessone, 2017).

According to several scholars, participants will develop an array of personal, interpersonal, and social skills." Chief among these skills is that of trust; trusting oneself and trusting others are vital components

Circus has a long tradition of working with communities and training non-professionals in basic circus skills. There is a growing body of research on using those circus-based methods outside the artistic practice. Many studies focus on youth or social circuses. A social circus is a" form of non-professional circus education where the focus is on personal development, social inclusion and self-expression as opposed to the achievement of a high level of artistic technique" (Cadwell, 2018, p 22).

The findings from these studies can be used to help interpret our results, but we also notice a gap. Few studies focus on how circus-based methods can be used in settings other than among youth and underprivileged groups. This paper explores the effects of circus-based methods on organizational and professional development, particularly on trust and sustainability.

2. Research Process

For the research process, design thinking principles have been used. The process was divided into four phases.

The first phase identified current challenges in different workplaces through interviews and a literature review.

In the second phase, the focus was turned toward the circus practice. Qualitative interviews were conducted with circus artists and circus pedagogues. A semi-structured discussion guide was set up, which has been proven to be an efficient way to collect qualitative data regarding behavior, attitudes, and values (Britten, 95; Potter & Hepburn, 2005). The data from the qualitative interviews were analyzed through thematic analysis by systematically identifying, organizing, and clustering patterns of meaning (themes) across the data set. Additional interviews were conducted with organizations that have used circus-based methods and an invention of methods that circus artists had used.

Insights from the research were then processed in a series of co-creation sessions, with the working group containing artists, pedagogues, an administrator from the circus, representatives from education, foreign affairs, and a corporate organization. These workshops were held iteratively throughout the process. The outcomes were mainly physical exercises on developing trust and creating performance workshops for different settings.

The fourth and final step was the workshops conducted in a series of iterations between November 19, 2021, and May 8, 2022. After each workshop iteration, participants' feedback was captured in qualitative and quantitative data. The data were analyzed in the following co- creation workshops with the working group and concerning theories. 190 people participated in five settings: a government agency, a private corporation, an educational institution, a municipality, and a not-for-profit organization. The aim was not to compare the different settings but to test the workshop in different environments. In the educational background, a randomized control group was used so that half of the students participated in the circus workshop and half in a more ordinary cognitive-based seminar on trust, addressing the same topics, but not through circus-based methods.

All participants were asked to sign a consent form where they agreed for the authors to use their input following these critical regulations:

- All data were to be anonymized
- All were asked to read and agree to a privacy note
- All were informed that they have the right to change their mind about what the author does with their information and to withdraw from the research entirely at any point and for any reason.

Table 1: Research process

First step: Understanding the Problem	Second step: Discover	Third step: Define	Fourth step: Develop & Analyze
Aim			
To understand the problem, primary research was conducted together with a literature review.	To understand what makes trust building in circus an integrated part of working together, primary research was conducted with respondents who have 'circus' as their profession or have had connections to the circus in their professions.	To create solutions to build trust, insights from interviews, literature reviews, and workshops were integrated into a series of co-creation workshops.	To understand the solution's potential, shortcomings, and areas for further development, a series of workshops were developed and tested in iterative sessions with different target groups. Quantitative and qualitative surveys were conducted with all external participants in order to explore how trust can be created through circus-based methods.
Method			
Qualitative Interviews & Literature Review	Qualitative Interviews	Co-Creation Workshops	Online and Physical Workshops Quantitative & Qualitative Surveys
Number of participants			
N=14	N=16	N=14	N= 190
Guiding Focus Areas and Participants			
Challenges to trust in a business context: • 6 employees on different levels Challenges to trust on a societal level: • 8 local employees at embassies across Europe	Insights on the process of trust among circus acrobats: • 7 acrobats. All working professionally for more than 4 years Gather already developed methods for trust: • 4 circus pedagogues. All with at least 5 years' experience as pedagogues and some professional experience working as performing artists Understanding what makes the circus methods and its approach unique to actors from other fields: • 5 people who are working in organizations, municipalities and companies who have used circus in workshops	Assuring a circus perspective: • 4 circus pedagogues • 3 circus artists • 1 CC employee Assuring relevance to other fields: • 2 participants from the Swedish Ministry for Foreign Affairs • 2 participants from the agency Futurniture Facilitation and transfer of knowledge: • 2 members of the core group	From a government agency: • 10 participants from the Swedish Ministry for Foreign Affairs From business: • 82 participants from Allianz, a mix of team members and managers From education: • 68 participants from a global master program at Stockholm School of Economics From a municipality: • 22 participants from the municipality of Malmö in Sweden From a non-profit organization: • 8 participants from a community sewing atelier which offers educational opportunities to tailors with refugee backgrounds.

3. Results and Discussion

From the first iteration, with participants working in a government agency, there were indications of the workshops' ability to transfer the circus' approach to trust in a playful setting and through embodied learning. The potential was identified for examples from the circus to work as a projection tool for the participants to discuss sensitive topics often not addressed with colleagues. Especially the circus approach to failure, as an acknowledged part of the creation process, served as an effective tool for a mind shift in the perception of failure.

Several iterations were then conducted at the company Allianz Suisse. During these iterations, perceptions of personal connection, level of trust, and readiness to share concerning the other participants before and after the workshop were gathered.

and personal connection among the participants.

- 85.7% of the participants either agree or strongly agree with the statement that the workshop increased their trust in the other participants.
- 85.6% of the participants either agree or strongly agree with the statement that the workshop increased their readiness to express themselves more openly with the other participants.

The qualitative feedback indicates that the Circus' perspective on trust and collaboration served as the basis for discussions among colleagues.

Two workshops were carried out with master's students at the Stockholm School of Economics. Half the students were randomly assigned to an online circus workshop, and the other half to a cognitive, more traditional workshop. All students answered a survey before and after the workshops to measure if a sense of trust was increased.

Also, here the findings were validated.

- 69.4% either somewhat agree or strongly agree with the statement that the circus workshop increased their trust in the other participants.
- 57.3% either somewhat agree or strongly agree that the circus workshop increased their readiness to express themselves more openly with the other participants.

However, and this is important to notice, the other non-circus workshop received similar ratings, which indicates that development could also be a critical topic.

When assessing the qualitative feedback, the circus' methods and approaches are perceived to give new learnings regarding trust.

The last workshops have not been evaluated yet. Therefore we only have the (very positive) qualitative feedback to rely upon, not the quantitative.

To sum up, most of the participants in the performance workshops experienced an increased trust in the other participants.

Therefore, it seems like circus-based methods can increase the experience of trust. We discuss how in the following, using theories from previous studies of circus-based methods and trust.

Through an iterative, interdisciplinary process, we created performance workshops using circus as a method, a metaphor, and a mindset. Circus training can enhance trust-building in a physical, embodied way, for example, when participants collaborate and guide each other blindfolded. An example is a participant who said:

"The "blind" test and trusting the other to direct your way made the most impression on me."

Previous studies have also shown that training circus skills can change the modes of encountering others, fostering trust, collaboration, bodily knowledge, and interactions (Bolton 2004; Dubois et al. 2014; Spiegel

The circus metaphors in the workshop in the form of film clips and personal stories are experienced as solid and authentic and act as successful accelerators for authentic discussions among the participants. As a metaphor, the circus becomes an area for projection. A natural connection between trust and circus acrobats creates curiosity for the participants to engage in the workshop. Here is a voice from a participating student:

"Focusing on a non-business area and projecting it into our studies made the most impression on me.

Previous studies support this. Several scholars emphasize the "enchantment" element connected with the circus. Enchantment is" a state that embraces the potential to become otherwise" (Wilson 2016, p 2). Circus is a sort of 'enchantment' and surprise, unveiling meaning in" new forms of attachment to the world" (Bessone, 2017, p 656).

As a mindset, the participants picked up many different things from the circus: the importance of trust, learning from failures, deliberate practice, playfulness, etcetera. These could be transferred to their settings, or as one participant expressed it:

"Working together (well) is about collaboration, practice, practice. Practice and patience. More playfulness would be very good also in a formal context as you actually "perform" better because you have fun and try out new things."

Circus teaches participants 'that nothing is impossible, and that doubt and fear are to be examined and absorbed into positive action' (Bolton, 2004, p. 193). Circus techniques and performances can be used as resources for interpersonal trust instead of achieving a high level of artistic technique (Cadwell, 2018). The aim is to create a space 'where ideas can be shared without fear, opinions, and attitudes can be openly stated, and fruitful conversation can flourish and grow' (Bolton, 2004, p 204).

Digging deeper into the topic of trust, previous studies of circus training have noted that trust is developed physically and emotionally between each other and oneself. Even if it is not a risk to life, losing face is seen as a threat – and needs trust. Participants had to trust each other physically and emotionally - and trust themselves. One expressed it:

"Yes, I experienced trust in the sense that because they would make fun of me or judge me while balancing badly. ;) So I felt very comfortable and therefore trusted myself."

Trusting those around you and trusting in the safety of the situation is crucial, but until trust in

t. Still, until you take that first step, the participants cannot truly participate. There genuinely trust becomes about trusting oneself, trusting others, and others, and as several scholars have pointed out how circus training can enhance psychological skills in participants, for example:

"Results showed that mental skills such as confidence, concentration, energy management, and emotional management are considered integral to success in circus also reflected differences that exist between sports domains, such ability to embody emotions and connect with the audience." (Ross & Shapiro, 2017).

Others emphasize the ability to focus. "Circus is a continuous dialogue with the audience and the viewers

the proper energy level to the task at hand ng been associated with optimal performance experiences in movement sciences and sports psychology. (Filho et al., 2016). Attention was also a key feature in an earlier study we conducted on what circus training could bring to business students (Stenström, 2016).

Other psychological benefits include the ability to relate to others (Cadwell, 2018) and a reduction in emotional problems such as worry, nervousness, lack of confidence, and fearfulness. (Neave et al., 2020). Welby Altidor, former Executive Creative Director of Creations at Cirque du Soleil, further describes how circus skills can enhance creativity and courage (Altidor, 2017).

Circus builds on risk as a key component. Without something to risk, the trust would not be needed (Coleman, 1990; Deutsch, 1958; Jøsang and Presti, 2004; Molm, Takahashi & Peterson, 2000; Szerszynski, 1999). The link between risk and trust becomes even clearer through Robbins' (2016) reasoning that trust emerges under conditions of risk and uncertainty – conditions in which the outcome of matter 'Y' is unknown. Thus, risk and uncertainty are necessary conditions for trust. Or, to rephrase it, trust is a way to calculate how to deal with uncertainty and risk logically.

Risk in the circus plays a central part in the performance of the act, the performed danger, as performative risk. The audience's perceived risk in the performed circus act is what draws an audience to be amazed by "death-defying" acts.

Circus also has a history of embracing failures and learning from them. Ibañez (2018) argues that trying out something new offers us opportunities for growth and change, "but with those opportunities comes the risk of failure. While we intellectually understand that to grow, we must take chances and try things we cannot accomplish until the skill has been learned, it doesn't seem to help how we feel about failing." Failure can offer an opportunity for building trust through vulnerability when acknowledging failure. Failures also provide chances for development and learning new things if you learn from your mistakes. As two participants noted, independently:

"I was reminded that failure is necessary and good."

"Failure should be celebrated, as it offers the opportunity for something new."

The approach to failure in the circus plays a central role in trust building. Between acrobats, failure is the very start of each new learning curve. When an acrobat starts training a new trick with a partner or alone, failure is assumed. The process has similarities with reward-based learning (Palminteri et al., 2015), as, among acrobats, the failure is acknowledged and owned, thus not an indication of a breach of trust. This enables a more accurate reflection detached from the influences of emotions. Using this circus approach in training did not only support a mind shift regarding failure but also as an enabler for vulnerable and authentic conversations.

These conversations contributed to perceived reliability among the participants and fostered sustainable relationships built on interpersonal trust.

"What I take from the workshop is to give initial trust instead of being suspicious. Take a leap of faith, communicate, express doubts, and collaborate on the best solution together".

Among acrobats, acknowledging the failure, analyzing it, owning it, taking responsibility, and showing a change in the next training session builds trust. When acrobats examine the loss in several small steps, each involved party learns how the other(s) behave in situations of danger and stress. And, through the event of failure, each party learns about the other's (and own's) ability, benevolence, and integrity, resonating with Mayer, Davis & Schoorman's model (1995).

Faith in judgment and competence is also built by affect-based- and cognition-based trust elements. Affect-based trust plays a significant role as a starting point as the connection between the acrobats needs to be personal and authentic to withstand the challenges of training, failure, pain, and exhaustion. The characteristics of affect-based trust resonate with other researchers' findings (Lewicki & Bunker, 1995), involving individuals creating a common ground by understanding expectations on responsibilities. When affect-based trust is established, cognitive-based trust plays a prominent role. When there is a high stake (life or death/injury) investment, a person's actions play a more prominent role than the emotional connection.

A significant discussion in the co-creation workshops was what characterizes the circus, or as it was expressed:

"How do you "circusfy" a workshop?"

Is it the skills that characterize the circus? The objects? The aesthetics? The ethics? The attitude? Or, perhaps, a combination of all and more.

From the outside, an essential element was the instructors, who all came from the circus and acted as role models, showcasing the circus mindset. Capturing this circus mindset is not easy, but it has elements of an inclusive attitude, creativity, presence, physical intelligence, humor, surprises, social awareness, and care. During the co-creation workshops, it was, for example, often pointed out how important it is that everyone can participate and that nobody feels too uncomfortable or excluded.

In earlier studies, the role of the instructors has been pointed out. "The presence of soft skills among circus tutors essentially goes unnoticed. Much like plumbing, it only becomes a problem when it stops working. However, when a tutor lacks that ability, or when insufficient time is given to trust-building within the class setting, the efficacy of circus as a strategy for personal development falters." (Cadwell, 2018, p 28).

Another aspect that turned out to be important in co-creation was the space. After a few iterations, one of the artists came up with the idea to build boxes showing the different topics in the workshop: trust, failure, collaboration, etc. These boxes could then be used in different ways: to play with, to co-create a workshop around, to introduce oneself, to build a physical space, etc. The boxes created an experience and made the circus element stronger.

Space is also vital in a metaphorical sense. The space blocks everyday life out of the 'circus bubble.' It

educational or business settings – towards the 'new' rules and goals of the game. This opens opportunities for new experiences, perspectives, and relationships.

Space is not only physical but also emotional. The principles of the circus inspire a space where ideas, opinions, and attitudes can be openly stated, and fruitful conversation can flourish and grow, according to Bolton (2004). This was also incorporated in the performance workshops, where attention was given to designing workshops where participants would feel safe. Just like a trapeze artist need to ensure that the trapeze and crash mat is functional for them to feel secure enough to train, it is essential to assure that all participants are familiar with the used technology and the anchor points. It is necessary to set a transparent frame for open and honest conversations.

Objects, and the manipulation of objects, are other key features of the circus. According to research, incorporating objects can be one way to extend the mind (Paul Murphy, 2021). The workshops included everyday objects, apart from boxes, plastic bags or newspapers, feathers, and balls.

Others include movement and the body (Paul Murphy, 2021), which might be the most apparent element when using circus-based methods. "It is the physicalities, and corporeal relationship experienced rather than the narratives illustrated [in the creation process] that become the locus of transformation' (Spiegel, 2016, p 55). Those comparing circus with sports emphasize how circus arts are non-competitive and open up physical experiences for those who do not like to compete (Ross & Shapiro, 2017). Embodied learning is a crucial feature of circus training. Or, as one of the participants writes:

"I've learned a new thing, played, and had fun. I felt my body. Experienced focus (inner and out)."

This is in alignment with the sociologist Hartmut Rosa's concept of resonance. Circus art can support the participants' experiences of resonance, which in turn can help them restore their relationship with the world. Instead of appropriating the world, as is often taught in management education, art opens up for *experiencing* it in an unpredictable, uncontrollable way. The experience is embodied through the skin, breath, voice, gaze, and other bodily organs and senses (Rosa, 2019).

Many studies have observed the psychological effects of circus training, but as important are the philosophical ones of changing the relationship and becoming more responsive to the world. "Undermining bodily and emotional labeling and expanding empathy, the social circus has the potential to affect subjectivities and communities beyond the time and space of the workshop, to foster an 'ethics of becoming "more responsive" to the world' (Wilson 2016: 10).

The specificities of the circus foster" a challenge to habitual modes of relating, one that breaks with habits of thought and interaction, to open up new individual and collective horizons for future social and cultural development" (Spiegel 2016, p 64).

This is true for bringing in arts-based methods in general. Art can be used as a sensitizing experience, bringing unexplored bodily senses such as tactile and taste to the educational setting (cf. Küpers 2017, Gallos 2020). Artistic interventions, such as our circus workshops, can help to destabilize the participants' bodily positions and provide them with a sanctuary in the form of an alternative discourse or a new vista

Bessone (2017) shows, for example, how circus training enhances the opportunities to be surprised by 'others' and encounter them in ways that undermine reductive representations, and Wilson (2016) continues: "Emphasis on creativity also implies accepting failure and ambivalence, remaining attentive to unknown outcomes and unpredictable solutions – that is, working towards an 'ethics of attunement'" (Wilson 2016: 15). This is in line with Hartmut Rosa's idea of resonance. One participant expressed:

"The circus interlude was simply "refreshing" and "something different": in other words: "Sau gut ;-)." The topic "trust" is so enormously important, and also every partnership/marriage/etc. is based on trust. This feeling of trust releases enormous energies: you feel protected, sheltered, supported, and caught if something does not work out as desired".

An earlier study explores how circus skills can be integrated into academic subjects. The authors conclude that "three common ways students experience agency through the integration of circus practice and academic knowledge. First, students can build new knowledge from their domains of comfort into domains of discomfort. Second, combining embodied and academic knowledge expands student access to creative solutions, thereby expanding their knowledge horizons. Third, we notice that the collaboration inherent in the practice of circus arts enables community building, which, in turn, elicits the development of trust in new situations. We see each of these elements as foundational for social change." (Hoak, Funk, & Berkley, 2021, p 147)

Therefore, three elements might contribute to enhancing sustainability through circus training: entering domains of discomfort, combining different knowledge forms, including embodied learning, and the development of trust.

We are not the first ones to recognize the potential for the circus to become a site of pedagogy. Through a similar path, Wilson (2016) concludes:

"The peculiar meanings and roles acquired by trust in circus practices, where learning entails placing one's integrity and sometimes life in the hands of someone else, and where creation and performing rely on skills of 'bodily listening' and non-verbal communication; and an emphasis on creativity which praises and values the unexpected character of the outcomes of learning or creative processes, and enables to reframe behaviors otherwise classified as marginal, deviant, or pathological, as factors of diversity 'without the minus,' and even as resources for artistry and inventiveness. These features normalize destabilization within social circus spaces, turning them into significant sites of 'politics and pedagogy'" (Wilson 2016, p 6).

Circus performance workshops as "significant sites of politics and pedagogy." Now, that is an exciting thought – and a tentative conclusion.

4. Limitations

Although the findings are inspiring, there are some limitations regarding reaching the same engagement across different generations and aspects of time.

been tested with temporary groups of people, no findings are made on long terms implications on established teams.

2. Speaking openly about failure seems to strike different nerves among different targets. A senior target can connect it to experiences at work. These issues might not occur as frequently among a younger generation as there are indications that reflecting on failure is more common.

3. The workshop has shown limitations in terms of time; a workshop of 90-120 min can serve as an initial introduction to the topics. A continuous critique has been the workshop's short length, which ties in with the findings that time is needed to build trust.

5. Conclusions

After having created, through an interdisciplinary, iterative process, and tested a series of circus-based performance workshops in different environments, we can conclude that the experiences point to that trust can be fostered, at least in the short term. Increased trust can potentially enhance social cohesion and sustainability.

Trust is experienced in different dimensions: physical, emotional, interpersonal, self-trust, cognitive- and affect-based. Circus becomes a method, a metaphor, and a mindset, an area of projection and enchantment where we can become otherwise.

Many previous studies have emphasized the psychological skills that can be enhanced: the ability to learn from failures, collaboration, vulnerability, focus, and attention – and we note the same.

Among the crucial factors are the instructors, the physical and emotional space, and the objects used. Of particular importance is the fact that the performance workshops allow for embodied learning.

Finally, the philosophical aspects are at least as important as psychological skills. These kinds of performance workshops can, in the best of worlds, shift how we relate to the world, create new horizons of knowledge, build communities, and cultivate social change.

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University Social Responsibility experiences in Higher Education: Engaged research in Kyoto University

Paola Sanoni[1], Fernando Palacio[2]

[1] *Jr. Associate Professor, Kyoto University, sanoni.paola.7n@kyoto-u.ac.jp*
[2] *(Former) Jr. Associate Professor, Kyoto University, dr.fernando.palacio@gmail.com*

Abstract

This study presents a selection of academic experiences based on the principle of institutional engaged research applied through the University Social Responsibility (USR) approach to several disciplines of Higher Education (HE) through participative projects to promote education through social action. These participative projects involved academic guidance and the application of students' knowledge integrating humanities, social sciences, natural sciences, engineering, medical, and life sciences to promote innovation and bring actual solutions to the social challenges of real communities targeting the members of the community as primary beneficiaries. These experiences were implemented as research projects locally and overseas, and they hold in common (1) their advocacy for contributing toward the accomplishment of SDGs focused on community development, and (2) their application of a participatory methodology at Kyoto University. This methodology appears engaging for the students, as it enhances the development of soft skills, and facilitates their social involvement through the fieldwork. Additionally, it challenges their creativity, fosters the use of their multi-language abilities and communication skills, and provides a unique opportunity for understanding some of the felt needs of society. Through these projects, HE institutions enact their USR engagements by emphasizing their community-based approach, highly relying on the cultural background, understanding, processing, and acceptance of the beneficiaries. As a result, the experience enhances the social sensitization of the students and promotes a positive and socially engaged attitude among future professionals. These experiences have also given the students a sense of empathy towards social needs in particular with the initiatives implemented in rural, isolated communities and communities in need or deprived of specific support such as understanding, or changing their perception of well-being.

Keywords: SDGs, USR, Social responsibility, higher education, sustainability

1. Introduction

Founded in 1897, Kyoto University is the second oldest national university in Japan. In the light of the multiple complex issues threatening the survival of humanity such as accelerated climate change, large-scale natural disasters, environmental degradation, and facing a post-pandemic scenario among many other global challenges. Kyoto University, as a socially engaged institution, actively promotes the discovery and development of practical solutions, it consistently shares not only its academic findings and progress but also engages with society at large in ways that allow for those contributions to be

Since its foundation, Kyoto University has constantly brought its academic developments to address social and environmental problems through concrete innovative solutions. Its historical commitment to academic freedom and the pursuit of a harmonious coexistence are pillars of its institutional identity. Its mission statement highlights the university's social engagement and responsibility promoted through cooperation with the local and global societies to disseminate the knowledge produced and guided by values that foster freedom and peace and to promote academic cooperation. This latter gains particular relevance with the advent of global initiatives at the heart of the United Nations such as the Goals of the Millennium, and its successor the United Nations Sustainable Development Goals (SDGs) have been received in the academic world as new opportunities for engagement and as channels to continue bringing the academic developments of the university to society.

Beyond offering a common language (Nhamo, and Mjimba, 2020), the SDGs have promoted an increased interest among scholars to overcome traditional approaches to academic contribution and to venture into more proactive, engaged, and down-to-earth kind of research (Mori, Fien, and Horne, 2019); while also promoting the development of new curricula and pedagogical advancements that bring the concepts of sustainability to the classroom (Alm, Melen, and Aggestam-Pontoppidan, 2021).

Within the higher education context, the concept of University Social Responsibility (USR) becomes central to understanding why and how universities embark on efforts beyond traditional education and research as a form to give back to society (Sawasdikosol, and Moral, 2009). There are several definitions in the literature, but for the purpose of this study, USR is defined as the shared responsibility of universities, understood as a wide-ranging and evolving concept whereby they contribute to social betterment by integrating their social responsibility policies in all spheres of academic life, hence into institutional management, teaching, research, services, and public activities (Shek, and Hollister, 2017).

A key feature of how the higher education sector functions in today's world relate to the drive universities feel to respond to social and environmental problems and to showcase those contributions in ways that the public can understand. In this sense, both the SDGs and the appearance and increasingly influential global university rankings are pushing universities to do their academic work in more engaged and participatory ways (De Iorio, Zampone, and Piccolo, 2022).

At this point, it is important to highlight that although USR and SDGs relate to each other in a number of ways due to the impact and reach of universities' contributions to achieving the SDGs, the USR framework of actions happens in a broader spectrum related to the life of universities (Castro et al., 2022). Thus, there could be a perception of overlapping the objectives and approach of USR and SDGs as both aim to contribute toward positive social and environmental changes. However, their essence, goals, audiences and stakeholders, methods, funding, and resources are different. For this reason, some universities would be in capability to do more and extend their mission from higher education toward an attitude of service and contribution to the global society.

Besides, there is a growing interest among HE institutions to include USR-oriented policies and activities in the way they function and engage with society. One of the most prestigious global associations is the

to promote a proactive mindset regarding how its academic contributions bring positive impacts to society, and of particular interest for this study is the promotion of engaged and participatory research focusing on universities' approaches to SDGs, and engagement with indigenous communities (Palacio, and Sadehvandi, 2022).

1.1 Purpose of the study

The purpose of this study is to present the methodology of ten projects as a selection of experiences in education and research at Kyoto University implemented with the common objectives of (1) promoting a collaborative and participative methodology for the students and (2) focusing on community members as the main beneficiaries. These particular characteristics enriched the interaction with the students and boosted their skill development in areas such as intercultural communication, and multidisciplinary collaboration, particularly during the implementation of fieldwork activities or online platform interaction. These projects were developed in a variety of disciplines of Higher Education (HE) and demonstrate how USR policies and practices are applied in the field and addressed to contribute toward the accomplishment of SDGs.

The methods applied on each project are widely supported by an organizational structure, institutional policies, and good practices of Kyoto University as a promoter of USR and its mission for contribution in society.

2. Methods

This study presents a list of 10 projects selected from a broad list of initiatives that contribute to the accomplishment of SDGs, in several disciplines and following the USR approach as each initiative aims for promoting a specific topic of development in the interaction of stakeholders promoted by social action. The study describes the methodology used by educators to promote a model of sustainable education including the participation of instructors, students, and community members in learning tasks. For this purpose, this study is based on empirical data collection research including personal in-depth interviews with the professors, researchers, or the students in charge of each project, processing of the existing data provided by them, and adding information through an independent data collection.

As a result, the study provides qualitative descriptions of the projects and the expectations of contributions of each project toward education for sustainability and accomplishment of SDGs in a participative and collaborative environment as well as a nurtured discussion about the supportive institutional framework that made possible such as initiatives. In some specific cases and due to the limitations of the COVID-19 pandemic, some practices were restricted (or addressed through an online approach), but the experimental component reminded as a principle toward a model of sustainable education that promotes a continuous

3. Results

Considering that universities are expected to create programs that raise ethical standards and encourage engaged citizenship among their graduates and researchers (Alzyoud, and Bani-Hani, 2015), and also that the USR approach overcomes the traditional philanthropy and fosters the idea of engaged academia and citizenship as a way to contribute to sustainable development (Vasilescu et al., 2010), the following projects represent clear examples of how USR can be put into action.

The projects selected for this study show examples of how engaged and participatory research can embed teaching technics that foster both learning and ownership among the students. At the same time, these projects show how each had incorporated USR aspects into its design and implementation in relation to addressing the SDGs, which was achieved by means of (1) promoting local initiatives to raise awareness and foster a change of attitudes aiming to address climate change and its impacts (SDG- 13: 13.3); (2) promoting inclusive quality education and lifelong opportunities (SDG4: 4.4, 4.7); (3) implementing international education through transborder collaborations oriented to the development of sustainable cities (SDG-11: 11.1;11.2;11.3); (4) building resilient infrastructure and upgrading the technological capabilities in developing countries (SDG-9: 9.3; 9.5); and (5) ensuring sustainable consumption and production patterns for emerging industries (SDG-12: 12.1).

It is important to highlight that as a result of the interactions produced through these projects, both learning and teaching of several disciplines are enhanced as a by-product of the process of sensitization for the students. This particular characteristic promotes a positive, empathetic, and more socially engaged attitude among future professionals creating a renewed interest and enhancing proactive responses from the beneficiaries to welcome initiatives that otherwise would not have existed.

During Kyoto University's presentation at the USRN Webinar Series on the university's approach to USR in the form of Engaged Research, projects with global, regional and local scope are presented in order to illustrate the wide reach and the multilevel nature of engagement of these projects and the diverse kind of initiatives that are taking place in order to foster and implement sustainable education (Table 1. List of USR projects selected for this study).

The diversity in the projects selected for the purpose of this study evidences the fact that the methodology used to address SDGs that includes the participation of students can be applied to several academic fields and yet bring similar positive outcomes. The following table offers an overview of the projects upon which this study was done and it refers to the name of the projects, the disciplines in which they were applied, the methodology each project used to be implemented, the level of impact, and the specific contributions to any particular SDG.

Table 1. *List of USR projects selected for this study (elaborated by authors).*

Project	Discipline	Methodology	Scope	SDGs contribution
[illegible]	Multidisciplinary	Collaborative	Global	4, 4.4, 4.7

2) Virtual Fields	Multidisciplinary	Collaborative	Global	4: 4.4, 4.7
3) Road repair in Kenya	Civil Engineering	Laboratory-Fieldwork	Regional	9: 9.3; 9.5
4) Soil Rehabilitation in Sahel, West Africa	Agriculture/recycling	Laboratory-Fieldwork	Regional	9: 9.3; 9.5
5) Grasscutters in Ghana	Wildlife	Laboratory-Fieldwork	Regional	12: 12.1
6) ASEAN NETWORK STI Coordinators project	Multidisciplinary	Laboratory- Fieldwork Participative Online discussion Public lectures	Regional	All
7) Online Public Lectures: #Stop and Think	Humanities/ Philosophy Multidisciplinary	Participative Online discussion Public lecture	Local	4: 4.4, 4.7
8) Everyone's food loss revolution	Environmental Studies	Collaborative- Fieldwork	Local	13: 13.3
9) My bottle dance	Environmental Studies	Collaborative- Fieldwork	Local	13: 13.3
10) Super SDGs sustainability talk	Environmental Studies	Collaborative- Fieldwork Online discussion Public lecture Live broadcasting-video	Local	13: 13.3

The following paragraphs offer a brief overview of each project and how each implemented its original teaching method to bridge engaged research with students' participation and external stakeholders contributing and benefiting from each project.

3.1 Projects with a global scope

The following projects were designed as platforms implemented on the first stages of the declaration of the COVID-19 pandemic between March and October 2020 and renewing their contents ever since. Students of undergraduate and postgraduate courses as well as professors and researchers were invited to collaborate and develop their materials of education and research in their areas of expertise or as a fieldwork experience and open it for the public domain.

(1) Corona Chronicles

The Center for Southeast Asian Studies (CSEAS) implemented the Corona Chronicles online platform, to gather the latest research findings from different countries and regions regarding the COVID-19 effects and its impact on individuals, communities, and nations. Also, the platform aims to gauge their reactions

provides accessible, clear, and concise commentary to a global readership, while it also welcomes research and articles from students sharing their views and experiences during fieldwork. To participate, students, researchers, and the public are invited to send their contributions in English, Japanese or their native language on a broad variety of topics that relate to the core topic of the platform which is COVID-19 effects and impact. Studies are welcome from individuals or groups, and results are shared publicly expecting to share information for readers from all over the world from a genuine source and open for discussion with participants from all over the world.

(2) Virtual Fields

Virtual Fields is a platform in a website, that provides video-teaching materials using aerial drone photography and Virtual Reality -or VR- images that capture forests, oceans, large-scale infrastructure construction sites, and experimental facilities of the university and of its partners overseas. The videos include university faculty expert commentary and guidance, for example showing how experiments are done in the field so students participating in the project can learn but also contribute in aspects like identifying facilities, developing the narratives and texts, carrying out technical production of the videos, etc.). Access to these materials is open to the public on the website named Kyoto University Virtual Fields. Virtual Fields is an initiative of Kyoto University ASEAN Center which is the international office of Kyoto University located in Bangkok and groups the efforts of education and research of Kyoto University in the region of Southeast Asia.

3.2 Projects with a regional scope

In the following projects, the students of undergraduate and postgraduate courses are invited to collaborate and develop their research in the areas as a fieldwork experience, sharing their knowledge and skills with the community in a collaborative experience.

(1) Road repair in Kenya

Road repair in Kenia is a project at the Graduate School of Engineering that aims to address the problems resulting from the fact that in Africa, 80% of the roads are dirt roads. The project engages with local people in the search for sustainable solutions in terms of repairing their own roads since they represent not only access and mobility but they represent life in itself, it is not only communications, but it is also trade, food, and family. The team works together with the communities by introducing simple methods to maintain existing infrastructure with the resources available, such as compact sandbags and using human labor, but more importantly, the project promotes a deep sense of ownership, independence, and self-reliance among the main beneficiaries and users. The project seeks to enhance awareness of the potential locals have to change their daily lives starting with the maintenance of their own roads which in the broad sense can contribute to overall development and wellbeing.

(2) Soil Rehabilitation in Sahel, West Africa

This project is an initiative of the Graduate School of Asian and African Area Studies. The project aims to problems arising from the devastation of lands, which in turn is worsening other problems such as food

the interest of the villages and creating conditions that may lead to civil war and terrorism. The project aims to rehabilitate soil that has been devasted as a consequence of people's habit of throwing garbage and leaving it unmanaged and to provide new conditions that can help prevent conflicts over agricultural and pastoral interests and increase social stability.

The research focuses on how certain plants grow in the garbage and how the soil and its nutrients change; with this as a base, the project seeks to foster a new mindset among the locals that consider ways to use garbage generated in the cities as a mean to restore the environment, improve urban hygiene, and to promote food security in rural villages.

(3) Grasscutters in Ghana

The Grasscutters in Ghana project at the Wildlife Research Center focuses on the grasscutter's genetic material in comparison to other well-studied rodents such as mice, the research seeks to identify their genetic advantageous traits, such as friendliness, high reproductive ability, intestine contents, and more.

This knowledge not only helps us understand what these animals eat, and when they eat, but also how to feed them better, while the project also fosters understanding among the locals that the grasscutters are also a rich and more sustainable source of protein, and that its human consumption can have important effects not only on a healthier diet but also in the environmental and economic impacts of related initiatives. This knowledge is also shared through several approaches to the local communities starting from elementary schools, as it is incorporated in relation to the importance of conserving the environment. This research is useful for increasing awareness of conservation and providing economic stability.

(4) ASEAN Network STI Coordinators project

This is an initiative of Kyoto University and the Japan-Association of Southeast Asian Nations (JAPAN-ASEAN) from the Science, Technology, and Innovation Platform (JASTIP) are leading an initiative to organize an online series of study group meetings for cultivating Science and Technology and Innovation (STI) coordinators between ASEAN and Japan in collaboration with Universiti Malaya, ASEAN Foundation, and the Committee on Science, Technology, and Innovation (COSTI) and the Sub-Committee on Science and Technology Infrastructure and Resources Development (SCIRD) and the ASEAN Secretariat.

This project started in 2020, and it aims to generate further awareness of cultivating professional Science, Technology, and Innovation (STI) coordinators in ASEAN and Japan. The project implemented a portal site to share results of joint efforts widely among the relevant ASEAN Community, Sectoral-Bodies, Universities, centers, networks, and committees to promote an active contribution of their joint efforts toward SDGs and the challenge of sustainability and develops periodical and tailored online events for collaborative work sharing their good practices and share the opportunities for institutional, funding and operative support among members in a diversity of research areas using an online co-learning mechanism of testing, analyzing, studying and reporting, together with a process of knowledge integration based on sharing common knowledge. These groups share their networks and knowledge resources as a main

sustainability from the past (industrial innovation, social contribution, etc); current (energy and environment, biodiversity and bioresources, disaster prevention) and future such as climate change, energy security, and the universal goal of humanity on this planet.

3.3 Projects with a local scope

These initiatives are designed to promote the participation of professors, researchers, students, and the community in general with the objective to raise awareness and sensitize the community members about specific topics related to sustainability. In these projects students of all ages and stages, workers from all industries, public in general, were welcome to share their thoughts and feelings rendering a platform for mutual understanding. All communications were designed to be developed in Japanese language as conceived for the local community, but they were so popular that up until now, some of the videos of their activities can be found subtitled to English and shared on social networks by participants.

(1) Online Public Lectures: #Stop and Think

The Online Public Lectures: #Stop and Think was set in the context of the Unit of Kyoto Initiatives for the Humanities and Social Sciences, established in 2018 as the implementing body of the Kyoto University-Designated National University Status and Concept "Future Form Transmission of Humanities and Social Sciences". This project advocates for the role humanities and social science have in real life, and the importance of speaking out about social issues. It promotes a vision with open solutions, without being confined to a narrow framework of expertise.

#Stop and Think lecture series started when the first state of emergency implemented in Japan due to COVID was lifted, proposing a post-corona society as a new opportunity. The project offers a virtual space to share the perspective of thinking broader and deeper about the future of society. In this series, 11 faculty members in the humanities and social sciences share their views on values and ways to rethink the future of our society through YouTube Live and Twitter Live, and anyone can watch them and participate in Q&A for free. These lectures delve into specialized topics presented by each faculty member who conveys suggestions for the society after COVID-19. Many affiliated researchers from the humanities have shared a sense of crisis about the transition of society under and after the pandemic.

(2) Everyone’s food loss revolution

This is a local project designed and implemented by the students with an SDGs focus, in the context of the umbrella project L’Ecole de Kyodai, at the Graduate School of Environmental Studies. L’Ecole de Kyodai is a group of students created to bridge academic initiatives with society by engaging with local communities, administrators, and the private sector, connecting transversely across academic fields, and encouraging student participation in the search for solutions to some key environmental problems.

This particular project reunites undergraduate and postgraduate students in a group of self-named Kyoto University Senior Rangers and it focuses on the organization of activities for raising awareness or promoting a revolution in the way we think about food, training to minimize the loss of food becoming waste mainly due to cultural assumptions that are based more on the notion of availability rather than

responsible consumption. The project engages with private enterprises in the organization of events such as workshops or exhibitions to raise awareness not only at the individual level but also at the institutional level, including for example hotels, restaurants, and other public and private institutions.

(3) My bottle dance: Sustainable use of plastics

This is another local project implemented by the students focused on raising awareness of the sustainable use of plastics. Major activities of the group include visits to facilities, events, and entities, such as gyms or sports fields, companies, recycling companies, local producers and exporters of agricultural products to educate different audiences about the impact's plastic bottles have on the environment. The students promote the use of reusable bottles among consumers, as well as the notion of refillable bottles among private companies. The awareness campaign is based on a dance that engages all audiences promoting the idea of using and reusing your own bottle at all times.

(4) Super SDGs sustainability talk: SDGs today and tomorrow

Students in this local project have created a YouTube Channel, where they share and disseminate short videos that aim at raising awareness to the general public regarding the SDGs, what they are and what they mean not only at the societal level, but also and more importantly at the individual level. The group promotes the notion that the SDGs are a personal responsibility, and that it is our own daily decisions that can have the biggest impact on how to achieve the goals proposed by the SDGs. The group proposes a new perspective of understanding the SDGs as a responsibility we all have to work for, where environmental friendliness is based on our daily decisions.

4. Discussion

The selected projects for this study implemented a participative methodology that provides plenty of opportunities for the students to implement their knowledge and their capacity to integrate the humanities, social sciences, natural sciences, engineering, medical, and life sciences to promote innovation and bring actual solutions to the challenges of real communities in a variety of scenarios, often addressing the approach of accomplishment of SDGs. Such contributions are developed as research projects that involve academic activities targeting the members of the community as primary beneficiaries. This methodology appears engaging for students, as it enhances their development of soft skills, encourages their social involvement through fieldwork, challenges their creativity and their use of multilanguage and communication skills, and it provides a unique opportunity for understanding the felt needs of society in challenging environments that may differ significantly from their surroundings at university or in their laboratories or classrooms.

4.1 Education for Sustainability

The concept of education for sustainability spurred from the pioneer discussions carried out during the United Nations Conference on the Human Environment in 1972 in Stockholm focused on environmental education and later education for sustainable development (Sterling, 2009). In this meeting, representatives from around the world agreed on the importance of fostering educational, informational,

Stockholm Declaration and Action Plan for the Human Environment, emphasizes the essential role of education in environmental matters for the younger generation as the basis for responsible behavior to be adopted by individuals, enterprises, and communities for protecting and improving the environment in its full human dimension (principle 19). This document also encourages governments to offer support for programs to develop and expand relevant knowledge (UN, 1972).

In 2022, the global challenges obliged the international organizations, governments, and all institutions with a prominent role in society to correspond with concrete measures in policy and practice to situations that jeopardize human security giving urgent relevance to the discussion about the concept of sustainability and what is feasible to do for reaching governments and the public. This situation brought to the table the topic of education for sustainability in critical scenarios as a top priority for public sensitization. Unfortunately, policy and practice do not seem to reach the point where the society is ready for the next pandemics, sanitary crisis, or further disruptions to respond with anything close to preparedness (Frutos et al, 2021). Then, education in the principles of sustainability, empathy, and compassion as a component of higher education and as a daily practice in society can possibly be the answer for bridging the barriers of inclusive education for sustainability.

For the purpose of this study, the authors consider the concept of education for sustainability based on the principle that there is an urgent need of spreading literacy and raise awareness about the current circumstances of critical aspects of the universe to ensure human survivability on earth. Regarding to the projects presented in this study, probably the most important issue is that all methods used in the projects are designed to guide the students to model themselves a criterion for sustainable options based on their own values and beliefs. Several authors point out the importance of an education that is oriented to promoting practical action revealing the transformative potential of students as agents of a sustainable future (Leal Filho et al, 2018), and the concept of sustainable education as a method for a sustainable transfer with an emphasis on “a model of education that aims to last” (Sterling, 2009). In that sense, the practice of fieldwork aims to imprint the knowledge on the students by doing and engaging with the members of the community that they aim to benefit.

4.2 Bridging USR and the SDGs

The concept of USR and the premises set by the SDGs explain why and how universities engage with society: both frameworks offer universities practical tools that help them overcome the traditional perception of universities as isolated or disconnected ivory towers. Each in its own way and through its own methods relates the institutional priorities of the university to the reality around them. Combined, these two offer universities a unique opportunity to understand each university’s own potential and power to produce impactful interventions, raise awareness about the holistic concept of social responsibility, and create synergies in the ways sustainable development can be achieved.

In the same path, there is a close connection between USR and the SDGs, as the role of the university and the importance of its leadership become more apparent, especially when it is based on faith and the

actions. In other words, the understanding of USR among all members of a university shall go hand-in-hand with the decision-making process to implement academic projects aiming to contribute to the achievement of the SDGs and for sustainable development as a whole (Bokhari, 2017). At this point it is relevant to consider the potential impact of USR in four critical areas: organizational impact, cognitive impact, social impact, and educational impact. Organization impact refers to the university's social and environmental responsibility toward employees and the environment; cognitive impact relates to the responsibility for the purpose and use of the scientific and technical knowledge of the research activities. Social impact refers to the promotion of mutual learning toward social development; and educational impact through forming future citizens and their ability to participate of the development of society (Mohamed, 2015). All that said, it is the institutional decision of the university to focus on results with more emphasis on one or another, and prioritize.

The activation of the role of USR in sustainable development only works if the engagement is linked with a strong implementation mechanism (Bohkari, 2017). For this reason, the universities interested in such contributions will adopt institutional measures to ensure there is sufficient support to enhance the path to follow as the institutional values of an organization as principles that guide their operations are institutional decisions (Larran, and Andrades-Peña, 2017). Thus, it is possible to recognize the institutional engagement of universities with sustainable development in education from two perspectives: their structural values, and their operational principles. The perspective of the structural values of the organization refers to the self-declaration of the values of an institution in the mission, vision, strategic plans, and long-term goals. The operational perspective refers to the implementation of effective policies that promote the engagement of their different departments and units and facilitates their engagement with sustainable development.

4.3 USR Conceptual Structure

Meseguer-Sanchez proposes a conceptual structure of USR with 7 components: social, equity, healthy, wellbeing, environmental, economic, and human. This conceptual structure sets the bases of USR on the affirmation that "the university must train responsible citizens with their environment, creators of creative ideas and committed to helping solve social, economic and environmental issues" (Meseguer- Sanchez et al, 2020). In parallel views, Berman on his in his book "Educating for Social Responsibility" highlights specific considerations to help identify the essential conditions to ensure the provision of opportunities for the students to involve in projects of university social responsibility and mentions specific possibilities (Figure 1: Fostering opportunities for the implementation of USR; Berman, 1990:77). In that sense, each of the projects listed above challenged the capacity of the students to engage with the world, taking them to the fieldwork or learning in challenging environments Thus, the nature of the projects described above evidence the capacity of the education system at Kyoto University to enhance the development of social consciousness by promoting plenty of opportunities for the students to engage with global issues. According to Berman, the development of social consciousness is a process that does not just happen but is the result of a structure that combines knowledge about the world, experiences from society, and

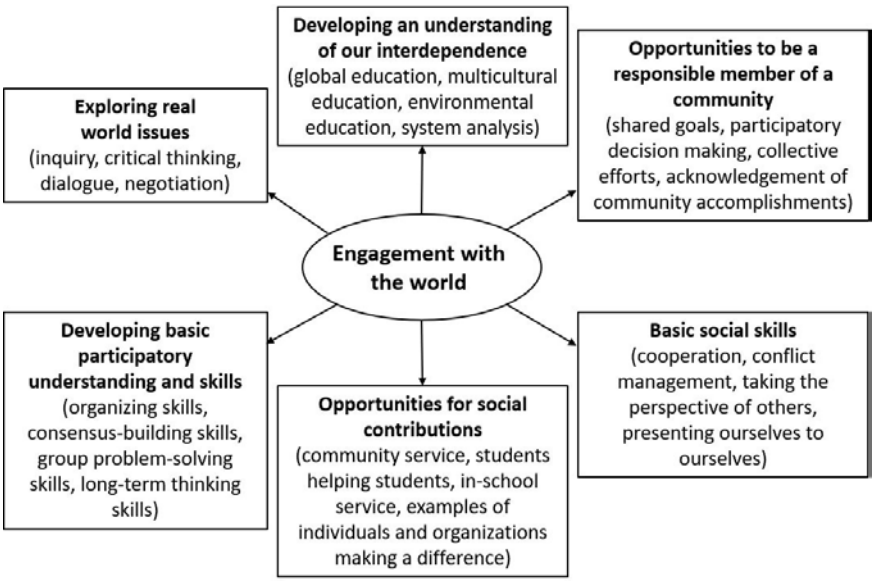

***Figure 1**. Fostering opportunities for the implementation of USR: The Development of Social Consciousness (Berman, 1990: 77).*

4.4 The role the SDGs on boosting education for sustainability

The SDGs provide a common framework of action, they also serve as a shared language that allows different stakeholders to share information in a way that is understandable and comparable even if the settings are completely different. For the higher education sector, in particular related to universities' commitment to USR, this represents a major opportunity in terms of enhancing their institutional commitment to educating for a sustainable future. However, such as universities' commitment to contribute to the accomplishment of the SDGs should be based on their own sense of responsibility to the future, and based on their own decision to produce research that is grounded on real problems with the intention to provide feasible solutions. This commitment must act as an institutional motivation to ensure the provision of an integral education that includes those problems in the curricula and offers opportunities for students' inclusion and participation.

From the perspective of the structural values of the organization, most universities affirm their institutional engagement and their commitment to its societal role in the declaration of their mission or vision as a way to secure sustainable institutional support by including social responsibility in their social, economic, and environmental dimensions (Bohkari, 2017; Larran, and Andrades-Peña, 2017). In that sense, Kyoto University's mission statement highlights the university's commitment to generating world-class knowledge based on high ethical standards through pure and applied research in the humanities, sciences, and technology. In the education field, the university is committed to the dissemination of diverse and high-quality knowledge that promotes independent and interactive learning and it strives to educate humane researchers and specialists with a sense of responsibility to the human and ecological communities. For this reason, all projects described in this study are widely supported by the institutional structure and policies of Kyoto University as a promoter of USR and its mission for contribution in

From the operational perspective, most universities are the owners of the policies they implement as long as they are aligned with their stakeholders such as the ministries that they are held by or their academic and administrative boards (Tetrevova, and Sabolova, 2010). Other organizations may use the concept as attractive without a system of reference that may relate purpose with results (Heras- Saizarbitoria, Urbieta, and Boiral, 2022). In this sense, it is essential that such policies are aligned toward embracing the interest of their members to build toward sustainable development from the perspective of higher education. Kyoto university's social responsibility is promoted through fostering cooperation with society at the local, regional and global levels to disseminate the knowledge produced, which is guided by values that foster freedom, peace, and academic cooperation. In terms of its governance, the University promotes the free development of learning, administrative independence, and institutional cooperation, in such a way that its administration conducts its duties with regard for the environment and respect for human rights.

Consequently, as it is an institutional decision of each university to define its own values and to establish its own policies in order to correspond with sustainable development through education and research, it is also a decision to establish its criterion to identify feasible opportunities that match its principles and to choose its partner institutions as not all opportunities for education in sustainability are for every university (Meseguer-Sanchez et al, 2020). From one side, universities are responsible for providing opportunities for their members to be involved and enhance the motivation for working with their communities but at the same time, universities also need to define institutional criteria to choose from the pool of opportunities considering their principles, priorities, capabilities, resources, and boundaries. For example, Kyoto University has a strict policy establishing that there is no collaboration in any manner, with military research. In accordance with the mission statement, all persons engaged in research at the University must understand that the research they individually choose to implement, and the outcomes of that research could potentially impact the future of global society. Thus, it is publicly stated that "no one at the University is permitted to be involved in military research that threatens those aims" (Kyoto University Mission Statement and basic policy on military research).

In a similar way, Kyoto University established a policy for Security Export Control to ensure that all exports of goods and technologies comply with the regulations of the Ministry of Economy, Trade and Industry of Japan (METI) which establishes that the equipment, materials, collaborative research and products derived are provisions of end-use control. Another policy regulates the proper use of research grants. All these policies are oriented to align the institutional principles, values, and interests in a unified criterion for choosing feasible opportunities, synergic partnerships, and for considerations about expected outcomes that align with the same criterion.

In parallel, some universities may have broader capacities and experience for sustaining a greater deal, as others may be at different stages of their institutional growth or have other assigned priorities. Thus, some universities may be able to adopt a holistic perspective and promote a broader view and readiness to implement, for example, challenging initiatives such as fieldwork.

4.5 Fieldwork as a method for participative sustainable higher education

their own learning process in higher education. Although it will depend on the institutional approach and organizational values to determine the limits of participation from immersive to participative avoiding intruding or invading the scenario of the community or beneficiaries which is another way of learning. From this point of view, Kyoto University has a long and strong tradition of international engagement and academic cooperation, with partners in many parts of the world in research about ethnology, ecology, geology, medicine, pharmaceutics and agriculture, flora, fauna, people, and culture. Over the last 60 years, the university has made an increasingly broad range of contributions to Africa. This is the reason why most of the fieldwork projects in this study have been selected from this region. The concept behind these research efforts has been the focus on finding the solutions to the various problems faced by the people. Throughout the experience, another valuable lesson learned is that the right attitude to approach collaboration is not to get something new to Africa or to the beneficiary communities but to learn from their daily practices and utilize that knowledge trying to improve their lives through interaction with community members. As a model of education for sustainability, the development of soft skills such as cross-cultural communication and negotiation are highly appreciated for the professional future in any field of work.

4.6 Sharing good practices and results as an institutional communication strategy

From another perspective, sharing good practices and results appears essential to promote the interest and commitment of the university for the purpose of reputation, but also to attract potential partners to the noble cause of working for the well-being of humanity and safety on the planet. Not doing so incurs into the perception of institutional neglect, and possibly loss of interest from their potential institutional partners or recruitment processes. In that sense, whilst it is true that most organizations in HE has shown their commitment to contributing to the accomplishment of SDGs, as the reinforcement of institutional engagement works as an internal call, each organization is independent of its policymaking. This means that there is only the willingness of the universities to work to make an effective contribution or not. There is no such measure of results or a mark to reach, only the noble intention to support a good purpose for the future of humanity for the further generations of researchers and students. Unfortunately, there are several organizations that point out their commitment to SDGs but their engagement is rarely found in their organizational operation (Heras-Saizarbitoria, Urbieta, and Boiral, 2022). In the end, each university is free to express its results either for attracting valuable partners for education, marketing and recruiting purposes or for external evaluation portrayed in university rankings. Again, it is an institutional decision.

5. Conclusion

The concept of education for sustainability may have changed its approaches over time but not its principles as education remind a prevalent aspect of responsible behavior for sustainable living. These days, still facing the struggles of the COVID-19 pandemic and the imminent effects of climate change reflected in floods, droughts, and other natural disasters, the global society may question the reasons why such discussions were not translated into preparedness before in order to face climate change, food security challenges, human security challenges, and the participation and inclusion of everyone through education

for the following generations as an extension of their role in society.

From the perspective of USR, the institutional engagement of universities relates to sustainable development in higher education from two perspectives: their structural values and their operational principles. From the structural values of the organization, it refers to including its institutional engagement in the statement of the mission, vision, strategic plans, and long-term goals including, for example, their commitment to the good of society. The operational perspective refers to the implementation of policies that promote and facilitate the engagement of their different departments with sustainable development and society. Additionally, it is necessary to establish institutional criteria for choosing the opportunities that align with both perspectives. For example, establishing boundaries to ally with certain partners, or establishing specific topics not to be involved. For example, reject potential partners working on military and weapons, or ban research on the development of technologies for such purposes. Later, it is relevant to consider finding effective ways of sharing the results with the intention to promote the essential interest and commitment of the university for the purpose of reputation, but also to attract potential partners to the noble cause of working for the well-being of humanity and safety in the planet. At this point, it is important to highlight that the methods applied on each project are widely supported by the organizational structure, institutional policies, and good practices of Kyoto University as a promoter of USR and its mission for contribution in society.

As well, universities have a role in boosting education for sustainability that goes beyond raising awareness and it is an institutional decision to transcend by reinforcing their commitment to future generations. This commitment must act as an institutional motivation to ensure the provision of a model of education with opportunities for the students to engage in the solution of real challenges. In these regards, Kyoto University fieldwork studies are conducted across various locations and fields. This method includes going to the actual place and living with the residents there for about 6 to 8 weeks. Then, the students are able to identify quite naturally the difficulties that people face and are more likely to propose feasible solutions. Often fieldworkers acquire a deep understanding of the local situation and their desire to solve those difficulties expands their research interests. Although, for the purpose of this study it was not possible to assess systematically the learning outcomes from each project.

Conclusively, the relationship between USR and SDGs has proven to work together for the good of higher education and for the good of society in terms of bringing alternative solutions to the felt social challenges of specific communities. Also, to promote an environment of social interaction for the students and their communities as a valuable experience for the development of their problem-solving and communication skills. As the SDGs provide a common framework of action, they also serve as a shared language that allows different stakeholders to share information in a way that is understandable and comparable even if the settings and the way universities work to contribute to them are completely different. For the higher education sector, in particular, the SDGs gain relevance in the context of the universities' commitment to USR. Thus, it can be argued that universities' best way to contribute to the SDGs lies in their forte: their academic power. It is up to each university to decide how to reflect in their actions their commitment to

opportunity to enhance their institutional commitment to a sustainable future for the global society.

5.1 Limitations of the study

This study describes how participatory methods for teaching contribute to a satisfactory learning experience, particularly in the context of institutional engagement of universities with the USR approach through addressing SDGs. Thus, two limitations to the generalization potential of the study should be noted. First, the empirical exploratory nature and the methodological approach used for this study rely on purposely selected projects that relate to their specific contexts. Some of these initiatives were conceptualized, at least in their initial stages, as either alternative methods of teaching and learning, as a response to a difficulty that finds an immediate response in applied science, or as an alternative to solve a particular problem in a given community. For this reason, this study can be considered as a showcase but not as a representative sample.

The second limitation is that the experience of the collaboration and synergies on the projects appears as more relevant than the methods applied for giving the students or the beneficiaries practical knowledge given that not all projects were originally designed for a specific contribution toward SDGs. For this reason, formal evaluations were left aside and the descriptions are focused on the opportunity to develop engagement with the world based on the opportunity and richness of the research experiences. Thus, another limitation of the study is related to the lack of identification of the learning outcomes. Unfortunately, for the purpose of this study, there was not a standardized method of assessment of the learning outcomes that enhances a comparison of the methods utilized by each project.

5.2 Future research

Further research may cover but is not limited to areas where USR can contribute with advancements of social implication such as (1) local and community approaches for improving access to elementary public services (such as education and health); (2) development of frameworks for collaboration with communities for actions and measurements to contain alimentary, health and climate disruptions (such as pandemics, providing refuge under critical circumstances, response to natural disasters, disaster mitigation, droughts, etc.); and (3) developing collaborative approaches to partner with other universities or higher education institutions located in different contexts that may bring alternative opportunities for participative teaching and learning as well as spaces for collaborations in the future.

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Posters

Encouraging the diversity of cultural expression among students: What educational institutions can do
Violetta Petrova

Implications of collaborative design and strategies for sustainable behavior applied on design practice in remote emergency teaching
Karla Scherer, Ana Brum, Aguinaldo dos Santos and Adriano Heemann

ENCOURAGING THE DIVERSITY OF CULTURAL EXPRESSION AMONG STUDENTS: WHAT EDUCATIONAL INSTITUTIONS CAN DO

What is culture?

The culture of a society includes common values and beliefs learned from previous generations, adopted by current members of the society and passed on to future generations. These common values and beliefs provide us with behavioural patterns, norms and standards which regulate all the aspects of our lives and sets of ready-made solutions to everyday problems. These solutions turn out to be cultural models and frameworks of behaviour in different situations within a family, in an educational institution, at work, in public life etc. They determine the ways people feel about or interact with their parents, other members of their own society and other societies, employment and leisure, clothes they wear and food they eat. Cultural patterns are acquired through various social institutions, educational institutions being among them. Educating young people about their own culture is of great importance and has always been paid great attention to. However, in a global society it is necessary to educate young people about other global or local cultures and teach and promote respect for a wide variety of cultural expression in different forms and formats.

Formal culture studies

Objectives:

- teaching relevant culture-related content (depends on a students' major and on an academic subject) => doing business in a multicultural environment, promoting diversity in a work place, improving employee morale etc.
- teaching skills related to the content => holding discussions, proving your point of view, showing respect for the others' opinions etc.

Ways and methods:

- integrating culture-related topics into foreign language courses (General English, Business English, English for Professional Purposes)
- focusing on familiarizing students with the working cultures of other nations including information on decent working conditions, decent pay, fighting all types of discrimination and other issues
- choosing class activities to develop the required skills - making and presenting projects on the best practicies and procedures accepted in foreign and Russian companies, developing and implementing criteria for ranking the projects together with students, encouraging students' contributions to optional e-teaching materials

Outcomes:

- students get ideas for improving business processes in their own companies (E-shops, delivery business, beauty parlours, dance studios, confectionaries etc) or for their future careers
- students get info about decent companies for internship or future job placement
- graduates ask for better working conditions and pay when looking for jobs
- graduates develop ideas for improving corporate life when they get employed

Informal culture studies

Objectives:

- familiarizing students with the cultural heritage of the city / area where the university is located
- familiarizing students with the local cultures of their peers
- familiarizing students with the cultures of other nations
- organizing events to encourage students' creativity

Ways and methods:

- encouraging students to join the government subsidized programme "Pushkin card" - participants can get a fixed amount of money for visiting the city museums and theatres
- forming partnerships with the city theatres to get info about "students' days" (reduced prices for students) or free options to visit events and performances
- holding votes on choosing cultural events at the university (culture days, food festivals, concerts)
- encouraging the students' drama society and amateur performances

Violetta Petrova, Financial University under the Government of the Russian Federation, Saint-Petersburg branch, track "Education"

Implications of collaborative design and strategies for sustainable behavior applied on design practice in remote emergency teaching

INTRODUCTION

The context experienced during the Covid-19 pandemic by educational leaders revealed a need to restart some teaching activities with no previous preparation of competencies for remote practice. Supported by accumulated teaching experience, it was possible to offer a discipline of product design practice for undergraduate students remotely. The unprecedented nature of such activity allowed the approach of this study as a research action on collaborative design applied in remote teaching of product design guided by strategies for sustainable behavior in Brazil.

METHOD

The method chosen was the collaborative action research aiming to understand concepts, principles, guidelines, and practices by observing the results of a given phenomenon (DORST, 2011; SANTOS et al., 2018). The challenge proposed to the students consisted of designing solutions that resulted in the rational use of water or energy in bathing in social housing by applying Design for Sustainable Behavior strategies extracted from the model of Bhamra et al. (2011). The Double Diamond (DESIGN COUNCIL, 2005) was adopted as a design process model, which enables the alternation between divergent and convergent thinking.

RESULTS AND DISCUSSION

Six projects were designed and redesigned for refinement towards commercially viable solutions. The projects were included in an e-book on bathing habits.

CONCLUSION

Aspects stand out in the experience that point to guidelines for the construction of a methodology for the global teaching of design practice in a remote environment with a focus on collaborative design and solutions-oriented to more sustainable behaviours: a) the division of teams by competencies and meeting of groups with unprecedented training; b) the current theme proposed, encouraging the search for realistic and contemporary data experienced by the students; c) availability of reference material developed by the post-graduation, with substantial research to be used; d) constant feedback and insights from teachers; e) application of two project phases: design and redesign; f) mirrored feedback and involvement of students in the evaluative process.

MSc. Candidate Karla Scherer, Ph.D Candidate Ana Brum,
Ph.D. Aguinaldo dos Santos & Ph.D. Adriano Heemann
Federal University of Paraná (UFPR), Curitiba, Brazil | Educating for Sustainability

2. Education

2c. Beyond the Resilient Subject: Art, Education, and Imagination

Abstracts

A Blend of Indigenous and Non-indigenous Learning for Improved Educational Outcomes

Dr Lillykutty Abraham

St. Joseph's College (Autonomous), Bangalore, India

Abstract

The proposed paper would examine the resilience of the Mavilan tribe in the context of their enforced dehumanizing circumstances. Mavilan tribe settled in the Kannur and Kasaragod districts of Kerala, India, once was a nomadic people. With time, they were reduced to bonded agricultural laborers as the landlords encroached on their habitats. During this tenure, they were dehumanized as a result of many forms of torture including abject poverty and deprivation. Yet the tribe was resilient to withstand these hardships and they survived the traumatic experiences.

The data collected through the ethnographic method will be analyzed to explore their courage and resilient nature to survive. The art forms of the tribe, especially their dance and songs reflect their saga of suffering and their efforts of resistance. These art forms also will be discussed to see how they collectively cope with the external attempts to disturb their harmonious life.

The objective of the paper is to discuss the need to bridge the gap between the academic and the indigenous communities, or in other words, to strengthen the knowledge sharing between these two groups.

The indigenous communities may not have many 'educated' persons. But their learning from their natural setting and socio-cultural context is unique. These indigenous groups that safeguard Nature can contribute to the education of younger generations for a sustainable way of life. It is also important that the academic communities reach out to them for the exchange of knowledge and life lessons. Such an exchange can add value to the existing educational programs.

As the resources in their habitats have dwindled and they are not market-ready, they face challenges to eke out a living. This is where the educated communities must respond proactively. These communities need technical assistance to meet the demands of their ever-evolving context. A blend of both the indigenous and the non-indigenous lifestyle has to take place 'to end extreme poverty, reduce inequality, and protect the planet.'

The proposed paper relates to **SDG 4,** Quality Education for all**,** and **Target 4.5,** to ensure equal access to all levels of education for the indigenous peoples.

The paper relates to the theme of the conference as it would focus on the **sustainable lifestyle** of the Mavilan tribe. The fact that the tribe survived despite its hardships showcases its **courage and resilience**. The paper also will be delving into the **art forms** of the tribe. It shall also deal with their **right to a dignified life** instead of the deplorable conditions that some of them face now.

Keywords: education, indigenous lifestyle, sustainable development, resilience, culture, courage, art forms, human rights

Track

Track 2c Beyond the resilient subject: Art, education and imagination

A description of *Aesthetic Knowing*'s role in Ecologies of Courage, followed by some Educational Considerations

Dr Ramsey Affifi[1], Ms Juliette Bertoldo[2]

[1]University of Edinburgh, Edinburgh, United Kingdom. [2]Maynooth University, Maynooth, Ireland

Abstract

The build up of atmospheric oxygen was highly toxic for early planetary life. However, because of the temporal and relational character of ecologies, what was once a disturbance had a chance to redeem itself through the dynamics it subsequently participated in. As contemporary ecological and social issues build upon and feed each other, we risk facing a build up of cowardice towards them. The more courage is needed, the harder it is to summon. The less we summon, the more those issues are exacerbated. It would seem we are stuck in a feedback loop, but the ecologies of courage and cowardice are more interconnected and shapeshifting than any simple vicious cycle.

In this paper, we explore how "aesthetic knowing" helps us perceive and respond to the complex relational nature of these shapeshifting dispositional ecologies. Aesthetic knowing is a felt evaluative response to quality of relationship, and as such it picks up on dimensions of persistence and change in ecological dynamics that analytic knowing deliberately prevents itself from seeing. In particular, aesthetic knowing evaluates the integration and disintegration of relationship. For example, a recurring idea from Aristotle through to today, considers beauty to be the perception of "unity in diversity." We can be spontaneously responsive to unity or to its dissolution in very complex systems because aesthetic knowing does not require that we pin down all the relevant components ahead of considering how they relate. The relationships appear as a whole, or Gestalt, with a sensed quality.

The ecology of courage fills with such evaluative experiences of beauty and ugliness, but what appears as integrated at one level or angle can appear disintegrative at another. If cowardice is to integrate into a beautiful ecology, how must we engage with it? How might fear oxygenate courage? Just as with analysis, perception of integration is empirical and therefore fallible. By keeping open threats against our current perceptions of integration, aesthetic knowing can provide not only conditions for new aesthetic experience, but also provide opportunities for cowardice to transform itself into courage. But because such openness means sometimes sitting with discord, this commitment itself requires courage. Such feedback loops are not tautological but constitutive of ecological dynamics, and far from being paralysing, they imply intervention points all across the system. We end with provocations for educators and educator culture. In that vein, this paper develops and connects several SDG themes that percolate disparately across many education systems, including Good Health and Well Being (+Target: 3.4) and Quality Education (+Target: 4.7), and concerned with ecological and social sustainability.

Track

Track 2c Beyond the resilient subject: Art, education and imagination

ARCHIPEDAGOGY: An Art Education for the Anthropocene

Dr Glenn Loughran

TU Dublin, Dublin, Ireland

Abstract

This paper sets out to explore a concept of educational subjectivity that is appropriate to the Anthropocene. Where the human capital subject of modern education remains the ideological blueprint for much educational theory and policy today, recent shifts towards Anthropocene thinking prompt a new conception of educational subjectivity that is entangled with the environment. At stake within this shift is a new understanding of agency within education that is neither radically autonomous nor infinitelyadaptable. Exploring the tensions between autonomy and adaptability, this paper considers how central concepts developed within island studies can be helpful for thinking about these shifts in artistic education. Utilising the postcolonial concept of archipelagic thinking to navigate the relation between 'locality' and 'world' this paper maps out the co-ordinates of an archipelagic art education for the Anthropocene, where the event of subjectivity shifts from the internal constructivist landscape of the student to the external, existential landscape of the world. This analysis will be supported by a practical artistic research project titled: What is an island?. The overarching aim of the project was to develop an artistic enquiry into the changing nature of islands within the political context of the Anthropocene. Whilst this journey was open ended and experimental, it also explored the formal characteristics of artistic research as an evental form of research that is appropriate to arts education and research in the Anthropocene. Since an event is always that which breaks with the normative situation, and, in this case survivalist modes of existence, this paper argues for an evental subjectivity in educational discourse. More concretely, the What is an Island project bridged the educational contexts of the BA in Visual Art on Sherkin Island and the MA in Art and Environment in the West Cork Archipelago (TU Dublin). Connecting these two points, the research performed a relational enquiry into the (a) values, tensions and concrete impact of visual arts education on isolated island communities (b) The development of artistic research and education platforms across island communities (c) The value of Archipelagic Thinking for educational subjectivity in the Anthropocene. To fully capture the scale of this project the following paper has been organized around three key structural dimensions: Site / Event / Sustainability. Through the Site of the project we gain an understanding of the educational contexts from which the project emerged. The second part of the paper will focus on the Evental quality of the research as it unfolded across three distinct archipelagic environments, from the West Cork Archipelago (2018) to The Galapagos Islands (2019) to the Virtual Environment (2020). Finally, the third section will focus on the Sustainable dimension of the research within Island communities and the potential for future orientations of archipelagic art education.

Track

Track 2c Beyond the resilient subject: Art, education and imagination

Dancing with the Other. A kinaesthetic and ethical shift from the egological to the ecological

Paul Moerman

Södertörn University, Stockholm, Sweden. University of Jyväskylä, Jyväskylä, Finland

Abstract

Dancing with the Other is a dance teaching method as well as the staging of a line of thinking arts *as* education, suggesting to reimagine education at large, and currently raved notions in educational contexts such as imagination, creativity, artistic expression and representation.

Education and dance are viewed and practiced as acts of transgression and as efforts to enter into dialogue with the social and natural world. The relevance and potential of dance as education are probed, as a mode of (kin)aesthetic experiencing in everyday school life, as well as a way of building ethically charged relationships infused by otherness, thus attending to issues of plurality and coexistence in a challenged global society begging for survival. A possible contribution by dance to an educational trajectory is suggested, reconsidering the human subject's very place in the world, notably an appeal prompting the Self to come into being by subjecting to what the world may be asking from one.

The theoretical lines of argument are informed by Gert Biesta's thinking on art as teaching, subject-ness and democracy in a world-oriented education, in dialogue with John Dewey's and Maxine Greene's thinking on art as experience, aesthetic literacy and aesthetic education, along with dance scholar Susan Stinson's stances on dance education and dancing as becoming.

The *Dancing with the Other* method is reviewed, along with an ongoing ethnographic field study, in which pre-service teachers describe and scrutinise their dance activities in the teaching and learning approach. The study results, discursively analysed, indicate that the participants experience dancing primarily in relational and existential terms of doing and undergoing, characterised by presence and concentration, intensified perception of movement, proximity, trust, communication, risk-taking and receptiveness for the unforeseen. Creating dance appears to be sensed in Dewey's terms of aesthetic experience, and the relations described may be understood as ethical in line with Hannah Arendt's and Emmanuel Levinas' thinking on freedom and otherness, fundamental in Biesta's and Greene's visions of education as a space for new beginnings.

This paper advocates the opening of spaces in education for the arts, letting dance remind us what education is about. The plead to reimagine education prompts a shift of focus from the autonomous, resilient Self and self-expression – the *egological* – to the necessity of being with others – the socio-*ecological* –, from predefined knowledge to the unpredictable, from conscious knowledge construction to pre-cognition, vulnerability and permeability through the senses, from education concerned with fulfilling universal ideas of humanism to education as a space for the unique human subject becoming, from education surrendering to market and competition to education as a space for encounters in plurality and coexistence in a precarious world calling upon us to act together for the entire planet's and mankind's survival – to let dance teach us what it is to be in the world, with others.

Keywords: Dance, art as experience, art as education, aesthetic literacy, aesthetic education, ethics in education, education and the existential.

Track
Track 2c Beyond the resilient subject: Art, education and imagination

Flying High, Falling Hard – Sustainability and presence in the performing arts

Professor Johanna Garpe, Assistant Professor Camilla Damkjaer

Stockholm University of the Arts, Stockholm, Sweden

Abstract

This presentation focuses on the possibility to create sustainability in an experience economy. Due to the development of digital overload combined with economic pressure, there is a heightened demand on humans' use of attention, requiring that we take in information through many channels constantly and simultaneously, quickly and with fast shifts. This also leads to changes in human perception and behaviour, developing a "click culture" where we shift our focus rapidly, moving from platform to platform in the need for instant gratification in terms of experiences. When we then attend or participate in the performing arts, there is no possibility to change channels or click on another device. What happens then?

In this conference we would like to present a research project, where we explore how to deal with this situation within the performing arts and performing arts education. One track within the project focuses on how we can draw on support practices, such as meditative practices, in order to develop a more critical and aware approach towards attention and sustainability. In this presentation, we will focus on how to challenge our own attention and aesthetic choices, training our capacity to refrain from quick delivery, to remain within slow and repetitive processes, and to stay open to other sense information and sense experiences.

One method within meditative practices focuses on how to pay attention to different sense inputs. But in the performing arts, the contemporary audience is mostly asked to use sight and hearing. However, historically, audiences have been absorbed in the event even through taste, touch and smell. This has been eliminated in the bourgeoise theatre, in order to control the audience's experience. But one may wonder if these other sensory aspects used historically did not only take away attention but also heightened attention. Today there is also a tendency to develop performing arts that to some extent mirrors the aesthetics of mediated practices, underlining the "4th wall" as a screen in new ways using digital technologies. At the same time, the very fundament of the performing arts is the live moment, involving embodied experiences with all senses, the possibility of improvisation and direct interaction. One question we would like to address is which role this live, sensory element can play in a sustainable relation to attention in the performing arts.

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Track

Track 2c Beyond the resilient subject: Art, education and imagination

Reducing Carbon Footprints and Environmental Impact of Performing Arts Production

Assistant Professor Charlie Åström, Assistant Professor Gunilla Pettersson Thavelin, Assistant professor Anders Larsson

Stockholm University of the Arts, Stockholm, Sweden

Abstract

In this presentation, we would like to present the beginning of a research project that involves the whole Department of Performing Arts at Stockholm University of the Arts. The project addresses the question of how we can develop ways to produce performing arts with a reduced carbon footprint and reduced environmental impact in a time of climate crisis.

The performing arts build on the collaboration between many artistic practices, such as dramaturgy and play writing, light design, costume design, make up and wig design, production management, set design, sound design, technical coordination of production, theatre directing. Each of these practices involve different environmental parameters – ranging from the use of chemicals in make-up, to the use of electrical power for light and sound devices or fuel when transporting artists across the globe etc. In this project, we will explore which questions each of these practices encounter when we need to reduce the climate impact, and which methods we can develop in order to do so, collaboratively as well as within in each specialisation. This will help us develop the education of future artists within the field.

Historically, the performing arts have used the technologies available in each period of time to create live events for audiences. Today, we need to reconsider how we relate to the aesthetic traditions of the field as well as the historical and contemporary technologies we use in order to develop new approaches where live events with less climate impact can be produced. This also includes looking into all aspects the production process, increasing re-cycling of materials and adapting travel patterns.

Instead of looking at this necessary shift towards a more climate friendly way of producing as a form of reduction, we would like to focus on which new technologies that are possible and which new aesthetic forms, formats, and ways of collaborating across the globe, we can envision. To explore this in practice, the researchers involved in the project will "produce" a fictive performance and performance process, in which we will investigate how every practice involved can reduce their environmental impact, through which methods and with which aesthetic consequences and possibilities.

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Track

Track 2c Beyond the resilient subject: Art, education and imagination

Rethinking Resilience in Environmental Education

Professor Carl Anders Safstrom[1], Dr Glenn Loughran[2]

[1]Centre for Public Education and Pedagogy, Maynooth University, Maynooth, Ireland. [2]TU Dublin, Dublin, Ireland

Abstract

Educational theory since Plato's *Republic* locates the subject in education within a pattern linking man and state. That is the resilient subject in educational theory appears at a particular location and for a particular reason; to be perfecting the state. Such location is, through Kantian theories of education, also from where the educated subject is perfecting nature's work. In the 20th Century, the resilient subject expanded through the theory of human capital, signifying a new relationship between education and society, where the modern autonomist subject increasingly merged with the neoliberal economy. Adaptability, market flexibility, and utility maximization are the economic pillars of a neo-liberal subjectivity that came to be defined in the late 20thcentury as 'the development- security nexus' that is, through the investment in human capital stock, such as skill and attributes, a subject can protect themselves against economic insecurity, against precarity[1]. Highlighting neoliberalism's capacity to appropriate its external antagonisms and resistances Julian Reid argues that the contemporary concept of resilience did not only develop out of classical neo-liberal subjectivity, defined here as human capital but also its alternative, oppositional discourse of sustainable development[2]. Emerging out an alignment between economic rationality and ecological rationality, this new survivalist subject is central to educational discourse and practice in the Anthropocene[3]. Within this context, we need to reconsider pedagogical subjectivity for the current age, one which is resistant to the appropriation of 'educational risk' into a paradigm of compliance and survival. Educational theory, therefore, needs to be formulated beyond perfecting either the state or nature, to relocate the subject in the reality of the everyday of life, to be able to move risk from basically meaning a threat to perfection, to an acknowledging of risk as an opening up of the present as autotelic, that is as itself carrying its aim, in the moment. Risk here, so we will conclude means to be able to unfold the present in ways that can't be foreseen, but which exactly, therefore, present the possibilities of new beginnings. This contribution will be discussing educational risk as central for the very understanding of education as such, by developing a sophistical practice of teaching.

Track

Track 2c Beyond the resilient subject: Art, education and imagination

The Potential of Arts-based Pedagogy to Face Imaginaries of the Anthropocene. A case study in Business School

Justine Buriller, Sylvain Bureau

ESCP Business School, Paris, France

Abstract

The Anthropocene is a term that highlights the consequences of human activity on their environment. Education in business school must adapt to this new reality. Far from being limited to the acquisition of formal knowledge or new skills, the Anthropocene calls for new narratives and imaginaries to deal with the ecological challenges. The pedagogical issue is not only to improve learning dynamics but also to help students in facing conflicting imaginaries. Drawing on the work of the philosopher Cornelius Castoriadis (1975), we consider that a "social imaginary" both constraints and enables our ways of thinking and acting. This social imaginary is formed by the ongoing tensions between a stable and established "instituted" imaginary, and the "instituting" imagination, that questions and transforms existing order, in an indeterminate and creative way. Based on this perspective, and leveraging the literature on arts-based pedagogy, we raise the following question: How can arts-based-pedagogy question instituted imaginaries of the Anthropocene? We explore the potential of a course – the Improbable seminar – taught since 2011 in a leading business school, that guides students to create artworks that challenge mainstream economic and societal models. The qualitative visual analysis of a sample of nine artworks, based on art history methods, discloses how they challenge the instituted imaginaries of the Anthropocene. We analyze the visual techniques that help the criticism to take shape and identify three types of criticism of the instituted imaginary in the artworks. This research provides three main contributions. First, we outline how artistic creations can embody the philosopher Castoriadis' theory of "social imaginary", by criticizing the instituted imaginary with different perspectives. Then we complement existing research on the power of visualization and materialization by exposing implicit imaginaries of the Anthropocene. Third, we contribute to arts-based pedagogy by discussing how creating artworks help developing students' critical thinking and imagination, through the implementation of a dialogical process. Students learn key competences and methods that can be used in the business world, and at the same time, they become more critical regarding mainstream economics. The subversive potential of art is leveraged to design new narratives that encourage students to reinvent values and rules, to shape more sustainable and desirable futures in the Anthropocene.

Track

Track 2c Beyond the resilient subject: Art, education and imagination

Full papers

Children's Rights to make their Voices Heard and Listened to

Communication with politicians in and through art as sustainable development

Cecilia Ferm Almqvist, Linn Hentschel[2]

[1]*Södertörn University, cecilia.ferm.almqvist@sh.se*
[2]*Umeå University, linn.hentschel@umu.se*

Abstract

The UN Convention on the Rights of the Child (article 12) states that children have a right to make their voices heard, and to be listened to. Other policy documents at several levels underline the right to freedom of speech through various forms of expression, as well as young peoples' right to express themselves through art. To organize educational situations where children get the chance to develop and explore artistic forms of expression at the same time, in ways where their ideas and imaginations are taken care of in processes of dwelling, demands flexible and norm-challenging pedagogues. As an example of how Anthropocene discourses of education can be challenged, and instead involve children in sustainable collective engagement, a project where children communicate with politicians in and through art will state example for our contribution to the conference. The aim of the study presented is to explore and describe how 10 years old children's voices can be heard and listened to in communication with politicians regarding issues that engage them, from planet wealth to after school activities. The study is based on a project arranged by a municipal art school, performed in schools, where *Kulturverket,* a group of artists and pedagogues work together with children in different art expressions. To come close to the educational practice, interviews with *Kulturverket* was performed, and art works as well as presentations of the project in social media was gathered. The material was analysed in a phenomenological, hermeneutical manner. Hanna Arendt's theories regarding democracy were used to understand mutual becoming in communicative processes, and to deepen the understanding of aesthetical experience, Michel Dufrenne was related to as well. The results show the importance of identifying, treating, and expressing ideas in interplay with art, and how such educational situations demands imagination, collaboration, flexibility, openness, and courage. To make children's voices heard and listened to by politicians in and through art constitute one thread in a sustainable social network beyond the Anthropocene – towards "social sustainable development and courage, culture, art, and human rights".

Keywords: *Arts education, Children's rights, Education for Sustainable Development, Democracy, Arendt*

1. Introduction

The UN Convention on the Rights of the Child (article 12) states that children have a right to make their voices heard, and to be listened to (UN, 1989). Other articles in the UN convention as well as other international as well as national policy documents in Sweden, at several levels underline the right to freedom of speech through various forms of expression, as well as children's right to express themselves through art (Ferm Almqvist, 2016). This presentation focusses on how children´s arts expressions based on the UN convention are enabled by a culture organisation in collaboration with schools, where the children's creative work as outcomes are sent to their local politicians. The project can be seen as an example of striving for social sustainable development through arts within an educational context.

Sustainable development can be defined as meeting "the needs of the present without compromising the ability of future generations to meet their own needs" (SOU 2004, p. 20). The concept is grounded in a holistic view of human and societal needs, situations, and problems where economic, social, and environmental conditions and processes are seen as "interdependent and mutually reinforcing" (SOU 2004, p. 20). A sustainable society should be "permeated by democratic values" (p. 20), that allow for citizens to participate in influencing societal development with inspiration and ability to do so responsibly. The Swedish school curricula offer a multitude of expressions regarding democracy, and the right to express oneself and be listened to (Ferm Almqvist, 2016). For example, there are several postulates that underline students' rights to become themselves, to express themselves, to respect other students' opinions, to gain different kinds of knowledge, and that teaching should be in accordance with democratic principles. In the recently changed curricula for compulsory schools in Sweden (Skolverket, 2022, it is stated that the school should offer students possibilities to take responsibility, affect and evolve a personal approach to overarching and global environmental issues, through education on how societal functions and our way of living can adapt to fit sustainable development (see Skolverket, 2022, p. 8). From a philosophical perspective, it is possible to say that a society shapes the school, and hence, the school shapes the future, implying that a perspective of sustainable development should be apparent in education in all forms, subjects, and levels (Jonsson, et al., 2012).

In an educational context, UNESCO has set the ground for the field of education for sustainable development (ESD) (2020). EDS accommodates growing sustainability challenges by enabling learners' (in all ages) knowledge production and agency towards societal transformation focussing on sustainable development. They emphasise that ESD is a lifelong learning process (UNESCO, 2022). National policy states that ESD in Sweden should strive towards that the

starting with a holistic view on human and societal needs, prerequisites, and problems (SOU, 2004). Since this presentation is based on an investigation of an arts project within a school context, we focus on how art in education and children´s rights can play a role in education for sustainable development.

Earlier research on children's rights in arts education show the importance of not only acknowledging children´s rights to express themselves, but also our responsibility to listen and encourage action based on children's expressions. For example, we may turn to Quinn (2010) explaining that for children to participate in influencing societal development, they need both a will and the actual possibility to change praxis. In Quinn's example, students were given the possibility to share thoughts on what they wanted to change in their school, which led to an art project where the students created their own school uniforms and sending in a petition on the rules on the school´s dress code, resulting in that their school management change the dress policy. As Quinn tells, this can be seen as an example of how an art-based project can lead to new understandings and create change. Quinn's emphasis on making children's rights to have their opinions heard and acted on are like Aspán & Balldin (2017), explaining that if children's rights to voice and express their opinions are to be meaningful in a democratic society, we must acknowledge and build on children´s interests and creativity.

Aspán & Balldin (2017) emphasises that there are certain aspects specifically relevant for teachers in projects focussing on children's rights in arts education, that need to be considered. According to Aspán & Balldin, it is of importance that teachers treat knowledge production in arts education as co-created between them and their students. Other collaborative aspects between teachers and students in similar settings are also highlighted by Illeris (2017), in her call to use art education “a symbolic place where teachers and students can experiment together with how to live our lives in more sustainable and collective ways entangling and intertwining environmental, social and mental ecologies of being” (p. 14). Moving further on teachers involved in arts education, Aspán & Balldin (2017) recommend avoid making decisions of *what* creative situations should involve or where it *could* or *should* lead. Instead, teachers should be open to children's opinions in the creative process, and as mentioned above, allowing the children to act on their interests and creativity. Ferm Almqvist & Hentschel (2021) also points to teachers' responsibilities in arts (music) education in relation to reinforcing social sustainability. Teachers should strive to create “a normative foundation for practical social change and sustainable development” (p. 109), that enables all students to feel entitled to participate in (musical) activities that allows them to develop their (musical) skills, and “recognize themselves through creative and constructive work” (p. 109). This could contribute to social sustainable development within arts (music) education. Another example that takes music (and poetry) as a starting point

school contributes to sustainable social change. The project resulted in a public performance aiming to create a further need for reflection on social sustainability. Dahlbäck & Schmidt describe how the project could be seen as an example of how to enable change on a more long-term basis, as the outcomes of such a project – participation in cultural events (both as performers and audience) could lead to increased life quality and function as an option to material consumption. The researchers underline the importance of developing these types of projects as permanent school activities.

As a way of understanding "how recent currents in art education can contribute to the development of environmental sustainability as a central perspective in the field", (Illeris 2012, p. 80) presents an epistemological a genealogical platform collected within the concept art education for sustainable development (AESD). Illeris (2012) also highlights that "(...) the most important requirement for AESD is not to work with pedagogy and ecology as themes but to embody pedagogy and ecology as open-ended, explorative, pragmatic, and playful modes of being and acting" (p. 14). We hope that our presentation can add to the research field of AESD.

To consider children's ideas as a starting point for societal change can be seen as a way of challenging the Anthropocene. The phenomenon of the Anthropocene is often defined as demonstrating unsustainable qualities of ecological, cultural, and social human relationships, and is a growing issue within the field of ESD (Fedosejeva et al., 2018). Fedosejeva et al. underline the call and need for research focusing on holistic understandings of sustainability in ESD, since it enables possibilities for change, to develop new understandings and perspectives in education. Furu et al (2021) also emphasize the need for holistic perspectives connected to sustainability in education and draws on the importance of holistic learning processes as contributing to reflection and discussion of value, knowledge, and skills. Furu et al.'s investigation of a multimodal storytelling project (including arts) in teacher education shows the potential to enforce what they label a more child-centered approach. In line with Jonsson et al. (2012) who state that; ". . . education for sustainable development should start in the life- worlds of the children" (p. 95), this presentation takes life experiences of 10-11years old children involved in arts education as a starting point. The aim of the study presented is to explore and describe how 10 years old children's voices can be heard and listened to in aesthetic communication with politicians regarding issues that engage them, from planet wealth to after school activities. The study is based on a project arranged by a municipal art school, performed in schools, financed by *The General Heritage Fond* and *Umeå Munipicality* called "Alla har rätt" [Everyone is/has right/s] in Sweden. A well-established municipal organisation in Umeå, *Kulturverket [The Culture Service],* has performed artistic projects of diverse kinds during fifteen years, based on the statement: "Children tell the professionals what to do" (Ferm Thorgersen &

the children, in relation to a chosen article in the convention through their specific artistic specialities. The working method was based on a "relay model" where the projects ideas and artworks were passed around as a "baton" in between the children and the artists-pedagogues. The ambition of the current project was to contribute to understandings of the UN Convention on the rights of the child, which since 2019 is statutory in Sweden. The goals for the whole three-year project were formulated by *Kulturverket* as follows:

- To strengthen knowledge about Children's rights
- To ensure that children from different parts of the city meet and work creatively based on the UN Convention on the Children's rights of the child, aiming to create relations and counteract segregation
- Increase children's knowledge regarding their democratic rights
- Give increased space for children's voices in public spaces
- Strengthen children's participation in society

One part project, which makes the base for this presentation, was the "politician-project" where one poet-pedagogue from *Kulturverket* worked with four classes, with the intention to let the children identify, treat, express, and communicate messages to powerful people in and through art, in the form of post-cards.

2. Methods and theory

To come close to the educational practice, interviews with a poet and pedagogue employed by *Kulturverket* was performed about the philosophies behind, as well as the planning, performance, and evaluation of the politician project (Kvale & Brinkman, 2009). In addition, complementary written communication was performed via e-mail (van Manen, 1990). The post-cards created by the involved children were available through *Kulturverket's* internal Google Drive. Photos and text concerning the project were also mediated through social media, which constituted one part of the generated material. The interview was transcribed verbatim. Written as well as visual material were analysed in a phenomenological, hermeneutical, and arts -based manner (Barone & Eisner, 2012; van Manen, 2002).

Further, to be able to understand how children's voices can be heard and listened to in aesthetic communication, Hanna Arendt's theories regarding democracy was used as well as Michel Dufrenne's theories of aesthetic experience. A basic statement for Arendt's view of political action, is that is an actualisation of a "who", dedicated to hope, rather than upon an implausible law (Kristeva, 2001). Humans must recognize the becoming of "who" inside themselves where

(1978) relieved in the plurality of the world, in the common sense, where thought and action are interrelated. The “who” is although never a solitary self, instead human becoming takes place in action and speech with others. Arendt (2002/1961) underlines that in the common place, the political space, human beings meet to try out, sharpening and equal views and standpoints, at the same time as they create the specific public square. The who manifest oneself in its ”dynamic exceptionalness that could not help blossoming before the multitude of other people . . . who receive and interpret the acts of each newcomer by implicitly asking him the question, ‘Who are you?’” (Kristeva, 2001, p. 173). The “who” is intertwined with nature, society and historical narratives through creative action, and the “essence” of the who is not possible to state only when life departs, through the story that is left. Hence, to express oneself, share one’s opinions and be listened to, becomes a crucial part of citizenship (Arendt, 1998).

According to Kristeva (2001) Arendt’s main goal is to “preserve the freedom of the “who” at the heart of an optimal political plurality (p. 181), which she labels as “space of appearance” and “political action” that affords dangerous freedom of bounds with other people (Arendt, 1998).

Inviting children to identify, treat and express their ideas in interplay with artistic forms of expression constitute a place for dwelling as aesthetic experience. That is where the aesthetic sensation (noesis) makes the aesthetic ”object” (noema) complete. According to Dufrenne (1973) presence, representation and imagination, reflection and emotions together constitute aesthetic experience. Based on a phenomenological way of thinking where human beings are interwoven in presence where meaning is grasped as something that touches and engages, and where significance appears before human understanding of things. Meaning must traverse through the body, as it exists immanent in perception, in the ”sensuous”. That’s why contemplation, or present reflection, becomes important for understanding. The weight of representation and imagination concerns going from the lived to the thought, from the presented to the re-presented. Imaginations and phantasy contribute to transcendence, which demands a view of body and mind. In other words, it becomes crucial to go beyond the directly experienced, and instead view the world as it opens itself. Imagination demands a specific engagement, a lived body and transcendence, through closeness and distance in interplay. Generally, the function of reflection and emotions in sensation, it can be underlined that the first is needed for ability to understand significance; ”To undo its appearance to understand its law” (p. 370). The latter does not mean that to go back to what was presented in presence, but emotion is seen as something that relates to a specific quality that makes the ”object” states its intimacy, and the representation becomes ”something else”. Emotions contribute to aesthetic experience on a deeper level, to experience the hidden, and the sublime. Dufrenne (1973) underlines that strangeness and challenges contributes to deepening, to let oneself become surprised and taken; the world must continually

pedagogues, and politicians.

3. Results and Discussion

The results show the importance of identifying, treating, and expressing ideas in interplay with art, and how such educational situations demands imagination, collaboration, flexibility, openness, and courage. The "politician project" that constituted a part of the larger project "Everyone is/has right" described above aimed to letting 10-11-year-old children, four classes at two different schools, be heard by politicians through creating postcards mediating the children's identified, and treated desires for the future. A poet and pedagogue employed at *Kulturverket* was the main responsible person for the project, which now and then was questioned by his colleagues. All following citations in the result derives from him. The project leans on a strong idea that every child in the municipality should be offered to express themselves and communicate in and through artistic forms of expressions, according to Arendt (1998) a crucial part of citizenship, not least to grasp and encourage the once "who had never come to think about to write a poem". *Kulturverket* label this as they "hit" the schools and children, opposed how voluntary (paid for, mostly parent-driven) activities work. "We just drive there and 'hit' them, they don't have a choice, in a good way". Another starting point, or impetus, is that two different classes, where the children don't know each other since before, shall meet, and in this politician project the two classes share their postcards with each-other, (literally), before the about hundred postcards are given to the politicians, and take each-other's messages into account, share meanings, and become themselves in plurality, to speak with Arendt.

Figure 1. *No homework, we need our spare-time.*

When the poet-pedagogue arrives to the classroom he talks about the Children's rights convention, to encourage a debate, where the children are encouraged to make their voices heard in plurality. They´re asked if they know which rights they have. They talk for example about the right to privacy, and the poet-pedagogue talks about diaries, and connects to poetry, as a form of diary. They also talk about that they have the right to be protected from violence and harassment, and that it can lead to that their parents can have a need to have a look in their devices. "So, then it becomes an exciting debate. Because two views are set up towards each other". The poet-pedagogue expresses that he wished he had even more time and space for argumentation, rhetoric, and debate in the project, as that is viewed as healthy, if is done in non-hectic and not so sensitive ways. Then they work further on with article 12 and 13, the right to make once voice heard, and freedom of speech. Then they get a paper where they are to answer a couple of "Who are you"-questions as "What do you want to tell a powerful person?" These starting points can be seen as important aspects of political action, actualising the "who" in line with the thinking of Arendt (1998). At the same time, it becomes evident that persons in power are distant from a child's perspective, which influence the character of the messages. "They think it is a list of wishes to Sancta Claus. And that is a bit fun". The children are not clear about what is possible to wish, or demand. Some want to have more time to train Ice-hockey, while many want the

is issues within the municipality, that these politicians can influence, and he walks around among the children and asks “Who are you-questions” to help them identify their ideas and desires, for example regarding how sports-equipment could be more available, even for poor people. The children become engaged, they start processes of becoming “who's” (cf. Arendt, 1998) in relation to the poet pedagogue, and each-other. Each session is two hours, and the first out of two ends with formulated messages, based on insights in children’s rights.

***Figure 2**. Every child has the right to speak to someone.*

The aim of the second session was to make meaning and deepening ideas in interplay with crating artistic post-cards. They get the question, “If an avatar was the spoke person for children, what would it be like?” Hence, the post-cards were to include an avatar, imagined and created by the individual child, who tells the message, verbally, or in the form of a poster. Most often the spoke persons were related to the message, to deepen the message, a process of identifying and investigating their ideas in relation to art as a form of expression. The children needed to be present, to use earlier experience as well as imaginations, to connect to their feelings as well as reflection, which according to Dufrenne (1973) is what characterise aesthetic experience. The activities caused high sound levels, that on the one hand concerned the poet pedagogue (as he feels the reactions of the class teachers), but he also viewed it as a sign of creativity, and a part of making one’s voice heard, starting with the discussions regarding the children’s rights

this"? The atmosphere in the classroom develops through the artistic workshops where the children cut and paste, like a creative workroom. "I think it is awesome that it becomes a creative activity".

Figure 3 *More Geography in school.*

The poet-pedagogue's vision, which he had to convince some of his colleagues about, was that the postcards were seen as artistic wholes, that the politicians had to be open for and experience aesthetically (Dufrenne, 1971). Some of the colleagues thought that the messages should be formed in ways that the politicians could easily understand and internalize, like proposals. "But they are so full of fantasy some of them, then something disappears". The poet-pedagogue underlines that something happens, when the children treat their ideas and express them in holistic ways: "We have to save the planet…and then – a square-formed hat". From a phenomenological perspective where human beings are seen as interwoven in presence where meaning is grasped as something that touches and engages, and where significance appears before human understanding of things, it becomes crucial to offer these possibilities to children. As Dufrenne (1973) underlines, meaning must traverse through the body, as it exists immanent in perception. Without the visual expressions, the messages get emotion-less, the poet- pedagogue continues. "Some of them has been angry when they made the cards, they "teared out" their characters, and you can see *how* they drew, how they spelled, and some of them really did their

the children know that this is something they share, they can't keep it, they show how they relate to people in society, they are a part of a historical narrative, and engaged in processes of becoming where the artistic messages "The medium is the message, so to speak", which goes in line with what Arendt (1998) and Dufrenne (1973) stress, that art works survive humans. The colleagues have also suggested that formal ways as "error reports", where broken lights, or fallen trees, for example should be reported, could be used to reach the politicians, which is in line with what Arendt's thinking of pluralism in politics, also protests towards. Even if security during the transportation to, as well as in schools, is something that is important according to the Children's rights convention, to use such established channels, is another view of democracy, that is not connected to becoming of "who's" nor deepened understanding offered in relation to art.

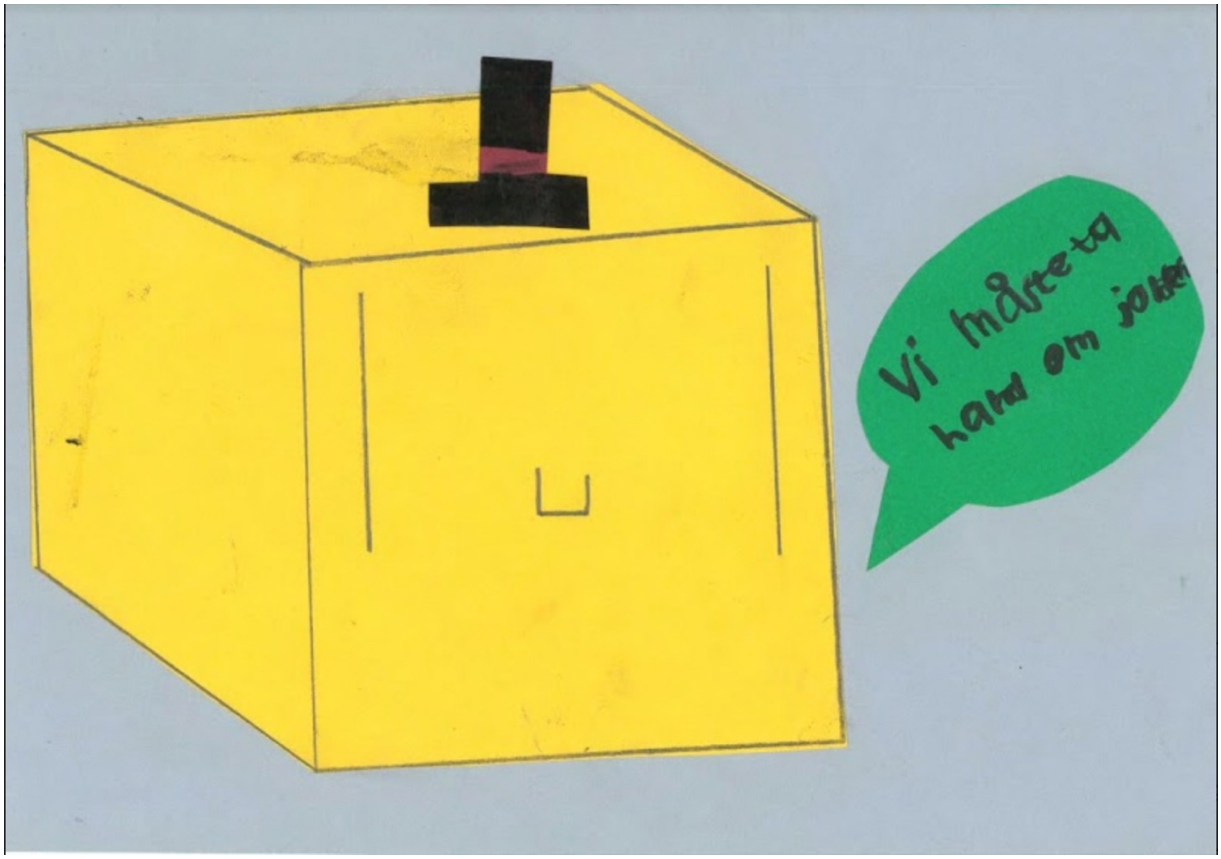

Figure 4. *We must take care of the earth.*

There are also several messages and questions in the material formulated by the children that are not developed in postcard artistic processes, but are partly mediated through a common avatar, who speaks digitally to the politicians. "So that politicians can go there and check out what the avatar says right now". The original intention was that the avatar should speak at council meetings, but *Kulturverket* couldn't imagine how that could be possible to realize. In these gathered messages the children are more open, and "uses" the freedom of speech. In the post-

and an imagined politician, a process of becoming a "who" in plurality. But even the politicians must be "hit" to come up with a reaction, and answer "In the newspaper or at their meetings or something". Otherwise, the children will just be heard, and not listened to, and then the democratic intention has failed, and the project can't be defined as sustainable.

The children went by bus to the municipal house city hall to be present when the postcards were given to the politicians. "Like a mini-demonstration". They were making their voices heard, they were taken seriously by *Kulturverket*, but were they listened to by the politicians? The chair of the cultural committee had been contacted and received the postcards in person. There is a hope that the post cards are shared among the politicians, that they can put them on the walls in their offices or be exposed in an open space at the city hall, to continue displaying the children's voices (Dufrenne, 1973; Arendt, 1998). "Because these are originals. I am so afraid that something will happen to them".

Figure 7. *The children and the avatar give the postcards to the politician.*

The poet-pedagogue had thought about letting the politicians participate in a similar post-card workshop as a way of answering the children, but he couldn't imagine who potentially could receive their mail. In line with Arendt's (1998) thinking, the children should be the natural receivers – a chance to not just be heard, but also listened to. Now of writing this paper, an interview with one politician is planned to be conducted and recorded, and then played in public at a public exhibition.

In addition, the gathered messages are mediated through artistic treatment on another level, namely through the poet's own artistic poetic work. "They wright so beautiful sentences now and then. It gives me so much". The messages live further on through the relay-model, in a poetry book, also present at the public exhibition. The children will hopefully get the feeling of being a part of something bigger. There will also be a speaker's corner including poetry reading, based on the children's voices.

Figure 5 *More breaks. Children need to rest.*

As mentioned, the messages are shared and mixed through a common Avatar, A 3D-animated figure on a webpage. The intention is to influence politicians, to be touched and engaged, through the sensuous (Dufrenne, 1973), a prerequisite for the children's voices to be listened to, "But how is that done, it's a really hard question"? Even counter arguments are signs of touch and engagement, and that the children are listened to, an important aspect of their process of becoming

if a child-avatar appeared and posed their questions. So far, the avatar is available, and share the messages of the children at a web page. https://kulturverketumea.se/dkv/builds/digitalavatar/.

An application is also constructed, which makes it possible to continually gather and share children's artistically identified, treated, and expressed thoughts, visions, and desires. But still, what about the politicians' reactions?

Figure 6 *I want answer. Why did you close the school at Brännland?*

The mentioned public happening, the exhibition, is about to be organized for the whole project, where the plan is that one important politician will come and speak (back) to the children, which is a part of the story to be continued. But it can be stated that such a response would be crucial in the common place that the public exhibition constitutes, a political space, where human beings – in this case politicians and children – meet to try out, sharpening and equal views and standpoints, at the same time as they create the specific square, if we listen to Arendt (1978).

4. Conclusions

The results show how processes of identifying, treating, and expressing ideas in interplay with art can be performed, and how such educational situations demands imagination, collaboration, flexibility, openness, and courage. The participating children's thoughts and artistic expressions

the results can't fully disclose how the children's ideas were met by the local politicians, or if their ideas will be acted upon. Aspan & Balldin (2017), in line with the thoughts of Arendt, underlines the fact that children must not only be given opportunities to express themselves, but also be listened to, and experience that their ideas are acted upon. To make children's voices heard and listened to by politicians in and through arts constitute one possible, but demanding, thread in a sustainable social network beyond the Anthropocene – towards "social sustainable development and courage, culture, art, and human rights".

The Children's rights convention is regulated by law in Sweden since 2020 (SOU 2016), and Swedish school curricula are based on democratic principles (Skolverket, 2022). Also, the Swedish government describes that a sustainable society as well as ESD should be based on democratic principles and a holistic view on human and societal needs (SOU, 2004). In line with Aspan & Balldin (2017) and Illeris (2017), the result also shows how knowledge production is seen as co-created and holistic. Earlier research underlines that ESD should strive for knowledge production and agency towards societal transformation, focussing on sustainable development for learners in all ages (SOU, 2004). This can be seen as an incentive for running similar projects like *Alla har rätt* in schools – projects where children's artistic expressions of views on issues that relate to them reach others and create a space for reflection and possibly grounds for action, in line with Dahlbäck & Schmidts (2021) recommendations. But, again, in the planning and running of such processes, the aspect of being listened to and acted upon, must be considered.

As stated in earlier research, taking children's ideas as a starting point for societal change can be seen as challenging Anthropocene by taking children seriously and address issues that concern them (such as ecological, cultural, and social human relationships in the world) (Fedosejeva et al., 2018; Furu et al. 2021). In a recently performed research study, we found that another of *Kulturverkets* projects – Sammankonst – worked contradictory to neo-liberal powers established in the Anthropocentric world (Ferm Almqvist & Hentschel, in press). We underline the importance by acknowledging that changing practice lies greatly in the hands of leaders, like in this case, politicians. If children's voices (through artistic expressions) are only heard but not listened to and acted on, practices can't be changed (Quinn, 2010). As Arendt (1978) claims, children's "who´s" are intertwined with nature, society and historical narratives through creative action, and their expressions are to be treated as a crucial part of their citizenship. To bring forth change, organizational, collegial, and political areas need to reinforce holistic views on knowledge and competence in contradiction to Anthropocentric values (Ferm Almqvist & Hentschel, in press), where children's "who´s" expressed through art is taken as serious participants in the debate on how to go beyond the Anthropocene and act. To promote sustainable participation in actual change of societal practice, we need to treat children as equal discussion

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3. Biodiversity and ecosystem services

3a. Life on land

Abstracts

Legal and Institutional Framework on Forest Confronted with Colonial Hrauma: how to decolonize and achieve SDG 15 in DRC?

PhD Candidate ROGER Mbuyu Kimpesa Kasulo

University of Kinshasa, Kinshasa, Congo, the Democratic Republic of the

Abstract

The Democratic Republic of Congo (DRC) is a vast country whose forests are central to the preservation of ecosystems services, biodiversity, climate and the planet.

During the colonial era, since the formation of the Congo Free State, these forests have largely been logged for the benefit of the Belgian King Leopold II, the Belgian State and other foreign European companies to the detriment of the Congolese State, including its people and institutions. Forests communities paid a horrible heavy price in terms of forced labour, denial of all human dignity, desecration of forests, despoiling of vital resources and habitat. Rubber extraction cost millions of human lives considered as the first genocide in DRC, while logging destroyed their habitat. Plantations production and the establishing of protected led local communities to work under ruthless conditions or to be expelled from their lands with negative cultural and well-being impacts.

As a result, these worse unequal experiences rooted traumas in the DRC's population and generate a distrust of the ancient colonial government (Western Countries), the logging companies and the State considered as a collaborator of the precedents.

After independence in 1960, the DRC maintained the enforcement of a 1949 Decree on the Forest Regime 42 years later and adopted, since 20 years, the 2002 Forest Code. The 1949 Decree disregards the ownership of forests by the population and sets conditions for logging that were out of reach of the population. The 2002 Code has brought innovations without completely decolonize the forest management system.

Investigating on the survival colonial model in the current legal and institutional framework and the state of forest projects in DRC will contribute to the understanding on the participation of the populations to domestic and international initiative on forest conservation measures, such as the REDD+ and the Agenda 2030.

The paper focuses on the implementation of the SDG 15 on life on land and proposes the decolonization of the legal and institutional framework on forest to foster the participation of the population by alleviating colonial trauma and promoting good practices in line with the Agenda 2030. Cultural, historical and well-being aspects should be the centrepiece of the implementation of the SDG 15. The paper highlights the courage of actors of change who contribute to shift the paradigm on forest protection and promotes the participation of the populations to the optimal enforcement of SDG 15.

Track
Track 3a Life on land

Full papers

Enhancing Sustainable Development on Land: Using birds of prey to disperse flocks of native birds that threaten resource use and human activities

Robert Wallis[1], Graeme Coles[2]

[1]*Federation University Australia, r.wallis@federation.edu.au*

[2]*Full Flight Birds of Prey, graeme@fullflight.com.au*

Abstract

One of the aims of SD Goal 15 *Life on Land* is the sustainable use of terrestrial ecosystems. When development of infrastructure, agriculture or other human use of the land is threatened by fauna that congregates in high numbers to exploit the resource under development, this sustainable use is in turn threatened.

Large flocks of birds at times can be particularly troublesome. Traditional control techniques have included poisoning, trapping and relocation, exclusion, use of decoys and loud noises and habitat manipulation such as provision of alternative food sources away from the target site. These methods have disadvantages, often including low effectiveness in actually dispersing the target birds.

We have used birds of prey (raptors) to successfully disperse flocks of pest birds that have threatened agricultural harvests, damaged sporting fields and infrastructure and posed high nuisance value at sporting events. The technique works best when the birds' damaging activity is localized and over a short time period. As it involves trained birds and skilled bird handlers, the technique is expensive but is cost-effective if the potential damage is significant and expensive.

The management of large flocks of pest birds that are native (as opposed to introduced) adds another challenge. The public can be less forgiving of the need to destroy the pest birds if they are indigenous to the area. Using raptors (birds of prey) to disperse – as opposed to kill the birds that cause damage - is an example of compassionate conservation where animal welfare (no harm) is of concern.

Here we describe case studies in Australia where the use of raptors has been effective in managing flocks of pest, native birds and one example in which the technique was less effective. The raptors have included eagles, owls, goshawks and falcons used to manage cockatoos and gulls. We also describe how we use the raptors for the control trials.

By carefully managing large numbers of native birds that threaten agricultural production or human community activities, the sustainable use of the land might be better achieved without loss of biodiversity.

Keywords: pest birds, control, raptors, Australia

1. Introduction

The sustainable development of terrestrial ecosystems is central to SD Goal 15 *Life on Land.* This goal involves the wise use of forests, preventing desertification and halting the loss of biodiversity. These

forest growth as well as contribute to desertification and biodiversity loss. The birds can also disrupt community activities and damage infrastructure.

Large flocks of birds – both indigenous and introduced to the area, can seriously disrupt ecosystem function and threaten the sustainable use of terrestrial resources. In agriculture, they can consume fruit and grain, foul the harvest, introduce disease, prey on other birds that consume insect pests and destroy the structural integrity of the crop (Garcia et al., 2020). Pest flocks can also lead to loss of local biodiversity, either through direct consumption or competition. Isbell *et al.* (2017) have demonstrated the link between loss of biodiversity and changes in the delivery of ecosystem services. Pest birds can also damage buildings, recreation facilities and disrupt community events (Coles et al., 2019).

Traditional methods of managing bird pests have included poisoning, trapping and relocation, exclusion, chemical repellents, habitat modification and using various scaring devices (Rivadeneira et al., 2018). Each method has disadvantages and these authors have argued that a multi-tiered, integrated pest management approach is likely to be the most effective in the long-term.

In this paper we discuss the use of birds of prey to disperse pest bird flocks in Australia. Using case studies, we evaluate the pros and cons of this technique and consider whether lethal (as opposed to non-lethal) takes by raptors might be more effective at managing bird pests. Our case studies include bird problems in agriculture, at sporting events and those that damage infrastructure.

2. Use of birds of prey to manage pest birds

Falconry has long been a recreational pursuit, but it has also been recognized for its value as a pest bird management tool. If we expand the technique to include other birds of prey (raptors), then there have been several studies on the effectiveness of bird hazing as a means to disperse pest bird flocks.

The earliest accounts of raptors dispersing pest birds were in managing airfields. Indeed, a conference held in Nice (France) in 1963 was specifically devoted to birds interfering with planes flying into bird flocks (especially gulls) (Busnel and Giban, 1965). Blokpoel (1976) reviewed the use of raptors that had been trained to scare birds at airports in five countries. His conclusions were quite specific: the technique did work effectively but required trained birds of prey, skilled handlers and
the technique's efficacy depended on the species of pest bird. Furthermore, the technique required daily flights by the raptors and only worked in good weather and during daylight hours. He also concluded the technique was quite costly and if every airport used raptors, then there would be insufficient trained ones in the world to manage the pest birds! Other studies successfully used raptors in combination with other bird-frightening methods such as shotgun patrols, taped distress calls and visual deterrents (Heighway, 1969; Mikx, 1969; Boulay, 1977). However, because other techniques were used, it is difficult to ascribe the success at managing the pest birds to these or the raptor hazing.

Another early study compared the effectiveness of using goshawks (*Accipiter gentilis*) to manage woodpigeons (*Columba palumbus*) on brassica crops. The technique failed, perhaps because of lack of

There have since been numerous reports of the successful use of raptors to manage pest birds in agriculture. These include falcons (*Falco* spp.) dispersing several species of birds that consumed leafy greens in the US (Navarro-Gonzales and Jay-Russell, 2016), falcons controlling introduced and a native species of birds that attacked grapes in New Zealand (Kross et al*.,* 2012), magpies (*Cracticus tibicen*) disrupting frugivorous birds that damage grapes in Australia (Peisley et al*.,* 2017), models of sparrowhawks (*A. nisus*) disrupting starlings (*Sturnus vulgaris*) feeding on rye grass in the UK (Devereaux et al*.,* 2006), and American kestrels (*F. sparverius*) dispersing birds that consumed cherries in Michigan, US (Shave et al*.,* 2018).

Raptors have also been used to control scavenging birds at rubbish dumps (landfill sites) with varying levels of success (Baxter and Allan, 2006; Cook et al*.*, 2008; Soldatini et al*.,* 2007). Success again depends on the species being controlled, the length of the period over which raptors are flown and whether other techniques are employed simultaneously.

3. Lethal versus non-lethal conditions

Using birds of prey to disperse pest birds without killing those target birds is considered a humane method of reducing the deleterious impacts of the pest population – certainly when compared with such methods as poisoning, shooting and trapping and translocation (Blokpoel, 1976).

If the raptor kills (or hunts and therefore has the potential to kill) some of the target population, does this increase the efficacy of the control method? There have been few comparisons between lethal and non-lethal use of raptors that allow for meaningful comparison. Baxter and Allan (2006) found peregrine falcons (*F. peregrinus*) significantly reduced the number of gulls at rubbish tips in England. In about one third of their trials, the falcons were able to hunt and capture their prey.

However, their data analysis did not discriminate between the prey reduction for lethal versus non- lethal trials. The authors surmised the falcons were successful "whether hunting, being flown to simulate hunting. Or more importantly, perceived as potentially present" in deterring the gulls from using the tips (Baxter and Allan, 2006 p. 1165). However, the experimental design did not allow any conclusion to be drawn on the relative reduction in gull numbers for three conditions: falcons that did not hunt, simulated hunting and falcons that actually took prey.

In another study of landfill rubbish tips in the UK, Cook et al. (2008) found that when lethal methods were used (falcons preying on gulls or the gulls being shot), the gulls no longer habituated to the raptors (which occurred when the birds did not hunt their prey). They found lethal techniques (shooting, falconry) which reinforce visual and audio cues with the occasional death of target birds, have the opposite effect on habituation and more gulls were deterred as the trial progressed. This is the most striking evidence that lethal takes (and shooting) do indeed have a positive effect on reducing numbers of gulls compared with non-lethal use of raptors.

In a study on grape damage in New Zealand previously mentioned, Kross et al. (2011) found New Zealand falcons translocated to wine-growing regions preyed on birds that fed on and damaged grapes. The

predation risk changed the birds' behaviour to become more "antipredator". Such actions included avoiding the sites, increased vigilance relative to the time spent actually foraging for grapes and also relocation by the frugivorous birds to less favourable sites in which to forage that had a lower predation risk.

There seems to be other anecdotal suggestions that if raptors can kill their prey, the control of pest flocks becomes easier, but hard evidence is lacking. In some cases, it seems authors intuitively think this should be the case without any experimental evidence. Thus Erickson et al. (1990, p. 314) state "The raptor species used preferably should be a natural predator of the pest bird species as the occasional kills it makes will help reinforce the perception of danger" and cite Grubb (1977) in support. However, Grubb (1977) makes no mention of lethal versus non-lethal control using raptors, referring to differential habituation only in terms of distinguishing between different aerial stimuli such as different shapes of raptors.

Inglis (1980) also believes shooting pest birds and the sight of dead or dying birds are aversive stimuli that could disperse pest birds from a site. His argument is based on the literature of avoidance conditioning. However, there are certain elements in its practice that are required:

The warning stimulus (in this case, birds seeing others taken by a raptor) must retain its potency for long periods (a single kill episode will likely be ineffective)

- It must occur spatially and temporally with the pest bird visits to the site (obviously!)
- A scaring device (such as the playing of alarm calls) could be used simultaneously with the aversion stimulus (e.g. hazing by falcons) so the pest birds associate the device stimulus with killing
- Novel scarers are preferable to ones used previously.

Inglis' suggestions are based on theory and his paper does not produce hard evidence that killing some of the pest birds as aversion stimuli actually increases the efficacy of pest dispersal. Furthermore, in his discussion the aversion stimulus of dead conspecifics is by way of shooting and not by raptor take.

Bomford and Sinclair (2002) reviewed the research on bird pests in Australia and listed the circumstances when scaring devices could be effective, including their reinforcement with real danger, such as shooting. Raptor takes of target birds could also be considered such a reinforcement stimulus.

Clearly there needs to be research undertaken that resolves whether lethal takes of pest birds reduce the impact they cause.

Lethal takes by raptors are likely to distress some in the community. Witnessing a predatory bird seize and consume a prey can be off-putting (Bird-control, 2022; Pigeon control resource centre, undated) and therefore likely to prove unpopular with the general public. This needs to be weighed against any increase in efficacy in dispersing the birds and the resultant reduction in damage and economic loss.

4. Methods and Results

In Australia we have successfully used birds of prey to disperse flocks of pest birds (Coles *et al*, 2019;

to infrastructure and (c) interference with sporting events.

2a. In the first case study we studied cockatoos that have threatened the harvest of almonds in a large orchard in northern Victoria.

The Olam Group is a large, multinational company based in Singapore that owns and operates almond farms in northern Victoria, some 120 km east of Mildura (Fig. 1). The total area of the farms is quite large – 12,000 ha and comprise 11 separate orchards – the largest of which has 320,000 almond trees. Flocks of Long-billed Corellas *Cacatua tenuirostris* and smaller numbers of Sulphur- crested Cockatoos *C. galerita* (both species hereinafter referred to as 'cockatoos') cause damage to the crop. These parrots roost overnight in trees along the nearby River Murray and fly to feed on the almonds during the day. The highest densities of parrots occur on the farms in the mornings.

About 400 parrots would fly from the river each morning and late afternoon along certain transit routes to the orchards. In the 2017 trials we used a trained Wedge-tailed Eagle (*Aquila audax*) to fly from the river to three adjoining farms along these transit routes. Three periods of flyovers, each lasting six days were conducted during the pre-harvest period. Flyovers consisted of the one handler releasing the eagle and another handler receiving the eagle that flew over a distance of about 200 metres at a height of 3-5 metres during early morning and late afternoon when the parrots were most actively flying to the almond trees. This was repeated during late morning when some parrots would attempt to return to the orchard. The eagle was attracted to the receiving handler rotating a lure; when the eagle landed on the handler's gloved hand, it was rewarded with food. The eagle had been trained not to attack or pursue the cockatoos but simply fly over in a direct line.

The parrots quickly returned to the river habitat after each flyover rather than dispersing further inland to the other farm blocks. As the trial progressed, fewer parrots would attempt to access the orchards. After the 18 days of flyovers, the parrots did not return to farm blocks until several months later when harvesting had finished.

In 2018 we repeated the trial. Again, about 400 parrots attempted to fly to the orchard each day, especially in the early morning and late afternoon. This time, low numbers (<10) of cockatoos returned during the day. We thus checked the farms every 30 minutes during the six-day period and flew the eagle an additional time if parrots were seen in the almond trees. This was effective and after the six days, no parrots were foraging in the orchards.

Importantly, we observed opportunistically that smaller, non-target birds did not respond to the eagle flying overhead.

2b. This case study involved a number of sites where cockatoos damage buildings, playing fields and golf course.

Native cockatoos (mainly corellas) cause significant damage to golf courses which provide the birds with bulbs, seeds and grasses as food. The birds tear up rhizomes and tubers as well and not only does the

Parliamentary Committee recommended management by shooting corellas (suggesting shooters disguise themselves as golfers and carry rifles in their golf bags!) and sounding alarm calls (Environment and Natural Resources Committee 1995).

We have worked on many golf courses in Victoria, Australia; their large area means birds can often be dispersed from one section of the course and relocate and damage another part. However, over time we have increased the success rate in damage mitigation and cockatoo management. One case study will be described here.

In April 2018 we flew either a Wedge-tailed Eagle or a Brown Goshawk (*Accipiter fasciatus*) over a golf course in Melbourne's south-east to disperse Little Corellas *Cacatua sanguinea* that were causing damage to the course putting greens. The corellas were especially abundant around a small dam on the course. If no corellas were observed on the greens near the dam, then the raptor was not flown. Checks were made up to six times a day for five consecutive days. A maximum of 50 corellas was observed at any one time. In all cases, they dispersed when the raptor was flown. In the early stages of the treatment, corellas returned in lower numbers within one hour. However, as the week progressed, corellas returned less frequently until by day five, no corellas were observed at all on the course.

Corellas remained absent from the course for eight months after the treatment but did return in small numbers after this. Repeated use of the eagle then quickly dispersed the corellas. An advantage of this study site was the corellas roosted in trees by a particular dam and did not disperse to other parts of the course after the bird of prey had been flown.

Little Corellas were also causing damage to the trees and sporting fields of a school in south-eastern Melbourne in 2018. Flocks of up to 400 corellas were observed. Three raptors (Wedge-tailed Eagle, Brown Goshawk and Masked Owl *Tyto novaehollandiae*) were flown daily for four days in July until corellas no longer appeared at the site. Two weeks later a large flock of corellas again returned to the school. This time the eagle was held on the hand and encouraged to flap its wings. On hearing the flapping noise, the birds dispersed. After two days, no corellas were seen and had not returned by the end of the year. This case study enabled us to test the efficacy used three raptor species as well as comparing the effects of flying the birds over the target species versus holding the eagle in the hand and having it flap its wings. The results of this latter set of trials need further analysis and more data collected before we can make definitive conclusions about the effectiveness of each operation.

Long-billed Corellas can cause damage to buildings (Environment and Natural Resources Committee 1995). In 2016 a flock of about 300 corellas were damaging an apartment block in Caroline Springs, an outer suburb in Melbourne's north-west. They were chewing wires, rubber seals and window seals, defaecating on the buildings and its grounds and their screeching was annoying guests. Our treatment to disperse these birds involved using one Barking Owl *Ninox connivens* and one Wedge- tailed Eagle over three consecutive mornings at the site. We used three techniques: flyovers by the raptors, encouraging the raptors to flap their wings or holding the birds still in the hand. Flying the raptor over the site proved the

eagle flap its wings to disperse the birds. After two months no corellas had returned to the site.

At another apartment block in Frankston, an outer south-eastern suburb of Melbourne, roosting Silver Gulls *Chroicocephalus novaehollandiae* on the roof of an apartment block could not be dispersed by flying raptors over the building. The gulls were nesting on the roof and were fiercely protective of their young, readily mobbing the raptors that were used.

2c. The third case study involves pest birds interfering with sporting events.

In 2015 at a Melbourne racecourse, a flock of Silver Gulls flew up in front of a group of thoroughbreds racing, spooking the horses and causing falls of horses and jockeys. Fortunately, no horses were put down, but jockeys were hospitalised and the race abandoned. To prevent a recurrence of such an event, the Victoria Racing Club has engaged Full Flight Birds of Prey every year since 2015 to disperse gulls during the prestigious Melbourne Cup Carnival which is considered the premier set of racing events in Australia. The gulls are attracted to where the crowd of over 100,000 congregate, perhaps attracted to the food dropped by the patrons. The Carnival runs over four non- consecutive days and involves 37 races.

We have used the opportunity to use different raptors as well as measuring numbers of gulls on the track 5 to 10 minutes before each race and during the race itself. We did not count numbers of gulls besides the racetrack (in the public area or in the space enclosed by the elliptical track) but on most occasions hundreds were seen in the marquee areas or flying overhead.

One bird of prey was flown over about half of the course (where the gulls congregated) immediately before each race. The raptors used over the years have been Peregrine Falcon (*Falco peregrinus*), Wedge-tailed Eagle, Barking Owl, Masked Owl, Barn Owl (*T. alba*) and Brown Goshawk. The birds were released by a handler near the start of the race and trained to fly to another handler at the end of the trial distance of approximately 1000 to 1400m. The number of gulls at the course has varied over the years but around 200 to 400 can flock in the middle of the course (off the track) during the events. Many land on the course between races; for example, in 2021 about 200 gulls were found on the actual track before the start of two races, including the Melbourne Cup race itself.

The dispersal of the gulls has been successful with no gulls ever found on the racetrack during the 37 races after the flyovers in each of the years before 2021. Furthermore, when a raptor flew overhead, gulls in the public areas off the track also took flight and dispersed for a short time, but never on to the track. In 2021, however, for the first time we observed gulls resettling on the racetrack once the race had begun. Numbers were very low on the few occasions this occurred e.g. three gulls flew across the horses as they ran to the finish line on Race 4, Oaks Day. In the 2021 trials, we also flew birds repeatedly before certain races to ensure gulls flew away from the track. Thus, before race 7 on Melbourne Cup Day, the owl was flown six times before the race. This was the Melbourne Cup Race itself and we wanted to be certain no gulls could congregate. Before race 8 on Oaks Day, the eagle was flown 10 times.

All species of raptors were effective in dispersing the gulls from the track, although there were insufficient

disruption to the horse races due to gulls. No injury or deaths of the raptors or gulls was observed during the trials and gulls were not seeing harassing the raptors.

5. Discussion

The recent COVID 19 pandemic has reduced the opportunity and our preference for further trials of dispersing pest birds in agricultural settings. The success of the eagle in mitigating the loss of almonds during harvest illustrates advantages this technique offers in pest management. These advantages include:

- no poisoning and deleterious effects on non-target species
- the technique uses a natural predator of the pest birds and has little impact on the animal welfare of both raptor and target and non-target birds
- low habituation of the target population to the raptors (compared with use of birds of prey models, loud noises, flashing lights etc.)
- compliance with Olam Group's sustainability commitment (Olam Group, 2019).

A further advantage in using the eagle to manage the cockatoos is that some time after the eagle has been flown, the cockatoos will return and clean up the rotting fruit left unharvested on the trees and ground (Saunders et al., 2016). If the cockatoos had been removed permanently by shooting, trapping or poisoning, the fruit that had been left would need cleaning up using other, costly methods.

The method also exemplifies compassionate ("no harm") conservation (Wallach et al., 2018) which reflects growing concerns of the community for the welfare of wildlife that is being managed, although some have argued compassionate conservation can actually work against effective conservation outcomes (Rower & Maris, 2019; Callen et al., 2020).

The case studies also demonstrate the technique is effective in dispersing cockatoos from urban sites where they are damaging buildings and infrastructure, although not nesting Silver Gulls that mobbed and harassed the raptors. Soldatini et al. (2007) described gulls of the genus *Larus* as highly social and intuitive bird species when testing the efficacy of three systems used to deter gulls from scavenging at refuse dumps in Italy. Silver Gulls have also proved difficult to disperse at Sydney airport using peregrine Falcons (Olsen 1994).

6. Conclusion

SD goal 15 promotes the sustainable use of terrestrial ecosystems to ensure no loss of biodiversity and sustained availability of resources for future generations. These aims can be compromised by human activities that encourage large flocks of native birds that damage agricultural production efforts, damage infrastructure and interfere with community activities. Traditional methods of control of pest bird aggregations such as poisoning, shooting, relocation and exclusion can deleteriously affect the sustainable development of human communities, the sustainable use of terrestrial resources and may have animal welfare consequences that are unpopular.

technique exemplifies 'compassionate conservation' in that there is no harm to both the raptor and the target birds.

The technique has worked well when the pest birds cause damage in a localized area over a specific time. Our trials are continuing to determine which raptors work best with particular pest species, and whether flying the raptor over the flocks of birds works better than using a tethered raptor and allowed to fly upwards or one that is simply hand-held. We also would like to use this technique of dispersing pest birds using raptors in conjunction with other methods, such as providing alternative food sources or habitat for the target populations. It will also be interesting to see whether the authorities will permit us to allow the birds of prey to hunt some of the prey that are causing the damage to test if a lethal take increases the techniques' efficacy. More work also needs to be undertaken on whether the effects of raptors on resident birds is the same as for migratory or transient flocks.

Using raptors is expensive – it requires trained and qualified bird handlers and usually several birds of prey on each trial. The technique is less effective for some target species in some circumstances (e.g. breeding gulls) and where there are several sites to which the birds can relocate and then re- invade once the raptors have ceased their flyovers.

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Fig. 1. Location of almond farms in south-eastern Australia in which a Wedge-tailed Eagles was used to disperse cockatoos.

Fig. 2. Damage caused by Long-billed Corellas to a green in a golf course in south-eastern Australia.

Fig. 3. The track at Flemington racecourse shows a flock of gulls that have potential to cause serious damage by spooking horses during races.

Fig. 4. Wedge-tailed Eagle used to disperse gulls at the racecourse.

Landscape-based Strategies to Avert Human-Elephant Conflict

A perspective from Assam's tea plantation regions

Barsha Amarendra[1], Prof. Amarendra Kumar Das[2]

[1]Indian Institute of Technology Guwahati, b.amarendra@iitg.ac.in
[2]Indian Institute of Technology Guwahati, dasak@iitg.ac.in

Abstract

Ever since the beginning of imperial tea and coffee plantations in India, elephants have assumed a quintessential role within the framework of plantation establishment and development. Within the British Tea Estates, elephants were revered, tamed beasts. This reverence, however, soon turned sour upon encountering their wild counterparts, who wandered in herds and trampled through plantations and habitations. Years of systematic habitat destruction and fragmentation under the pretext of plantation expansion and settlement growth have rendered the wild elephants restricted in their area of movement and food sources. Owing to the human-curated circumstances of habitat loss and starvation, wild elephants are compelled to roam closer to human habitations, sparking conflicts. Affected humans poison or electrocute them or blow them up by placing crude bombs in delicacies like jackfruit. Heightened conflict in the plantation regions and the fact that elephants are an endangered species has become a bone of contention for plantation owners. While many owners are split over a sustainable solution, few have attempted to employ sustainable landscape design solutions to harbour a peaceful coexistence. The paper seeks to highlight the variety of landscape design strategies incorporated into Assam's tea plantations for negating human-elephant conflict. The paper employs fieldwork to document the strategies devised by different plantation regions, supplemented by interviews with concerned stakeholders. The paper creates a comprehensive, visual toolbox of existing design strategies that interested stakeholders can implement. By doing so, the paper initiates the discussion towards cataloguing landscape-based solutions for preventing human-elephant conflicts and situating these solutions in a comprehensible, visual style that can guide various stakeholders concerned.

Keywords: Asian Elephants, Assam Tea Plantations, Tea Plantation Ecology, Habitat Enrichment, Sustainable wildlife co-existence

1. Introduction

The narrative of the intertwined lives of Asia's largest land mammal and the humans of the Indian subcontinent dates as far back as the 4th Century BCE. Formidable in their physique and regal in their aura, the Asian elephants were upheld as a valuable royal asset amongst the great dynasties that wielded control over the sub-continent. Elephants were deemed the suited carrier for the kings and an

indispensable part of a kingdom's warfare. The benefit lay not only in their sheer size but also in their concern for their human trainers (Ramaswamy, 2016). For the kingdom's common folk, elephants were sacred beasts. In Hinduism, elephants were regarded as a personification of Lord Ganesha, the elephant-headed god of beginnings. In Buddhism, elephants were considered holy guardians from whom Lord Buddha eventually reincarnated into a human form. As a result of these attributes, elephants in the country were treated with great reverence by the entire Indian populace. This veneration for the elephants extended even into the years of the British Raj. The British administration in India continued the local ruler's traditions of employing the elephant's resourcefulness in military conveyance. They humanised their association with the elephants by naming and mustering them (Sivasundaram, 2005). Similarly, elephants continued to be regarded as an advantageous locomotive asset under the British Raj. Their role in the European colonisation through logging and transportation involved in building roads, railways, and other infrastructure projects cannot be overstated (Ramaswamy, 2016). They were also used to traverse the country's difficult terrain. Additionally, the British recognised elephants as good hunting friends (Singh, 2020). This British appraisal of the elephant's human-like qualities greatly influenced the beginning of the wildlife protection policy in India with the Elephant Preservation Policy of 1879 (Singh, 2020).

Despite all this endearment, the British Enterprise in India, particularly Assam, has been detrimentally involved in the Asian elephant's present-day existential crisis. The discovery of tea in Assam prompted the legislation of Wasteland Grants that allowed vast tracts of forestlands and grasslands in the state to be cleared for tea plantations. In 1839, a year after the First Wasteland Grants came into effect, 2,638 acres of tea plantations were established amidst Assam's wilderness. By 1873, following two amendments in the Wasteland Grants, the area under tea plantation expanded to 2,35,852 acres (Projapati, 1984). This expansion in acreage continued at a swift pace well into the 1920s, after which it slowed down considerably till 1993. Starting in 1993, the state witnessed an unprecedented mushrooming of new tea plantations due to the state Government's encouragement of small tea growers. Consequently, by 2011, the total area under tea cultivation in Assam increased to 322.21 thousand hectares, at considerable cost to wildlife habitats. This situation is more distressing because British planters employed elephants to tear down their own habitats for conversion into tea plantations. Figure 1 depicts the imagery of elephants clearing the forested grounds for tea cultivation. The parallel trajectories of large-scale agricultural expansions, the unchecked and unplanned proliferation of human settlements, and callous infrastructural development further aggravated this situation of habitat loss. It culminated in Assam's resident population of 5,719 wild elephants presently confined to the state's largely fragmented reserve forests, 22% of the elephant's forest habitat being encroached upon (Bhattacharya, 2019). Only a mere 12.9 per cent of elephant corridors connecting the fragmented habitats are under forest cover, while the rest are in mosaics of different land use, such as human settlements, agriculture or tea gardens (Sharma et al., 2022). Additionally, unregulated human extraction of forest produce from these limited forest fragments has degraded elephant habitats' quality and significantly reduced forage availability (Sharma et al., 2022).

Figure 1. *Elephants are clearing their habitats for tea cultivation to commence in Assam.*

Subjected to these circumstances, elephants have been forced to change their migratory routes and stray toward human settlements in search of food, thus bringing the animals into more frequent confrontations with humans (Amarendra & Bhuyan, 2022). Often, these confrontations result in deadly outcomes. Between 2010 and 2020, the Assam Forest Department recorded the death of 825 elephants due to the human-elephant conflict; many of these were reported from the state's tea plantations. This occurrence arises from the combination of two factors. Firstly, most tea plantations are located adjacent to forest fragments, making their resident community vulnerable to elephant encounters. Coupled with the community's practice of cultivating paddy once a year, the elephants get drawn into the territory of the tea plantations by the fragrance of the paddy fields. Secondly, elephants perceive tea gardens as extensions of their forest habitat, as they have been part of their migratory routes over centuries (Sunder, 2020). The relatively higher canopy cover found in the tea plantations is a preferred resting point for elephants during the day while migrating between foraging grounds. Sometimes they use plantations as a 'base' to forage on succulent crops in outlying areas (Bhattacharya, 2019). Figure 2 shows elephants using the tea plantation's canopy-covered areas as resting points during the day.

Figure 2. *Elephants perceive tea gardens as an extension of their natural habitats.*

Although this intricate positioning of the tea plantations in the elephant's constrained existence results in numerous fatalities each year, it also presents a unique opportunity to protect the state's wild elephants. In recent years, the conversation around elephant-friendly approaches for conflict mitigation has motivated plantation owners to explore landscape-based conflict mitigation solutions. This paper analyses the landscape-based solutions implemented in the tea plantations for ensuing a peaceful co-existence against the broader backdrop of the varied strategies presently employed to mitigate human-elephant conflict. In doing so, the paper brings forth a comprehensive understanding of the Asian elephant's essential necessities and how they can be satisfied by enriching the elephant's preferred stepping stones, in this case,

landscape-based conflict mitigation solutions have been highly muted. The present paper bears significance for its attempts to initiate a dialogue on the new paradigms of elephant protection.

2. Methods

The sensitivity surrounding the discussion of human-elephant conflicts in Assam required formulating a methodology to gather data through different qualitative methods for the enquiry to result in a well-founded narrative. The methodology developed for the paper comprises four phases. In the first phase, newspaper clippings on the human-elephant conflict in Assam were gathered from 2010 to 2022. The newspaper clippings so compiled were categorised under the tags of elephant casualty, anti-elephant strategies and elephant-friendly strategies. The significant proportion of clippings concerning elephant casualty necessitated an understanding of the reasons for the advent, persistence and heightening of human-elephant conflict in Assam. The second phase, thus, reviewed opinion pieces and interviews in newspapers, along with books authored by native scholars, conservationists and activists, to discover this pretext. In the third phase, the clippings tagged under anti-elephant strategies were evaluated for their commonality of use and frequency of being the reason for elephant casualty. These strategies were then cross-examined against government directives and reports to understand the causes for the continued perpetuation of such trends. The fourth phase comprised an analysis of the last clippings, those tagged under elephant-friendly strategies. Strategies that exhibited a landscape-based approach were filtered out, and the implementing tea garden management was contacted to conduct field visits. The field visits were programmed to witness the strategies being implemented first-hand while also partaking in unstructured walk-along interviews to ascertain the effect that these solutions have had on nurturing a state of peaceful coexistence. Once a holistic understanding of the situation on the ground was grasped, a visual toolkit of the various landscape-based elephant-friendly strategies was curated. The intention behind the creation of a visual toolbox was to make available a quick reference that could inspire other tea plantations in the state, and the country, to also adopt sustainable landscape strategies that nurture a state of peaceful co-existence between elephants and humans.

3. Results and Discussion

3.1 The Grim Reality of Elephants in Assam

The Indian state of Assam harbours 5,719 elephants, the highest population of wild elephants in the country after Karnataka (Ghosh, 2018). This positions the state as India's prime elephant range and a crucial epicentre for elephant conservation. However, the elephant's survival in the state's prime habitats presents a grim reality. As touched upon in the introductory passage, against the backdrop of an ever-shrinking habitat and chocked corridors connecting their fragmented habitats, elephants are driven by hunger and thirst to stray into villages and raid crops. Owing to the adjacency of the tea plantations to forest habitats, the tea-growing community's villages often fall prey to wandering herds of elephants. Although the elephants only want to reach the paddy fields without any confrontations with the villages of tea-growing communities between the forest cover and the fragrant rice fields (The Sentinel, 2021), the situation of losing valuable paddy harvest after an entire year's hardship prompts these villagers to undertake measures that lead to confrontations. Villagers pelt stones and hit the elephants with sticks to

implements strategies to safeguard the entirety of the plantation from elephant wanderings and destruction. Plantations install barbed/razor wire or electric fencing to keep elephants out of their plantations, but in actuality, end up threatening their very lives. Electric fencing has led to elephants being electrocuted, while barbed/razor wire fencing has resulted in elephants succumbing to septicaemia. The drainage ditches of the tea plantations are another death trap for elephants. As the name suggests, these ditches are created for agricultural reasons to keep the roots of the tea plants from rotting. There is no elephant-detergent intention behind its existence. Nonetheless, its articulation into deep trenches with steep edges results in calves stumbling into them, getting stuck, injuring themselves and sometimes dying (Fobar, 2021). The surviving elephants, constantly suffering wounds and obstructions, become irked at the slightest provocation (Akhtar, 2021). This, in turn, causes a high number of human fatalities. In the tea plantation district of Udalguri, Assam's hotspot of human-elephant conflict, from 2001 to 2020, around 345 people and 206 elephants have lost their lives owing to human-elephant conflicts (Akhtar, 2021). Figure 3 illustrates the various instances of elephant fatalities upon encountering humans.

Faced with such facts and statistics, one is compelled to wonder why strategies that have proven to cause confrontation and deaths on both sides persisted? The logic for it can be found in the policy approach of government establishments. For years, State Forest Departments have relied upon deterrent methods for conflict mitigation, focusing primarily on protecting human lives and property rather than the elephants. As such, the forest departments promoted measures such as chasing problem elephants, using olfactory and auditory deterrents, and constructing physical barriers among villagers and tea plantation management. For instance, the big buzzword in the 80s and 90s was EPT or Elephant Proof Trenches dug to keep the elephants out (Roy, 2015). These are the same trenches where elephant calves often succumb to their deaths. Through the 2010 ‘Gajah Report’ and the 2017 ‘Guidelines for Management of Human-Elephant Conflict’, the Ministry of Environment, Forest and Climate Change sought to diverge from the forest department's deterrent approach and advocate for landscape level protection and management strategies. However, their 2020 advisory document titled ‘Best Practices of Human-Elephant Conflict Management in India’ dismissed their earlier sustainable advocacy. The 2020 document cited anti-elephant deterrent measures practised by forest departments as best practices to be followed, despite those measures being validated time and again as precursors for aggravating conflicts and causing fatalities. As pointed out by various leading wildlife conservationists reviewing the recent government directive, without considering the elephant's behaviour and ecology and addressing the root cause of conflict, i.e. habitat loss and fragmentation, band-aid, ad-hoc solutions’ will not be effective (Bindra & Rawat, 2020).

Figure 3. *Elephant fatalities in Assam upon venturing into human spaces.*

3.2 What Elephants Need?

It is thus imperative to recognise the needs of the Asian elephants to strategise solutions that would nurture a peaceful co-existence in our shared terrestrial ecosystem. The first facet to be understood is the Asian elephant's habitation pattern and preferences. Asian Elephants are an 'edge species' dependent on forest edges or ecotones (Fernando, 2015). They prefer to spend much of their time in tall, mature forests, with frequent forays into grasslands to satisfy the needs of being a mega- herbivore. Additionally, Asian elephants are long-range animals that migrate from one habitat to another within their home ranges. Asian elephants in North-east India have exhibited a home range of over 4,000 square kilometres. Such a large forested area to designate as a protected elephant habitat for Assam's elephants no longer exists. But Elephants have a long life span, and therefore, despite the forests not being there, they would return to their once primary habitat in which human beings now live, resulting in conflict (Rahman, 2021). These return journeys to their primary habitats have another crucial factor that requires consideration. Young calves in a herd determine the pace of the herd and duration of stay at various places along their route. Calves take smaller strides than their adult counterparts and require frequent rests on their journeys. They also need assistance feeding and bathing, leading to the herd having to rest for hours at a stretch at a particular place. Pregnant elephants often give birth in the canopy covers of the tea estates that fall on their route. In such cases, herds move from the birth location only the next day, and even then, they have to wait for two days for the newborn to have the strength to join the herd (Amarendra & Bhuyan, 2022). Adequate rest spaces in the elephant's migratory route become essential for cow elephants and their newborn calves. Figure 4 depicts the young calves struggling to rest while on journeys. With the calves being at the centre of a herd's priority, adult elephants become violently protective when humans disturb the resting intervals of a herd with calves.

Figure 4. *Young calves require safe spaces of rest in their migratory route.*

The second facet to be understood is the Asian elephant's dietary necessities. Asian elephants in India spend up to 19 hours a day feeding due to their daily nutritional requirements of almost 150 kilograms. Their dietary consumption comprises a large proportion of grass and substantial amounts of leaves, tree stems, tree barks, and roots. They tend to prefer grasses as they grow in abundance; hence, they are easy to gather and have few secondary compounds (Fernando, 2015). The non- availability of grasslands in

such as rice and banana. As mentioned in the preceding section, when elephants venture out of their forests, they seek food, not intentionally getting into confrontations with humans. If the elephant's food security is taken care of, the entire problem of human-elephant conflict is averted. Hati Bondhu Foundation, under the visionary stewardship of Mr Pradip Bhuyan, has been able to make such a scenario a successful reality. Through their Elephant Habitat Enrichment Program, Hati Bondhu has initiated plantation of approximately 70 acres of barren land at Hatikhuli and Nonoi; which lie on the frequent migratory route for wild elephants; with favourable grass species such as Tiger broom grass *Thysanolaena)*, Tora *(Alpinia nigra)*, Napier *(Cenchrus purpureus)*, and fruit trees such as elephants apples *(Dillenia indica)*, and Jackfruit *(Artocarpus heterophyllus)* - to supplement the nutritional requirements of elephants (Amarendra & Bhuyan, 2022). In another two sites of Ronghong and Thuramukh, Hati Bondhu has sensitised local communities to initiate paddy plantation for elephants on community land - thereby creating a 'Food Buffer Zone' to keep elephant herds strategically contained in a demarcated area for a short period and away from primary crop fields during the harvesting season (Amarendra & Bhuyan, 2022). While strategies such as addressing the food security of elephants are conventionally unthought of, Hati Bondhu, through their programs, has exhibited that remedies for reducing crop- raiding behaviours lie in being able to address its causes; their need for food (Amarendra & Bhuyan, 2022). Figure 5 illustrates the strategies adopted by Hati Bondhu to create food security.

Figure 5. *Hati Bondhu is creating food buffers for wild elephants in Assam.*

The final facet to be understood is the Asian elephant's water requirements. Asian elephants prefer being close to freshwater bodies as their body requires them to drink water at least once daily (Fernando, 2015). As a result of their intensely fragmented habitats, most elephants in Assam have to make regular journeys from their place of stay/rest to the sources of water. Their traditional water sources have become engulfed by human settlements and infrastructure, leading to confrontations and deaths. During the 2017 droughts in Karnataka and Tamil Nadu, dehydrated elephants strayed into villages around reserve forests in search of drinking water and, in the process, damaged crops (Goswami, 2017). Similarly, despite frequent deaths in Assam, elephants regularly risk dangerous passages over roadways and railway lines to access water bodies (Amarendra & Bhuyan, 2022). Hati Bondhu, within their program of paddy plantation for elephants, has incorporated several ponds that provide water security to the elephants. The foundation undertook this strategy to give the elephants all their requirements within one standard buffer zone,

provide water to wild elephants.

Figure 6. *Hati Bondhu is creating water security for wild elephants in Assam.*

3.3 Nurturing a state of coexistence

Elephants are intelligent animals who adapt quickly to temporary mitigative measures (Sharma et al., 2022). Years of experiencing elephants wandering into tea plantations have made the plantation management aware of this characteristic. Plantation management is also mindful that elephants are compelled into human spaces due to the necessities of food, water, and refuge while on their migratory routes. While many plantation managements remain oblivious to the need for sustainable solutions that address the root cause of the conflict, quite a few managements in recent years have begun to act upon the intrinsic necessities of the elephants. These plantations have pioneered the implementation of landscape-based strategies that break away from the conventionally prescribed anti-elephant ad-hoc fixes and embrace an elephant-friendly stance. Their solutions address the issues of food and water security, along with recognising the potential for creating safe spaces and passages for elephants within the extents of the tea plantations. These strategies adopted by the tea plantations to create an elephant-friendly have been illustrated in figure 7 and discussed in the subsequent points:

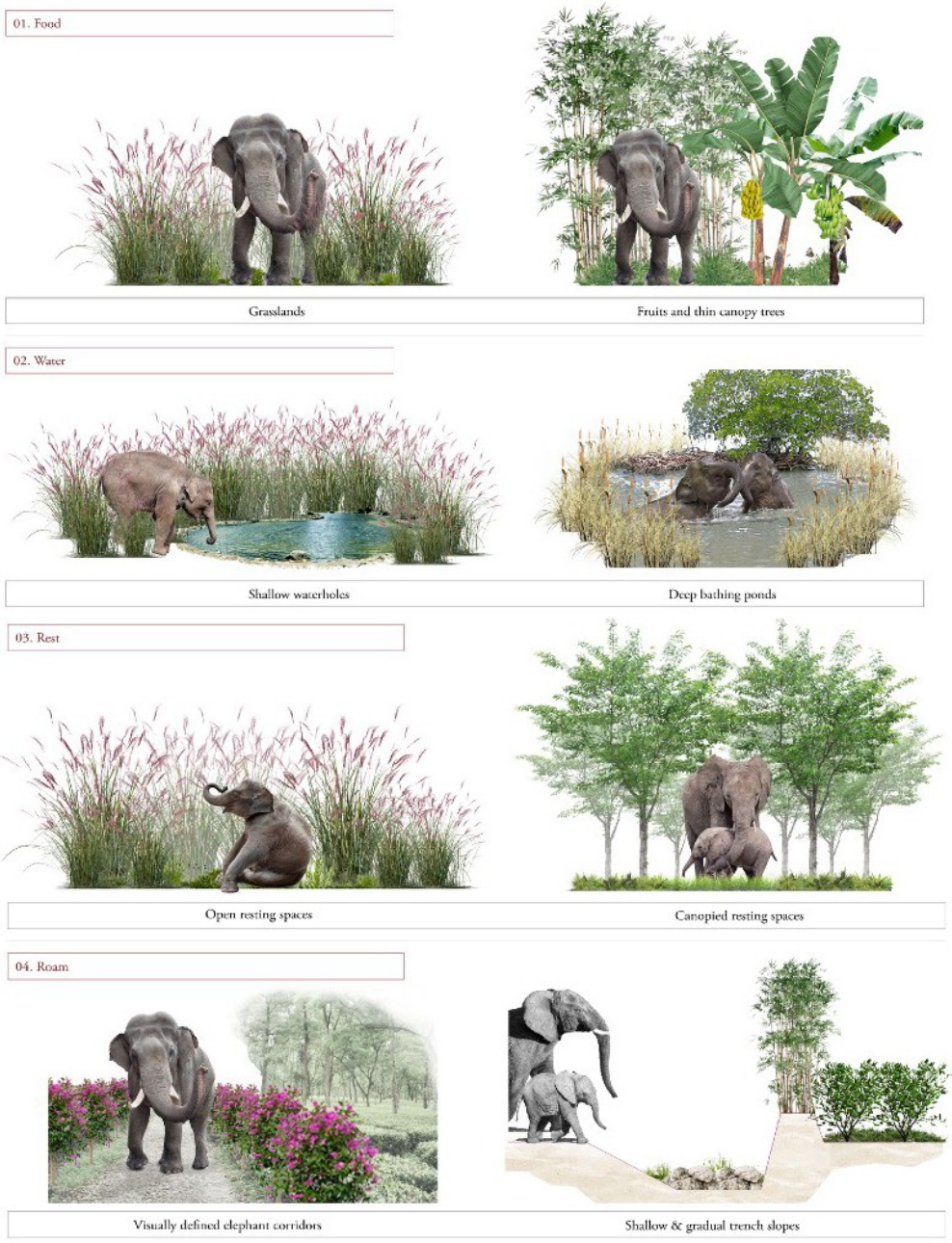

Figure 7. *Visual toolbox of landscape-based strategies for conflict mitigation in Assam.*

Elephant Buffers: Small tea-grower, Tenzing Bodosa's 40 acres of tea gardens have incorporated buffer zones planted with vegetation that elephants are fond of, from elephant grass and elephant apples to bamboo and starfruit (Sunder, 2020). In addition, his tea gardens also maintain forest patches where elephants come to take refuge during the day. There have been instances of cow elephants coming to give birth amidst the plantation's buffer and returning to their forest habitats. Similarly, McLeod Russel's plantations in the Mangaldoi circle have preserved clusters of shade trees within the plantations, where cow elephants and their newborn calves usually seek refuge.

1. Water holes: Tenzing Bodosa's tea gardens have created water holes for elephants to drink water during the summer. In Nonaipara Tea Estate, temporary water holes are regularly filled with water when the natural water holes are found running dry in the summers. Unlike in the first two cases, McLeod Russel's plantations in the Mangaldoi circle have created large water bodies that can cater to the year-round needs of the wandering elephants on the plantations. Both young and adult elephants can be seen drenching in these water bodies during days of oppressive heat.
2. Elephant Passages: Estates lie on historic migratory passages of elephants in Assam. To allow free movement, Apeejay's Sessa Tea Estate in Sonitpur has begun converting the route used by elephants through the tea estate into a formal elephant corridor, through which they can move undisturbed and unobstructed. In Nonaipara Tea Estate, the management has removed bushes to clear the path for the elephants. Along this path, bright bougainvillaea plants that flower through the year have been planted to provide visual cues to the labourers and the elephants of the designated migratory corridors. The Nonaipara tea estate has also modified the plantation's deadly trenches to be more conducive for elephant calves. The slopes into the drains have been made U- shaped from the traditional sharp V-shaped steep drop (Saran, 2021).
3. Harmless Fencing Solutions: For areas within a tea plantation that require elephants to be kept out, sustainable fencing solutions have come into use. In Apeejay's Sessa Tea Estate, bio-fencing is being implemented using thorny bamboo easily grown in Assam. Natural in their compositions, these fences do not induce wounds that lead to septicaemia deaths. Nonaipara Tea estate, on the other hand, has erected a solar-powered fence along its northern boundaries. Solar fences give a mild electric shock that is not lethal to the elephants.

While these solutions have been implemented in a few tea estates as opposed to the hundreds of tea plantations in Assam, they have been highly successful in averting cases of confrontations and, most importantly, deaths. Solutions such as defining corridors for movement have slowed the elephant's advances through the garden. They have been reported to pad quietly along these corridors, causing no harm to the tea plants and entering the jungle areas (Saran, 2021). Solutions such as buffers for food and refuge, along with waterholes, channelise the herds of elephants to designated zones within the garden. Elephants straight away go to these areas instead of straying into human habitations. The tea garden communities have also become wiser to not go into these spaces created for elephants, ensuring that elephants within the tea estates can remain undisrupted and unprovoked.

4. Conclusions

Elephants are intrinsic to India's cultural and religious identity. With a total population of 27,312

position of being able to become a safe haven for these regal beasts. However, historical and contemporary factors have confined India's elephant population into fragmented habitats with limited food and water requirements. The right of passage between these fragmented habitats to seek food and water is also denied to these elephants as a result of callous policy decisions when it comes to planning land use and land development. In particular, Assam's forests and elephants are reeling under increasing encroachment pressures from government-led infrastructure development, private construction, and agriculture. This has pushed the elephants into circumstances of extreme fragility and fatality when it comes to their survival. The death of 825 elephants due to human-elephant conflicts is not compensable. Each life lost strikes a nail into the coffin of the species' very existence in the country.

Against this grim backdrop of losing many elephants each year to episodes of human-elephant conflicts, the tea plantations of Assam have come to the limelight as effective niches for elephant conservation. Elephants already perceive and use tea plantations as stepping stones as they navigate through a human-dominated landscape. By incorporating an understanding of the elephant's survival necessities and thereby addressing those through landscape-based strategies, tea plantations can be spatially and ecologically intervened to become a crucial stepping stone in a larger, more elephant- friendly landscape. Tea plantations spearheaded by environmentally sensitised leadership have already embraced this sustainable stance. Case studies of the tea gardens that have broken away from the conventionally prescribed ad-hoc fixes have exhibited positive results in averting human-elephant conflicts. Elephants have become calmer inside the precincts of these tea plantations, and the growing tea community has also been able to shed their fear and insecurity to develop positive attitudes toward their presence in the same landscape.

The current elephant management policy of the country is still aligned with protection within reserve areas and the implementation of deterrent measures when elephants stray into human habitations. Within this backdrop, the elephant-friendly efforts pioneered by the tea plantations of Assam have exhibited the need for visionary leadership and courage to diverge from the prescriptive to defy the prevalent status quo and establish much-needed sustainability paradigms. These pioneering cases have showcased that management must be courageous to uphold their environmental consciousness despite considerably greater financial investments than conventional methods. The management is additionally required to have the courage to work towards evolving these solutions even when they fail in the pilot phases. While these positive cases from the tea plantations of Assam have initiated a tangible momentum towards seeking sustainable paradigms for co-existing with elephants, complacency is fatal now. These cases are one in a hundred, with most stakeholders having the power to make impactful changes still doing nothing to address the elephant's basic survival necessities. The current research can be developed in the near future to address the qualms of plantation management in shifting toward these landscape-based strategies. By presenting statistics such as muted elephant encounters, positive co-existence perceptions in intervened tea gardens, and financial damages saved against the one-time investment made towards these interventions, the current research could strengthen the case for incorporating these landscape-based strategies in more tea gardens in the state. With only 5,719 elephants surviving in the state of Assam, if these sustainable solutions are not amplified, elephants will continue to be forced into confrontations that would lead to their eventual annihilation.

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3. Biodiversity and ecosystem services

3b. Life below water

Abstracts

Source Tracking of Fecal Contamination in Northern Oligotrophic Rivers

Dr. Sharon Maes, Prof. Monica Odlare, Prof. Anders Jonsson

Mid Sweden University, Östersund, Sweden

Abstract

The naturally oligotrophic rivers in northern Sweden are generally characterized by a low pollution level. However, an increasing trend in *E. coli* contamination has been observed in the most upstream catchment area of one of the large rivers of Norhtern Sweden. This change in microbial water quality will have a severe negative impact on the ecosystem, wild animals, visitors, inhabitants as well as indigenous people dependent on the land for their daily income, such as Sami herders. To limit or prevent the discharge of fecal pollution into the river system and also to estimate the danger that this contamination can pose to human health, it is important to know the source of this contamination. Based solely on structured water sampling, it is still very difficult to pinpoint the sources of fecal pollution. Therefore, a combined analysis of eDNA and microbial source tracking of *E. coli* isolates from river samples was performed to identify the source of fecal pollution in the research area.

E. coli isolates were collected from water samples taken along the tributaries Enan and Handölan. Simultaneously, eDNA samples were collected on the same locations. Additionally, fecal and sewage samples were taken to collect *E. coli* isolates with a known host source being either human, beaver or reindeer. Also, sequences from genomic *E. coli* DNA originating from human (obtained from NCBI and University of Alberta, School of Public Health) and from beaver (obtained from University of Alberta, School of Public Health) were collected and included in the study. *E. coli* isolates were used for the amplification of three Intergenic Regions and subsequent analysis of Single Nucleotide Polymorphisms to identify host-specific genetic markers in the *E. coli* genome. eDNA samples were subjected to metabarcoding targeting mammal DNA to determine the relative species abundance in the water samples.

The *E. coli* prevalence in the research area varies between <1 and 210 CFU/100mL and is dependent on e.g. sampling location (possible point sources), time (tourist intensity and area specific events such as reindeer calve marking) and weather (precipitation, river flow, UV radiation). A library containing the data from *E. coli* isolates that are known to be originating from the species human, beaver and reindeer was developed and used to identify the host source of the *E. coli* isolates collected from water samples. Consequently, *E. coli* isolates could be identified as originating from human, beaver, reindeer or a different mammal species. Results from the eDNA analysis provides information about the relative abundance of mammal species on a certain location. Although these results don´t provide a direct link to the presence or absence of fecal pollution by these species, it can provide interesting knowledge about the source of fecal pollution when combined with the *E. coli* prevalence data from the same sampling locations and times.

Track

Track 3b Life below water

Transdisciplinary, Global, Important, and Challenging: Reflections on ocean climate finance projects in the sustainable development agenda

Dr Sebastian Thomas[1,2], Angela Bruckner[3], Dr Thu Ba Huynh[4], Carmen Munhequete[5], Yunae Nam[6], Arpana Pratap[7], Dr Larissa Shnayder[8]

[1]Curtin University, Perth, Australia. [2]Blue Praxis, Melbourne, Australia. [3]University of Melbourne, Melbourne, Australia. [4]FHI360, Melbourne, Australia. [5]United Nations Office for Project Services, Maputo, Mozambique. [6]SK forest, Seoul, Korea, Republic of. [7]Pacific Islands Development Forum, Suva, Fiji. [8]Blue Praxis, Utrecht, Netherlands

Abstract

More than a third of the total human population lives within 100 kilometres of an oceanic coast. The Intergovernmental Panel on Climate Change (IPCC) estimated in 2019 that 680 million people were living in low-lying coastal areas and projected this number to exceed one billion by 2050. Whether living in cities or smaller communities, people rely on the ocean to provide food, resources, energy, oxygen, livelihoods, recreation, spirituality, and other essential goods and services. As the human population continues to grow, however, its impacts on the ocean, both in coastal zones and further out in the high seas, are increasing as well. In combination with climate change effects including ocean acidification, sea level rise, and global warming, human activities are causing depletion of marine fisheries, deterioration of water quality, deoxygenation, loss of biodiversity, death of coral reefs, coastal erosion, and other negative outcomes. The ocean is vital to communities and the global economy; the ocean is in crisis.

The 2030 Agenda for Sustainable Development includes 17 sustainable development goals across five critical dimensions: people, prosperity, planet, partnership, and peace. Within this framework there are many opportunities for ocean-focused mitigation and adaptation projects, and multiple public and private instruments that can provide finance for such initiatives. However, an analysis of the Green Climate Fund – one of the most important finance vehicles for climate change mitigation and adaptation initiatives, particularly in developing nations – finds that only around 2% of funds are being directed to ocean-related projects and programs.

This paper presents data on the nature, distribution, types, and impacts of ocean-related climate finance (OCF) and provides reflections on the state and trends of OCF following a global research and capacity building initiative conducted across multiple Commonwealth countries in Africa, the Pacific, and the Caribbean. The analysis finds that there remain substantial gaps in understanding of ocean climate change issues across government, industry, and community sectors. Further, there are specific challenges and opportunities for ocean climate finance in the sustainable development agenda, including the need for and difficulty of transdisciplinary initiatives, the importance of global links and partnerships, and potential for paradigm shifts through new technologies and approaches.

Track
Track 3b Life below water

3. Biodiversity and ecosystem services

3c. Ecosystem services

Abstracts

A Healthy Environment and Human Development: Is it possible to achieve both objectives?

Dr Gustavo Nicolas Paez Salamanca[1], Urvana Menon[2], Luisa Vargas[3]

[1]WWF Myanmar, Nay Pyi Daw, Myanmar. [2]WWF Myanmar, Yangon, Myanmar. [3]Independent, Bogota, Colombia

Abstract

It is becoming increasingly evident that one side of this debate is driven by economic interests focused on short-run economic gains, without care for the way in which wealth is distributed, sustainable goals, or opportunities for future generations. However, if we care about the sustainable improvement for people and their livelihoods, especially those who are the most vulnerable, we realize that healthy environments and human development are not competing objectives – they are one. As many countries rapidly deplete their natural resources, caring for and investing in these resources in Myanmar is imperative to create safety nets that guarantee the basic needs of the people of Myanmar. WWF-Myanmar's strategy takes a holistic approach to improving the lives and livelihoods of those living today and aims to protect the natural environments that will support the lives and livelihoods of generations to come.

This report is the first in a series of four reports in which we lay out the theoretical justification for investing in nature and the challenges to doing so. Following reports will review the current state of Myanmar's natural resources, its governance and legal framework for protecting natural environments, and how to begin implementing solutions. The current report is divided into four chapters that integrate economic, environmental and social elements into the development discussion and provide a framework to evaluate the importance of investing in nature to foster sustainable development. Although the examples are based on Myanmar, the concepts presented in this report are valid for any development discussion.

The first chapter discusses the inadequacy of traditional economic frameworks to assess the role nature plays in the improvement of society and recommends analysing development projects based on their capacity to provide safety nets and basic needs. By integrating behavioural and development theories, the chapter summarizes the core development model in a pyramid of needs that can guide policymakers in identifying relevant projects. The second chapter examines the role of nature. Based on a systems' theory perspective, it explains how the different characteristics of natural systems affect livelihoods. The chapter discusses how nature is never static and, by aligning our processes to nature's cycles, how we can improve our resilience to natural and economic crises. The third chapter joins the previous two and explores how concepts such as ecosystem services and nature-based solutions can support our economic and social development. Moreover, this chapter discusses the different types of services that nature provides and how each helps communities progress through levels of development. The chapter concludes by showing how adequate environmental management is a holistic topic that requires a good understanding of ecosystems and their interactions with society. Finally, chapter four discusses how human incentives affect environmental protections, focusing on the role of power groups and governance arrangements.

Track

Track 3c Ecosystem services

Cultural Services of City Parks – measurement and improvement options

PhD Noémi Csigéné Nagypál

BME, Department of Environmental Economics and Sustainability, Budapest, Hungary

Abstract

City parks are important elements of urban green infrastructure, contributing to the sustainability of local communities and providing ample services. They provide services of local and global importance: for example, they are important from the aspect of climate change adaptation − by local climate regulation − and mitigation by carbon sequestration. The relevance, measurement and improvement options of cultural services are assessed in case of city parks. The paper consists of two major parts: an international literature review about the calculation of the total economic value, using various methods, focusing on cultural values, as well as the introduction of the results of two online surveys prepared in Budapest. The literature review provides a comprehensive overview of valuation methods: revealed and stated preference techniques, presenting their benefits and limitations. Two city parks of different attributes – location, size, history, functions – have been selected for the online survey, one located in an inner district and the other situated in a relatively green, outer district. The attitude, knowledge, preferences, and behaviour of local people are assessed, including the importance of the various elements of total economic value – non-use, option and use values – and ecosystem services for them and their willingness to pay for the maintenance of the two parks. The results for the two parks are compared, identifying common elements and specialties. According to the Common International Classification of Ecosystem Services, recreational value belongs to the cultural value of the major categories, but local citizens consider it as a narrower part of the total value. Use value is especially important for those who visit and use the parks regularly. It is concluded that cultural value can be measured using various methods and it can be enhanced at a relatively low cost, by awareness-raising among others. The more conscious use of city parks may increase their contribution to local level sustainability.

Track
Track 3c Ecosystem services

Factors Affecting the Use and Value of Traditional Ecological Knowledge in Conservation and Management of Savanna Ecosystem Services among the Rural Communities of Capricorn District Municipality, Limpopo, South Africa

Miss Sibongile Moloise, Dr Abraham Matamanda

University of the Free State, Bloemfontein, South Africa

Abstract

Over the years, people have formed an intimate relationship with their immediate physical environment. They have developed a body of knowledge on ecosystems and their services since the beginning of human existence and passed down through generations known as Traditional Ecological Knowledge (TEK). This knowledge is incorporated into traditions, cultural practices, and lifestyles. However, the introduction of urbanisation and western science and culture have resulted in TEK and ecosystem services degradation. Furthermore, the academic world undermines TEK, considers it non-scientific, and disregards TEK's conservation policies and plans for ecosystem services. The research investigates the existence of TEK, its status, and how it is or can be applied in the conservation and management of ecosystem services in rural communities of Capricorn District Municipality in Limpopo province. Primary data of the study is accumulated through in-depth interviews and observations from a sample population of 18 years old plus people who directly depend on ecosystem services in rural communities. The expected results of the study are that TEK was dominantly used previously for the conservation and management of ecosystem services.

Conversely, its effect has declined in communities that are becoming developed and westernised. The proposed abstract relates to SDG 11, Target 11.4, SDG 15 Target 15.1, Target 15.4 and Target 15.9. Environmental, economic, and social factors are most important for sustainable development and courage; hence development should not come at the expense of either of the three. Instead, it should enhance them. This study assesses how evolution has affected cultures and the natural environment. Therefore, the importance of culture and its use to conserve the environment and provide humans with basic needs explored in this study relate to the conference's topic. Conservation policymakers need to understand the relationship between man and the environment and bring environmental management plans and strategies that allow people to sustainably benefit from nature, which can be achieved through cultural practices and traditions.

Track

Track 3c Ecosystem services

Impact of Rural Transformation on Land use and Ecosystem Services in Three "Real Labs" in China

Dr. Suili Xiao, Till Fuegener, Prof. Wolfgang Wende

The Leibniz Institute of Ecological Urban and Regional Development (IOER), Dresden, Germany

Abstract

China is undergoing rapid changes in rural areas where new opportunities linked to urbanization processes and rural revitalization. Rural transformation (e.g. urbanization, industrialization, agricultural modernization as well as ecological conservation) leads to a shift in land use which has had a major influence on vegetation and further impact on biodiversity which underlies all services provided by ecosystems that are crucial for human well-being. Though empirical research in three "real labs" in Huangyan-Taizhou, supported by remote sensing analyses and GIS tools, as well as matrix approach, land use and land cover change, green vegetation condition (NDVI) and ecosystem services (especially biodiversity) were analyzed spatially and temporally from 1992 to 2020. Our findings indicate that, firstly, urban areas increase dramatically in the new industrial area at Xinqian Smart Molding Town with 394 % increase, followed by Beiyang Agricultural Township with 143 % and Jianyang Wetland Park with 595 %. Simultaneously, forest area in these three study areas decreased by 69 %, 9 % and 49 %. Secondly, urban expansion has led to a loss of vegetated land in all three research areas during the past three decades. The biomass and density of vegetation, estimated through NDVI calculations, has slightly increased in Beiyang Town. Still, the values of mean and median NDVI are slightly decreasing in Xinqian Molding Town and Jianyang Wetland. Thirdly, the supply of ecosystem services, including biodiversity in each research sites is developing downwards. Whereas the research site of Beiyang Town is showing the least change in ecosystem service supply, Xinqian Moduling Town band Jianyang Wetland Park are experiencing a strong decline in ecosystem service supply during the research period. Main drivers of relevant changes and different transformation patterns are also discussed. The results and detected impacts of rural transformation on biodiversity and ecosystem services might be employed to improve sustainable development strategies, spatial planning, and biodiversity conservation.

Track
Track 3c Ecosystem services

Rational Management of Veterinary Antiparasitic Treatments in the South-east of France

Doctor Ilyes Bouasla[1], Professor Philippe Jacquiet[2]

[1]Institute vétérinary sciences, Constantine (khroub), Algeria. [2]National school vétérinary, Toulouse, France

Abstract

The ecotoxicity of veterinary antiparasitic treatments, studied for a long time, and the

development of resistance against several families of antiparasitic molecules lead to thinking about the proper use of antiparasitics, in order to reduce their ecological impact while controlling the health and economic issues within herds. The study presented here explores these notions within the framework of the support of a group of nineteen breeders from two French departments (Gard and Hérault). They are engaged in a process of reasoned management of the parasitic risk through the respect of a notebook of environmental protection burden, relative among others to the conservation of threatened species such as the ocellated lizard, Timon lepidus. These breeders practice various activities as well as different types of breeding (sheep or beef cattle, Camargue cattle, dairy goats, racehorses). Semi-structured interviews with the breeders made it possible to describe their practices and to understand how they integrated the reasoned management of the parasite risk into their strategy. Coprologies were carried out in order to determine the rate of infestation of herds by gastrointestinal endoparasites and to recommend targeted treatments using molecules that are not ecotoxic for the environment or/and management of the parasite risk into their strategy. Coprologies were carried out in order to determine the rate of infestation of herds by gastrointestinal endoparasites and to recommend targeted treatments using molecules that are not ecotoxic for the environment or/and effective alternatives, of which the strategy must be adapted according to the type of breeding and species. The majority (80%) of breeders are moving towards a reasoned strategy without necessarily being aware of it since they rarely treat their animals and are generally concerned about applying the right treatment methods. Nevertheless, they seem to need close support for the diagnosis, the choice of the time of treatment and the molecules to be used as well as for the management of animal movements between plots. The study shows the essential role of practicing veterinarians in this type of approach. However, awareness raising and training must be organized in order to encourage their involvement.

Track
Track 3c Ecosystem services

Soil Fungi as a Tool for Carbon Sequestration in the Mitigation of Climate Change

Mr Tijjani Mustapha[1], Mr Nura Jibo[2]

[1]Federal University Dutse, Dutse, Nigeria. [2]African Climate Change Research Centre., Dutse, Nigeria

Abstract
Fungi are a group of organisms that can be present in almost every part of the ecosystem. Soil inhabiting Arbuscular Mycorrhizal (AM) fungi are very important group with wide range of ecological importance that form symbiotic relationship with over 80% of vascular land plants. AM fungi are known to have crucial influence in the recycling of organic matter in the soil. They sequester soil carbon by assimilating atmospheric carbon from plant hosts to harness it biologically for the development of their body structure (Hyphae). AM fungi lock carbon into the soil by rhizodeposition or soil aggregate formation as well as their role in carbon fluxes between the plants and the atmosphere, thereby preventing climate change by hindering the carbon from re-entering into the atmosphere.

Methodology:This paper uses quantitative and qualitative methods in analyzing Arbuscular Mycorrhizal sample data collated and Bio-assayed under different climatic condition. It utilizes a cost-efficient technology such as pot culture method for large scale commercial production of AMF inocular.

Expected results:With over 500 million farmers cultivating about half billion hectares of land globally, the role of AMF can be utilized through modern technologies to incorporate the use of these microbes as a means of biological carbon sequestration. They increase agricultural productivity and transformation of agricultural fields in to carbon sink.

Conclusion: Arbuscular Mycorrhizal can be used as bio-fertilizer in sustainable agriculture. An assessment of the performance of edible mycorrhizal mushrooms using bioassay and pot culture method can identify the most suitable species with the best physiological ability in soil carbon sequestration, which reduces excessive and uncontrolled use of chemical inorganic fertilizers. The levels of environmental pollution are also minimized.

Key words: Mycorrhizal Fungi, Carbon Sequestration, Climate Change Mitigation, Arbuscular Mycorrhizal, Soil.

Track
Track 3c Ecosystem services

4. Climate change & Energy

4a. Predictions and responses

Abstracts

Assessing Farmers' Perception of Climate Change and Adaptation Behaviour: A study of Kashmir valley, Western Indian Himalayan Region

Mir Khursheed Alam, Shyamasree Dasgupta

Indian Institute of Technology Mandi, Mandi, Himachal Pradesh, India

Abstract

Farmers' livelihoods in the Indian Himalayan Regions (IHR) are under direct exposure to and are subject to widespread risks arising from multiple climatic hazards, climate change and variability. While 'adaptation' is the process of adjustment to actual and/or expected climatic conditions in the long term, in the absence of available information, infrastructure, and socioeconomic ability, farmers often adopt certain 'coping' mechanisms that provide them cushion only against short-term losses. A holistic understanding of the available adaptation processes, and their determinants are, therefore, instrumental in developing well-targeted and effective adaptation strategies. This study aims to understand the nature of farmer responses; their determinants; and the scope of institutional/planned adaptation and policies, in the face of climate hazards, and climate change in the Kashmir Valley. The analysis is based on cross-sectional survey data of 648 (apple and rice) farming households in four districts that correspond to the cold humid and warm subhumid agroecological zones in Jammu and Kashmir. Results demonstrate that majority of the farmers believe in climate change (93%) and are also cognizant of local-seasonal variation in temperature and precipitation regimes as 94% of them have observed it more pronounced in the last decade. Farmer responses are largely confined to 'autonomous coping' with higher uptake, with a few planned adaptation measures in place with a minimal uptake. Adjusting apple farming practices (such as harvesting, pruning, grafting, and spraying) are some of the prominent farm-level autonomous-coping strategies in response to reducing the crop damage due to inter-annual and inter-seasonal climate variability and extreme weather events. Farmers opt for crop transformation and variety diversification, and water-use management adaptation measures in response to long-term climatic impacts. Despite the scope, there exists a significant planned adaptation gap, given the minimal provision of adequate infrastructure, early warning, agriculture credit, and crop insurance. An analysis based on Multivariate Probit Regression models also suggests that recurrent multiple hazards experience constraint autonomous adaptation of farmers (related to crop transformation and variety diversification) and induce them to adjust farming practices and water use management measures. Farm, household, economic and institutional determinants play important role in determining the kind of measure that the farmers are likely to opt for. The outcomes of the study suggest the need for an enhancement of planned adaptation mechanisms that would prove essential not only to complement community-based and autonomous adaptation, but also crucial for the achievement of other sustainable development goals such as sustainable natural resource management, and food and human security. The study emphasizes resilience-building adaptation interventions that target farmers with potentially low adaptative capacity, such as aged and experienced farmers, farmers without/low formal education, fewer income sources and limited connectivity to the district headquarters. Effective institutional mechanisms such as enhancement of investment in agro-infrastructure, alternative livelihood options, integrated farming, and robust early warning system are key to reducing the long-term risk and shaping climate-resilient communities in the Himalayan region

Track

Track 4a Predictions and responses

Assessment Framework of the Transport related Carbon Mitigation Options for Efficient Fleet Management

Dr. Tibor Princz-Jakovics

Department of Environmental Economics and Sustainability, Faculty of Economic and Social Sciences, Budapest University of Technology and Economics, Budapest, Hungary

Abstract

The aim of this research is to provide an assessment framework for the evaluation of the transport related carbon mitigation options to increase the efficiency of the fleet management planning tools. Enterprises usually operate integrated and professional fleet management systems and plan carefully the renewing options of their fleets. However, mitigation of the emissions by the road vehicle fleets should be accelerated, because the contribution of the transport sector to the total carbon emissions (including private and public fleets) is significant. Energy consumption of the road vehicles can be calculated by the specific fuel consumption patterns and operational data series for the fleets. The observed changes in the size and composition of the fleets are mainly reflect to the tendencies that the newly purchased electric and hybrid vehicles partially replaced the vehicles powered by internal combustion engines. Rationalization of the vehicle use can significantly reduce mileage and carbon emissions, however in some cases the possibilities for lower utilization of the fleets are limited and determined by the profiles of the companies or organizations.

Reduction of the transport related emissions can be achieved by increasing the share of e-mobility options for higher level efficiency and alternative propulsion vehicles, like hybrid or pure electric vehicles are preferred to be used. Based on the planned hybrid or pure electric vehicle purchases the acquisition costs are calculated as one of the major elements of the total cost of ownership. Operational costs can be optimized if solar panel energy production is available for charging on site. The unit cost of PV investments is expected to decrease due to declining solar prices and some other additional investments (i.e. the use of battery energy storage) would also increase the efficiency of such investments. Based on the numbers of carbon emission savings and the total gross costs of carbon saving options, the MAC (Marginal Abatement Cost) values of the fleet renewing measures are calculated and can be compared with other options for carbon mitigation. In the planning phase of green vehicle procurement as a measure, it is necessary to consider many aspects together: the level of contribution to decarbonisation, in addition to the aspects of the operational and functional use of the vehicles and the financial possibilities available for fleet renewal. The theoretical contribution of this research is the assessment framework which provides relevant data for fleet operators to be able to examine and calculate the long-term financial and decarbonisation effects of renewing options of their fleets.

The topic of the proposed abstract especially relate to the following SDGs and Targets: 9.4, 11.4, 11.b, 12.6 and 13.3. This research work also relates to the topic of the Conference: “Sustainable Development and courage: culture, art and human rights” by supporting the necessity renewal of the road vehicle fleet to achieve climate conscious mobility culture. E-mobility options provide resource efficient solutions, underly the relevance of SDG 11.4 “Strengthen efforts to protect and safeguard the world’s cultural and natural heritage” and efficiently contribute to the international discussion at the Conference.

Track

Track 4a Predictions and responses

Decentralized PV Generation can Satisfy Electricity Demand in Urban Areas: A city case study at Santarém, Portugal

Diogo Dias[1], João Joanaz de Melo[1,2]

[1]NOVA University, Lisbon, Portugal. [2]CENSE, Lisbon, Portugal

Abstract

Climate change has become a matter of major social concern. Reducing the impacts of the energy system, including decarbonization, has become one of the most serious and urgent challenges of our society. Photovoltaic (PV) is becoming increasingly important as an alternative electricity source. However, large PV facilities often create other conflicts with natural and productive areas. Installing PV on rooftops entails higher investment costs and organizational difficulties but has significant long-term advantages: it avoids land use conflicts, enhances energy communities, is more resilient, reduces energy transportation losses, and mobilizes investments by families and companies.

This paper reports the research on the potential of PV generation and its implementation in the city of Santarém, Portugal, a municipality of 62 000 inhabitants. The study focuses on the core urban area of residential and service buildings, with a population of 30 000 (the industrial zone was not included). The study comprehended the following steps: definition of 15 building types based on electricity use patterns; identification of project design criteria for rooftop PV installation, considering building characteristics in the city; delimitation of the study area (968 ha) and its division in large service buildings and 13 homogeneous urban zones; characterization of the large buildings and sample areas of 1 to 3 ha in each urban zone; calculation of PV energy yield in the samples and extrapolation for the study area; calculation of electricity demand by building type and use, based on statistical data; examination of obstacles and

Synopsis of results: in the study area it is possible to install 176 MW of PV on a useful roof area of 99 ha; the estimated productivity is 280 GWh/year, which would avoid 44 kt CO2/year of emissions; Santarém has the potential to satisfy 2.5 times the electricity consumption of residential and service buildings; coupled with energy efficiency measures in the buildings, PV potential could reach 3.0 times the electricity consumption. However, to reach even a fraction of this PV potential, policy measures such as tax incentives, and support at local level, such as technical helpdesks, will be necessary. Current legislation allows energy communities, but existing regulations are biased towards the incumbent large companies. Investments in decentralized PV are viable from an economic standpoint but interested parties (families and small companies) do not possess the necessary technical, organizational, or financial means. This is therefore not a technological or economic problem, but an institutional and cultural problem.

This paper relates especially to SDG targets 7.2 (increase share of renewable energy), 13.1 (resilience and adaptive capacity to climate-related hazards), 13.3 (climate-related education) and 11.4 (protect and safeguard cultural and natural heritage).

Our contribution relates to ISDRS2022 main topic on two counts: PV must be made compatible with the architectural treasures of the city, famed as the Portuguese "Gothic capital"; and we face major educational, cultural and institutional challenges (and certainly much courage) to implement new habits and technologies in old neighbourhoods.

Track

Track 4a Predictions and responses

The Impact of Climate Change on Hungarian Agriculture

Kinga Biró[1], Dr. Ottó Toldi[2], Dr. habil. Mária Szalmáné Csete[1]

[1]Budapest University of Technology and Economics, Budapest, Hungary. [2]Climate Policy Institute, Budapest, Hungary

Abstract

In Hungary, a secure food supply, and the basis for the export surplus is provided by a high supply of arable land concerning the population. Hungary has a strong export capacity. In the future, the population is expected to rise and the per capita food supply to decline. Agricultural production is one of the most exposed to the ever-changing weather, with the average temperature rises and changes in rainfall patterns due to climate change. Within Europe, the Carpathian Basin is the most exposed region to climate change, along with the southern countries (Gaál et al. 2014, Hadnagy et al. 2013).

The paradox of the agricultural sector is that the sector can decouple itself from the adverse effects of climate change by becoming more intensive, which, together with increasing the profitability of agricultural production and crop security, increases GHG emissions. Achieving climate neutrality by 2050 will also require a contribution from the agricultural sector, and we can already see that the traditional approach will not achieve the desired results. The goal for Hungarian agriculture is to produce more, realizing its potential and fulfilling its mission in global food markets while reducing greenhouse gas and other pollutant emissions. Hungary has all the tools to achieve this.

In order to gain a better understanding of how Hungarian agriculture will change, how is the exposure of agriculture, and what adaptation measures can be applied, will be examined the scenarios of future GHG emissions from agriculture is being carried out.

Crop production can adapt to climate change by favoring short-duration varieties, which are less exposed to the weather. Species and varieties replacement and the introduction of new and more resistant species, such as batata, are playing an increasing role. Autumn and spring crops respond in opposite ways to climate change. While summer droughts are expected to cause a significant reduction in the average yield of spring crops, the expected wetter winter-spring seasons may even increase the yield of autumn crops. In livestock production, increasing importance will be given to improved feeding, which will reduce methane emissions from cattle. The tools of precision farming and Agriculture 4.0 are gaining ground in crop and livestock production. From the early 2030s, we will increasingly talk about the dawn of the digital age of agriculture, with the launch of Agriculture 5.0 tools - like robotics, drone-based remote sensing, automation, industrial production of proteins, carbohydrates and bio-actives, molecular farming, functional fertilizers, functional food and feed production, bio-herbicides, bio-pesticides -, with near-zero GHG and other pollutant emissions, circular material flows and zero waste. From a climate perspective, agriculture is perhaps the most conservative sector, with no sign of technologies yet that will deliver marketable and significant reductions in emissions. Nevertheless, wherever we are in 2050, agriculture will have two powerful tools at its disposal to achieve climate neutrality: it can even reduce its current emissions by planting carbon-climate crops on marginal land and by basing agriculture on renewable energy.

This proposed abstract aims at dealing with goals by SDG12, SDG13, SDG15.

Track

Track 4a Predictions and responses

The Potential for Hydropower Carbon Capture and Storage (HPCCS) - Measuring CO2 degassing from turbines at a medium-sized hydropower station in Northern Sweden

Ms Moa Hallqvist, Associate Professor Andreas Andersson

Mid Sweden University, Östersund, Sweden

Abstract

To limit the human impact on the climate, a shift towards renewable energy systems is a necessity. The increased demand for renewable energy that such a change entails will place great demands on the efficiency of hydroelectric power and its ability to adapt to future climate, both on a regional and global scale. All emission scenarios that limit global warming to 1.5 ° C require that we use large-scale carbon capture and storage (CCS). Although CCS has started to be used at large anthropogenic emission sources, implementation of CCS at natural carbon sources are few. Freshwater lakes and rivers are significant sources of biogenic carbon dioxide and are important parts of the global carbon cycle. Inland waters have been shown to be supersaturated with dissolved carbon dioxide in relation to the atmosphere, leading to CO_2 evasion. Similarly, hydropower plant reservoirs have been shown to be sources of greenhouse gases. The turbulence and drastic pressure changes that occur when the water passes through the hydropower plant turbines will theoretically increase the rate of CO_2 degassing from the water. In this study, we investigate the potential for Hydropower CCS by measuring CO_2 concentrations in the water upstream and downstream of a medium-size hydropower plant (Kattstrupeforsen, Indalsälven) in one of the rivers of northern Sweden. Measurements were performed during September-October 2019 and April-May 2022. The degassing of CO_2 from Kattstrupeforsen was calculated based on the upstream-downstream gradient in CO_2 and measured discharge from the hydropower plant. The results show a daily degassing corresponding to 0.98 t CO_2 in autumn and 1.8 t CO_2 in spring. The linear relationship between the upstream CO_2 concentration and the concentration difference found in this study was used to estimate the annual emissions of CO_2. Annual emissions in a range of 1200-2000 t yr^{-1} were found.

Track
Track 4a Predictions and responses

Posters

FiRa – Expert
Tom Hunger and Marlen Gabriele Arnold

The embeddedness of actors in Brazilian energy transition
Gabriela Marcon and Anete Alberton

Partial pressure analysis of CO2 (pCO2) up- and downstream of a hydropower plant in Kattstrupeforsen, Sweden
Yannick Elias Gerling and Andreas Andersson

FiRa – Expert

Research aims and tasks

R&D project within the Central Innovation Program for SMEs (ZIM)

Funded by the Federal Ministry of Economics Affairs and Climate Action (BMWK)

Project partners

UNIVERSITY OF TECHNOLOGY IN THE EUROPEAN CAPITAL OF CULTURE CHEMNITZ

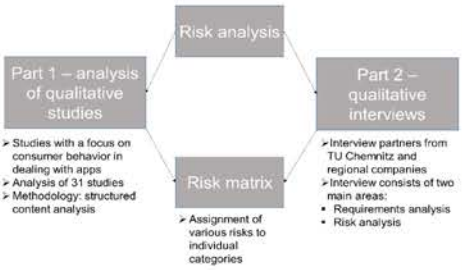
GAD

Goal:
Development of a **prototype** of a model-based monitoring system as a **self-learning expert system**, which provides recommendations for action for **facility managers**

Current task: risk analysis

Future tasks:
- Scenario analysis
- Definition of sustainability standards
- Analysis of rebound effects
- Data analysis and evaluation

Methodology



Part 1: analysis of qualitative studies

- Databases: Scopus and Web of Science
- Search string consists of terms of app development and user requirements
- Search string resulted 1866 articles
- 137 duplicates could be identified
- After the screening process in Rayyan, 67 articles could be analyzed
- 31 articles met the inclusion criteria

ELSEVIER

WEB OF SCIENCE

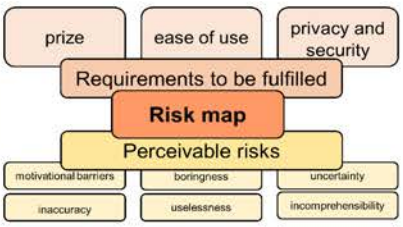
Part 2: qualitative interviews

- The interviews relate specifically to the app to be developed
- Special focus on uncovering possible risks
- The goal of the interviews is to:
  - identify the requirements and risks for the own app,
  - check whether the identified risks from the articles also apply to the app

Results

Risk map

Three main requirements
- The price-benefit ratio
- The user satisfaction, which is divided as follows:
  - Efficiency
  - Quality
  - Usability
  - Learnability
  - Understandability
- Privacy and security, which can be divided into
  - Privacy protection
  - Privacy
  - Access rights to cell phone data



Users identify perceptible risks as follows:
- Motivational barriers
- Boringness
- Uncertainty
- Inaccuracy
- Uselessness
- Incomprehensibility

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

Tom Hunger M.Sc. & Prof. Dr. Marlen Gabriele Arnold,
University of Technology Chemnitz,
Chair of Corporate Environmental Management and Sustainability

The Embeddedness of Actors in Brazilian Energy Transition

Introduction

Infrastructure, which has a very strong synergistic component with the environment, is the basic set of goods and services made available to individuals, so that they can integrate socially, with conditions for the development and improvement of life. Energy, among the components of the infrastructure, is perhaps the one with the greatest range of interactions and environmental impacts (Reis & Santos, 2014). Energy settings for developing countries typically present a significant expansion in energy use, and in particular electricity consumption (Fankhauser & Jotzo, 2017).

Economic growth and energy consumption are intrinsically related and tend to increase in emerging countries, especially China and Brazil (OECD, 2015; Saini & Sighania, 2019). The energy industry is facing nowadays a global transition of its well-established sociotechnical system. Efforts to mitigate climate change, new energy sources, and technological developments are in the core of this movement (Berkhout et al., 2012; Ismaeel, 2019; Sovacool et al., 2020).

Brazil already invests in initiatives related to the energy transition. The country stands out on the world stage using three times more renewable sources than the average (EPE, 2021d), though the process is still in motion, and improvements require the involvement of multiple actors.

The analysis of the sociopolitical interactions between the actors involved in the potential changes in the Brazilian electricity industry provides to better understand the role of these actors in the transition paths. It is inferred that it is possible to intuit by a trend of energy transition from an innovation niche or motivated by the exogenous pressures of the landscape from the analysis of the actors involved in the process. Different transition paths may coexist (Ismaeel, 2019). In order to analyze the role of actors and accommodate consumption, cultural, and sociopolitical dimensions, the multilevel perspective framework (MLP) is adopted (Geels, 2002; Marquardt, 2014; Geels, 2018; Ismaeel, 2019).

The guiding question that arises is: Who would be the actors involved in the transition processes in the Brazilian electricity sector?

This paper aims to identify and categorize the actors involved in the process of energy transition in the Brazilian electricity sector in a multilevel perspective (MLP). A literature review was carried out, then a documental case study.

Theoretical Background

The Actor-Network Theory can help to define and coordinate functions within a social structure comprising both social and natural (Callon, 1986; Law, 1992; Callon, 1999; Latour, 2012), as is the case in the electricity sector - especially in Brazil. On the other hand, the Stakeholder Theory offers tools to prioritize the interests (Michell et al., 1997; Rowey, 1997) that will be decisive for the promotion of an energy transition. Therefore, this theoretical background approaches the two theories to address the actors in energy transitions.

Stakeholders in transitions can be investigated regarding the roles they fulfill, such as co-producing knowledge for action, understanding contemporary transitions and exploring sustainable solutions for transitions (Frantzeskaki & Rok, 2018). All actors are potential stakeholders, since it's not always easy to distinguish the interests that deserve consideration (Phillips & Reichart, 2000).

Multilevel Perspective for Sociotechnical Transitions

The transition process can occur both due to the pressure of innovation niches on the socio-technical regime, as well as exogenous aspects, that is, pressures from the broader environment on the regime, as is the case, for example, of climate change in the panorama of decarbonization. Thus, it is fair to say that regime shifts can be either top-down or bottom-up.

Based on the guiding question presented in the introduction, examining the findings in the literature and the documental evidence from the case study, we intend to categorize and place the main actors in the Brazilian electricity sector at the MLP levels, to infer a more bottom-up or top-down energy transition trend. The MLP can help to visualize the organizational field, highlighting the disruptive actors for the promotion of the Brazilian energy transition.

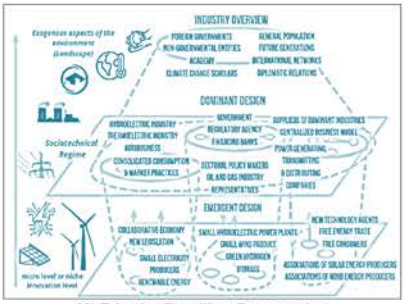
Electricity Industry in Brazil

The formation of the Brazilian electricity sector went through several phases. In the early 1900s, during the so-called "Old Republic", foreign companies established themselves in the country with a strong importance in the establishment of energy policies.

Climate change is a global issue and the fact that Brazil has renewable sources does not exempt it from pursuing decarbonization, besides energy justice and efficiency. In Brazil, many governmental institutions, within their sphere of action, have the competence to formulate and implement policies, plans, programs, and projects that can impact the behavior of energy consumers, as the individual's choice involves several dimensions. There is a need to improve institutional governance for better coordination and communication among different actors.

The actors in the electricity sector can be classified in different ways. The first classification made is the distinction between sectoral economic agents and institutional agents. . The government, regulatory agencies and institutions supporting the planning of the electricity sector can be included in this category, which we can call "Governmental and Institutional Agents".

Economic agents can be subdivided into sectoral and non-sectoral, given that many actors are not directly involved in the sector's activity, but interfere in its course. Three major categories of actors emerged from the case study: i) institutional actors - among which government actors, ii) civil society & financial agents - among which academy, banks and ONGs, and, iii) technological & environmental actors - as entrepreneurs and niche innovation companies.



MLP in the Brazilian Perspective.

Source: The authors (2021) based on Geels (2002).

From the analysis of the Brazilian scenario, we sense that the groups coexist at the multiple levels of the MLP, exchanging views and influencing each other, while suffering pressure from the socio-technical landscape that represents aspects that are exogenous to the sector itself.

Partial pressure analysis of CO_2 (pCO_2) up- and downstream of a hydropower plant in Kattstrupeforsen, Sweden.

Introduction

The atmospheric concentration of carbon dioxide (CO_2) has increased by as much as 45% since the start of industrialization. Carbon dioxide plays a major role for the global climate and the CO_2 emission from inland waters is a major component in the global carbon cycle and is estimated to 1.9 PgC yr^{-1},(Human impact eq. to 7.8 PgC yr^{-1})[1]. All emission scenarios that limit global warming to 1.5°C require the use of large scale carbon capture and storage.

Study Aim

The aim of this study is to measure the partial pressure of CO_2 in the water up- and downstream of a hydropower plant. The guiding question in this context is whether the hydropower plant is able to capture the positive CO_2 fluxes and emissions provoked by turbulences in the water.

Material and Method

In addition to a preliminary literature review, the main focus was on methodological on-site work:

Materials:

- eosGP CO_2-sensor, datalogger for pCO_2 mapping
- Zerogas N_2 (0 ppm) and Ref. Gas CO_2 (1000 ppm)

Methodology:

- Built up of instrument supportive construction
- Sensor calibration
- Three-day check ups
  → Data download and sensor adjustments
- Spacial variation analysis
- Data analysis in Microsoft Excel

Figure 4: eosGP CO_2 (Eosense Inc. Dartmouth, Canada)[4]

Figure 1: Map of Sweden[2]

Figure 2: Map of Kattstrupeforsen and the hydropower plant[3]

Figure 3: Sensor supportive construction

Data analysis

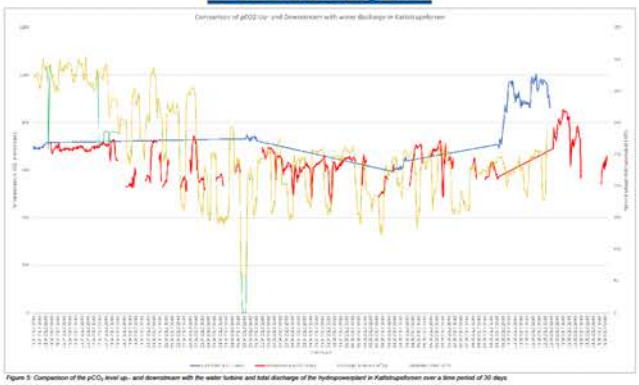


Figure 5: Comparison of the pCO_2 level up- and downstream with the water turbine and total discharge of the hydropowerplant in Kattstrupeforsen over a time period of 30 days

Spacial variation analysis

Table1: Analysis of the sensor signals values in different spacial variations within the measuring period of the 4th of may in 2022 . The values in the timespans are average values from these periods

Time 04.05.2022	pCO2 [ppm]	Temperature [°C]	Spacial variation
9:40	600.27	11.07	Instrument mounted normally
10:50	71.79	19.60	First calibration with the zero gas
11:00	864.01	23.60	Second calibration with CO2 (1000 ppm)
11:15 - 12:00	584.28	9.17	Sensor 24 cm above bottom level
12:00 - 13:00	657.58	8.45	60cm further out, instrument fully submerged, free floating
13:10 - 14:50	634.58	8.78	130cm further out, instrument fully submerged 10cm into water, sensor immobilizely mounted
14:50	1561.77	6.29	Instrument placed 10 cm above the bottom, catches up bottom signal
15:00	636.09	8.61	
15:10	580.37	8.99	
15:20	610.85	8.54	

Discussion

The spacial variation proves that a variation of the rivers surface position has no influence on the pCO_2. The opposite effect showed a variation in the water depth due to the bottom signal of organic matter and the air signal caused by low water levels. When the water discharge of the power plant was low, the water level decreased, which resulted in no pCO_2 value being measured. This is due to a service maintenance of a turbine since 25th April. The sensor height was in most cases adjusted to the water level. If no pCO_2 value downstream is available, the sensor measured the air signal.

Conclusion

Since the pCO_2 is higher upstream than downstream, it can be concluded that the fluctuation of the water due to the turbines leads to an increased water-gas exchange and thus CO_2 could be stored in the hydropower plant.

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Yannick Elias Gerling, Hannes Röttger and Andreas Andersson,
Mid Sweden University, Department of Ecotechnology and Sustainable Building Engineering
Track 4a: Predictions and responses

5/16/2022

4. Climate change & Energy

4b. Affordable and clean energy

Abstracts

Measuring Sustainable Energy Transition: A comparison of indicator sets

Éva Kármán-Tamus[1], Dr. Tamás Pálvölgyi[1], Dr. Tekla Szép[2]

[1]Budapest University of Technology and Economics, Faculty of Economic and Social Sciences, Department of Environmental Economics and Sustainability, Budapest, Hungary. [2]University of Miskolc, Faculty of Economics, Institute of World and Regional Economics, Miskolc, Hungary

Abstract

Sustainable energy transition is a key element of circular economy, social welfare and justice. The recent global energy crises brought on by COVID-19 also highlighted the importance of decarbonisation and the necessity of shifting energy sources from fossil fuels towards renewable energy. Seeing the existing states and the trends based on changes is necessary for the process of decision-making, and indicator sets are a widely used tool to communicate various issues to policy makers. There are multiple indicator sets in connection with sustainability and energy, all assessing the issue with a different perspective and focus.

In our previous studies, we built a comprehensive indicator set and compiled a composite indicator for measuring the performance of the European Union Member States in the field of sustainable energy transition. Firstly, we developed representative indicators covering the three dimensions of sustainability (i.e. economic and development-related dimension, human and social dimension, and natural resource-related and environmental dimension), called Sustainable Energy Transition (SET) indicators. After multiple steps of data testing, we used normalization and weighting methods to calculate the composite indicator.

The goal of this study is to compare the Sustainable Energy Transition composite index and additional sustainability indicators, for example the Human Development Index (HDI), which provides an indication of a country's human well-being or the IEA's Energy Development Index (EDI), which focuses on a country's transition to the use of modern fuels. Our preliminary results suggest that interrelations between SET indicators and HDI show typical spatial distribution, mainly driven by the country's primary energy mix and differences in energy policies.

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. It becomes clear that the global energy security, economic geography of globalization, the economics of climate change and climate policy are closely related, which means that we should concentrate not only on energy transition but we should raise the attention to the importance of the sustainable energy transition. Because of this, we developed our indicator set keeping the sustainable development goals in mind. Our study especially relates to SDG7 and SDG13, which may serve as a basis to achieve affordable and clean energy and to combat global climate change.

Track
Track 4b Affordable and clean energy

Full papers

Improving the Implementation of Green Public Procurement

Evidence for public procurement of renewable energy of Sweden

Arash Kordestani[1], Natallia Pashkevich[2], Andreas Stephan[3]

[1]*School of Social Sciences, Sodertorn University, Sweden, arash.kordestani@sh.se*
[2]*School of Social Sciences, Sodertorn University, natallia.pashkevich@sh.se*
[3]*Department of Forestry and Wood Technology, Linnaeus University, andreas.stephan@lnu.se*

Abstract

The main purpose of this paper is to explore how public authorities can promote renewable energy tender participation of potential suppliers. Currently, public authorities struggle to attract more participants to tenders and thus to achieve lower prices and better quality of goods and services and to reach sustainability goals. By using arguments from the public interest theory of regulation and transaction cost economic theory we investigate how evaluation criteria, type of tendering procedure, submitted value of the tender, and common procurement vocabulary affect the number of participants in public tenders and, thus, contribute to the openness and competition in the bidding process of renewable tenders. For public agencies, the obtained results demonstrate the importance of paying attention to tendering procedures and types of goods and services in relation to the number of participants in public tenders. Public agencies, therefore, generate a twofold impact on promoting sustainable goals – one via different types of the tendering procedure, and the second via the goods and services acquired.

Keywords: Public procurement, Sustainability, Renewable energy, Policies

1. Introduction

Climate change, the COVID-19 pandemic, migration, inequality, and growing unemployment are challenges that we are faced with nowadays and to a large degree connected with consumption patterns. The government plays an important role in managing these patterns, being an important and influential customer (Halonen, 2021; Rosell, 2021). For example, worldwide public procurement accounts for around 14% of the global GDP and EU public procurement accounts for around € 1.8 trillion per year (Cinti, 2020). Being an important customer, the government in the form of public authorities has the potential to use its power to boost sustainable development. Also, this potential seems large and essential, scientific insights, in general, are scarce on what policies and strategies can help public authorities to address current global and local challenges.

Public procurement policies regulating the purchase of goods and services have been benefiting societies through ensuring access to available resources and reliable energy services, improving energy efficiency, increased innovation, and efficient resource use. During the last decade, there has been a growing recognition of the importance of public procurement legislation to promote sustainable development goals (Lundberg and Marklund, 2018; Pouikli, 2021). Public procurement policies can facilitate the aforementioned goals and policies through the increasing number of bidders per tender from one side and challenging public authorities to find innovative solutions to promote the sustainable behaviour of tender companies (Jääskeläinen and Tukiainen, 2019). However, these policies that aim at changing the behaviour of companies willing to participate in public procurement tenders remain a challenge for public authorities. Moreover, it is highlighted that public procurement is characterized by a low rate of competition that negatively affects its efficiency (Nemec et al., 2020). From a theoretical perspective, there is currently a lack of knowledge about key constructs on how public procurement policies can be developed and what type of information is required by tenderers to facilitate a tendering process. Therefore, this paper seeks to answer the following research question: *what are the key types of factors that affect the number of participants in public tenders and, thus, contribute to the openness and competition in the bidding process of renewable tenders?*

Particularly, since the area of public procurement is not well theorized (Flynn and Davis, 2014), we use arguments from the key public procurement theories including the public interest theory of regulation (Stigler, 1971) and transaction cost economic theory (Williamson, 1993) we formulated key hypotheses to investigate how evaluation criteria (based on price only, on cost only, or on best price-quality ratio), type of tendering procedure (open, simplified, or direct award), submitted value of the tender, and common procurement vocabulary (CPV) affect the number of participants in public tenders and, thus, contribute to the openness and competition in the bidding process of renewable tenders. We collected public procurement tenders' data in Sweden from a database, Visma Opic which resulted in the final sample of 187 companies. Two different regression methods of Poisson and negative binomial were applied to test the formulated hypotheses.

In contrast to previous literature, we found that the evaluation mechanism has no significant impact on the number of tenderers. However, the type of procedure 'simplified' shows a positive significant effect. Moreover, CPV in terms of 'electricity' and 'architectural services' also has a significant effect on the number of participants in tenders which contributes to the openness and competition in the bidding process of renewable tenders. Therefore, this paper provides important knowledge on a highly debated and complex topic in predicting the number of potential bidders in the public procurement process (Ballesteros-Pérez et al., 2016; Jääskeläinen and Tukiainen, 2019) by highlighting the importance of specific factors, including a tendering process and tender characteristics.

In the next section, we present key literature and factors that according to previous studies can affect the number of participants in public tenders. Further, we describe how we collected and analyzed the available data. In the next sections, we present the results and conclusions of the present study.

2. Literature review

Public procurement is a complex phenomenon with several stakeholders and contradicting demands, including as a result the best economic outcome, yet efficiency goals compete with political goals and environmental issues (Rokkan and Haugland, 2021). Theoretical application in public procurement research is highlighted as low and the area of public procurement is under-theorized (Flynn and Davis, 2014). In our study, we use arguments from the public interest theory of regulations (Stigler, 1971) and transaction cost economic theory (Williamson, 1993). In general, the public interest theory of regulations states that regulation is formulated in a way to protect and benefit public at large to overcome unbalanced market results (Hantke-Domas, 2003). According to this theory, public agencies have to provide equal treatment of suppliers and strict procedures with high transparency. Although the public interest theory of regulations does not explicitly explain participating in a tender, procurers are assumed to follow public interest theory in order to develop their regulations to not violate public trust and encourage participation in the procurement system. While regulations are developed by public agencies to benefit public at large, at the same time these agencies should control and constantly work on the reduction of costs in tenders. According to transaction cost economic theory (Williamson, 1993), procurement strategy and transaction attributes should match in order to decrease transaction costs that occur due to economic exchange. Comprehensive accounting and reduction of such costs without sacrificing value should become one of the most important elements in public process efficiency and optimization (Williams, 2014; Petersen et al., 2019). In our case, we can hypothesize that when the number of tenderers increases there is more room for negotiation and a higher probability that prices, including transaction costs of tenders, will decrease.

To attract tenderers in the auctions, public agencies should consider certain factors that affect the tenderers decision to bid and competitiveness in the tendering process. For example, it is highlighted that the decision to bid is based on the attractiveness of the tender and market situation (Leśniak and Radziejowska, 2017). In another study, it was established that job characteristics, the company strength, design quality, the project cash flow and rate of return are important factors influencing the decision to bid (Alsaedi et al., 2019). Another type of research demonstrates that estimated value of procurement, award price context and accuracy of cost estimation are also important in attracting tenderers to auctions (Fry et al., 2016; Hanák, 2016; García Rodríguez et al., 2019). Bidders experience is also shown as one of the most important factors that can affect competitiveness in tenders (Keung and Shen, 2017). While it is shown that there are different types of factors that can affect the decision to bid and competitiveness in public procurement context, this area requires more studies of historical data from past tenders to create a basis for further development of public procurement policies and strategies (Jaśkowski and Czarnigowska, 2019). In our study, we include two types of factors that were available from historical data: (i) factors that characterize a tendering process (evaluation criteria and type of tendering procedure) and (ii) tender characteristics (submitted value of the tender and CPV).

2.1 Evaluation criteria

It is of utmost importance that companies' participation in tenders and the tender assessment follows a transparent process on the basis of equal treatment, non-discrimination with particular attention to the principle of proportionality. General provisions for public procurement ask companies and procurers to ensure open access to all suppliers, and it prohibits design of procurements that excludes a group of suppliers (Sweden law of public procurement, 2016; Dotoli et al., 2020). Evaluation criteria are decisive for giving guidance to tender evaluation and for selecting the bidder having the highest score (Bergman and Lundberg, 2013; Chen, 2008; Mateus et al., 2010; Stilger et al., 2017). Evaluation criterion could be based on price only, on cost only, or on best price-quality ratio (European Commission, 2018). The first form is the most popular one in which the lowest price bid will be awarded a tender (Konkurrensverket, 2020). Cost evaluation means cost effectiveness which can be expanded to include life cycle costs. Petri and Olve (2014) discuss that investment calculations (such as life cycle cost analysis) which extend across both production and market and include entire life cycle are seldomly used compared to traditional product calculations. The best price-quality ratio (BPQR) is flexible, and it allows to consider environmental or social considerations together with quality in awarding a tender (European Commission, 2018; Preuss, 2011). The BPQR was formerly labelled as the most economically advantageous tender (MEAT). MEAT was used as a criterion instead of the lowest price bid. However, the new public procurement guideline specifies MEAT as the umbrella name for awarding a contract when price, costs, and BPQR are used in the assessment approach (Directive 2014/24/EU, European Commission, 2018; Konkurrensverket, 2019).

The price competition through awarding contracts to the lowest price bid has been the traditional evaluation criteria and is an effective approach limiting favoritism (Bulow and Klemperer, 1996; Yao and Tanaka, 2020). But, due to concerns about quality, and later by including environmental and societal criteria in public procurement (Sebastian et al., 2020), other approaches such as BPQR and life cycle costs analysis are increasingly used. The European Parliament and the council of the European Union formulated directives in 2014 to encourage procuring organizations to increase quality orientation in public procurement (Directive 2014/24/EU). The advisory board for the European Research Area asked for 2% budget of public procurement to be dedicated to innovation. The Europe 2020 flagship initiative "Innovation Union" is an example of dedication of public procurement to increase innovation to improve quality (Appelt and Galindo-Rueda, 2016). Whether choosing an alternative approach compared to the lowest price bid led to higher quality is still a matter of debate. Bergman and Lundberg (2013) argue that although the combination of quality and price is a suitable criterium for evaluating contracts, in situations where several potential suppliers can offer the same product the usage of lowest price bid is preferable. The level of the desired quality needs to be specifically mentioned otherwise high-quality bidders are more likely to withdraw from lowest price bid procurements (Yao and Tanaka, 2020). Although BPQR and cost evaluation are used to reduce the effect of lowest price in tenders by means of including other criteria to award a contract, the result of another study shows that there is a marginal greater risk for review compared to lowest price bid (Konkurrensverket, 2014). This marginal difference can be explained by a lower number of tenders with BPQR as evaluation criteria compared to lowest price bid. Hence, the decision whether

BPQR and cost evaluation in procurement are effective in increasing competition relative to lowest price is still an unsettled question. Therefore, the research hypotheses can be formulated as follows:

H1: The choice of evaluation criteria plays a significant role in increasing the number of participants in public tenders.

2.2 Type of tendering procedure

Further, we include in the research model such an important factor as a type of tendering procedure since public procurements have to follow these specific procedures prescribed by the legislation. While this factor is shown to be important in relation to competitiveness and openness of public tenders (Heijboer and Telgen, 2002; Tikkanen and Kaleva, 2011; Soudek and Skuhrovec, 2016), current literature is lacking studies that can guide public authorities in choosing the optimal tendering procedure that minimizes transaction costs and increases competitiveness. In relation to competitive tendering, it was recommended before choosing either more open or more restricted tender procedure, it is important to take into account the expected level of market competition, expected tendering costs and time that will be involved (Heijboer and Telgen, 2002). In empirical studies, it was shown that the open procedure was preferable than more restricted procedure when the value of the contract exceeded the EU threshold (Tikkanen and Kaleva, 2011). Another study has shown that an open procedure can reduce the final price of the tender and attract more competitors (Soudek and Skuhrovec, 2016). Yet, the choice of the tender procedure by relying only on the public procurement regulation without having a clear methodology on how this choice is related to the procurement process costs was criticized in another study (Carbonara et al., 2016). In general, if the tender is about the established threshold public authorities are obligated to announce tenders at the EU level. In another case when threshold is not reached, the tender is announced at the local level. Given the above, we hypothesize that:

H2: The choice of tendering procedure plays a significant role in increasing the number of participants in public tenders.

2.3 Submitted value of the tender

While in a regular auction, a seller wants to sell items to several tenderers with the highest possible price, public procurement has a reverse auction where a public agency as a single buyer wants to purchase items from several tenderers (Chen et al., 2005). Moreover, public agencies want to spend their financial resources as efficiently as possible and usually during the reverse auction prices decrease when the tenderers underbid each other. Therefore, tenders are awarded usually to the bids that bring the best value for money for the public agency.

From the point of view of the tenderer, the bid estimation strategy is crucial to ensure probability of winning tenders and, at the same time, economic efficiency of the tendering company (Hanák et al., 2021). When a tenderer decides to bid on a contract, a submitted value of the tender (an estimated value of a procurement that public agency is willing to pay for the performance of the public contract) can play a significant role

value of procurement has a direct impact on the number of tenderers in the public auction and a higher estimated value attracted more tenderers (Onur et al., 2012). In another study, it was found that there is a slight positive correlation between price difference of a tender (expected and awarded prices) and the number of submitted offers (Man et al., 2014). It was established that in the multicriteria bidding strategy of tenderers besides risks and attractiveness, cost-oriented pricing plays one of the main roles in the decision to participate in public tenders (Hanák et al., 2021). Therefore, the hypothesis can be formulated as follows:

H3: The submitted value of the tender plays a significant role in increasing the number of participants in public tenders.

2.4 Common procurement vocabulary

Transparency of public procurement is highlighted as one of the key issues to promote competitiveness and openness of the procurement process (Coviello and Mariniello, 2014; Lundberg and Bergman, 2017). To promote higher transparency and simplify the tendering process, governments make their procurement data accessible online on different platforms. It was shown, for example, that in countries with more transparent procurement systems, the probability of firms to engage in the bidding process is higher (Knack et al., 2017). In another study, it was also confirmed that the public accessibility of procurement data increases the likelihood of improved competitiveness and facilitates the entry of new tenderers (Duguay et al., 2020). However, while in general it is established that the transparency is important for public procurement competitiveness it is highlighted that future research should provide more detailed evidence on which types of transparency matter for openness and competitiveness of public procurement (Bauhr et al., 2019; 2020). In our study, we focus on CPV codes which is a classification system that standardizes contract type by product as one of the transparency types. We consider this vocabulary as one of the channels through which transparency contributes to better competition through improving business efficiency. Potential tenderers benefit from this vocabulary by saving time on information collection and analysis. Therefore, we expect that:

H4: Common procurement vocabulary plays a significant role in increasing the number of participants in public tenders

3. Methods

This section contains data collection, variables, and data analysis.

3.1 Data collection

We used public procurement databases in Sweden, and Tenders Electronic Daily (TED) to find tenders that were related to renewables. Dataset included tenders that had their closing date in the year 2020. The geographical focus was on Sweden. This consideration made it possible to cross check tenders between

as evaluation criteria, and 283 used price as the evaluation criteria. Then, we ruled out “cancelled” tenders, and the ones with unclear decision or unclear information about tenderers to focus only on successful tenders which have information about tenderers as well. In total, our sample contained 187 tenders.

3.2 Variables

"Submitted value of the tender" added as a continuous variable. Then, we created dummy variables from evaluation criteria, "type of procedure", "Main CPV" to add to the regression model. There were 22 different CPV codes and testing them showed that CPV codes belong to architectural services, and electricity are significant predictors in the regression model. These two CPVs are independent (in other words one tender submit to either of these CPVs), and as a result they were incorporated in two separate regression models. Table 1 explains variables and frequency of appearance in the dataset including the mean and max for tenderers count and Submitted value of the tender. Figure 1 shows the frequency of and descriptions of CPV codes as it appeared in the final dataset.

Table 1. *Variables definitions and references.*

Variable	Subgroup (Frequency)	Definition	Ref
Tenderers count	No subgroup (1-11 participants)	Number of participants in a tender	
Evaluation criteria	Price-Quality (55)	tender evaluation criteria: The Best Price Quality Ratio	EU public procurement directive 2014/24, Article 67
	Price (132)	tender evaluation criteria: lowest bid	EU public procurement directive 2014/24, Article 67
Type of procedure	Open (42)	Anyone may submit a full tender and there is no opportunity for negotiation	https://europa.eu/youreurope/business/selling-in-eu/public-contracts/public-tendering-rules/index_en.htm https://www.upphandlingsmyndigheten.se/inkopsprocessen/forbered-upphandling/valja-upphandlingsforfarande/
	Simplified (134)	Anyone may submit tenders and there is an opportunity to negotiate with the supplier	https://www.upphandlingsmyndigheten.se/inkopsprocessen/forbered-upphandling/valja-upphandlingsforfarande/
	Direct award (11)	Direct purchasing when the value of the procurement is below direct procurement limit, and under certain situations. EU:s general provision must be followed.	https://www.konkurrensverket.se/upphandling/lagar-och-regler/direktupphandling/ https://www.konkurrensverket.se/upphandling/lagar-och-regler/troskelvarden/
Main CPV	22 subgroups	Common procurement vocabulary for classification	https://www.upphandlingsmyndigheten.se/inkopsprocessen/forbered-upphandling/valja-upphandlingsforfarande/
Submitted value of the tender	No subgroup (17297 Kr. – 32077000 Kr.)	Estimated value of a procurement	https://data.europa.eu/euodp/repository/ec/dg-grow/mapps/TED_advanced_notes.pdf

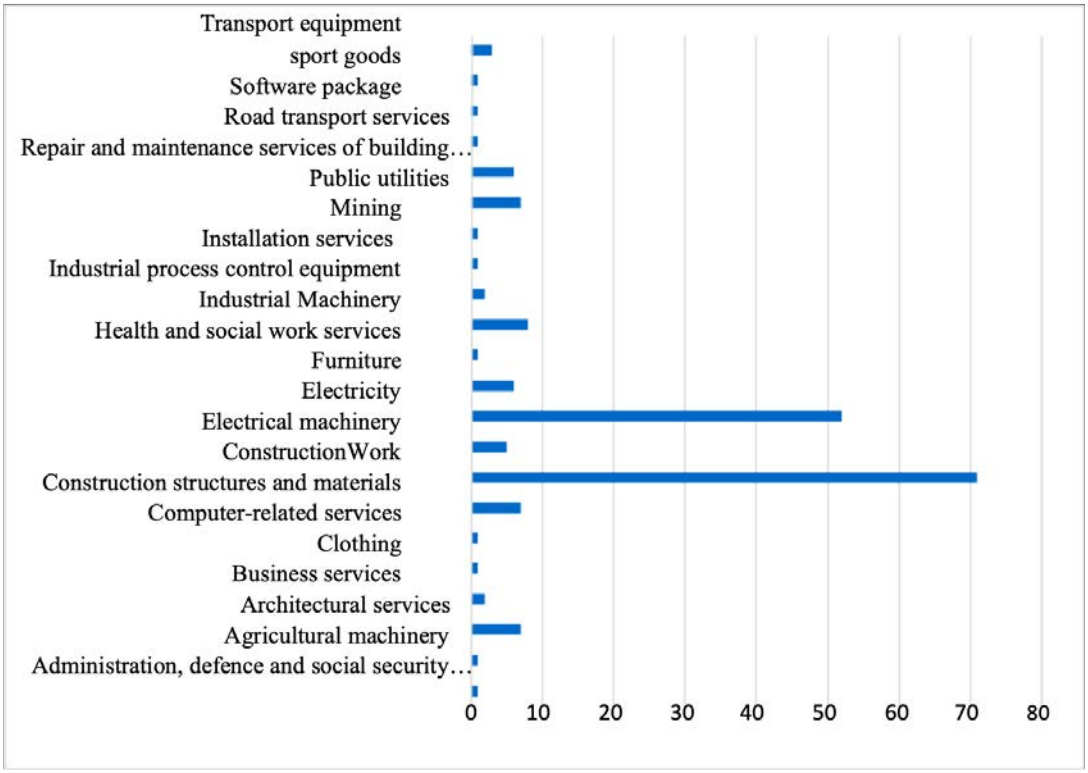

***Figure 1**. CPV codes.*

3.3 Data analysis

Boxplot and ggplot were among techniques we used to identify and remove extreme values, and outliers. We investigated the mean and variance differences among predictors to examine how big the difference between mean and variance are. The bigger the difference between mean and variance the better predictor variable. Evaluation criteria did not show that it is a good predictor variable while type of procedure showed better results. However, we took both to the regression model to see whether it impacts prediction results of the regression model.

The dependent variable of this model was to find what factors affect the number of participants in public tenders through testing four research hypotheses. Hence, we created a regression model, and used negative binomial regression model. This type of regression which is the more generalized form of Poisson regression is suitable for over dispersed data (Cameron and Trivedi, 2013). Testing the size of variance to the mean for the dependent variable revealed data dispersion and the usefulness of using this method over Poisson regression (Variance Tenderers count / Mean Tenders count = 2.282). We used R-programming for data analysis. We created factor models from “evaluation criteria” and “type of procedure”. “Price” subgroup was the reference group in evaluation criteria, and “direct award” subgroup was the reference group in “evaluation criteria”.

4. Results and discussions

The negative binomial regression models the log of the expected count as a function of the predictor variables. Table 2 and 3 shows parameter estimates using negative binomial regressions. The dependent (Response variable) is "Tenderers count" and beneath are predictor variables.

Table 2 shows that evaluation criteria: price-quality, and type of procedure: simplified, and main CPV: architectural services including intercept are significant predictors of tenderers count. The indicator variable shown as "type of procedure: simplified" is the expected difference in log count between this group and the reference group (type of procedure: direct award). The expected log count for "type of procedure: simplified" is 0.625 higher than the expected log count for "type of procedure: direct award". Also, for a one unit change in the "main CPV: architectural services" variable, the difference in the log of expected counts of the response variable is expected to change by 0.75, given the other predictor variables in the model are held constant. The negative binomial regression estimates when all variables in the model were evaluated at zero showed that the log of the expected count for "tenderers count" is 0.768.

Table 2. *Negative binomial regression parameter estimate results: Architectural services.*

Tenderers count	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	0.768	2.42E-01	3.166	0.00155	**
Evaluation criteria: Price-Quality	-0.0584	1.07E-01	-0.547	0.58468	
Type of procedure: open	0.325	2.72E-01	1.199	0.23072	
Type of procedure: simplified	0.625	2.46E-01	2.539	0.01111	*
Main CPV: Architectural services	0.753	2.32E-01	3.253	0.00114	**
Submitted value of the tender	-0.000	7.69E-09	-0.966	0.33416	

Significance codes: * p < .05, ** p < 0.01, *** p < 0.001
Number of observations = 187
2 x log-likelihood: -806.408
BIC: 843.0258

Table 3. *Negative binomial regression parameter estimate results: Electricity.*

Tenderers count	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	0.715	2.45E-01	2.916	0.00354	**
Evaluation criteria: Price-Quality	0.002	1.10E-01	0.022	0.98217	
Type of procedure: open	0.398	2.71E-01	1.469	0.14187	
Type of procedure: simplified	0.574	2.48E-01	2.311	0.02084	*
Main CPV: Electricity (solar panel and energies…)	0.250	1.08E-01	2.312	0.0208	*
Submitted value of the tender	0.000	7.79E-09	-0.483	0.62887	

Significance codes: * p < .05, ** p < 0.01, *** p < 0.001
Number of observations = 187
2 x log-likelihood: -810.87
BIC: 847.4881

Results of table 3 shows that "type of procedure: simplified" is about 0.574 higher than "type of procedure: direct award", and one unit change in "electricity CPV" will change the log of expected counts of "tenders count" by 0.25 unit. The negative binomial regression estimates when all variables in the model were evaluated at zero showed that the log of the expected count for "tenderers count" is 0.715 for tenders in electricity subgroup. We also did ANOVA tests to make sure to know whether subgroups are significant or the whole variable is significant. ANOVA test showed that "type of procedure" and "Main CPV" are significant predictors for "Tenders count" variable.

These two models can be simplified in the following equations. The log of the "tenderers count" can be predicted with a linear combination of "type of procedure" and "Main CPV" in architectural services" and "electricity":

Tenderers count = exp (Intercept + 1.05*Main CPV+0.67*Type of Procedure simplified) Main CPV: Architectural services

Tenderers count = exp (Intercept + 0.341*Main CPV + 0.59*Type of Procedure simplified)
Main CPV: Electricity (solar panel and energies…)

Table 4. *Results of hypothesis test.*

	Hypothesis	Supported
H1	The choice of evaluation criteria plays a significant role in increasing the number of participants in public tenders.	No
H2	The choice of tendering procedure plays a significant role in increasing the number of participants in public tenders.	Yes
H3	Submitted value of the tender plays a significant role in increasing the number of participants in public tenders.	No
H4	Common procurement vocabulary plays a significant role in increasing the number of participants in public tenders.	Yes

Table 4 shows that hypothesis 1 which is about the impact of evaluation criteria is insignificant. Although a previous study (Sebastian et al., 2020) suggest to use BPQR, but our study did not find a significant effect of either of these variables. One explanation could be that number of tenders with BPQR as criteria were much lower than the reference group (price-quality: 55 tenders, price: 132 tenders). We suggest future research to consider samples with higher number of tenders with BPQR as evaluation criteria.

Hypothesis 2 was supported, and it showed the that simplified procedure type is a significant predictor compared to direct award. But type of procedure: open could not show significant difference compared to type of procedure: direct award in predicting cumber of tenderers. It is worth to mention that we tested to exclude CPV codes from the regression equations which gave marginal significance (p -value < 0.1) to tender type: open in comparison to reference group direct award. However, tender type: simplified was still significant and stronger which showed the higher prediction power of this type of procedure in determining the count of tenderers. As stated in the literature review, previous studies mention the importance of choosing the optimal procedure type (Heijboer and Telgen, 2002; Tikkanen and Kaleva, 2011; Soudek and Skuhrovec, 2016). Although Tikkanen and Kaleva (2011) mentioned the importance of type of procedure: open, but our study did not find support for that. It could be argued that type of procedure: simplified is an extension of type of procedure: open with the privilege of negotiation which might make this procure type more suitable for SMEs.

We did not find significant effect of submitted value of the tender on number of tenderers, and hypothesis 3 is not supported. In this regard, our results are rejecting the findings of a previous study (Onur et al., 2012) on the role of submitted value of a tender. The reason to this might be the high dispersion of values (mean: 4.96E+06, variance: 4.7E+13). Therefore, we suggest future research to consider this variable as a categorical variable rather than a continuous variable.

Common procurement vocabulary plays a significant role in number of tenderers (H4). There were two CPV codes among 22 CPVs of renewables which showed significant effect, architectural services, and

these CPV codes attract many tenderers. For instance, one tender attracted 57 tenderers, and 10 of which were winners. Also, electricity tenders appeared quite often in renewable tenders, and it attracted several tenderers. Thus, current study support findings of previous study on importance of transparent procurements (Coviello and Mariniello, 2014; Lundberg and Bergman, 2017), and introduces electricity and architectural services as two popular categories for tenderers in renewable energies.

4.1 Extended model

This part is for further research, and we appreciate feedback on that. We also run different models with further variables to investigate whether prediction of the model improves. We used Bayesian information criterion (BIC) for scoring and selecting a model with lowest score. We created a new dependent variable which is the sum of winners and tenderers called WinnersTendersCount. This new variable will give us more tenders since 34 tenders were excluded from dataset since the information for tenders were missing while information for winners existed. This could be because of data entry mistakes in the databases and tenders were ignored. Theoretical justification for this variable is that variables are part of tenderers and those predictors variables that predict number of tenders can predict number of winners. In other words, tenderers turn to winners and these predictors can be considered as predictors of winners. Then, we created few other predictor variables. One of them was to consider the logarithmic transform of the submitted value of tender to reduce the variation of this predictor variable. Furthermore, we computed another categorical variable which shows the type of procurer. We found that there are different categories of procurers; university, limited companies (Aktiebolag in Swedish), government, and municipalities. Results showed that logarithmic transformation of the "submitted value of a tender", and count of winning by a firm, "type of procedure: direct award" can predict the dependent variable which is the number of winners and tenders. This model showed lower BIC compared to main results of the paper.

5. Conclusions

With the research question of what are the key types of factors that affect the number of participants in public tenders, this paper goal was to contribute to the openness and competition in the bidding process of renewable tenders. Achieving this goal help public authorities to promote renewable energy tender participation among potential supplier and reach sustainability goals.

The research question was answered with help of formulating four hypotheses. Two hypotheses related to the impact of tendering process and common procurement vocabulary codes on number of tenderers were supported. Type of procedure: open and CPV codes of architectural services, and electricity showed significant results compared to their reference groups. While two other hypotheses related to the impact of tender evaluation criteria and submitted value of tender became insignificant. The regression models using significant variables are created for consideration of public procurers, policymakers, and SMEs. We have outlined several avenues for further research in the discussion part of this paper.

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Life Cycle Assessment of a Proton Exchange Membrane Unitized Regenerative Fuel Cell for Residential Buildings

Teresa Maria Gulotta[1], Roberta Salomone[2], Francesco Lanuzza[3], Giuseppe Saija[4], Giovanni Mondello[5]

[1]*University of Messina, Department of Economics, Piazza Pugliatti 1, 98122, Messina, Italy, teresamaria.gulotta@unime.it*

[2]*University of Messina, Department of Economics, Piazza Pugliatti 1, 98122, Messina, Italy, roberta.salomone@unime.it*

[3]*University of Messina, Department of Economics, Piazza Pugliatti 1, 98122, Messina, Italy, francesco.lanuzza@unime.it*

[4]*University of Messina, Department of Economics, Piazza Pugliatti 1, 98122, Messina, Italy, giuseppe.saija@unime.it*

[5]*University of Messina, Department of Economics, Piazza Pugliatti 1, 98122, Messina, Italy, giovanni.mondello@unime.it*

Abstract

A Life Cycle Assessment (LCA) of unitized regenerative fuel cell (URFC) system with polymeric electrolyte membrane (PEM) applicable in residential buildings is carried out to evaluate the energy and environmental performances of this emerging energy storage technology. The individual components of the URFC system (catalyst, stack, balance of plate, storage tank, electric and electronic auxiliary devices) were modelled using Simapro software. The scope of analysis is cradle-to-grave, with a functional unit of 1 kWh of electricity produced by the URFC system in 10 years. The life cycle inventory of the study includes both primary and secondary data. In particular, primary data was collected from laboratory experiments conducted within the "ELETTRORIGENERA" project (PO FESR SICILIA 2014-2020 AVVISO 1.1.5 - PROGETTO ELETTRORIGENERA N. 08ME2899200216). Instead, secondary data, such as peer-reviewed studies and commercial databases, are used when primary data are unavailable. The potential impacts are evaluated using Cumulative Energy Demand (CED) and CML-IA baseline assessment methods. The results showed that 1 kWh of electricity produced by the URFC system could emit about 0.263 kg $CO_{2\,eq}$ in global warming potential and 15 MJ of cumulative primary energy. The operation phase is responsible for more than 65% of all impact categories, except for photochemical oxidation and acidification potentials, in which the highest impacts are linked to the manufacturing phase. In addition, the analysis identified that catalysts generate the most significant impacts in URFC system manufacturing. On the contrary, although end-of-life treatments generate negligible impacts, recycling part of metals and catalysts to avoid the production of virgin materials could reduce the impacts by at least 38%. Further, these results could be used in future studies to evaluate the impacts generated by different end-of-life and control strategies of the URFC system and their effects on the hydrogen technology's performance and compare alternative energy storage technologies.

Keywords: Life cycle assessment (LCA), PEM, URFC, hydrogen technology, end-of-life

1. Introduction

In 2020, energy production and its use accounted for over 75% of the European carbon dioxide (CO_2) emissions (Eurostat, 2021). Therefore, decarbonizing the energy system is one of the primary keys for achieving carbon neutrality by 2050. Within the new Green Deal (European Commission, 2019), European Commission (EC) proposed a series of indications to reduce emissions and external energy dependencies. One of these proposals refers to installing renewable energy systems (RES). However, their wide application in the years was restrained due to their intermittent energy production, which could generate a mismatch between offer and demand, causing, e.g., electric grid instability in the case of photovoltaic panels (PV) and wind farms. To resolve this issue, policymakers and industries are pushed toward developing and investigating high-efficiency energy storage systems coupled with renewable sources for increasing self-consume (Wang et al., 2016).

Among the different proposed energy storage systems, the Proton Exchange Membrane Unitized Regenerative Fuel Cell (PEM-URFC) is a promising energy storage technology that can produce clean energy for different sectors, from building to industry and mobility sectors. Indeed, this electrochemical device could work both in fuel cell (FC-mode) and electrolysis (EL-mode) modes producing, from water and electric energy, hydrogen, oxygen and thermal energy convertible into electric energy and water vapour when required (Saeed & Warkozek, 2015).

Despite this potential advantage during the operation phase, the manufacturing and disposal of such PEM-URFC systems may be quite energy and resources consuming (as for their technological predecessors) due to manufacturing processes and raw materials used that could overlap the sustainability benefits of the technologies (Stropnik et al., 2019). For that reason, the environmental sustainability of this energy storage technology has to be evaluated, from raw materials extraction to disposal, including the manufacturing and operation phases.

In this context, the Life Cycle Assessment (LCA) method (ISO, 2020a, 2020b) could be applied to identify the main hotspots during the whole life cycle of an energy system or compare different technology management strategies. Indeed, this method can capture the complexity and interdependencies of technologies providing a comprehensive and objective analysis useful to address the environmental sustainability of systems and identify the potential impacts/benefits achieved during each life cycle phase. Its usefulness has been amply demonstrated by numerous LCA studies conducted on fuel cells and electrolyzers. Despite this, the energy and environmental sustainability of the life cycle of URFC systems has not been extensively evaluated. Indeed, based on the authors' knowledge, the research on PEM-URFC systems is still limited to the economic analysis of components and energy evaluation of their efficiency during operation (Gabbasa et al., 2014; Paul & Andrews, 2017), and only Mendecka et al. (2020) applied the LCA method to a solar-based poly generation system, accounting for a URFC as part of an off-grid system for non-residential buildings.

This preliminary study evaluates the potential energy and environmental performance of a small URFC system installable in residential buildings to increase knowledge of energy storage technologies. The proposed case

FESR SICILIA 2014-2020 AVVISO 1.1.5 - PROGETTO ELETTRORIGENERA N. 08ME2899200216). The LCA method is applied following a cradle to grave approach.

2. Material and Methods

2.1. Case study description

The proposed case study focuses on a PEM-URFC system characterized by a power of 1 kW and 3 kW, respectively, for FC-mode and EL-mode. The system is designed to work with electricity produced by PV panels mountable on the roof of residential buildings. The technology consists of: i) stack, ii) balance-of-power (BoP), and iii) storage of hydrogen. In particular, the stack is the core of the URFC system, which produces and reconverts the hydrogen fuel thanks to the bifunctional cells. Instead, the BoP is designed to: collect produced water, maintain the thermal balance, and produce regulated power. Generally, the BoP for supporting the PEM-URFC stack includes the cabinet, cables and electronic control units (Mendecka et al., 2020). Overall, the URFC during the use phase in EL-mode can produce hydrogen, oxygen and thermal energy. The hydrogen and oxygen are compressed and stored in tanks of polymer liner reinforced with composite material, while the heat is accounted as waste and purged in the environment. Instead, during FC-mode, URFC produces electricity and water vapour. The electricity could be directly used by end-users, while water vapour could be condensed and reused in EL-mode. Since URFC systems have not reached a mature development, the maximum lifetime of the component is not yet clearly established (Gabbasa et al., 2014; Mendecka et al., 2020). However, for this case study, a lifetime of 10 years is estimated (Mori et al., 2014), considering the average use of 4 hours per day in EL-mode and 4 hours per day in FC-mode. During tests conducted on existing URFC stacks, the efficiency for EL-mode and FC-mode respectively resulted in 0.8 and 0.5. Based on that, the URFC may produce 15,705 kWh of electric energy. The operation characteristics of the URFC system are reported in Table 1. Further information on the assumption made for estimating the energy and water consumption during operation is reported in section 2.3.

Table 1. *Summary of the operation characteristics of the URFC*

Parameters	EL mode	FC mode
Operating time, hours[1]	15,000	15,000
Efficiency[2]	0.80	0.50
Nominal stack voltage, V[2]	1.65	0.60
Nominal current density, A/cm2[2]	0.60	0.50
Nominal URFC power, kW[2]	3.00	1.00

(to be continued)

Table 1 *(continued)*

Parameters	EL mode	FC mode
Operating temperature, °C[(2)]	70	70
Operating pressure of H_2, bar[(2)]	0	15
Operating pressure of O_2, bar[(2)]	0	1
Electric energy consumed, kWh[(3)]	42,832	0
Electric energy from PV, kWh[(3)]	49,109	0
Water consumed | recovered, l[(3)]	9,158	8,395
H_2 produced | consumed, kWh[(3)]	34,265	0
H_2 produced | consumed, kg[(3)]	1,028	942
Energy consumed by compressor, kWh[(3)]	2,349	0
Electric energy produced DC, kWh[(3)]	0	15,705
Electric energy produced AC, kWh[(3)]	0	14,449

[(1)]Data assumed,
[(2)]Data from laboratory experiments,
[(3)]Own calculation based on a simplified model.

2.2. Goal and scope

The LCA method is applied according to the ISO 14040-44:2020 (ISO, 2020a, 2020b) using Simapro software (PRé Sustainability, 2022). The goals of this study are:

- to evaluate the energy and environmental performances of the life cycle of the PEM-URFC system;
- to identify the components or processes responsible for the highest environmental load.

The functional unit (FU) selected for the analysis is represented by 1 kWh of electric energy produced by the URFC in FC-mode in 10 years. No multifunctionality is accounted for in the URFC system for lack of information on the thermal energy produced during the FC-mode and accounted as waste.

The system boundaries are defined following a cradle-to-grave approach, including the processes connected to raw material extraction, components manufacturing, operation of the URFC system and its end-of-life. While, impacts of intermediate transport, installation and maintenance are excluded from the analysis due to a lack of information. Furthermore, the effects of cell degradation, which are supposed to be 1% every 1,000 cycles - resulting from preliminary tests on the bifunctional cell - are excluded from the model.

For the Life Cycle Impact Assessment (LCIA) phase, the CML-IA baseline method (CML - Department of Industrial Ecology, 2016) is applied. According to the guide for LCA of hydrogen technologies (Masoni & Zamagni, 2011), the following impact categories are chosen to be included: abiotic depletion (ADP), acidification potential (AP), global warming potential (GWP), eutrophication potential (EP), and photochemical oxidation formation (POF). Furthermore, the Cumulative Energy Demand (CED) (Frischknecht et al., 2015) is also assessed, dividing the six indicators into renewable and no-renewable contributions.

2.3. Life cycle inventory

The foreground life cycle inventory of the URFC is modelled using both primary and secondary data.
Primary data are collected from the system's preliminary design and laboratory experiments within the ELETTRORIGENERA project. Secondary data are used when primary data are unavailable, collecting them from literature studies and commercial databases. The energy and environmental datasets are selected from

Ecoinvent 3.8 (Wernet et al., 2016). A depth description of inventory data is reported below, divided into URFC life cycle phases: i) manufacturing, ii) operation and iii) end-of-life.

2.3.1. Manufacturing phase

Concerning the manufacturing processes of the PEM-URFC stack, the data are collected through interviews of ELETTRORIGENERA projects' partners and refer to weight of materials and number of components. In particular, the PEM-URFC stack includes 30 bifunctional cells with an active electrode area of 100 cm^2, fixed between two gaskets and endplates with ties and rods. Each bifunctional cell consists of: i) a membrane electrode assembly (MEA), ii) a bipolar plate, iii) two frames, and iv) two gaskets whit hole (polytetrafluoroethylene - PTFE). A detailed list of components and primary materials used is reported in Table 2.

Foreground data for BoP and storage are estimated according to Lotrič et al. (2020) and Mendecka et al. (2020). Since the data of selected literature case studies correspond to different power sizes, the mass for BoP and storage are estimated by scaling down the mass of each resource to match the power sizes of the case study. This calculation is performed following the approach used for biogas plants by Fusi et al. (2016) by modifying the equation (Eq. 1) in order to estimate the mass of materials instead of environmental impacts as follows:

$$m_k = (P_{URFC} / P_{ref})^{0.6} \cdot m_{k,ref} \qquad \text{Eq. 1}$$

where is the mass of k^{th} materials of system object of study and reference (*ref*) system, P is the power of URFC system in EL-mode and that of the reference case study (*ref*), 0.6 is the scaling factor used according to Fusi et al. (2016).

The inventory data are summarised in Table 2, specifying the sources of data, the availability of manufacturing datasets and the amounts of materials for FU. However, the inventory data of some materials of the URFC stack (i.e., Nafion, PTFE and Iridium and Ruthenium oxide) are missing in the Ecoinvent database. For that cases, the amounts of energy and resources used for manufacturing are estimated according to previous literature studies on PEM-fuel cells and electrolyzers (Evangelisti et al., 2017; Simons & Bauer, 2015; Stropnik et al., 2019b; Zhang et al., 2015), except for $IrRuO_2$. For this latter case, having no LCI data available in the literature, impacts are assumed to equal palladium, general mining with ruthenium and other platinum group metals (Mori & Štern, 2016; Snowden-Swan et al., 2016).

Table 2. *Materials for the URFC manufacturing for FU (1 kWh of electric energy produced by the URFC in FC-mode in 10 years)*

Intermediate products	Materials	Dataset	Units	Value
Stack				
Membrane*	Nafion[a]	No	kg	1.24E-05
Gas diffusion layer*	Titanium	Yes	kg	3.43E-04
Catalysts*	Carbon black	Yes	kg	1.15E-07
	Platinum	Yes	kg	3.25E-07
	Iridium-Ruthenium[b]	No	kg	1.72E-07
Ink preparation*	Carbon black	Yes	kg	8.99E-07
	Methanol	Yes	kg	6.65E-07
	Nafion[a]	No	kg	7.37E-06
Bipolar plate	Titanium	Yes	kg	1.01E-04
Frame	Ertalyte (PET-P)[c]	No	kg	1.27E-04
Gasket final	PTFE[d]	No	kg	1.28E-06
Gasket hole	PTFE[d]	No	kg	2.11E-05
Current collection plates	Copper	Yes	kg	1.41E-05
Endplates	Aluminium	Yes	kg	2.46E-04
Tie and rods	Iron	Yes	kg	3.18E-05
Storage				
Tank	PET	Yes	kg	2.02E-04
BoP				
Cables and wires	unknow	Yes	kg	1.11E-04
Insulation	Polystyrene	Yes	kg	5.16E-05
Coolant	Ethylene glycol	Yes	kg	1.17E-04
Auxiliar component	Electronics for control units	Yes	kg	3.94E-04
	Transformer low voltage	Yes	kg	1.37E-04
Cabinet & others metals	Aluminium	Yes	kg	9.56E-04
	Chromium steel	Yes	kg	3.05E-04
	Iron	Yes	kg	2.81E-05
	Steel	Yes	kg	7.03E-03

* components of the membrane electrode assembly (MEA),
[a] manufacturing process assumed by (Evangelisti et al. 2017),
[b] manufacturing process assumed by (Mori & Štern, 2016),
[c] manufacturing process assumed as PET,
[d] manufacturing process assumed by (Simon and Bauer, 2015)

2.3.2. Operation phase

The use phase of URFC includes the consumption of electric energy from PV and deionized water. For calculating these values, energy, hydrogen, oxygen and water flows are calculated using the energy and chemical performances (i.e., efficiency, voltage and current density - Table 1)[1] of the URFC stack in a simplified model developed to design a renewable fuel cell[2] (Saeed & Warkozek, 2015). While the energy consumed during compression of hydrogen in storage is calculated through the model of Saeed
Warkozek (2015), considering the operating pressure in electrolyzer (1 bar) and that in fuel cell (15 bar) modes. Then, the electric energy provided by the PV is the sum of the electric energy required by electrolysis and compression processes.

Instead, the final net water required in 10 years by URFC results in 763 kg. This value is calculated by subtracting the water vapour produced in FC-mode from that required in EL-mode. It is assumed that the water vapour may be condensed using, e.g., a passive system and, after purification, reused in EL-mode. This system may recover about 90% of the water consumable in EL-mode. The estimation is in line with the ELETTRORIGENERA project's partner consideration.

2.3.3. End-of-life phase

For the end-of-life phase, a range between 88% to 96% of metals are assumed to be recycled, according to Lotrič et al. (2021) and Mendecka et al. (2020). Full disposal has been assumed regarding other materials, i.e. Nafion, PTFE, and metals' remaining parts. They are treated as inert materials in landfills.

Concerning the electrocatalyst layers, the recycle treatment is modelled according to Duclos et al. (2017) and Lotrič et al. (2021), in which a hydrometallurgical process is used to recycle 76% of Pt from the MEA. Instead, the plastics are put in municipal incineration plants for energy recovery.

The datasets on the treatment of waste cables and electronic scraps from the control unit reported in Ecoinvent 3.8 are used to model the end-of-life of cables and auxiliary components.

In addition, all recycled materials are modelled as avoided energy and environmental impacts linked to the avoided virgin materials production. Thus, they are accounted for as "credit" in the results section to show their potential energy and environmental benefits.

[1]During laboratory experiments, the ELETTRORIGENERA project's partners were able to measure the efficiency, voltage, current density of URFC stack. These data are used into this study to calculate the in and out flows of hydrogen and water.

[2]The renewable fuel cell represents the Discrete Regenerative Fuel Cell (DRFC), the predecessor of the URFC technology, in which an electrolyzer and a fuel cell are separate components of the same system.

3. Results and Discussion

The life cycle impact assessment (LCIA) is presented in Table 3. In particular, the first column of the table shows the system's impacts without energy and environmental credits, while the second one shows potential impacts taking into account the credits. All values are expressed per FU.

In the first case, the URFC system could emit for FU about 2.76 x10^{-5} kg Sb_{eq} in abiotic depletion (ADPe), 3.49 x10^{-3} kg $SO_{2\,eq}$ in acidification (AP), 0.263 kg $CO_{2\,eq}$ in global warming potential (GWP), 8.02 x10^{-4} kg $PO_4^{3-}{}_{eq}$ in eutrophication (NP) and 1.56x10^{-4} kg $C_2H_{4\,eq}$ in photochemical oxidation (POFP) categories. Focusing on CED, the URFC could consume about 15 MJ of cumulative primary energy to provide 1 kWh of electricity to end-users, of which renewable energy sources (e.g., solar, biomass, and others) contribute 74%.

Table 3. *Energy and environmental impacts of 1 kWh of electricity supplied by the URFC system*

Impact categories	Unit	Total		Variation [%]
		without credit	with credit	
ADPe	kg Sb_{eq}	2.76E-05	2.64E-05	-4.3%
AP	kg $SO_{2\,eq}$	3.49E-03	2.13E-03	-38.9%
GWP	kg $CO_{2\,eq}$	2.63E-01	2.38E-01	-9.6%
NP	kg $PO_4^{3-}{}_{eq}$	8.02E-04	6.72E-04	-16.2%
POFP	kg $C_2H_{4\,eq}$	1.56E-04	1.05E-04	-32.9%
CED_{nr}	MJ	3.63E+00	3.26E+00	-10.2%
CED_r	MJ	1.16E+01	1.16E+01	-0.1%

The main environmental impact contribution (40% in AP to 99.5% in CED_r) in the URFC system comes from its operation phase (Figure 1). Instead, the manufacturing phase contributes from 0.47% (CED_r) to 59.34% (AP) and 52.30% (POFP) and end-of-life treatment for less than 2.07% (CED_{nr}).

Focusing on impacts with credits, it is possible to observe that recycling materials such as platinum, titanium and other metals could reduce the energy and environmental results of the URFC system. The highest variation is generated in the AP (-38.9%), followed by POFP, in which the impact is reduced by 32.9%. Instead, for the other impacts categories, the results decrease from 0.1% (CED_r) to 10.2% (CED_{nr}).

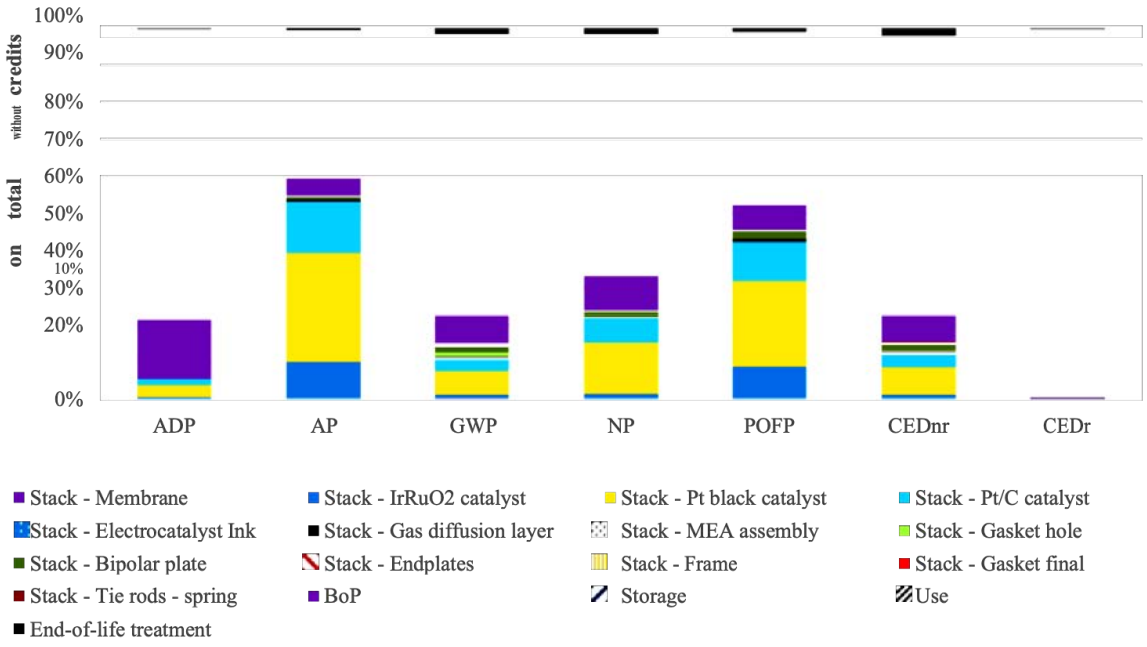

Figure 1. *Energy and environmental hotspots of the URFC system*

Regarding the URFC system manufacturing, stack production contributes from 25.82% (ADP) to 92.06% (AP), and it represents the most impactful component in all categories, except for ADP and CEDr, in which BoP is the main contributor. On the contrary, the lowest impact in URFC system manufacturing is related to plastic tanks contributing less than 1.80% in all environmental categories.

Concerning the URFC stack, its impacts are shared amongst these components: 62-97% coated catalyzed membrane (CCM) production (catalyst, membrane and ink preparation), 0.43-4.77% gas diffusion layer (GDL) production, 1.33-23.89% bipolar plates, and the last 0.98–11.50% represents the production of endplates, tie and rods, frames and gaskets. The catalysts manufacturing dominates the AP and ADP impacts of the CCM production for 96.85% and 95.00%. The leading reason for the high AP of catalysts is the sulphur dioxide emitted in the air during the extraction of the platinum metal groups (platinum and palladium) and their refinement at the site (Mendecka et al., 2020). While, the substantial contribution of catalyst production in ADP impact is caused by elements directly used in processes and those generally mined with them (e.g., gold, tellurium, nickel) (Snowden-Swan et al., 2016). Instead, the primary contributor to the NP impact of the stack is the phosphate water emission in the air that, as indicated in Mendecka et al. (2020), could be associated with the treatment of sulfidic tailing and spoil from mining. Bipolar plate production represents significant, although minor compared to the catalyst, environmental impact sources in GWP and CED categories. The primary contributor to bipolar plate production is heat, electricity and relative carbon dioxide emissions in the air.

Instead, the BoP production contributes from 7.93% (AP) to 74.19% (ADP) of the URFC system manufacturing, dominating the ADP and CED_r impact categories. This result is due to the production of the

Concerning the operation phase of URFC, the electricity provided by PV is responsible for more than 99% of each energy and environmental impact accounted for in this study. On the contrary, the water reintegrated for FU is about 0.05 kg, contributing to less than 0.01% of each impact category.

It should be highlighted that the preliminary study here presented is characterized by limits that could affect results. Most of them are connected to gaps in the literature and commercial databases, such as the missing: of reliable life cycle inventory for some materials production; of reliable information on energy and chemical performances of the URFC in an intermittent context for an extended period; of a model to estimate the effects of bifunctional cells degradation on resources; and of energy consumed for maintenance. These data need to be analyzed in depth via uncertainty analyses to observe the potential variations in model impacts in future studies.

In addition, the energy and environmental impacts of the operation phase could be affected by several factors, such as the operation lifetime or the technology used for electric supply. Indeed, although the electric energy source used in this study is renewable, the selected Italian renewable electricity generation from the PV dataset includes the manufacturing technology, which strongly affects the energy and environmental results of the URFC system. Indeed, if a wind turbine with a power size >1MW is used instead of 3kW PV panels mounted on building roofs, the impacts could be reduced from 32% in AP to 69% in ADP. On the contrary, using electric energy produced by geothermal plants could increase the CED by about 75%.

4. Conclusions

This study proposes a preliminary LCA study on a PEM-URFC system, from manufacturing to end-of-life. Primary data combined with secondary data were used to model the energy and environmental impacts of the life cycle of the URFC system. The paper aims to evaluate the energy and environmental impacts of 1 kWh of electricity produced by the URFC system in fuel cell mode and identifies which components could generate the most significant environmental load.

The analysis showed that the highest potential environmental impacts are associated with the operation phase, which contribution ranges from 40% to 99.5% (respectively for AP and CED_r), followed by the manufacturing phase from 0.47 to 59.34% (respectively for CED_r and AP), and end-of-life treatment for less than 2.07% URFC system impacts. The preliminary analysis of the potential reuse of metals and catalyst shows that by avoiding virgin material, production would decrease from 0.1 to 38.9% (respectively for CED_r and AP).

In addition, the catalysts' materials represent the resources that generate the most significant impacts in all categories, except for CED and ADP, for which the main contributors are metals used for cabinet and electronic components. Regarding the operation of the URFC system, the energy supplied by PV panels dominates all impact categories due to, first, the resources and energy consumed for PV manufacturing and then, the 90% of the water that could be recovered during each cycle, impacting for less than 0.01%.

generators, characterized by crucial manufacturing or use phases (Mendecka et al., 2020). In addition, since URFC systems have not reached a mature development and application, different scenarios on operation management and end-of-life strategies have to be carried out. For example, future studies could estimate: i) the impacts of alternative renewable energy technologies accomplished on the URFC system, ii) the effects of using the heat produced instead of purging it into the environment, iii) the effects of bifunctional cell degradation on the maintenance phase or the impacts of a useful life longer than ten years.

However, to evaluate the accuracy of future LCA results, uncertainty analysis on missing reliable inventory data has to be carried out. Since research on URFC is still limited to experimental analysis, researchers, engineers and industry have to work hard to develop valuable documents that could help LCA practitioners carry out reliable life cycle inventory, collecting and identifying representative data on URFC manufacturing and end-of-life treatments.

Funding

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Posters

Decarbonising heat-grids through interactive decentral prosumers

Alina Anapyanova

Decarbonising heat-grids through interactive decentral Prosumers

Problem impulse:

Integrating decentral renewable heat energies into new and existing heat grids creates significant potential in achieving climate neutrality and achieve sustainable development goals: ***SDG 7 , SDG 11, SDG 12, SDG 13.***

However, the process of decarbonisation in the building sector and heat-grids in Germany lacks momentum, innovations in technology and business models do not currently prevail.

Heat-supply strategies have thus to be reconsidered due to the current gas supply-shortages in the context of Ukraine-War and the Climate Crisis.

Research context:

A clear regulatory framework for a collaborative heat supply through decentral Prosumers in heat grids is missing.

Suitable Business Models for Prosumer-Heat grids in Energy-Communities are needed.

Conflict of interests arises between the current Business Modell Heat Grids Operators and integrating potential decentral renewable Heat Sources/Prosumers.

Business and Organisation Models have to be planned in cooperation with the Electricity Grid Operators (flexibility-services).

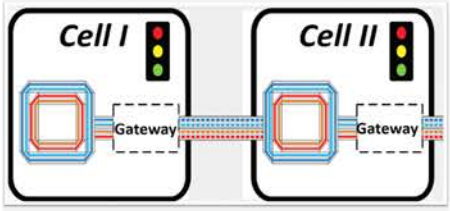
Due to the geopolitical crisis resilient energy systems should be designed responding to external and internal shocks.

Context needs:

*How to foster the **transformation-potential** for Energy-Communities through regulatory adjusments and economic incentives?*

*How to create **suitable technical and economic framework** or decentral renewable energy prosumers in existing heat grids (with **sector-coupling** utilities)?*

*How to design **cellular heat-grids**?*



Graphics: Meyer, 2022 (Interactive Heat Grids)

Research methods

- Actor-oriented approach based on the homo oeconomicus institutionalis
- Field research (interviews, monitoring of project implementation)
- Research follows an interdisciplinary orientation (law, economics, technology)
- Delta-Analysis helps to assess the status quo constellation from an "ideal state" perspective.
- Theory of Change allows a visioning of change (Activities-Output-Impact Assessment).
- Multi-Level Perspective Analysis analyses different dimensions and aspects influencing the successful implementation of Prosuming-Innovation in Heat Grids.

Assessment criteria:

Climate neutrality

Integrating renewable heat sources and prsoeumers allows a new potential for decarbonisation of heat-grids (solar thermal, waste heat, geo thermal energies).

Energy eficiency

Integration of decentral heat sources often demands specific technical requirementsto be fulfilled.

Electricity-grid compatible

Peak-Shaving and Load-Shifting through the flexible use of Heat-Pumps Heat-Grids: flexible energy storage for electricity can be achieved.

Use of locally produced and renewable power for heat pumps allows for a further decarbonisation and energy efficiency.

Actor involvement

Role as "prosumer" offers a high potential of willingness to participate in the change.

Energy communities offer a suitable environment for a collaborative heat-supply systems with prosumers.

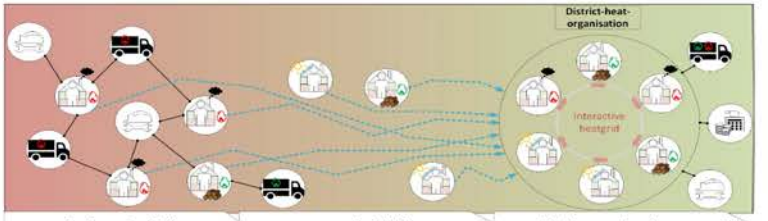
Resilient

Diverse energy sources can foster resilience (also in times of geopolitical crisis).

Integrating decentral renewable heat sources has to be balanced with a goal of a stable energy supply.

Research question:

What adjustments to organizational and regulatory framework conditions are recommended with regard to the goal of climate-neutral integration of decentralized heat sources and storage systems into heat-grids?



Graphics: Meyer, 2022 (Interactive Heat Grids)

Alina Anapyanova, Darmstadt University of Applied Sciences
(Research group Sofia/Project s:ne: Systeminnovation for sustainable development);
Track: Climate Change and Energy (4b): Affordable and Clean Energy

5. Production, consumption and innovation

5a. Corporate Sustainability and Corporate Social Responsibility

Abstracts

CO2 as Important KPI in the 21st Century for Corporate Performance

Professor Tineke Lambooy[1,2,3], Drs. Rebecca Scholten[1]

[1]nyenrode business universiteit, breukelen, Netherlands. [2]utrecht universiteit, utrecht, Netherlands. [3]airlangga universitas, surabaya, Indonesia

Abstract

The scientific data on climate change urge for a transformation of the business models of the private sector: CO2 emissions must be avoided or neutralised. Governments can play a role in this transformation by changing the rules for the private sector. Besides that role, the private sector itself shows initiatives in introducing new business models. Institutional investors, consumers and NGOs also influence the behaviour of companies. As Lawrence Lessig of the New Chicago School argues in his 'pathetic dot theory' (1998) that law, social and cultural norms, the market and architecture (technical infrastructure), are all regulators of behaviour.

Shell, the Dutch-British oil & gas company, was ordered in 2021 by a Dutch Court to change its business model in order to reduce the CO2 emissions caused by all of its activities, including its upstream and downstream activities, by 45% by 2030.The figure of 45% relates to international scientific predictions as to what is necessary in terms of reducing CO2 emissions in order to stay within the internally agreed-upon Paris limits. Subsequently, Shell changed its strategy and communicated new CO2 targets, i.e. different from the targets it had published in the previous years.

In this paper, data are collected from Shell's and several other European oil & gas companies in their public communications concerning their CO2 emission goals. The focus of the paper limits the research to the years as of 2016, i.e. the year after the Paris Agreement was agreed upon. An analysis is made concerning the KPI CO2: did corporate targets change in the years 2016-2021 and (how) were such targets subsequently achieved? What is the motivation presented by such companies for changing their targets? Was any explanation provided for not reaching targets? if that was the case? Did any laws or court cases influence this?

The methodology is doctrinal combined with a comparative case study analysis. The data are collected from publicly available information such as annual reports, shareholders' communications and the companies' websites. Finally, the pathetic dot theory of Lessig is applied to reflect on the regulators of any changes found concerning the KPI CO2 in the communication by the selected companies.

Track

Track 5a Corporate Sustainability and Corporate Social Responsibility

Economic Assumptions Informing the Climate Change Scenarios of Australian Corporations

Ms Angela Bruckner[1], Dr Sebastian Thomas[2]

[1]University of Melbourne, Melbourne, Australia. [2]Curtin University, Perth, Australia

Abstract

Climate change is a major threat to businesses due to physical impacts of extreme weather and long-term environmental change and the regulatory and financial risks associated with carbon pricing, insurance costs, and the potential for corporate assets to be stranded. Increasingly, company directors are being held liable for these climate risks in corporate strategy. In response to pressure from shareholders and regulators, firms are considering how best to identify, evaluate, and disclose the commercial risks of climate change to their businesses.

The Taskforce on Climate-related Financial Disclosures (TCFD) has recommended that corporations publish a number of disclosures designed to inform investors and other interested stakeholders of the corporation's exposure to risks relating to climate change. One key recommendation is that corporations undertake scenario analysis against climate scenarios, including (at a minimum) a 2-degree scenario. However, the TCFD has identified scenario analysis as the recommended disclosure with the lowest level of implementation by organisations. Among the top 100 publicly listed companies in Australia, by 2019 only 10 of 72 firms operating in climate-exposed sectors have undertaken scenario analysis on either their entire business or significant segments of their operations.

This paper examines the economic assumptions underpinning the publicly available scenarios used by corporations. The results show a wide variety of climate-related scenarios and targets, and scenarios in which underlying assumptions have been modified to better suit corporate circumstances. Some scenarios may overstate future economic growth rates over the medium term, and many analyses explicitly exclude potential economic impacts of climate change. Although there is evidence of some degree of corporate engagement with scenario analysis, there is insufficient transparency regarding the assumptions drawn from publicly-available scenarios, with implications for the comparability of these corporate disclosures. There is also little evidence that engaging in scenario analysis has influenced the long-term strategy of the companies considered.

Track

Track 5a CSR and sustainable entrepreneurship

Managing Sustainability in Arts and Culture Organisations: The journey of Nottingham-based SMEs as change actors

Dr Ana Rita Domingues, Dr Muhammad Usman Mazhar, Ms Sarah O'Boyle, Professor Richard Bull

Nottingham Trent University, Nottingham, United Kingdom

Abstract

Arts and culture organisations play an essential role in society as educators, places to maintain and share values and social interaction. Even though arts and culture organisations are associated with significant impacts on the environment, society and economy, they are rarely considered in corporate sustainability research. Arts and culture organisations can be active actors in education for sustainability and drivers of change by empowering individuals and groups. They also play an essential role in the journey to decarbonise and decolonise the art world. The present research aims to understand better the experience of arts and culture organisations on corporate sustainability. It identifies drivers and barriers to implementing sustainability strategies and management systems and the crucial role of leadership and sustainability champions in organisational culture for sustainability management. This study conducted survey questionnaires and semi-structured interviews with key stakeholders in arts and culture organisations based in Nottingham, England. Art galleries, theatres and museums are used as case studies. Qualitative data was collected and analysed through content analysis. Internal documents and regulations were analysed to critically understand how the external socio-political and legal context impacts arts and culture organisations. Findings show that organisations supported by Arts Council England must account for their carbon equivalent emissions, which influences their chances of receiving funding. The socio-political context has significantly impacted their engagement in sustainability-related initiatives to guarantee access to resources. The internal culture and leadership in line with sustainability values play a crucial role in adopting changes to improve primarily environmental and economic performance. However, changes are primarily cosmetic, not involve transformational changes. Actions rarely result from a sustainability strategy or policy and are not supported by a sustainability management system. Some sustainability principles in arts and culture organisations mainly result from funding requirements and leadership and organisational culture for sustainability management. The proposed contribution relates to this year's ISDRS Conference theme by addressing how sustainable development is managed in arts and culture organisations. Specifically, it addresses how the traditional mention of sustainable development as ecological, economic and social dimensions is being interpreted across arts and culture organisations and its implications for society. The present work especially relates to the SDG 9 Industry, Innovation and Infrastructure (mainly, target 9.4) and SDG 12 Responsible Consumption and Production (particularly, target 12.2, 12.5,12.6, 12.7, 12.8).

Keywords: Sustainability strategy, Sustainability management system, SDGs, SMEs

Track
Track 5a CSR and sustainable entrepreneurship

Sustainability in Public Institutions in Germany: Enablers and barriers to organisational change in cultural production and basic services organisations

MA Coco Klußmann

Technische Universität Dresden, Dresden, Germany

Abstract

L'art pour l'art as credo for the production of a high cultural good (such as theatre) is still a prevalent idea, whereas a public basic service organisation (such as a wastewater plant) is supposed to be naturally sustainable. But what happens, if you introduce ideas of sustainable development into the very veins of such organisations? As part of a city-wide project "Future City", a theatre and a wastewater plant took part in the transition experiment "venture sustainability" in 2020/21 and their process has been researched in a qualitative case study. For this, expert interviews have been conducted with opened ended guideline questions, which has been triangulated with participatory observation.

The fact that art can catalyse sustainable development by i.e. artful (education) practices or content that is related has been well discussed in existing literature. On the other hand, dealing with wastewater is in itself a sustainable practice, directly related to SDG 6. Complementary this, I will argue, that introducing ideas of sustainable development to an organisation, is foremost a social innovation to that respective organisation's culture. Regardless of the instrumental potential or the "product" that is produced (be it high culture or basic service) or the fact that public institutions should be aligned with governmental governance concepts (such as the SDG), this comes rather as a shock to an organisation, as existing structure, procedures and practices of resources' allocation are under suspicion to be contested. So, to answer the question how and with which force such an innovation can be introduced and eventually woven into existing organisational structures, the involved actors' power struggle top-down and bottom-up has to be traced. Resolving this power struggle is a question of the organisations' identity involving the specific mode of (co-)management and respective imaginaries.

This abstract directly tackles SDG 16.7. as it investigates the process of responsive, inclusive, participatory decision-making of the involved organisations. Indirectly, SGD 12.2./12.5./12.8. are included in the process of the theatre and SDG 6.5. in the wastewater plant's process.

This abstract relates to the conference's topic in the way that it sheds light on art in the sense of the cultural industry, taking into account that art is not only a small scale "nice to have" that can be made use of as a vehicle or medium for sustainable development. Art as part of cultural institutions such as public theatres are an essential part of a society's communication and education system and thus are less "free" and easy to make use of as they are sometimes supposed to be when considered as "just making arts".

Track
Track 5a CSR and sustainable entrepreneurship

Sustainability Leadership of Social Entrepreneurs: The Driving force for sustainable development

Ms. Reeti Kulshrestha, Prof. Arunaditya Sahay

Birla Institute of Management Technology, Greater Noida, India

Abstract

The leadership is increasingly coming under the radar for being at the centre stage of driving the planet, people, and profit sentiment. Sustainability is the new strategic imperative that has caught momentum and the responsibility lies with the leadership to address the socio-economic-environmental sustainability at its core. Sustainability is no longer a buzz word but has become an essential part of national, community and corporate life. Right leadership is required at every level, especially at the top of the organization. Of late, social entrepreneurs have become the frontrunners in this sustainability movement. We find the traditional and social entrepreneur to be working on opposite directions causing socio-economic tensions. In either case, sustainability leadership is needed. While the traditional business is well researched with regard to sustainability leadership, little research has been conducted to look into the sustainability leadership of social entrepreneurs. It, therefore, becomes important to explore how social entrepreneurs practice sustainability leadership and achieve sustainable development goals.

Our paper brings in a new perspective by examining the work carried out by social entrepreneurs applying the 5I model of sustainable leadership (Mazutis and Abolina, 2019) that focuses on the five critical leadership tasks namely inspirational work, integrative work, identity work, implementation work and institutional work. Collecting data from five social entrepreneurs using semi-structured interviews, we illustrate how their work leads to sustainable development thereby contributing to the SDG goals.

Keywords- Sustainable leadership, sustainability, social entrepreneurs, sustainable development goals

Track
Track 5a CSR and sustainable entrepreneurship

Sustainability Management Initiatives in Non-Profit Organizations: An integrative review

Susana Trindade[1], PhD Fellow Natacha Klein[1], Prof. Dr. Tomás B. Ramos[2]

[1]CENSE–Center for Environmental and Sustainability Research, Department of Environmental Sciences and Engineering, NOVA School of Science and Technology, NOVA University Lisbon, Campus de Caparica, Caparica, Portugal, Costa da Caparica, Portugal. [2]Universidade Nova de Lisboa, CENSE, Center for Environmental and Sustainability Research, Costa da Caparica, Portugal

Abstract

Non-Profit Organizations (NPOs), also called "third sector" organizations, have an increasingly important role in society, especially in the current global changes context, including the pandemic situation and the new environmental, health and socio-economic challenges. The Social Economy sector is characterized by being a considerable contributor to national income and expenditure, as well as a significant employer. These institutions provide various human services, from health and education to social and community development services helping children, young people and families, supporting social and community integration and providing assistance to the elderly and disabled. Most of the time, they fill a gap in many areas that the governments don't provide. As for the environment, there is no country that is not experiencing the drastic effects of climate change. It is important to use the environment and its resources rationally and protect the Earth. Governments, the corporate and private sector, as well as the third sector must be on the same page to overcome these challenges. NPOs have been studied from different perspectives including the financial, managerial, leadership, social impact, performance, marketing, procurement, innovation perspectives. However, there is a general lack of knowledge on their sustainability practices and strategies at the organizational level. Consequently, this research aims to provide a systematic overview and analysis of existing sustainability management initiatives in NPOs. The research method was a systematic and extended literature review involving academic and non-academic contributions on organizational sustainability and NPOs found through international scientific databases, in particular, Scopus, Web of Science and google scholar. A qualitative content analysis was conducted to explore the selected documents. The results of this research are now being analysed, but preliminary findings showed that the literature covering organizational practices and strategies in NPOs is still limited.

Keywords: sustainability; non-profit organizations; third sector; management, practices; strategies; literature review

Track
Track 5a CSR and sustainable entrepreneurship

Full papers

Corporate Governance and Non-financial Disclosure: A bibliometric and critical review

Naciti Valeria[1], Pulejo Luisa[2], Rupo Daniela[3]

[1]*University of Messina, valeria.naciti@unime.it*
[2]*University of Messina, luisa.pulejo@unime.it*
[3]*University of Messina, Daniela.rupo@unime.it*

Abstract

The Sustainable Development Goals set out in the 2030 Agenda have the merit of having introduced an expansion of the concept of sustainability, no longer focused exclusively on the environmental dimension, but on a set of conditions that are fundamental for the pursuit of the general well-being of the community. In this context, the pursuit of sustainable economic growth can no longer be considered a slogan for companies to propagate. It now represents a binding objective, the concrete realization of which requires the integration of sustainability in the process of defining corporate strategies and the adoption of transparent and comprehensive accountability tools. In the recent years, in the context of reporting problems related to sustainability, there have been numerous legislative interventions and contributions from the scientific community that have determined an expansion of the information content of the traditional economic and financial reporting prospectuses produced by companies. Despite the critical issues still present in relation to the Corporate Sustainability Disclosure, virtuous paths have also been outlined by companies that are increasingly aware of the social role they play in the current economic context, of their social responsibility (CSR) for results and impacts deriving from the actions carried out and the values that guide the choices of economic governance. For companies that aim to compete on the market the adoption of "socially responsible" behaviour and the promotion of best practices today appears to be an obligatory and no longer voluntary choice. This awareness has favoured the use of tools, first the social report, capable not only of feeding the control system, accounting for the sustainability of the actions carried out and representing and communicating the "social value" generated but also, to foster dialogue with its stakeholders and obtain their consent and, finally, to support decision-making processes and to guide government decisions. The paper intends to examine the link between corporate governance and non-financial disclosure by means of a bibliometric analysis, a theoretical research method of a quantitative nature that allows identifying the most relevant scientific contributions, defining specific research areas and their interconnections, and therefore identifying the main research trajectories of the investigated topic, thus highlighting the different paths that scholars have taken in the past to connect the area of corporate governance with that of non-financial reporting. From the analysis emerges that with or without legislative obligation, the recognition of social responsibilities in the company is essential to outline the position and value of the same in the territorial, political, and social system with which they interact. There is more. It can be seeing more and more clearly how a progressive convergence is developing between processes, tools, and models of voluntary and mandatory disclosure. And how the process of institutionalization of non-financial reporting practices is inextricably linked to the profiles of governance.

1 Introduction

The evolution of corporate governance and management models, as well as of measurement and reporting tools, can contribute to meeting the social and environmental expectations of stakeholders, combining where possible the improvement of income performance. Furthermore, the social dimension of corporate responsibility, which involves stakeholders in defining the lines of action ¬and forms of communication (so-called stakeholder engagement), must also consider the potential for new environmental and social dissemination initiatives.

In this context, non-financial information is destined to become one of the most widespread tools, through which information is disseminated to business interlocutors, useful for evaluating the concrete commitment of the company in the social dimension (Ho, 2020). This business-environment communication system requires structural and coherent relationships between the corporate mission and corporate governance and constitutes an integral element for its management, according to a logic of coordination in which the mission makes the corporate purpose explicit; corporate governance identifies the corporate governance structure, and the declared social responsibility represents the information objectives (Naciti, 2019).

Furthermore, governance control contributes to the creation of value improving the quality of external information, including the use of voluntary information, thus helping to reduce the information asymmetry between those who participate directly in the management and those who are excluded from it.

The quality of non-financial reporting and its consistency with actual practices are also strongly linked to corporate governance (Poddar et al., 2019). Indeed, it defines principles, rules and procedures that influence the way in which a company is managed, administered, or controlled by managers in the interest of investors. Corporate governance is therefore linked to CSR as it aims to create value for both shareholders and other stakeholders (Morhardt, 2010). In this direction, the new provisions of the Directive are orienting corporate conduct towards greater dialogue with more stakeholders and introducing new structures and mechanisms of corporate governance.

In this interpretative framework, the last part of this monographic work intends to examine the link between corporate governance and non-financial reporting by means of a bibliometric analysis, a quantitative theoretical research method that makes it possible to identify the most relevant scientific contributions, define specific research areas and their interconnections, and therefore identify the main research trajectories of the topic investigated.

Following the methodology proposed by Van Eck and Waltman (2010), in this section we proceed using text mining and clustering analysis based on the co-citation of the literature in the years from 2016 to 2021. This methodology allows us to identify the main theoretical blocks of the field studied, revealing the type and intensity of the connections existing between them, thus bringing to light the different paths that scholars have taken in the past to connect the area of the corporate governance with that of non-financial reporting.

This study essentially consists of a three-stage analysis process: the first step concerns the acquisition of data, including the search for those of a bibliographic nature. The second phase consists of the examination of the items (publications) obtained using a specific software (VOS Viewer, the potential and analysis tools of which will be described below). Finally, in the last phase, the conclusions of the research are converted into networks analysis that can be further interpreted.

Quantitative analysis using bibliometric indicators and a database of citations returns important information on the values relating to the impact of each scientific contribution published by the relevant scientific community. In this sense, ¬bibliometric analysis can be used to identify research gaps and provide guidance for future investigations on the topic. Additionally, bibliographic data is used in this type of analysis to establish internal links in the literature, analyse citation and co-citation levels, and algorithmically discover clusters.

2. Research design

2.1 Data selection

Data selection follows the five principles proposed by Kipper et al. (2019) and the bibliometric procedures he explained in order to obtain the datasets.

The first criterion concerns the selection of the database, it is carried out among all the best known and complete ones: Web of Science (WoS), Science Direct, Scopus, Medline and Embase. However, database coverage is a key priority in this study to unravel the evolution and conceptual structure from previous literature investigated in the two most cited databases such as WoS and Scopus. Therefore, the same search strings were used in the two databases and, finally, the database containing a greater number of publications than the other, namely Scopus, was selected. The latter is periodically updated with entries of articles from thousands of international publishers, subjected to peer reviewing processes: in fact, more than 2300 Open Access are indexed, and it is possible to export metadata and publications belonging to different research fields.

The second criterion concerns the choice of the time interval: this study proposes as a time reference the years following the issue of Directive 2014/95 / EU on non-financial reporting obligations. The third criterion relates to the accuracy of the search terms to be selected: corporate governance, integrated reporting, non-financial disclosure, social reporting, sustainability reporting, environmental reporting, social accountability, voluntary disclosure, mandatory disclosure. Each search term has been quoted in order to apply the logical operators "AND" and "OR" to refine and extract the search results. The fourth criterion concerns the selection of the type of documents. Scientific articles are predominantly favored by researchers. In this procedure, the filters made available by the database are used.

Finally, the last criterion concerns the selection of bibliometric software: in this regard VOSviewer to other software since it provides a clear visualization of the data and has a high compatibility with the metadata

2.2 Methodology

With the rapid advancement of data mining, information analysis, and graph rendering technologies, it is now possible to evaluate huge volumes of literature data using software programs and to "express" the data through its visualization. In this study, the VOSviewer software was used , it is a software that allows you to create and view econometric networks, allowing you to identify the main topics that have been treated in the past (keyword analysis), the most cited papers in our sample (citation analysis), the studies that were most cited by the papers of the sample monster (co - citation analysis), journals , authors, organizations that appear more frequently in the literature.

Basing ourselves on keyword analysis, the frequency with which a topic appears in the literature, as well as the co - occurance models, reflects the importance of the same. The size of the circle (node) indicates the number of times the keyword has appeared, and the colors denote which cluster it belongs to. In simple terms, the importance of a keyword is only the frequency with which it appears in publications. The strength of the connections between two key words, say i and j , is the number of elements, each of which contains both key terms in the title, abstract or list of keywords.

This approach, called unified, groups the data based on both the distance and the strength of the relationship between the nodes, with the following term reduced to a minimum:

$$V(x_1, ..., x_n) = \sum_{i<j} s_{ij} d_{ij}^2 - \sum_{i<j} d_{ij}$$

where sij denotes the strength of the association between keywords i and j calculated from:

$$s_{ij} = \frac{2mc_{ij}}{c_i c_j}$$

where ci is the total number of co- occurance of keyword i with all other keywords so that:

$$c_i = \sum_{i \neq j} c_{ij}$$

while m denotes the total number of occurrences for all keywords so that:

$$m = \frac{1}{2} \sum_i c_i$$

Note that ½ in the equation removes the double count between c ij and c ji .

$$d_{ij} = \begin{cases} 0 & \text{if} \quad x_i = x_j \\ 1/g & \text{if} \quad x_i \neq x_j \end{cases}$$

3 Results

3.1 The sample: descriptive analysis

Following the above criteria, 411 articles were identified, with an average of 9.04 citations per article and an h-index of 30.

Figure 1 shows the total number of publications between 2016 and 2021, more precisely all the articles published up to September 2021. It is evident that the theme of corporate governance and non-financial reporting has refined over time. In fact, in 2016 the number of published articles was rather low (34), subsequently, the scientific community has intensified the interest on ¬the subject, enriching the debate with a growing number of publications. The peak is in 2019 with 93 publications. It should be noted that the trend of publications decreases from 2019 to 2021, in fact in 2020 we record a decrease of 8.61%. This could be due to the impact of the Covid-19 pandemic on scientific publications in this area. The urgency to fight the virus has in fact pushed researchers and scientific journals to disseminate studies on the Covid-19 topic much faster than normal and with free access, thus cutting out studies that did not address these issues.

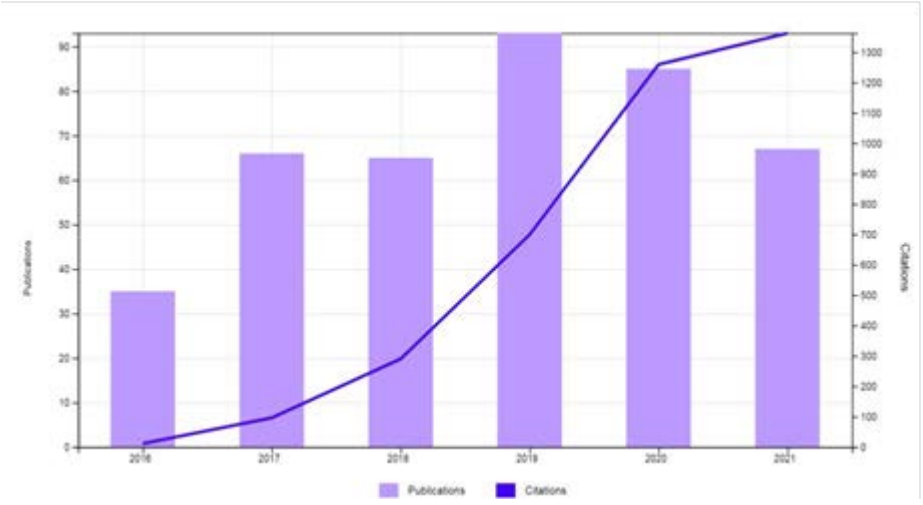


Figure 1. *Trend of publications and citations*

Table 1 shows the top ten countries with the highest number of articles published. The top three contributors in terms of publications are the United States of America (49), England (48) and Italy (40). Interestingly, the remaining publications from other countries (Australia, Malaysia, Spain, the People's Republic of China, South Africa, Tunisia and Indonesia) provide a lower academic contribution. This may be linked to the lack of knowledge and dissemination of the topic together with the non-mandatory application of environmental standards, as well as the importance assigned to the reporting system at national level.

Table 2 shows the research institutes that have published a minimum of five articles. Compared to table 1

they have more articles and citations. The reason for this is that any single American research institute has no more than three articles. The top ten affiliations contribute 73 articles, equal to 17.8% of the total number of publications (411).

Table 1. *Top ten nations in terms of number of publications*

Country	*N. publications*	*No citations*
United States of America	49	453
England	48	507
Italy	40	656
Australia	30	365
Malaysia	30	235
Spain	28	330
China	21	135
South Africa	18	297
Tunisia	18	87
Indonesia	15	37

Table 2. *Organizations with at least five publications*

Organization	*N. publications*	*Quotes*
University of Portsmouth (England)	9	84
University of Sfax (Tunisia)	9	32
Salamanca University (Spain)	8	124
University of Witwatersrand (South Africa)	8	124
University of Auckland (New Zealand)	7	203
University of Southampton (England)	6	101
Huddersfield University (England)	6	138
Mansura University (Egypt)	5	75
King Abdulaziz University (Jeddah, Saudi Arabia)	5	22
University of Valencia (Spain)	5	74
University of Salento (Italy)	5	61

Most of the research institutes with the highest number of publications are located in Europe with universities in England (University of Portsmouth, University of Southampton, University of Huddersfield), Spanish (University of Salamanca and University of Valencia) and Italian (University of Valencia). Salento) with a total of 39 publications. Therefore, there is a concentration at European level of institutions that study aspects related to corporate governance and non-financial reporting. This is attributable on the one hand to the similarity of the legislation of European countries, on the other to the fact that, recently, the Brussels Commission presented a legislative proposal to modify the Directive on non-financial reporting. The new legislation that derives from it, the Corporate Sustainability Reporting Directive (CSRD), is aimed at expanding the number of companies that must comply with the Directive; this indicates that in the coming years, European research institutes will increasingly address the issue of non-financial reporting as a necessary condition for regulatory compliance.

Among the non-European institutions, the University of Sfax in Tunisia stands out with 9 publications, the University of Witwatersrand in South Africa with 8 publications, the University of Auckland in New Zealand with 7 publications, the University of Mansoura in Egypt with 5 publications and King Abdulaziz University in Jed dah, Saudi Arabia with 5 publications.

Table 3. *Authors who have published at least four documents*

Authors	*N. publications*	*No citations*
Hussainey, Khaled	8	60
Raimo, Nicola	7	102
Vitolla, Filippo	7	102
Ntim, Collins G.	6	138
Maroun, Warren	5	115
Ruby, Michele	5	102
Agyei-Mensah, Ben Kwame	4	40
Jarboui, Anis	4	36
Pizzi, Simone	4	61
Rodrigues, Lucia Lima	4	87
Velte, Patrick	4	138

Table 3 shows the authors who have published at least four research contributions. The authors do not present in the list have not reached this minimum threshold and therefore it is believed that the scientific research disclosed does not have continuity of themes and temporal references. This affects the current progress of research and the evolution of corporate governance and non-financial reporting issues: where some authors still have a single publication, it is believed that particular attention is lacking on the topic, which translates into an attention gap that it is expected to increase in the years to come. The authors who submit at least 4 publications are all university-educated, which demonstrates that the interdisciplinary link between scholars other than the university (non-university research bodies and, in particular, bodies responsible for defining the regulatory framework ¬and of reference self - regulation). In this perspective, it is noted that instead it would be desirable, in the opinion of the writer, for the research to arise from an interrelation between scholars of the problem and those who are responsible for issuing regulations, guidelines on non-financial reporting and academics.

Table 4 shows the top ten journals in terms of publications on the topic ¬. Relating the number of citations to the number of articles disclosed in column 3, we read that Business Strategy and the Environment has the highest number of citations (276), followed by Corporate Social Responsibility and Environmental Management (239), Corporate Governance the International Journal of Business in Society (192) and Meditari Accountancy Research (123).

Table 4. *Top ten journals in terms of the number of publications*

Journal	*N. publications*	*Quotes*
Sustainability	18	94
Corporate Governance the International Journal of Business in Society	15	192
Journal of Financial Reporting and Accounting	15	32
Business Strategy and the Environment	12	276
Journal of Applied Accounting Research	12	88
International Journal of Disclosure and Governance	10	43
Journal of Management & Governance	10	70
Corporate Social Responsibility and Environmental Management	9	239
Journal of Accounting in Emerging Economies	8	72
Meditari Accountancy Research	8	123
Accounting Research Journal	7	23

From the analysis of the journals, it emerges that the scholars' approach to the theme of corporate ¬governance and non-financial reporting is multidisciplinary and develops along two main lines. The first concerns highly specialized journals on the topic of environmental sustainability (Sustainability, Business Strategy and the Environment, Corporate Social Responsibility and Environmental Management), while the second concerns journals that investigate the profiles of Corporate Governance and Accounting (Journal of Financial Reporting and Accounting, Journal of Applied Accounting Research, International Journal of Disclosure and Governance, Journal of Management & Governance, Journal of Accounting in Emerging Economies, Meditari Accountancy Research and Accounting Research Journal).

This result testifies to the orientation that has been developing in recent years to consider the issue of so-called non-financial reporting as an integral aspect of financial reporting, therefore not as something subsidiary to the latter, but as a reporting area intended for dialogue and interconnect with traditional financial reporting.

3.2 Data processing and network analysis results

The program used for bibliometric analysis allows you to conduct network analysis. Thanks to a software potential that allows you to create and view bibliometric maps, VOSviewer it can in fact be used to build maps of scientific journals or authors using co-citation data, as well as keyword maps based on co-occurrence data. The software uses a specific mapping technique to create clusters.

3.2.1. Keyword analysis co-occurrence

The keyword co-occurrence network analysis determines which terms were frequently used in the sample papers. This type of analysis helps to understand what kind of topics and ¬problems scholars are most interested in. The VOSviewer creates a map, with the distance between the terms taken as an indication of the relatedness of the various keywords. The more two or more terms appear to be related, the smaller the distance between them. Co-occurrences in the articles were examined to establish the correlation of terms

Figure 2 shows the keyword co-occurrence network map, where the numerous keywords linked together by various lines are presented.

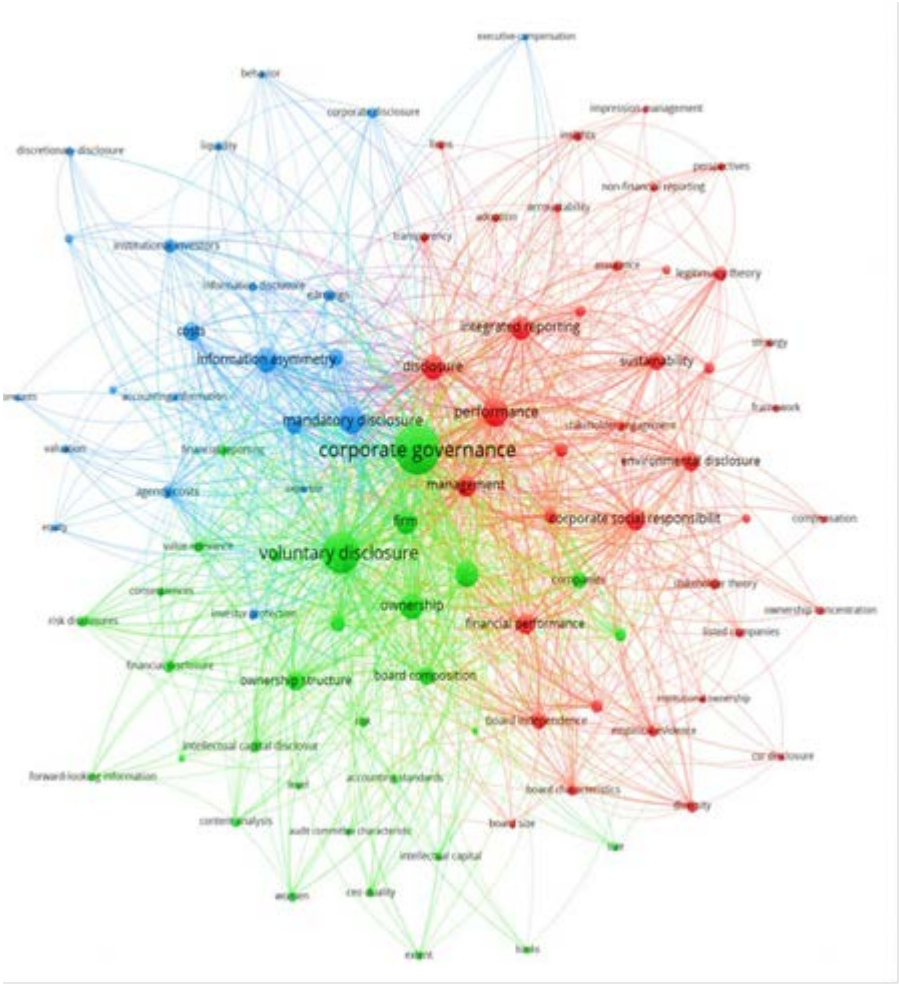


Figure 2. *Keyword co-occurrence network map*

The lines indicate that these crucial headwords appeared together in multiple items. Thus, the terms that have been used most often indicate that more searches have been done in certain areas (Table 5).

Table 5. *Top ten key words in terms of frequency*

Rank	*Keyword*	*Frequency*
1	Corporate Governance	333
2	Voluntary disclosure	220
3	Performance	123
4	Mandatory disclosure	95
5	Ownership	86
6	Board of directors	85
7	Information asymmetry	78
8	Integrated reporting	72
9	Corporate social responsibility	62
10	Financial performance	53

The keyword co -occurrence network map (Figure 2) shows three main clusters, which can be distinguished by their colours: “red cluster”, “green cluster” and “blue cluster”. Although the results of the keyword cluster analysis suggest that the clusters should be considered formally separate, in the corporate literature the topics addressed by the two groups of publications are logically linked and strongly connected.

Starting from the red cluster, we see words such as corporate social responsibility, performance, accountability, integrated reporting, disclosure, environmental disclosure, stakeholder theory, sustainability, non-financial reporting, etc.

The basic assumption of CSR is the concept of accountability, i.e. the ability to communicate one's social commitment to the vast audience of stakeholders, as well as to shareholders in a complete and transparent way. The analysis shows that in recent years, many scholars have focused their attention on the profile of CSR and sustainability reporting, which has now become the subject of transversal and multi- form investigation. In particular, the previous research has addressed the need to give an account to the stakeholders of the results achieved as well as the wider impact of a different nature that their activity determines on the reference context, and today we can affirm that the growing diffusion of the social responsibility tools to which we are witnessing is due to the progressive recognition of CSR by companies operating in various sectors and geographical contexts (Kolk, 2008).

Furthermore, in the red cluster the significant importance of integrated reporting issues becomes evident, in close connection with the disclosure and performance aspects. These three keywords make up the largest nodes in the cluster. It should be noted that this strong link finds clear explanations in terms of the research results developed in the last six years:

on the one hand, the flourishing of studies and experiences on integrated reporting is fuelled by the recognition of the standard for the purpose of the regulatory obligation of non-financial disclosure;
on the other hand, the most recent studies are particularly aimed at investigating the link between financial performance (financial performance is another relevant issue) and CSR performance. Among other things, the issue of disclosure is significant for judging the quality of reporting and at the same time represents, in many studies, an attribute that enters the metric used to estimate non-financial performance (level of disclosure as a proxy of the level of social performance).

As widely discussed in Chapter 1, in addition to having a purely economic dimension, the company's activity also has a socio- ¬environmental dimension that impacts on the reality of various actors, that is, the stakeholders. Furthermore, through its strategic-reflective role, the communication function has a greater effect on corporate behaviour than in the past.

Through a high degree of coherence and synergy of all corporate communication initiatives, external expectations, as well as management and production actions, the corporate reputation is in fact strengthened. Non-financial reporting therefore assumes the dual significance of being an effective tool for informing company policies in terms of enhancement and protection of human, natural and social resources,

a corporate management image that has the consent of the community, enhancing reputation, which is critical to generating the company's broader public trust.

From the bibliometric analysis, another research topic emerges relating to the mechanisms of corporate governance, sustainability and environmental disclosure (the green cluster in Fig. 2). There are two main reasons for thinking that corporate governance mechanisms are important for environmental performance. First, substantial investments and long-term strategies are required for sustainability of performance, and this implies a major impact on the capital structure and profitability of the company. Secondly, the natural environment requires multiple ¬levels of coordination, both at the organizational level and involving the entire supply chain and other stakeholders. Therefore, governance becomes more applied to a broader form of monitoring of business activities that includes the impact on the environment and on society.

This additional aspect often arises in response to stakeholder requests and can potentially create tensions and conflicts between shareholders, boards of directors and CEOs, as it requires them to take on corporate responsibilities in a new way (Rao and Tilt, 2016). The benefit that derives from the adoption of eco-friendly strategies in the corporate context is represented by the so-called sustainable profit.

Sustainable profit is linked to the creation of direct economic value; therefore, the practice of enhancing environmental impact has become increasingly widespread. Therefore, pushing companies to adopt sustainable strategies does not only mean embracing ethical responsibility, but rather the positive returns that derive from it in terms of economic performance, organizational efficiency, competitive capacity and reputation improvement make it particularly attractive. Consequently, it is clear that sustainability can become an integral part of governance strategies by being part of the analysis of best practices. The difficulty of quantifying spill overs in real terms of sustainable strategies is due to the nature of the resulting benefits, which are mostly made up of intangible assets. These elements guarantee the company the ability to create a profile based on image enhancement, product quality or brand reliability.
From this analysis it emerges that this cluster of publications is closely related to the previous one, as regards the fraction of publications relating to sustainability reporting and voluntary reporting. In fact, as expressed above, sustainability reporting allows companies to evaluate and quantify the results of sustainability strategies in general, and of CSR policies in particular, allowing a tangible quantification of the intangible benefits deriving from sustainability.

Another theme that appears, both in the red and in the green clusters, is that of the characteristics of the board of directors. In fact, the cluster shows words such as board composition, women, CEO duality, board independence, board size and diversity.

In this sense, the board of directors is understood as the most important governance mechanism within the company and therefore its composition, in terms of gender, age, nationality and professionalism of the members is considered a determinant of the organisation's performance. in general, and of sustainability strategies, in particular. Boards of directors have generally been studied as a homogeneous group and, likewise, business practice has usually overlooked the importance of board composition and its

past decade, researchers have focused on evidence regarding the role of boards, particularly their efficiency. More recently the attention to the diversity of the board of directors has increased: the corporate governance reflects a balance between the various solutions proposed within the ¬company. Indeed, according to the theory of social and psychological dynamics, within ¬the board of directors there could be compensatory effects between directors ¬belonging to (gender) minorities such as to affect the performance of a company. Many authors have found that diversity of boards of directors ¬can provide organizational benefits ranging from competitive advantages, for example, to pursue stronger marketing strategies or attract stronger human resources, to better performance. According to previous literature, diversity can be defined as the variety of the composition of the board related to observable demographic aspects such as gender, age, ethnicity, nationality, cultural background, religion and degree of independence and other less visible ¬aspects (such as education, professional experience in the sector, skills).

Finally, in the blue cluster the most frequent word, which is the only one in the ranking of the top ten keywords, is mandatory disclosure. However, the areas of investigation covered, their foundations and the research methods provided by scholars are rationally interconnected in the scientific community. In fact, the smaller number of elements displayed in the blue cluster is offset by the interaction with the red and green clusters. The focal point of the blue cluster is' mandatory reporting association and information asymmetry. As a background to this link, we coherently trace some of the most important words of this cluster agency cost. Following this interpretative scheme, the links with the theme of value relevance are well understood, intended to investigate the effects on the market of non-financial information (market effect), i.e. the response in terms of the market value of equity with respect to the disclosure of non-financial information.

In fact, in the face of poor information efficiency, greater communication is required through continuous and timely information flows to the market, which can limit opportunistic behaviour of the subject. In these uncertain conditions of contractual quality or incompleteness and moral hazard, corporate information is entrusted with the role of information and reporting functions. Communication plays an informative role when it offers the client the opportunity to make rational investment and divestment decisions in advance, in order to choose which agent to negotiate with and to what extent the level of discretion granted is compressed. On the contrary, when it offers the opportunity to verify the decision made by an economic entity (agent), it performs a reporting function. Furthermore, due to the discretion to adopt non-financial reporting standards, the various procedures envisaged for the determination of materiality can create information asymmetry and strongly question the ability of organizations to guarantee the comparability of non-financial information in the same economic sector and / or in the same reference context (Legislative Decree no. 254/2016 on non-financial reporting).

Therefore, disclosure of non-financial aspects was mostly a voluntary practice adopted by companies in response to stakeholder expectations and to gain legitimacy. However, several studies have shown that the quality of voluntarily reported information is rather poor, does not correspond to effective and responsible behavior and is a symbolic management practice.

Hence, governments and the EU have become aware of the ineffectiveness of voluntary disclosure, which results in unbalanced, inaccurate, inconsistent and incomparable information (CE, 2013). As a result, many countries have started requiring mandatory non-financial disclosures. The latest regulatory intervention refers to the non-financial EU Directive, which modifies the "soft" obligations included in the previous Directives (2003/51 / EU and 2013/34 / EU).

As reported by the same Directive, the EU promotes corporate responsibility and increases transparency which in turn promotes the trust of stakeholders (mainly investors and consumers) and, consequently, the access of companies to their resources. The EU assumes that companies comply with ESG disclosure requirements because this results in positive legitimacy and / or economic gain.

For a more detailed analysis of the evolution of the search from 2016 to the present, a separate survey was conducted on the chronological appearances of the keywords ¬. Figure 3 shows the weighted average year of occurrence of the keyword for 411 papers. From 2016 to September 2021, the transformation from blue / purple to dark green, light green and yellow shows the average years of occurrence of the keywords. The change in this time frame reflects the evolution of the corporate governance and non-financial reporting theme. Overall, it can be observed that the blue / purple cluster contains the main keywords of the previous literature: corporate social responsibility, sustainability, stakeholder theory, diversity and csr disclosure.
The green cluster highlights pioneering studies on the topic of non-financial reporting by focusing on the aspects concerning the relationships between integrated reporting, corporate governance, voluntary disclosure, environmental disclosure, information asymmetry. More recently, however (words in yellow), issues such as board composition, executive compensation, earnings, discretionary disclosure, ceo duality, equity, risks and accountability have emerged.

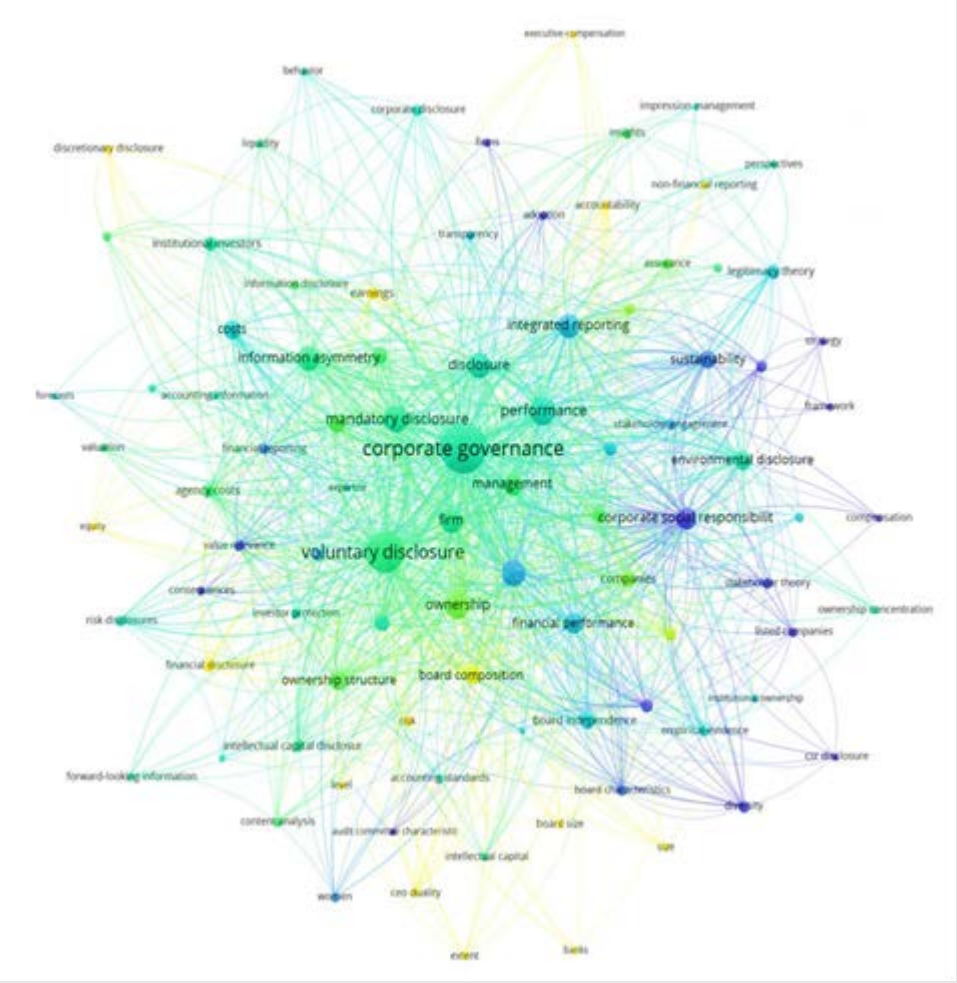


***Figure 3**. Overlay Keyword co-occurrence network map*

3.4.2. Analysis of citations

Even in the business area, the number of citations is often used to monitor the relevance and scientific effect of the research. According to De Villiers and Hsiao. Consequently, a high citation index for a research publication typically denotes that it has had or will have a major effect in the area.

Table 6 shows the most cited sample papers. The first article was published by Hussain, Rigoni, Orij in 2018. The study empirically investigates the relationship between corporate governance and the triple sustainability performance (economic, environmental, social) through the lens of agency theory and stakeholder theory. The results of this study contribute to the improvement of the ongoing standards definition process, as regards the in-depth review of the economic dimension of sustainability carried out within the GRI framework.

***Table 6.** Top five publications in terms of citations*

Title	*Authors*	*Quotes*	*Year*
Corporate Governance and Sustainability Performance: Analysis of Triple Bottom Line Performance.	Hussain N .; Rigoni U .; Orij RP	163	2018
The economic consequences	Barth ME; Cahan SF; Chen Li;	127	2017

associated with integrated report quality : Capital market and real effects .	Venter ER		
Diversity of Board of Directors and Environmental Social Governance: Evidence from Italian Listed Companies.	Cucari N .; De Falco SE; Orlando B.	111	2018
The association between integrated reporting and firm valuation .	Lee K .; Yeo GH	106	2016
What are the drivers of sustainability reporting? A systematic review.	Dienes D .; Sassen R .; Fischer J.	88	2016

In the second article by Barth et al. determine whether previous research that found a positive association between integrated report quality and enterprise value is actually true. The authors find no evidence of a relationship between integrated report quality and cost of capital but find that higher integrated report quality is associated with greater investment efficiency.

The third paper by Cucari et al., investigates the association between environmental, social and governance (ESG) disclosure and board diversity in Italian listed companies. Their research findings show that disclosure of the company's CSR is associated with the CSR of an independent director and committee. Furthermore, women on the board are negatively correlated while the age of the board is not significant.

The fourth article was published by Lee and Yeo, the authors examine the -association between integrated reporting and corporate valuation, using a sample ¬of listed companies in South Africa. They show that company valuation is positively associated with integrated reporting disclosures. According to the authors, this result suggests that the benefits of Integrated Reporting outweigh its costs.

In last position with 88 citations, we find the paper by Dienes et al. The manuscript systematically examines existing studies and analyses the drivers of sustainability reporting using a qualitative approach. The review suggests that firm size, media visibility and ownership structure are the most important factors for disclosure of sustainability reports, while corporate governance appears to have an influence only on the existence of audit or control committees. sustainability.

3.2.2 Analysis of co-citations

Co-citation analysis is a useful tool for determining the structure and evolution of a topic. We speak of co-citation when two separate publications are cited through a third article. The goal of this type of analysis is to uncover a hidden pattern of relationships with authors based on their publications, such as revealing authors who have not actively collaborated but have been referenced by other articles at the same time.

As in other network analyses, the multiple lines starting from each node reflect the co-citation frequency of the authors and the thickness of the nodes represents the strength of the co-citation bonds.

Figure 4 shows the co-citation analysis map. It is possible to observe the presence of three clusters of different colours (red, green, and blue). They are strongly interconnected with each other, in particular the blue one is grafted into the red and green clusters.

Figure 4*. Co- citation network map*

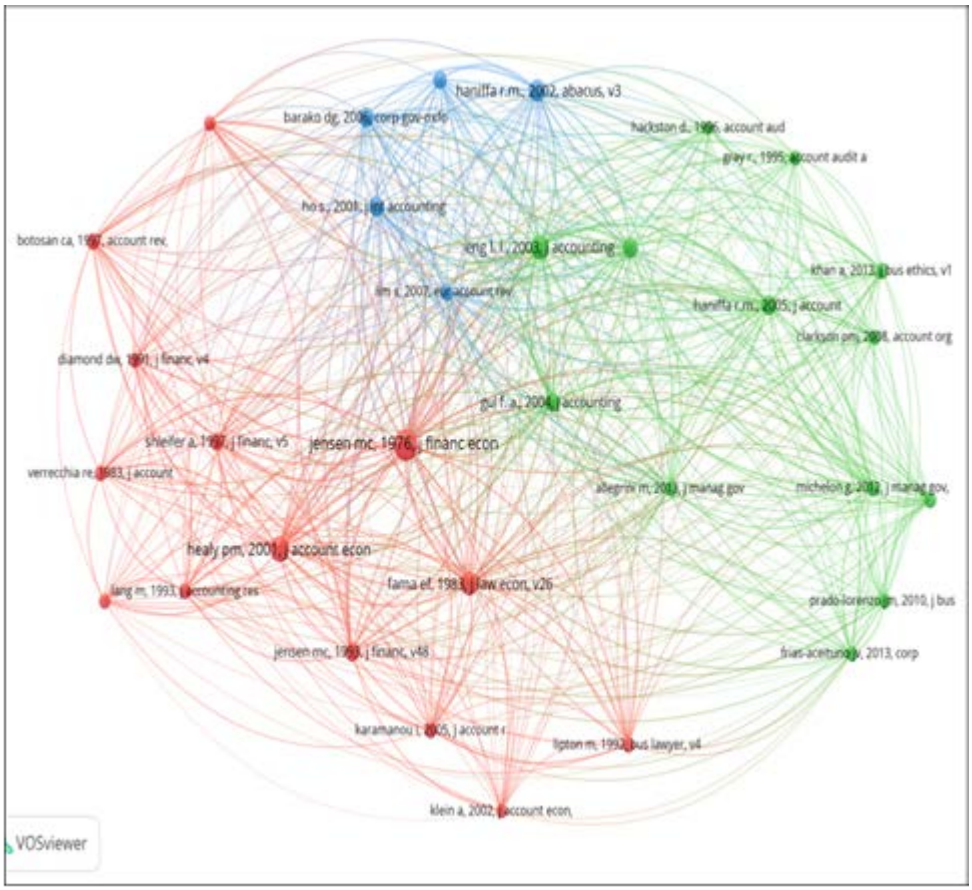


Table 7 shows the top ten most cited publications that are present in the co-citation analysis cluster. The ranking is presented in order of citation, where citation refers to the number of publications in the sample citing the paper.

Although the table is presented in order of citation, from the most cited to the least cited, it is more useful to comment on the works in chronological order (from the most remote to the most recent) to understand

Title	*Number of items in our sample that mention the document*	*Cluster*
Jensen MC, Meckling WH (1976), *Theory of the firm: Managerial behavior, agency costs and ownership structure* , Journal of Financial Economics.	163	Red
Healy PM, Palepu KG (2001), *Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature* , Journal of Accounting and Economics.	107	Red
Eng LL, Mak, YT (2003), *Corporate governance and voluntary disclosure* , Journal of Accounting and Public Policy.	97	Green
Fama EF, Jensen MC (1983), *Agency problems and residual claims* , The Journal of Law and Economics.	91	Red
Haniffa RM, Cooke TE (2002), *Culture, corporate governance and disclosure in Malaysian corporations* , Abacus.	78	Blue

Table 7 - *Top five publications in terms of co-citation*

The first study is therefore that of Jensen and Meckling (1976) - red cluster - considered the pioneering work on agency theory, which has been the theoretical basis of most accounting and corporate governance studies. The work identifies the way in which the agency problem arises, providing a definition of what they call agency relationship: " ... a contract under which one or more person (principal) engage another person (agent) to perform some service on their behalf which involves delegating some decision-making authority to the agent. If both parties to the relationship are utility maximizers, there is good reason to believe that the agent will not always act in the best interests of the principal (Jensen and Meckiling p.33). Basically, the authors analyze the contract in which the principal gives the agent the power to act on his own and clarify the possible consequences of the characteristics of this agency relationship. They verified how the person in charge (agent) has greater discretion in the choice, that more information on the principal (asymmetric information) can be used for personal gain rather than for business, and it is not entirely because the remuneration is linked to the result. of the activity. This "asymmetry of power" between the two counterparties of the contract creates an opportunistic form for the agent identified as information asymmetry and moral hazard, which can lead him to maximize his own usefulness and therefore pursue a relationship with others. Produce the so-called "agent problem ". This is the fundamental role of the corporate governance: the agency problem should be limited by corporate governance mechanisms whose execution involves agency costs.

The second, more remote, article is that of Fama and Jensen (1983) - cluster red - in their study argue that independent directors, providing both professional skills ¬and monitoring activities, can add value to the business ¬. Furthermore, according to the authors, private property should reduce agency costs because property rights are largely restricted to "internal decision makers" whose personal involvement ensures that

allocation of resources. Finally, family management should further reduce agency costs because the shares tend to be held by "… agents whose special relations with other decision agents allow agency problems to be controlled without separation of the management and control decisions. For example, family members… therefore have advantages in monitoring and disciplining related decision agents " (Fama and Jensen,1983, p 306).

The third position, in chronological order, is occupied by Healy and Palepu (2001). The authors find that voluntary disclosures are more relevant to investors than mandatory disclosures, especially when voluntary disclosure: "Firms provide disclosure through regulated financial reports, including the financial statements, footnotes, management discussion and analysis, and other regulatory filings. In addition, some firms engage in voluntary communication, such as management forecasts, analysts 'presentations, and conference calls, press releases, internet sites, and other corporate reports. Finally, there are Disclosures about firms by information intermediaries, such as financial analysts, industry experts, and the financial press " (Healy, KG Palepu , 2001. p.2).

In 2002, Haniffa and Cooke (2002) examine the importance of various corporate governance characteristics (cultural, race and education), as well as company-specific factors ¬, as possible drivers of voluntary non-financial disclosures in the annual reports of Malaysian listed companies.
Finally, the study of Eng and Mark (2003)- green cluster - which occupies the third position in terms of citations examines the impact of ownership structures and the composition of the board on voluntary disclosure. According to the authors, managerial ownership and blockholder ownership are two main governance mechanisms that help control agency problems. Their findings show that less managerial ownership and significant government ownership are associated with increased disclosure.

4. Discussion and Conclusion

Corporate governance mechanisms and non-financial reporting has increased significantly in recent years. By means of this survey it was intended to provide a first verification of the theoretical assumption in order to better understand the knowledge base of the research line investigated.
Several relational approaches based on existing publications on the topic (441 articles) were used in bibliometric analysis, including citation analysis, keyword co-occurance analysis, and co-citation mapping analysis (Waltman et al., 2010).

Several implications of the current study emerge that should be addressed. The first implication is based on a deeper knowledge of the governance tools related to non-financial reporting. From the analysis of keywords and papers in terms of citation and co-citation , it emerges that this relationship is influenced both by internal mechanisms that are attributable to the board of directors (both in quantitative and qualitative terms), to the figures of the CEO and the chairman of the board, to the audit committee and to ¬any presence of other committees (risk committee), the management incentive and remuneration policies; and external mechanisms, i.e. the action of external stakeholders other than shareholders, the managerial and outside labour market directors.

On closer inspection, the internal and external controls, and responsibilities of the board of directors are the result of interventions and recommendations aimed at supporting corporate policies based on a single environmental, social and governance (ESG) standard according to a single keyword: transparency of information favours long-term sustainable development, and it is in this context that sustainability involves multiple themes in a horizontal and complementary manner.

In addition, as the chronological analysis of keywords shows, the most recent research that addresses the issue of corporate governance and non-financial reporting seem to be interested in analysing how each component of corporate governance influences corporate sustainability practices (Michelon and Parbonetti, 2012)., strategies, and performance. Surely, these aspects should be investigated, both by addressing additional and new dimensions (for example, cultural variable in multinational companies), by analysing the interaction between individual aspects, and by studying how diversity is reflected in the formulation of communication strategies. In this sense, diversity management has been on the organization's agenda since the early 1990s, with numerous managers and scholars arguing that diversity has both a long and short-term impact on various business dimensions.

The most important elements in determining a corporate governance model capable of protecting the holders of property rights are the number of independent directors, the presence of sub-committees, the separation of offices between CEO and Chairman and, finally, the number of shares held. by the administrators. In fact, a board composed of many directors would have difficulty in coordinating its activities and would not allow the active participation of all members, thus determining ineffective monitoring action. Furthermore, the division into sub-committees increases the supervisory power of non-executives and the separation between the Chief Executive Officer and the Chairman should ensure greater independence of the administrative body. The analysis shows how all these aspects have recently been associated with sustainability practices and performance. In particular, the scholars have shown that the corporate governance structure should allow mechanisms to improve not only the financial performance of the company, but also its sustainable performance, supporting wider stakeholder participation. Additionally, lenders will be more likely to interact with companies that show greater sensitivity to sustainability initiatives. In turn, through the concept of corporate sustainability, the role of the board of directors goes beyond the idea of simply maximizing shareholder well-being, as it also includes an ethical approach to stakeholders.

Co-citation analysis revealed, most studies in this ¬field primarily base their considerations on stakeholder theory, agency theory, and legitimation theory. On closer inspection, these theories provide a snapshot linking corporate governance mechanisms and non-financial disclosure by focusing on the crucial role of the board. The board is, in fact, the main corporate decision-making body which has the task of controlling the conduct of executives and of addressing, in a balanced way, the interests of the various stakeholders through the implementation of adequate strategies and disclosure policies that embrace both financial matters than non-financial matters. However, the effectiveness and efficiency with which the board pursues its monitoring and reporting tasks strictly depends on the set of skills, competences, experiences, and

based on an adequate composition of the board of directors with regard to the diversity of its members. Indeed, men and women have different personalities, socio-cultural backgrounds, leadership styles, skills and expectations which, when properly combined, can enrich discussions and improve decision-making within the board.

Stakeholder theory, as well as agency and legitimacy theory, are certainly useful for addressing issues related to the functioning of corporate governance structures and mechanisms and their effects on reporting, but they are of less help when it comes to analysing aspects. more specific. For example, the need to transform (translate) a corporate sustainability strategy adopted at the level of the board of directors into concrete actions by the company's employees should be addressed by specific organizational theories. Similarly, how the diversity of the composition of the board affects the board's decision-making process regarding non-financial reporting appears to be an aspect that cannot be addressed by leveraging only the theories of stakeholders and agencies; rather, psychological or organizational behaviour theories might provide useful insights in this regard. This aspect can undoubtedly constitute an in-depth topic for carrying out subsequent research.

Finally, corporate governance, understood as the institutional framework that regulates the process of formulating and implementing corporate decisions, it is constantly evolving: this debate is destined to be constantly renewed, because on the one hand the issue is subject to regulatory evolution and on the other, they are the same actors to change their behaviour in order to create value.

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Evolving Purpose towards Sustainability

A maturity model on how purpose implementation enhances corporate sustainability

Fernando Ruiz-Pérez[1], Álvaro Lleó[2], Marta Ormazabal[3]

[1]*University of Navarra, Tecnun School of Engineering, Manuel de Lardizábal 13, 20018, San Sebastián, Spain.*
frperez@tecnun.es

[2]*University of Navarra, School of Economics and Business, Campus Universitario, 31080, Pamplona, Spain.*
alleo@unav.es

[3]*University of Navarra, Tecnun School of Engineering, Manuel de Lardizábal 13, 20018, San Sebastián, Spain.*
mormazabal@tecnun.es

Abstract

In uncertain times, companies face difficulties in achieving corporate sustainability. The academic literature indicates that sustainability can be achieved through the implementation of corporate purpose, but does not indicate how. In this article, we present a maturity model that, in three stages, seeks to address this question. Strategy is a fundamental aspect, especially in the early stages, and seeks to adapt the business model around the purpose. It also shows the actions for leadership to be deployed in the company until it reaches all employees. Other actions, later on, correspond to the use of human resources systems to ensure the impact of the purpose on sustainability; and the role of communication to make it all work. It also illustrates what sustainability outcomes can be expected at each stage, and what employee behaviors are affected by implementation. It is therefore not only a theoretical contribution that answers the question posed above, but a practical contribution to companies. The maturity model will help them to understand the implementation process, and the actions in it will help them to choose the right path.

Keywords: Purpose Implementation, Corporate Sustainability, Maturity Model, Focus Group, Corporate Purpose

1 Introduction

Today, companies find themselves in a precarious position for the survival of their business. We see this, for example, with the crisis of confidence among customers and governments (Hollensbe et al., 2014), the competition for resources, and the increase in competitiveness (Gartenberg et al., 2019). In addition to these economic problems, companies receive pressures to have a positive impact on the social and environmental environment (Engert et al., 2016), especially after the economic crises and the Covid-19 pandemic (Sharma et al., 2020).

Therefore, economic, social, and environmental sustainability has become a fundamental aspect for companies (Dyllick & Muff, 2016). Corporate sustainability is difficult to define, but most definitions include an improvement in economic and social performance and a decrease in environmental impacts

(Meuer et al., 2020). This is known as the triple bottom line (Bansal & Song, 2015), and this is the definition we will refer to in this paper as corporate sustainability.

Over the past 30 years, academia has produced an enormous amount of research on corporate sustainability (Feil et al., 2019). Of particular relevance is how to ensure that companies generate this positive impact in the long term (Benn et al., 2014). To this end, previous studies have pointed out two fundamental aspects: the unity of the different stakeholders around the company, and the inclusion of sustainability in the company's strategic decisions (Engert et al., 2016; Husgafvel et al., 2015; Hutchins et al., 2019).

This is no easy task (Kiron et al., 2017), and it has been pointed out that one of the main assets facilitating these two processes is corporate purpose (Dyllick & Muff, 2016; Jimenez et al., 2021). The corporate purpose is understood as the company's raison d'être (Mayer, 2020), as the objective beyond profit (Henderson & Van Den Steen, 2015). Purpose has value as a unifying element among stakeholders and is able to contribute positively to each of them (G. George et al., 2021), what connects it to sustainability.

But corporate purpose has another advantage: the entire company can be articulated around it, creating the purpose-driven organization (Quinn & Thakor, 2018). This means that the elements incorporated into the purpose are present in the company's strategy, leadership behaviors, systems, and communication, among other aspects (Lleo et al., 2019). The real power of purpose is not for companies to have it, but to live it in the daily operations (White et al., 2017), in a process known as purpose implementation (Lleó et al., 2021). It has been postulated that this implementation is necessary for the purpose to have an effect (Rey et al., 2019). The greatest impact observed in the implementation is in the behaviors of employees, because they are the ones who carry out the activities that contribute to the impact of the purpose (Lleó et al., 2021).

However, although authors have identified the various ways in which purpose relates to sustainability, *how* this implemented purpose generates sustainability has not been explored (Jimenez et al., 2021). We performed a review on how previous research have had addressed the impact of corporate purpose on sustainability, and we discovered that it is usual to relate them, but no study had delved on how purpose-driven companies achieve this sustainability (Ruiz-Pérez et al., 2022). This is why in this article we aim, based on the need for purpose implementation, to explain how to create a sustainable purpose-driven organization.

This process is long, and requires multiple actions on the part of the company (Rey et al., 2019). Therefore, we believe that the best way to address the challenge of explaining how the implementation
of purpose makes the company more sustainable is through a maturity model. A maturity model presents the evolution of a system over time in a series of maturity states (Cuenca et al., 2013). They are helpful because they guide in a process by clarifying the activities to follow (Mettler, 2011).

2 Methods

Once the need for this maturity model has been identified, it is advisable to define the scope of the model (Mettler, 2011). There are different ways to tackle this task. There are maturity models, for example, to assess strengths and weaknesses, or tools that compare the company's activities with the best practices

specific aspects or on general descriptions (Mettler, 2011). They can also be used to guide improvement initiatives and monitor progress in a pragmatic way (Iversen et al., 1999; Röglinger et al., 2012). That is, not so much looking for a picture of what the perfect company looks like, but to help understand how to move forward in a complex process (Mettler, 2011).

We aim in this research to help companies to implement the purpose to generate sustainability, so we will take this last perspective of maturity models. Wanting to facilitate purpose-driven companies on their way to sustainability, we will seek to make a model that presents the actions aimed at implementing purpose, and justifies a rationale for the emergence of sustainability consequences.

Therefore, in the model, the maturity levels will differentiate between the actions to be developed to implement the purpose and consequences of sustainability. The basic levers for implementation are strategy, leadership, systems and communication (Lleo et al., 2019), and the sustainability consequences are extracted from a previous study that defined employee sustainable behaviors and economic, social and environmental sustainability at a corporate level (Ruiz-Pérez et al., 2021).

To design the model, different authors propose qualitative approaches that are capable of capturing the complexity of maturity (Mettler, 2011), and also not to do it from a theoretical point of view, but close to those people who are applying this in their day-to-day life (Correia et al., 2017). For this reason, the development will be carried out through two focus groups.

The focus group methodology is defined as the research technique through which information is collected through the interaction of a group with the topic proposed by the researcher (Morgan, 1996, p. 130). This methodology is good for delving into how processes occur (Kitzinger, 1995). This aspect is particularly relevant to us at this stage of the research. It is also a methodology that allows for discussion among participants in order to elicit common knowledge across different contexts (Nyumba et al., 2018).

However, this restricted the selection of participants. It was not possible to choose a random sample of companies, since the topic requires knowledge of the management and strategic vision of the company. Therefore, we resorted to a selection of a specific audience that could provide the knowledge we were seeking (Nyumba et al., 2018), as recommended in these cases (Tong et al., 2007). We contacted the human resources managers of purpose-driven companies that we had assessed and had seen a high degree of implementation among the workforce.

Table 1. *Information of the focus group participants*

Position	Company size	Company sector	City (Country)
Head of Social Responsibility	50 employees	Medical services	Paterna (Spain)
CEO	100 employees	Iron & Steel Industry	Manresa (Spain)
Head of Human Resources	250 employees	Chemical industry	Tarragona (Spain)
PR & Communication Manager	unknown	Automotive	Tondela (Portugal)
Head of Social Responsibility	600 employees	Logistics	Dos Hermanas (Spain)
Head of Human Resources	250 employees	Textile	Alcoy (Spain)

Eight companies were contacted in November 2021, of which two had to leave the process due to scheduling problems. Table 1 shows the composition of the focus group participants. There is no fixed number of participants in a focus group, which varies between two people and two dozen (Nyumba et al., 2018). The most common proposal is usually between four and eight people (Kitzinger, 1995), a requirement that we fulfill.

We decided to divide the focus groups into two, for reasons of schedule and intellectual effort. The first session addressed how the levers implement the purpose; and the second how companies generate sustainability consequences. The researchers provided material in advance to the participants, reminding them of some key concepts and presenting the first activity to be done in the focus group (Tong et al., 2007). Due to the physical distance between companies, it was decided to use an online focus group modality, and participants were informed that these sessions would be recorded for later analysis.

The main biases of this methodology appear when a single individual orients the conversation with his charisma towards his opinions, or when the most shy people tend to avoid giving their opinion because it is dissenting (Mukherjee et al., 2018). To avoid these biases from the outset, the six participants were divided into two groups of three, each with a moderator and a listening researcher to assist the moderator if the discussion got out of focus. Each group was asked to brainstorm on the actions that could be taken to implement the purpose from the strategy. Afterwards, a discussion was opened in which they explained why this action was important, and at what level of maturity it was necessary to carry it out. This was done for strategy as well as for leadership, systems and communication.

Once both groups had identified the actions and had assigned them to levels through a discussion, both groups were brought together. First of all, both results were compared, looking for coincidences and opening a debate on the differences of opinion. Subsequently, the moderator pointed out aspects that
may not have appeared and the reason for this absence. This was also done by separating strategy, systems, leadership, and communication

The second day, also conducted remotely two weeks after the first, was different. Previous research, especially the mentioned previous study (Ruiz-Pérez et al., 2021), had produced a list of sustainable behaviors and three lists of corporate sustainability variables. Therefore, the brainstorming phase was not necessary and the assignment of maturity levels for the sustainability consequences proceeded directly.

3 Results and Discussion

The maturity model presents three stages of maturity of the purpose implementation:

Stated purpose: is the most immature stage of purpose-driven companies. At this maturity level, or stage, companies have defined what their purpose is and have made a public statement showing it. However, there has been no implementation throughout the company.

Initial Implementation: is the intermediate stage of maturity. At this level, the company has taken a series of actions to ensure that the purpose is lived in day-to-day actions and decisions are consistent with the

before the purpose statement. Nor do all employees have the purpose in place, and it is possible that there are still inconsistencies between what is stated and what is lived.

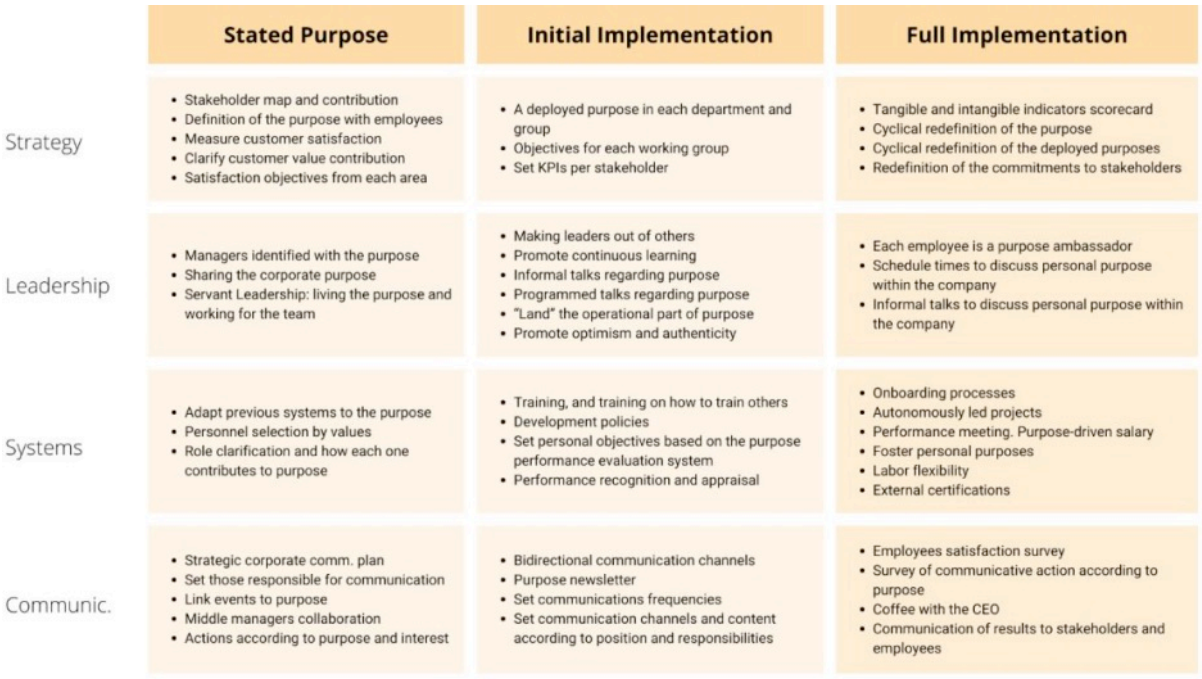
Full Implementation: the stage of full maturity of the purpose implementation. At this level, all company decisions are aligned with the purpose; all interactions with stakeholders and all operations are conducted with the purpose in mind; and all employees share the purpose, making it applicable to their jobs.

One of the objectives of the actions of the maturity model is to help complete the definition of these maturity levels. Thus, these descriptions given above are complemented by the actions extracted by the experts, as we will now see.

3.1. Purpose Levers

To implement the purpose, we rely on strategy, leadership, systems and communication. The actions indicated by the experts are shown in Figure 1.

Figure 1. Maturity Model for the Purpose Implementation. Own elaboration



Strategy

Before considering the purpose implementation, the experts commented that a purposeless strategy is focused on revenue. One of the changes that the purpose brings is the search for a contribution to society, to colleagues, to the planet. This requires −before the purpose statement− a map of stakeholders and the impact that can be had on them. This preliminary work does not study what impact the company *wants* to have on these stakeholders, as this will be done once the purpose has been defined. It is only a matter of locating the stakeholders that surround the company.

The experts also recommended conducting customer satisfaction surveys to observe what they value about the company, and thus be able to establish the differences between what the company expected and what it is achieving. The company, through the image that customers have of it, can observe what differentiates it from the competition and support its purpose.

However, as noted by the experts, this approach is becoming more and more common at the company's foundation. Companies that are born in this competitive environment and under strong environmental legislation are often aware of their own identity. This does not imply that they live this identity in all aspects of the company, or that their strategic operation is aligned with the purpose, but they already have this differentiation more defined. In none of the six participating companies had this been the case; all of them were born as a classic company.

indicated that this is usually done with group dynamics of all employees, but that prior work is necessary on the part of management. This prior work should guide these exercises towards the discovery of the purpose.

I. Stated Purpose

In this stage, the company has done the work of defining the purpose with the employees, making them participants of the new stage in the company. Not only that, but in light of the purpose, strategic documents such as the company's mission, vision, and values should also be updated.

The management must now clarify the contribution to each stakeholder identified in the previously developed stakeholders map. The purpose shows what contribution the company wants to have, but it must have specific contribution proposals associated with it in order to implement it. The company must focus on the value provided to the customer.

The strategy is to make the purpose the center of the business model, which should be based on the contribution made to the customer. To do this, one of the possible means is a discussion in each work area on how value is provided to the end customer. Each area should set objectives to achieve customer satisfaction.

II. Initial Implementation

With these actions, we would enter the initial phase of purpose implementation. Regarding the impact on stakeholders, the participants state that in this phase KPIs (Key Performance Indicators) should be associated to the different stakeholders in order to measure the impact on them. Later on, these KPIs will be used to monitor whether or not the objectives are being met.

Initial implementation is a phase in which the purpose is deployed throughout the company. This is done in the work groups, areas, and departments. In order to carry out the implementation, it is necessary for each of these groups to "particularize" the general purpose to their occupation. The experts commented that the best way to do this is in a top-down manner according to the divisions of the company. For example, if the company is divided into departments that in turn have areas that in turn have work groups, a "particular purpose" of the department should be done first. With this departmental purpose and the general purpose of the company, a purpose of each area should be realized collectively, and so on. This "roll-out" or "dissemination" has been noted in the literature (Malnight et al., 2019), we are not aware of it going so far as to specify that each work group should have a purpose that connects to the overall one.

But it is not only a matter of finding the purpose of each working group. The strategy must help implementation through a definition of objectives. These objectives should be discussed within the group, seeking consensus, and only if consensus is not reached should the person in charge decide. Regarding the monitoring of these objectives, some experts pointed out that they should be monitored on a monthly basis.

In short, for the initial implementation, objectives and indicators should be studied for stakeholders at the company level, and their fulfillment should be monitored. At the working group level, a purpose should be defined that stems from the corporate purpose, and objectives should be defined that are derived from the overall strategy.

III. Full Implementation

In this phase, a dashboard of tangible and intangible indicators should be set up in order to have updated information on how the company is performing and how its employees are doing.

But what the experts discussed most at this stage is the need to update the purpose and the consequences that this has. This has been little addressed in previous literature, and it is a point to which the experts gave importance. If the purpose is the identity and the contribution of the company, it has to be something that changes, because the environment is changing, the company is facing new problems, and therefore the impact it can have on stakeholders changes as well. Therefore, the definition of the purpose must be reviewed cyclically, although the experts did not propose an estimated frequency.

In the number of strategic actions that the experts discussed, it can be seen that the bulk of these occur in the purpose statement phase; with the initial implementation being an adaptation at the working group level, and the full implementation phase being the cyclical redefinition of the purpose.

Leadership

This aspect is one of the most discussed in previous literature (Cardona et al., 2019; Williams et al., 2014). It refers to the behaviors of managers, middle managers, and, in short, of all people with responsibility over others in the company.

A preliminary reflection of the experts consulted is that leaders in purpose-driven companies have similar leadership styles. Therefore, it does not vary much to belong to one or the other work group.

I. Stated Purpose

The first and most important action is that senior managers must identify with the purpose. This also extends to middle managers, even at such an early stage of implementation. In short, the point is that, as soon as there is a declared purpose, the leaders by hierarchy must have this identification. In fact, a case was mentioned in which, after seeing that he would not be able to identify with this purpose, a senior manager left the company. In terms of leadership, the company "cannot afford" to have leaders who do not identify with the purpose.

Beyond this identification, the experts also noted their role of dissemination, of "sharing the purpose"; that is, communicating it. In this regard, they mentioned that it was important to take advantage of the different occasions to remember what the purpose was and what could be done to live it.

But the most authentic way to communicate purpose is to "live" it. Both managers and middle managers must exemplify the purpose through their actions and decisions. The role of middle management is seldom

experts also considered that the fact that they identify themselves and set an example not only facilitates implementation, but that if this behavior is absent it makes implementation much more complicated.

This way of "living the purpose" is one of the defining characteristics of the leadership style expected in purpose-driven companies: servant leadership. These leaders are concerned that the purpose is alive in their actions, but they are also people who work for the team. In a way, they see in their team the possibility of operationalizing the purpose and, therefore, they are dedicated to their team.

II. Initial Implementation

Once the purpose is more implemented, and the different workers have adapted it to their work groups (as we saw in the strategy section), the leader is characterized by the promotion of continuous improvement within the company and its workers. They also promote optimism, sincerity, and contribute to all this with their own behavior. The ultimate goal of these actions is to generate new leaders; to make leaders among the workers under their charge.

It is also at this stage that the steering committee should include a discussion on purpose in its meetings. The idea pointed out by the experts is to share experiences to facilitate the transition to the purpose-driven company. In this section of the meetings, managers should talk to each other about how they are personally living the purpose in their jobs. This should also be incorporated into the meetings of the leaders of the different divisions of the company.

Also, leaders must be aware to lead not only by example but also by word of mouth. Take advantage of informal moments, meetings, to talk to workers about the purpose. Discuss it, comment on it, see the application in the day to day. Talk about the purpose and consider it as a criterion to find solutions to the problems that emerge.

III. Full Implementation

In this phase, as one expert remarked: "all employees are leaders, all employees are ambassadors of purpose". Therefore, they have to show the characteristics already mentioned: service, consideration of the purpose in all actions, promotion of the purpose with their example.

And there should also be continued scheduling of times throughout the company when the purpose is discussed. Employees should be able to talk to their line managers and peers about how they are living the purpose; in planned meetings as well as in informal conversations.

Systems

Purpose-driven companies take established management and performance appraisal systems and illuminate them with purpose.

I. Stated Purpose

It is important to adapt the different management systems to the purpose. The performance appraisal system must also be aligned. According to the experts, alignment means, for example, eliminating features that go

stakeholders must also be reflected in these management systems, especially commitments to employees. At this level it is also important to clarify the roles at every job post and how each job has a significant contribution.

A selection by values should also be started (if it did not already exist). As seen in the strategy, in this phase the mission, vision and values must be updated. Thus, candidates should be screened not only for their competencies, but for the meaning they can bring to the actions they are going to perform. The experts pointed out that this is progressive, since in the stated purpose phase the company-wide implementation has not yet begun, and therefore it is not advisable to focus on new recruits while neglecting those workers who are already there. Again, inconsistency could be detrimental.

II. Initial Implementation

In this stage, the performance appraisal system has to be applied in a definition of objectives for each of the workers. The leaders have to have meetings with the workers to define these objectives, based on the purpose. It is worth remembering that in this phase the adequacy of the purpose to each of the work groups has already taken place (see the strategy subsection).

It is also important at this level of maturity to recognize employees for their efforts to live the purpose. The experts' proposal was not only to recognize their performance, but also their effort and attitude. It was not clarified whether this recognition was to be given publicly or privately.

In a more organizational rather than personal way, professional and personal development policies should be pursued at this stage. These development policies must also be reflected in staff training. As indicated, training is not only the training to perform the job well (in accordance with the clarification of roles mentioned above), but also the ability to train new people. This training of oneself and others is not only on the professional and technical level of the job, but also on the aspects of purpose.

The aim of this employee development and their motivation by purpose-related objectives is to achieve in a more advanced implementation that the projects are led autonomously. This autonomy is given in the work groups. However, this autonomy must occur when the employees have the purpose implemented, and the leaders are in the aforementioned action of creating new leaders according to the purpose.

III. Full Implementation

Finally, most system actions are performed with a full implementation of the purpose. For example, the company should embrace an onboarding process. The purpose-driven enterprise is an organization in which everyone knows his or her place and contribution. This can make the first days of new incorporations more complicated, and so this onboarding is proposed, done by leaders and fellow workers, in which the job is explained to them, what is expected of them, examples of how to live the purpose, etc.

Also, the experience of purpose is reaffirmed with an aspect mentioned in the literature: the inclusion of personal purposes (B. George et al., 2008). The company must ensure that each employee connects the company's purpose with his or her personal purpose. And, if they have not discovered what their personal

purpose is, help them to do so. In this way, employees work for their own personal fulfillment by contributing to the company's purpose.

To observe how it has been meeting the objectives set based on performance according to the purpose, it is proposed at least an annual meeting with the immediate leader in which this performance is evaluated. All experts stated that there was retribution or recognition of some kind for meeting these purpose objectives. Approximately half of the companies surveyed had a financial reward bonus based on the objectives of the purpose.

Labor flexibility also arises at this level of maturity. In a full implementation, people know what they have to do for the company and what is necessary to dedicate both in time and resources. This gives rise to the freedom and autonomy that employees are given, depending on their job.

In order to finish with the systems, the experts agreed that it is advisable to obtain external certifications of the quality of the systems, such as, for example, the seal of equality. This will prevent the system from becoming accustomed to the fact that certifications require periodic reviews.

Communication

When asked what a communication without purpose looks like, the experts indicated that it results in a communication that does not have a narrative, is "messy", and, as a result, is not directed at stakeholders.

This means that the company does not make known the impact it has, nor does it propose the impact it could have.

I. Stated Purpose

Once the purpose is defined, this change. One of the first steps in the stated purpose stage is to elaborate a corporate strategic communication plan. This plan contemplates the most interesting communications according to the importance that the company assigns to its actions. This then has to be translated into communicative actions based on the purpose and the target interest group.

In more internal communication aspects, it is necessary to define those responsible for communication, and to make it clear that the different areas must collaborate with communication. As it is the phase of defined purpose, it is convenient that workers receive communication of the purpose not so much with explanations but with actions. Therefore, a fundamental communicative task is to link events and actions with the elements of the purpose and the values of the company

II. Initial Implementation

In this stage, the experts assigned actions only in communication towards employees. They defined as fundamental to create communication channels in both directions, such as social networks, e-mail, suggestion box, intranet... These channels can be simultaneous, since they will be used for different communication purposes.

One of these channels should provide a newsletter on the purpose, with a defined frequency. This newsletter

by the company in favor of the implementation, messages or testimonials from managers and employees, etc.

Finally, there must also be a guide that defines channels and the content of messages according to each employee's position. There can (and, according to experts, should) be communications only for specific areas, with different content from those that are carried out globally. And the company must have the capacity to achieve this. All the companies studied had some application or web service that allowed them to do this, both internally developed and outsourced.

III. Full Implementation

Communication in a full implementation is also very much directed at employees. One action that came up is a satisfaction questionnaire for all employees. This has to be done with a certain frequency and, the experts felt, with questions not only of general satisfaction but also oriented to the fulfillment of the purpose. Another necessary questionnaire is how employees view the communication actions according to the purpose. In other words, they should share their opinion on how they consider the company is doing its communication, knowing what the purpose is.

Also, as a disruptive element of hierarchy and vertical communication, the possibility of having a conversation with the CEO of the company was proposed. One of the companies followed a "coffee with the CEO" policy. Some experts wanted to generalize to senior managers, but those companies that had this communication action said that it was important and more useful if it reached the top manager of the company.

Finally, the company must communicate its results periodically with the indicators already developed. This communication must be made to employees and other stakeholders with whom a commitment has been acquired through the purpose.

3.2. Sustainability Consequences

We will analyze also how the purpose implementation generates sustainability consequences in four aspects: sustainable behaviors, economic sustainability, social sustainability, and environmental sustainability. The consequences indicated by the experts are shown in Figure 2.

Figure 2. Maturity Model for the consequences of Purpose Implementation. Own elaboration

	Stated Purpose	Initial Implementation	Full Implementation
Sustainable Behaviors	• Codes of conduct	• Water, materials, and waste reduction • Suggestions for the reduction of environmental impact • Work relations • Work performance • Innovation related suggestions	• Employee transport • Social grous • Employee wage
Economic Sustainability	• Risk and crisis management • Corporate Governance • Codes of conduct	• Economic Profit • Technology and Innovation	
Social Sustainability	• Employment of local population • Communication of environmental risk • Relations with suppliers • Equal opportunities	• Local community projects • Social innovations • Employee relations • Human Capital Development	
Environmental Sustainability		• Water, energy, emissions, materials, and waste reduction • Environmental impact of products	• Transport

Sustainable Behaviors

I. Stated Purpose

Compliance with codes of conduct appears in a phase of stated purpose, especially at management levels. The experts considered that the new definition of roles that takes place in this phase leads to a search for coherence and integrity, and that this aspect improves when the role in the company is better known.

II. Initial Implementation

Most of the sustainable behaviors appear in the initial implementation phase, although they are fully developed in the full implementation stage. For example, two economic behaviors that begin to bear fruit in the initial implementation are job performance and innovation suggestions. In the case of the former, the employee knows better what to do, and is more motivated to do it in order to reciprocate to the company. In the case of innovation suggestions, all the experts agreed that it was not an increase in the quantity of suggestions, but in their quality. Employees know their job better, but they also know the company, the processes, and what the company is looking for. This is why there is more impact on this behavior.

Purpose implementation also affects compliance with working hours. This sustainable behavior refers to employees complying with the hours they are required to work. This ensures social sustainability by ensuring that employees have a healthy work-life balance. The experts consulted reported that in purpose-driven companies, working hours are taken care of, and no one is expected to stay on overtime. However, from an initial implementation they felt that employees do not mind spending more time to finish their work. This is in line with studies showing that, when employees share the corporate purpose, they put in extra hours and effort.

Also, on social sustainability, a behavior that begins to be observed in this stage is employee relations. The

employees to care about each other as the purpose is implemented. Some will do it out of altruism, out of service, but even if this altruism is not present, employees know that helping others helps the company itself, and the impact it wants to have.

Another social sustainability behavior that appears in the initial implementation phase is that of actions by social groups. For example, in one company, Saturday mornings are dedicated to handing out hot breakfasts to homeless people in the nearest provincial capital. In another, they collaborate with high schools to raise awareness among students of the environmental challenges facing business and society. This is not limited to participation in activities that the company may have with stakeholders to whom it is committed; it is also the proposal of new activities by employees and the organization of these activities.

The initial implementation also includes environmental sustainability behaviors: saving water, reducing materials and waste, and suggestions for reducing environmental impact. The logic behind the suggestions is the same as in the innovation suggestions: the employee knows his or her job better and, therefore, the environmental consequences it may have. The suggestions are therefore more enriching. It is not the number that increases, said the experts, but the quality of the suggestions.

On water, materials and waste, the experts could not agree on the extent of the impact. Obviously, there is more or less impact depending on the responsibilities of the employee and the sector of the company.

All the experts indicated that it was necessary for management to comment that environmental sustainability was one of the company's objectives, and preferably stated in the purpose. In several cases, the company had had to support this message from the purpose. The recommendation made by the experts was to include the environment as a stakeholder with which to have a positive impact. If this were the case, water, materials, and waste would be reduced more easily and, above all, more widely among the workforce.

III. Full Implementation

Following these behaviors, the experts selected two variables that appear only when the company has already fully implemented the purpose. The first of these is the salary issue. There was dissension among the experts, since, as one indicated, "they are never going to be happy with their salary," but it did indicate that the emergence of purpose in the first phase decreased employee requests. They now had a transcendent motivation to deal with as well. However, with the purpose in place these demands reappeared, but this time as a function of the purpose objectives. As indicated in the systems, financial or emotional rewards should be applied at this stage for the performance of purpose-driven objectives. This is exactly what employees are demanding. Finally, it was also apparent (although not all experts agreed) that employees changed their means of transportation to get to the company. As they indicated, this depends on the location of the company and the possible alternatives. In short, the implementation of the purpose has a clear impact on the sustainable behaviors of employees, especially from its initial stage and with an increasing impact as full implementation is achieved.

Economic Sustainability

I. Stated Purpose

It starts having an impact from its statement, as it makes governance better. Experts attributed this to the fact that purpose makes it easier to navigate complicated environments with good corporate governance. In the end, it is all about aligning decisions with the purpose and, if the purpose is well stated, it makes it easier to question. By way of comparison, one expert noted that without a purpose the company may have good governance, but it does not usually consider the whole organization.

From the same statement, the impact on risk and crisis management is also noticeable. Having a purpose sets a course to follow, and uncertainties can be better resolved. In addition, according to the experts, the purpose statement already at the declaration stage creates a unity in the steering committee that makes it easier to make decisions in this area. Between a declaration phase and an initial implementation phase, the results would be seen by the codes of conduct, as has been seen to happen in employee behaviors. This is also based on the clarification of the company's values.

II. Initial Implementation

All other economic sustainability results appear in the initial implementation phase, although they are fully developed in the full implementation phase. Of these, the most characteristic is economic profit. The experts agreed that purpose-driven companies have higher profit, but that this only appears when the purpose is already being implemented. It may not be a noticeable improvement at the beginning, but it is already showing at this stage. With respect to the generation of technology and innovation, there is no radical change. A company that is not dedicated to it, such as a technological start-up, for example, will not see its number of patents increase by acquiring a purpose. However, according to the experts, processes are improving, and there is a spirit of continuous improvement among employees, which does improve innovation within the company.

III. Full Implementation

As mentioned above, all the variables on which the implementation or declaration has an impact increase their results in this phase.

Social Sustainability

All experts agreed on the logic by which impact on social sustainability was achieved. This logic is: the company's commitments to stakeholders directed the actions carried out in the levers, achieving these social results.

I. Stated Purpose

The impact on social sustainability aspects appears in the purpose statement. For example, the company's commitment to the environment in which it operates is reflected in two aspects: employment of local people, and communication of potential environmental hazards. The second aspect was more debated, as not all the companies had an environmental commitment to their local community.

The purpose also changes the way suppliers are treated. This is due to the fact that more aspects than

whose activity goes against what the company is looking for. Consistency is required from the earliest stage of the purpose-driven company. But it is also a positive aspect, since the purpose can make a competitive supplier more interested in participating in the company's activity. It also happens in the stated purpose phase equal opportunity. In purpose-driven companies there is commitment to employees. The company must take special care to favor all its employees equally. Promotional opportunities, for example, should be well communicated and accessible. For this action it was indicated that the development also continued with the different phases, improving each time and receiving feedback.

II. Initial Implementation

The other consequences of social sustainability appear in this phase. For example, local community projects are supported both financially and with the collaboration of the employees. This has been done in various companies through an NGO competition, in which they evaluated which of the various proposals was most in line with their purpose. As the turnover and capacity of some companies has grown, the number of projects supported has also increased. Social innovations are also being encouraged, as they are based on commitments to stakeholders.

On the employee side, it is at this stage that the relationship between employees is significantly improved. This has also been indicated in the section on sustainable behaviors. It is also in this phase that there is an improvement in human capital, sustained by two factors. First, as seen in the systems, the purpose increases the education and training given to employees, but it is also that the employees themselves participate in the process of transformation into a purpose-driven company.

Finally, two aspects of social sustainability are in dispute over whether the purpose has an impact or not. There are arguments for and against because of the experience of companies on whether the purpose improves relations with unions. Proponents that it does improve are based on the fact that the unions observe that the company is interested in the workers as well; but detractors believe that this is only used as an excuse to justify their claims. The other aspect under debate is that of working hours, since, as we have seen, they are fixed by agreement and the purpose does not change them. However, the workers in the situations in which they are required are going to contribute these overtime hours.

III. Full Implementation

As with corporate economic sustainability, the experts indicated that the results mentioned in the other two phases are improved in this one.

Environmental Sustainability

Finally, we come to the variables of environmental sustainability. There are two aspects that experts have pointed out in this area. The first is the growing legislation in this area, which in some cases means that the obligation does not allow the impact of the purpose to be seen. Some variables considered, such as toxic waste management or operations in environmentally sensitive locations have been considered as "not impacted" by the purpose for the reason that they are highly legislated. The second aspect is the need to include environmental considerations in the purpose for this impact to be significant. This second

consideration shows the relevance of including the environment as an important stakeholder for the company and of including it also in the strategic actions already mentioned.

II. Initial Implementation

In this aspect of sustainability, the results first appear when the purpose is initially being implemented. This is the case with a reduction in waste generated, a reduction in materials, energy and water used, and, in general, a reduction in emissions and effluents. It should be noted that the experts considered that most of these reductions occur when the purpose is fully implemented, but their first results appear at this stage.

Related to all these reductions in environmental impact we also have an improvement in the environmental impact of products, processes and services. Some of the experts considered that they were related to the variables in the previous paragraph, but independently they considered that there is an improvement in this phase.

II. Full Implementation

At the maturity level of full implementation is when the company should have already changed the transport it uses for both internal company mobility and logistics, if any. This can be with the hybridization or electrification of the fleet of personnel transport vehicles, but also with the optimization of logistic routes considering the emissions produced.

4 Conclusions

In the article we have tried to answer the question of how companies can implement the purpose to achieve corporate sustainability. We have done this with the described maturity model, which presents four aspects already mentioned in the literature: strategy, leadership, systems, and communication. However, it presents the actions with which these levers implement the purpose in a detail that is a novelty when it comes to understanding how implementation occurs. These actions also open the door to convert the maturity model into a diagnostic tool to place purpose-driven companies in one of the following maturity levels.

Another theoretical contribution is that purpose-driven companies have been related to the three parts of sustainability. Implementation, as argued in the results, leads to the emergence of sustainable behaviors and, these, to improvements in economic, social, and environmental sustainability. The specific variables on which it has an impact is also a contribution, as they can now be monitored and studied in depth to see the relationship that specific actions have with the results in these sustainability variables.

Finally, the maturity model also has practical implications. For example, companies can use it to better understand their own implementation process and, by comparing the actions established for the different models, decide what action to take next. It can also be used to facilitate the expected sustainability results. With further work, this maturity model could become both an implementation guide and a diagnostic tool for companies using the purpose to become more sustainable. Thus, the actions listed here can be evaluated according to their degree of implementation and their degree of impact. This will make it easier for companies to achieve the desired sustainability.

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Moral Identity of Sustainable Entrepreneurs

Reeti Kulshrestha* and Arunaditya Sahay

Abstract

Worldwide, around 80% of the start-ups fall by the wayside. Sustainable entrepreneurs, who are few and far between, are individuals who develop sustainable ventures. The literature on sustainable entrepreneurship associates sustainable entrepreneurs with knowledge, skills, entrepreneurial self-efficacy, motivation, intention, values and attitudes, their business orientation, and moral cognition. The sustainability orientation of the venture places more emphasis on the moral aspect of the entrepreneur. Currently, there is a lack of understanding on how sustainable entrepreneurs navigate through their moral identity, how their moral identity gets formed and what are the antecedents of moral identity. In addition there is little knowledge on how moral identity influences their decision-making process and actions arising therefrom. There are still challenges in making meaning of sustainable entrepreneurship in theory and practice, and moral identity as such remains underexplored. It is said that morality plays an important role in decision making, ethical behavior and moral reasoning. Rooted in self, morality is self-organizing, self-reflective, and self-regulatory mechanism that regulates an individual's behaviour while facing moral issues. Adopting narrative inquiry, we delve into the moral identity of sustainable entrepreneurs to derive deeper meaning of their actions and practices. The research contributes to taking identity conversation in sustainable entrepreneurship research forward and bringing moral identity of sustainable entrepreneurs in focus.

Keywords- Moral Identity, Sustainable Entrepreneurship, sustainable entrepreneurs

1 Introduction

Traditionally, the purpose of entrepreneurship research was to generate economic value and make profits. Therefore, the focus was more on economic value creation measured by tangible outcomes like sales, profit or return on investment (ROI). With this emphasis on fulfilment of economic objective, environmental, and social issues were mostly avoided (Sarango-Lalangui et al., 2018). Gradually the field of entrepreneurship research opened up to other value creation opportunities like social, ecological, environmental and sustainability. As sustainable development has come about as a pressing issue affecting the world, sustainable entrepreneurship research is receiving increased attention (Teran-Yepez et al., 2019). This extension of knowledge to include other entrepreneurial activities acknowledged entrepreneurship as a solution to problems of economic social and environmental nature called as sustainable entrepreneurship (Munoz and Cohen, 2017). Yet another way to look at sustainable entrepreneurship is the process of opportunity recognition, creation, and exploitation to create economic, social, and ecological value (Belz & Binder, 2017; Eller et al., 2020). Since sustainable entrepreneurship addresses the environment more holistically, therefore, it holds great promise to contribute to sustainable development. It has the power to replace unsustainable products and services and transform markets and societies by providing socio-economic-environmental value that lead to sustainability (Esteves et al., 2021). But in order to create lasting

entrepreneur right from the start. While some research has been carried out on sustainability orientation and its interaction with entrepreneurial intention (Kuckertz & Wagner, 2010) and entrepreneurial action in venture creation (Muñoz & Dimov, 2015), little is known as to how entrepreneurial behaviours reinforces or acts counterproductive to sustainability orientation over a period of time. With focus now on sustainability and sustainable entrepreneurship, it is safe to assume that there will be a shift in the DNA of the entrepreneur including who they are, what actions they perform and why they are motivated to do what they do.

Entrepreneurs have been addressing sustainability related challenges for a while now. Thompson et al. (2011) distinguish between a social, environmental, and sustainable entrepreneurs. They mention that while the three are similar in their mission-driven strategies with the social entrepreneur inclined towards social, the environmental entrepreneur understandably towards environment related market failures, the sustainable entrepreneur strategizes with an objective to reap long-term benefits and achieve "triple bottom line" with all three, environmental, social, and economic benefits. In this manner, the sustainable entrepreneurs become agents of change committed to striking a balance between economic viability, social welfare, and environmental protection (Munoz and Dimov, 2015). Sustainable entrepreneurs, therefore, occupy the centre stage in achieving sustainable entrepreneurship to achieve and maintain a balance in triple bottom line goals within their businesses (Teran-Yepez et al., 2019). In the analysis carried out by Teran-Yepez et al. (2019), the findings reveal that entrepreneurs of the future need to be competent in sustainable entrepreneurship and possess different traits like systems thinking, foresight, strategic management skills (Ploum et al. 2018) while appreciating various norms and ready for action. Research suggest that when dealing with value-driven problems like sustainable development, individuals should possess values and norms that go beyond looking for tangible business outcomes for themselves (Teran-Yepez et al. (2019). Their boundaries need to reach out to include others. Scholars opine that amongst other competencies, the morality of the entrepreneur influences sustainable entrepreneurial process (Diepolder et al., 2021). Hardy and Carlo (2005) explain moral identity as "the degree to which being a moral individual is important to an individual's identity." But how this morality influences entrepreneurial behavior and venture creation process is still largely unknown. This creates knowledge gap in the sustainable entrepreneurship field (Musona et al.,2021). There is a lack of understanding on identity research in sustainable entrepreneurship. With little theoretical grounding on sustainable enterprise creation and entrepreneurial behaviour of the entrepreneurs is available, an identity perspective helps in explaining why sustainable entrepreneurs do what they do and how they do that (Musona et al., 2021).

Since a sustainable entrepreneur has to balance between three aspects, social; economic and environmental, it becomes even more interesting to see how the entrepreneur navigates his moral identity keeping the economic and environmental considerations in view. Exploring moral identity of sustainable entrepreneurs and how it influences their behaviour and actions shall bring out more insights into the field of sustainable entrepreneurship. Theoretical Background Sustainable Entrepreneurship Entrepreneurship is now increasingly being looked upon as a vehicle for creation environmental and social value (Musona et al., 2021)

and Vereeck (2004) define sustainable entrepreneurs as those who perform entrepreneurial activities and contribute to sustainable development by doing sustainable business. The three pillars of sustainable entrepreneurship namely social, environmental, and economic, refer to people, planet and profit. The word 'entrepreneur' means 'taking the initiative to bridge' and as such entrepreneurs bring together money, people, and ideas to establish value creating enterprises and networks (Schaltegger and Wagner, 2011). Sustainable entrepreneurs in addition also bridge the divide between environmental progress and market gains. Schaltegger and Wagner (2011) suggests that the core motivation of sustainable entrepreneurship is to contribute to solving societal and environmental problems through the realization of a successful business. Thus, sustainable entrepreneurship can be described as an innovative, market-oriented and personality driven form of creating economic and societal value (Schaltegger and Wagner, 2011). The objective of the sustainable entrepreneur is to make profit by providing sustainable value. This becomes even more pronounced in the post pandemic world. Mulqueen (2022) says that in the post pandemic reality, sustainable entrepreneurs face a complex ethical dilemma as they owe moral responsibility in their entrepreneurial practices and strategies. In sustainable entrepreneurship research, studies have examined and alternatively explored motivation, managing tensions between the three goals, and mobilization of resources (Musona et al., 2021). Our paper argues that it becomes imperative to explore identity of the sustainable entrepreneur as we make an attempt to understand their moral responsibilities, ethics, entrepreneurial actions, intentions, and behaviour, because it is the identity of the entrepreneur where the genesis of his being originates.

An individual holds multiple identities, and looked at from different vantage point, moral identity could have a personal identity aspect or a social identity aspect too. Entrepreneurs take up entrepreneurship for reasons of their own accord. Choosing to practice sustainable entrepreneurship, which is perhaps most complex of all, calls for a different personality traits, identity and moral obligation which is indicative of more of 'other oriented' behaviour than 'self-serving' interest. And when we wish to explore the identity of a sustainable entrepreneur, moral identity was found a good place to begin our research as it is scantily explored and promises rich insights.

2 Identity of a Sustainable Entrepreneur

The identity of sustainable entrepreneurs has various identity dimensions, including society, community as their frame of references, their social motivation, and their self-evaluation (Cesinger et al., 2021). Since sustainable entrepreneurs pursue the goal of generating profit and also creating social and/or ecological value, they often experience tension. In such a situation, they need a strong moral compass to remain true to their purpose and moral responsibility towards stakeholders. Fauchart and Gruber (2011) termed them as missionary founders who "believed that firms can be powerful agents of change in society and engaging in new enterprise can pursue their vision and advance particular causes, generally of a social or environmental nature."

We explore the moral identity in this paper as we believe that exploring moral identity helps in understanding the sustainable entrepreneur and the enterprise that he creates for generating social,

3 Moral identity

An individual has three primary identities, personal; social; and role identity. One's identity drives one's actions and behaviour. Research in the field of moral psychology suggests that for a better understanding of moral action, one has to consider the role of the self in morality, also called as "moral identity" (Jia and Krettenauer, 2017). Moral identity means how being moral is central to an individual's identity (Hardy and Carlo, 2011). Different scholars have researched moral identity and have expressed it through structure, mechanisms, and dynamics. According to Blasi's Self-Model of moral identity, when a person's identity is more centred on morality, there is an increased desire to live consistently with one's sense of self. Similar to this thought, Colby and Damon (1992) iterated that moral identity is the unison of the moral and self-systems. The more the unity between people's sense of morality and their personal goals, the more moral an individual will be. Frimer and Walker (2009) accounted this unity to the synergy between self interest and other-oriented interest. These are not seen as competing or opposite forces. The more the synergy, the more moral an individual will be. This communion of personal and moral goals becomes a powerful source of moral commitment and motivation for an individual which in our study is the sustainable entrepreneur (Frimer & Walker, 2009).

There is another explanation for moral identity given through schemas (Aquino, Freeman, Reed, Lim, & Felps, 2009). Schemas are mental representations of various dimensions to us, our relationships, and the experiences we have (Fiske, 2000). In our case, the moral identity of individual may include having morally important schemas available for information (Lapsley & Lasky, 2001). Individuals perceive moral schemas and their importance differently and give varying importance to morality with the overall sense of self (Aquino et al., 2009). Researchers opine that though in most cases, moral identity is something that is relatively stable across situations—like a personality trait (Moshman, 2005), but to some extent, the sense of moral identity is also constructed from one moment to another (Monin & Jordan 2009) and may be more or less active situationally (Aquino et al., 2009; Stets & Carter, 2006). Moral identity is an important source of moral motivation and can be a good predictor of moral actions and commitments (Damon & Hart, 1992) depending upon how moral identity is conceptualized (Blasi, 2004). A few studies examined and concluded that there are strong links between moral identity and action. This is the reason we decided to explore moral identity and how it contributes to becoming a sustainable entrepreneur.

There are discussions on social entrepreneurship which reveals an individual's morality (Paramita et al., 2022). This makes us assume that it applies to sustainable entrepreneurship as well. Studies indicate in the mentioned domain that the influence of moral identity is significant when individuals feel perceived proximity with the social problem they are trying to address. This study provides theoretical contributions to the literature on social entrepreneurship and ethics.

4 Moral identity in Entrepreneurship

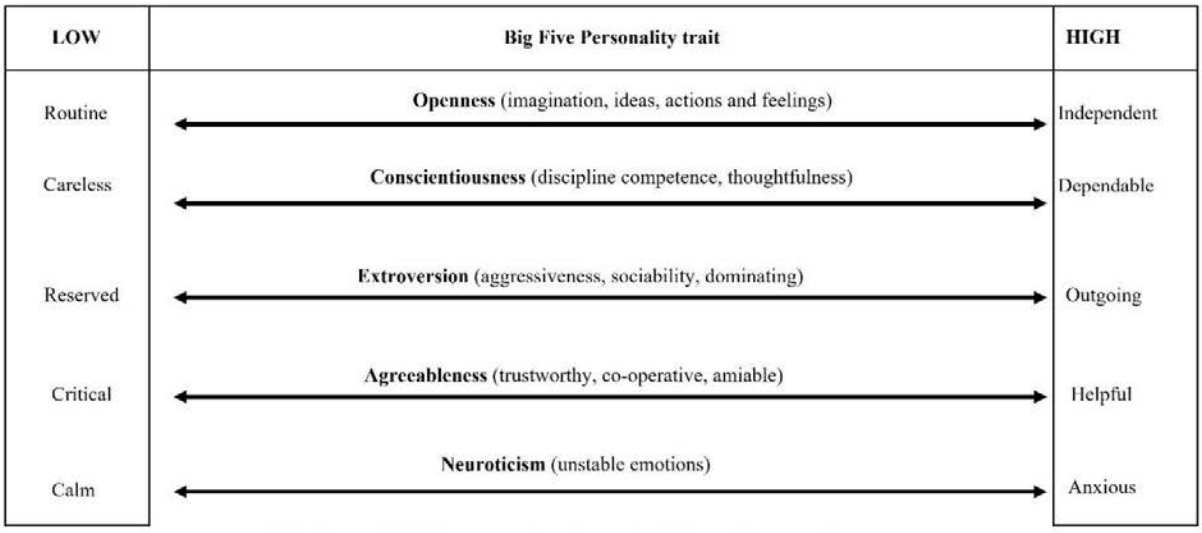
Aquino and Freeman (2017) opine that moral actions arise from moral identity as the entrepreneurs desires to have self-consistency (Blasi,1983). Towards this, Blasi (2005) proposed a three-component model of

defined moral identity as a self-schema which did not require a very long list of moral traits. They stated that stimulating a subset of moral traits would influence the entire network of associated traits. This meant that if an individual had some of the trait associations, the importance of moral identity for that individual and the centrality of moral identity could be assessed. They argued that moral identity is a selfregulatory mechanism that spurs an entrepreneur to make choices and take actions that show 'others' orientation which psychologists and moral philosophers consider important and defining feature of morality. Such mechanisms have its roots in the right and the wrong ethical behaviour (Aqiono and Reed 2002). Further to this, Kaptein (2019) shared that a leader, which in this case is a sustainable entrepreneur commits himself to a cause depending upon his moral identity and such leaders for whom moral identity is important, their actions are consistent with their moral identity and common understanding of being moral (Mayer et al. 2012). Therefore, we can say that for each individual, the centrality of moral identity is different in their overall self-concept (Aquino and Reed, 2002). This explains why entrepreneurs address ethical issues and utilize their resources to solve such problems (Eisenbeiss, 2012). This is true even more in the case of sustainable entrepreneurs who utilize their resources addressing social, environmental and economic objectives while being consistent with their moral identity and actions. Scholars have addressed the curiosity of whether moral identity create an intrinsic desire to do the right thing (Imbriaco,2017) and found that this can be explained by understanding it with the lens of identity theory (Stets and Carter, 2011) which states that an individual's actions are based upon their "identity meanings and interpretations" and that their actions and behaviour are largely regulated keeping that in mind.

A recent meta-analysis of antecedents of moral identity by Xiaofeng Xu and Ho Kwong Kwan (2021) revealed that gender, personality traits and organizational context (specifically, leadership style and ethical climate) are strongly associated with moral identity. In this study to explore moral identity, we have taken up the Big Five personality traits theory similar to that of Xu and Kwan (2021) .

5 Big Five theory of Personality traits

The biggest advantage of looking at moral identity with this theoretical lens is that it gives the freedom to explore a trait along a continuum rather than giving binary explanations. The model asserts that each personality trait is on a spectrum and an individual is ranked on a scale that swings between two extremes. Each personality trait mentioned in the model represents broad category of many personality-related terms. Each such trait covers multiple facets. We show the big five traits below along the spectrum.



Compiled by authors based on Big Five Personality Traits (Fiske, 1949).

It has been observed that people's scores of these Big Five traits remain generally stable for most of their life with only minor changes from one's childhood to becoming adult. However, in research conducted by Soto & John (2012), they showed that while agreeableness and conscientiousness increased with age, the gregariousness decreased with increase in assertiveness. Extraversion remained largely unchanged. They further showed that the openness to experiment and savour different experiences and being neurotic decreased as one grew older. Thus, some aspects changed significantly in the five traits, and some remained quite stable. This made exploring moral identity of sustainable entrepreneurs interesting as well as having potential for significant contribution towards moral identity literature.

6 McAdams and Pals (2006) Integrative Theory of Personality

McAdams and Pals (2006) articulated this five-point framework for describing an integrated personality. They described personality as (1) an individual's unique evolutionary and developing pattern of (2) dispositional traits, (3) characteristic adaptations, and (4) selfdefining life narratives, situated in (5) the culture and social context. McAdams and Pals (2006) opine that each human life is uniquely individual and variations on dispositional traits makes for the most stable and identifiable aspect of their psychological individuality (McCrae & Costa,1997). Other than the dispositional traits, the theory states that there are various adaptations that an individual undergoes (Emmons, 1986); these are socialcognitive (Mischel & Shoda, 1995), and developmental (Elder, 1995; Erikson, 1963) contextualized in time, place, and/or social role. In addition to this, each life has a uniquely individual personal narratives of their life stories and how they make meaning and construct identity (McAdams, 1985, 2006, 2008; McLean et al.,2007; Sarbin, 1986; Tomkins, 1987) and become liquidly modern selves (Bauman, 1996). This approach to understanding moral identity also says that context has a very significant role in development of personality. It shows a stronger impact on adaptations and life stories of people. The context provides with themes and plots for the psychosocial construction of identity. Morality influences our social lives (Mc Adams,2010) and the five basic traits identified by the researcher carry important moral meaning.

The most urgent need is to further probe the antecedents of moral identity from the perspectives of personality traits (Xiaofeng Xu and Ho Kwong Kwan, 2021). In light of the above literature, our research question is:

What are the antecedents of moral identity of sustainable entrepreneurs that define their moral self?

Methodology

The study applies a case study design with qualitative data collected through unstructured indepth interviews, carried out through narrative enquiry with enterprise founders. The data was complemented with secondary materials such as websites, online videos, news articles, and other media coverage. It was then analyzed in stages through thematic analysis. Since we wished to explore the moral identity of sustainable entrepreneurs, looking at the antecedents of moral identity was found a good place to begin with that was supported by literature to understand moral identity better and the dimensions that help forming moral identity. We take up the personality traits antecedents to probe moral identity of two sustainable entrepreneurs. A qualitative study requires rich data. We have chosen two entrepreneurs in order to carry out in-depth exploration with each one of them. The choice of these two entrepreneurs has been based on their suitability for the study. We wanted to study entrepreneurs who have been considerably for a long period of time into entrepreneurship. This would help us in seeing for any changes in their traits as time progressed and their identities evolved. Entrepreneurs who are into creating social value are better suited for exploring moral identity as they are 'others' oriented. We also take support of two frameworks that help explaining the personality traits, Fiske's (1949) Big Five theory as used by Xiaofeng Xu and Ho Kwong Kwan (2021) in their meta-analysis and McAdams' integrative theory (2009) that suggested future research to look at moral identity from the personality traits antecedent perspective. So, while the BigFive theory shall give us good grounds to carry out further analysis and research, the McAdams theory shall further enrich data analysis and interpretation bringing in deep insights. While Big Five reveals the traits that remain relatively stable over time, the McAdams theory captures evolution and temporality of moral identity. For the purpose of our study on moral identity, we have taken up two case studies of sustainable entrepreneurs who have been founders of the enterprise. We took Anshu Gupta of Goonj, and Parag Aggarwal of JanaJal.

7 Analysis and Findings

Anshu Gupta, Founder, Goonj

"*Goonj is an idea*", Anshu proudly says. Goonj is a social enterprise in India, which pioneered the idea of reusing cloth discarded by city households as a sustainable resource to generate work and empower marginalized people. We took up Goonj as a case study in this research to understand how a social enterprise uses an 'unsustainable' resource that ends up in landfills, into building sustainable societies, meaningful living, transitioning into a circular economy. By moving from 'Cloth for work' to 'Dignity for work', Goonj transforms the lives of socially and economically marginalized people by building trust, new opportunities, better living, and human dignity, through innovative use of discarded, under-utilized, and reusable urban

people in many ways, giving access to sanitation, health, education, cleaner environment, and dignified living. By ensuring that nothing goes waste, from cloth to other materials such as audio tapes or paper, Goonj becomes environmentally, socially, economically, and thus, sustainability-oriented enterprise. By carrying out unstructured interviews with the entrepreneur, we gathered narrative data to explore the moral identity of the entrepreneur in question. Our exploration was supported by looking at the personality traits elaborated by two theories, the Big Five traits and McAdams integrative theory.

We did a thematic analysis as described below:

Statements	**Big Five Traits**
"I did not like working for others and becoming an entrepreneur liberated me and gave me freedom" *"I had different experiences studying in all sorts of schools which were sometimes very good, sometimes not so good and even sometimes the ones which are now a part of Goonj's education vertical"*	Openness to experience
"My parents were very honest, and I am saying it repeatedly because it was and is a big part of my value system and where I come from"	Conscientiousness
"I have always been result-oriented since childhood, I wanted outdoor activity. Even today I find joy in activities like repairing of house or center even though I am no longer required there, but I take part. It gives me joy. I love the creative side of it, of building things. So, I would find this desk job dead and not what I wanted. I felt I was not made for this; this was not me. I felt my calling was different"	Extraversion
I ensured that all my employees and volunteers got their salaries and no worker associated with us during suffered. We did extensive work with migrant workers to help them in this hour of crisis. *"Such was my upbringing that there were times when being the only school in the area, the child who would bring milk to my house daily in the morning, would be studying with me in the class sometime later. Such was the beauty of our early days that we saw life as one and not different".*	Agreeableness
"We have not known any other way. Our house help was treated the same way we would be treated, offered food in the	
same utensils, and served hot food before they started their chores. Such was the way of life I had seen".	Neuroticism

Parag Agarwal, Founder, JanaJal

"Our mission is to make safe drinking water Available, Accessible and Affordable"- Parag Agarwal

JanaJal is a social enterprise that offers sustainable solutions through SMART technology where SMART represents Sustainable, Measurable, Agnostic, Resilient, and Timely. JanaJal envisions building India's first water-sharing economy and the largest decentralized water distribution network through installation and operation of water ATMs. The company is working to make safe drinking water available, accessible, and affordable to common man. They are trying to achieve this in a sustainable manner. The technology talks about being sustainable where JanaJal Hybrid Water ATMs maximize efficiency by utilizing solar energy and regular electricity minimizing down time due to power outages. JanaJal also encourages consumers to carry their own bottles and containers to collect water thereby reducing the generation of hazardous plastic waste. The enterprise, further, empowers and creates social entrepreneurs who serve communities with utmost dignity and pride. JanaJal 'Water on Wheels' (WOW) is an environment-friendly battery-operated vehicle that helps take safe water to households and contributes to the 'Right to Water' mission. It fulfils SDG goals with the objective of delivering water to peoples' doorstep allowing women increased economic productivity and children more time to focus on education. Parag is a sustainable entrepreneur who envisions a country where no one is denied the right to clean drinking water. He believes in democratization of water. Below are his narratives based on five personality traits.

Statements	Big Five Traits
"I always wanted to make a difference. I wanted to contribute, always wanted to overcome those gaps" *"I have always dreamt big and had been hearing comments of people all my life that I stretch beyond my means".* *"It served as the biggest motivator and the cause for fire to burn in my belly. I wanted to change the situation; I wanted to add to the fortunes of my family. I wanted to add to the financial and economic position of my family. My mother would often say that amongst all children on the maternal side, only I have inherited my grandfather's genes. Maybe I have always been wired like that".*	Openness to experience
"Born into a middle-class family, I have always had everything counted and measured, nothing was in excess". *"I have never cared for money, though I wanted to earn money to support my family, it held no value for me".* *"I had always drawn a line which I never crossed. As an entrepreneur you have to make a zone for yourself in which you will stay and operate. I made that for myself and never crossed those boundaries".*	Conscientiousness
"I had a risk appetite at all times. So, at the age of 21, I joined the stock markets in 1991"	Extraversion
"People were always most important to me"	Agreeableness
"You develop a mind which learns to overrule the heart and tells how you that it is ok till this point only, and if you go beyond this, it will hurt you, you may even spoil your relationships only to be blamed and end up defending yourself to people". *"I have two minds; one that applies to myself, and another to the world outside. In my internal silo, I have doubt not about myself but for the fact that am I doing the right thing…because I have a big responsibility.*	Neuroticism

8 Discussion

Based on the analysis, we can say that for Anshu Gupta is an independent openminded person who is imaginative, creative and has ideas that he wants to make them come true. He is also a very conscientious person as he shared in his narrative that their family values are based on honesty and integrity. That is how he has been brought up. He is high on extraversion as he shares that he was always interested in outdoor activity and an inside job made him feel chained. He also came out to be very agreeable as he was very empathetic towards his employees and to people he did not even know such as the migrant workers who were suffering due to extreme critical conditions of Covid19. The data shows him to be a calm and even-tempered person as he says that their house always treated everyone equally and that there was no distinction amongst people. This instilled in him a sense of equality and stability in his outlook towards life. He shares that his parents were very honest and ethical people, and that quality has been corner stone for him.

Parag, too, comes out as an openminded person high in ideas and imagination as he is always thinking beyond his means. Born in a middle-class family, he shares that he did not care for money for money's sake but only for the things he could do with it for others. For himself, money had no value. He stated that he had made boundaries for himself as an entrepreneur and always stayed within that zone. He is high on extraversion as he aggressively goes out and takes risks to move ahead in life. He is very agreeable as people were most important to him and would go to any extent to help others. Finally, he is found to be initially more emotional when he would trust others outrightly because of which he also got cheated and hurt by people. Gradually he became more careful with people and drew lines for himself so that he could stay away from such people and protect himself. He believes that as an entrepreneur, he has huge responsibility and so he always keeps checking upon himself whether he is doing right or wrong.

9 Conclusion

The study was carried out based on the Big Five personality traits by Fiske (1949) to know the antecedents of moral identity of the sustainable entrepreneurs. It also revealed how moral identity gets formed over a period of time and how important is the role of the context. We have yet to do the analysis based on the McAdam's (1996) integrative theory which will further enrich our understanding of moral identity. As future research avenue, exploring gender and organizational context can give significant peek into understanding moral identity from a different perspective.

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Supporting sustainable transformations in corporations

Development of a strategic framework linking operational excellence with sustainability

Katharina E. Roche[1], Rupert J. Baumgartner[2]

[1]*Institute of Systems Sciences, Innovation and Sustainability Research, University of Graz, Merangasse 18/II, 8010 Graz, Austria, katharina.roche@uni-graz.at*

[2] *Christian Doppler Laboratory for Sustainable Product Management in a Circular Economy, Institute of Systems Sciences, Innovation and Sustainability Research, University of Graz, Merangasse 18/I, 8010 Graz, Austria, rupert.baumgartner@uni-graz.at*

2. Abstract

Operations are critical for companies' efforts towards sustainable development, as they dictate which resources are used, the organisation's actual impact on environment and people as well as its economic performance. To achieve sustainable development, sustainable operations management is in search for models that integrate operational excellence with sustainability. This research aims to provide a comprehensive strategic framework integrating operational excellence and sustainability for enabling sustainable transformation of corporations. The research approach includes a literature review, providing a background on operational excellence, sustainability, and hoshin kanri. For both operations manage- ment as well as sustainability comprehensive frameworks were used as a foundation and adapted to- wards a potential framework for linking sustainability with operational excellence. As a management system for operations management hoshin kanri provides the main basis, which includes operational excellence principles. The Framework for Strategic Sustainable Development was combined with hoshin kanri, due to its practicality, its clearly defined sustainability principles, planning process as well as combination possibilities. The resulting framework illustrates how strategic sustainability goals can be aligned within a cooperation and in turn to achieve these in practice. This research contributes to- wards supporting corporations in their efforts to transform into sustainable businesses. The framework linking operational excellence with sustainability may serve as a theoretical base for future research that will include applying the framework to a company and further refining the framework.

Keywords: Operational excellence, hoshin kanri, sustainable operations management, Framework for Strategic Sustainable Development

1. Introduction

The increasing climate crises have massive implications for businesses as global markets are thoroughly interconnected (Drake and Spinler, 2013). Companies have not only been increasingly pressured by

are also increasingly seeking to achieve competitive advantage through corporate sustainability (RobecoSAM, 2014). A critical sustainability viewpoint is provided by operations management (OM). Operations dictate what the business does, i.e., which resources are used and, in turn, the organisation's actual impact on environment and people as well as its economic success (Drake and Spinler, 2013). Measures such as the triple bottom line (3BL), involve people, profit and the planet, and the goal of maintaining viable social as well as economic organisations. OM is increasingly connected to sustain- ability, and it now concerns both the operational drivers of profitability and their relationship to people and the planet (Kleindorfer et al., 2005). However, in research so far, it is not obvious how far social and environmental objectives are incorporated into various facets of OM (Gunasekaran and Subrama- nian, 2018). Sustainable OM is in search for models that integrate operational excellence with sustain- ability (Walker et al., 2014). Organisations are facing a substantial new challenge in terms of opera- tional sustainability (Bhandari et al., 2019; Ghadimi et al., 2019). The challenge for a company is to cope with business requirements in a short time, but at the same time to build up an appropriate culture, necessary leadership skills and operational excellence, all of which are necessary to be successful in the long term. However, there is often a disconnect between strategy and implementation, where day-to- day business has priority over the consideration of investing time and effort in planning in the long- term (Kudernatsch, 2019). Translating corporate strategy into operations strategy has been a key focus of OM for many decades. However, there still lacks a comprehensive framework that integrates the literature (Thürer et al., 2019). A management system, seen as to have potential for linking strategy and implementation in the long-term is hoshin kanri (HK), a specific form of policy deployment; among many other names in western countries (Jolayemi, 2008). Since the 1960s, HK has been put forward as a system for OM in Japan; it was invented by the Japanese company Bridgestone (Akao, 1991). By 1975, it had become widely adopted by other Japanese industries (Kondo, 1998). HK and versions thereof have been implemented by companies all around the world, such as Toyota, Hewlett-Packard, Nissan, Xerox, Texas Instruments, Tyco, IBM, Porter and Gamble and AT&T (Evans and Lindsay, 2005; Feurer et al., 1995; Witcher and Butterworth, 1999, 2000; Kudernatsch, 2019). HK is often asso- ciated with Total Quality Management (TQM) and Lean production (Lean or LP) and it is considered a typical system for OM (Karaszewski, 2010; Chiarini, 2013; Jolayemi, 2008). Due to a different cul- tural approach and problems related to translation from the Japanese, HK was not well known or used by Western companies until the 1990s (Tennant and Roberts, 2001). The TQM and Lean production movements brought HK to the attention of many worldwide companies that implement TQM and Lean. However, HK has not received as much attention as other management systems, such as the Balanced Score Card (BSC) (Witcher and Chau, 2007). As quality and sustainability are seen by the global com- munity in both business and customer markets as required characteristics, addressing operations and enhancing sustainability will become a necessary task for organisations (Piercy and Rich, 2015). The Framework for Strategic Sustainable Development (FSSD) is a meaningful strategic framework for

sustainability with potential to be combined with HK. It includes clearly defined sustainability princi- ples and planning process as well as combination possibilities with other management methods and tools (Broman and Robèrt 2017).

and operational excellence through HK. With regard to the research goal, the following research questions were formulated:

RQ 1 How can a framework for linking sustainability with operational excellence using hoshin kanri look like?

RQ 1.1 How can sustainability be linked to operational excellence through hoshin kanri?

RQ 1.2 How can operational excellence and sustainability be combined and applied through hoshin kanri towards a conceptual framework?

1.1 ***Theoretical***

Background

Operational

Excellence

Excellence tools are used by people in organisations as means to achieve results and requires people's motivation and participation, meaning strong leadership, top management commitment and fully in- volved and inspired employees (Shingo Institute, 2014). For a company to succeed in the long term, it needs to participate in a multitude of activities such as organisational excellence, product leadership, customer relationship management, to name a few (Found et al., 2018). Operational excellence has no commonly accepted definition (Found et al., 2018), however, definitions include many similar compo- nents. It can be defined as process efficiency and effectiveness with the systematic integration of an organisation's culture and its human resources (Bourke, 2014) and can be characterized as strategy that organisations use to provide quality, ease of purchase, price, and service in such a way that no other company in the sector or industry can match (Treacy and Wiersema, 2007). Sony (2019) stresses that via the so-called "4P's", people, partnership, process, and products, business or organisational excel- lence can be achieved. Organisational culture is considered as one of the most important critical success factors for the implementation and success of operational excellence programs; New techniques are often not embraced by an organisational culture, due to a lack in appropriate leadership or strategy (Carvalho et al., 2019). In any case, the results of operational excellence programs are influenced by the organisational culture and enablers (Carvalho et al., 2019). Enablers are current parameters and practices that utilize and help enterprises achieve agile capabilities (Bottani, 2009). Management ena- blers are among others, total quality management (TQM), Lean Management, total productive mainte- nance, kaizen (i.e., continuous development), supply chain management, among others (Carvalho et al., 2019). For an operational excellence program to be successful in the long-term, it is necessary for an organisation to be aware of the social, economic, and environmental demands of stakeholders and to transform these by reacting with suitable and innovative operational excellence solutions (Sony, 2019).

Hoshin kanri methods and models

HK or policy deployment prioritizes and focuses on a few selected goals that are important to achieve the

to achieve these goals are developed respectively. There are HK methods and models stated in most HK-related literature (da Silveira et al., 2017). Most importantly and dominantly are the Deming Cycle of Plan-Do-Check-Act (PDCA) or variations thereof, and the so-called “catchball” process. Oth- ers are the link between top management/business strategy and daily management/day-to-day business, as well as certain planning tools, the X-Matrix and A3 Report (Tennant and Roberts, 2001; Witcher, 2003; Jolayemi, 2008; da Silveira et al., 2017). The most recurring model within literature is the FAIR model (Witcher and Chau, 2007), illustrated in Figure 1. According to da Silveira et al. (2018) FAIR relates to the PDCA/Deming cycle, with the keywords focus (act), alignment (plan), integration (do), and review/responsiveness (check). The first step (focus/act) entails deciding on a few key strategic priorities for the coming year. These "hoshins," or strategic priorities, are significant adjustments re- quired to achieve the company's medium- and long-term goals. Increasing improvement and hoshin- related targets are expressed in a QCDE-scheme, where "quality" (Q) refers to customer goals, "cost"

(C) refers to efficiency and financial goals, "delivery" (D) refers to internal processes, logistics, and innovation goals, and "education" (E) refers to human resource development, morale, and safety goals (Witcher and Chau, 2007). The annual goals are then developed and deployed iteratively, both vertically and horizontally, within the organization with the so-called "catchball" process in the second step (alignment/plan) (da Silveira et al., 2018; Tennant and Roberts, 2001). The catchball mechanism starts with a carefully planned break through goal or hoshin and represents the operationalization of the strat- egy. Catchball consists of feedback and discussion about goals and the means to achieve these goals; the process is meant to close the “knowing-doing” gap (Pfeffer and Sutton, 2000). During this process, the goals and resource allocations can be affected (Tennant and Roberts, 2001). The agreed upon per- formance targets and action plans are integrated into the work routine in the third step (integration/do). The fourth and final element of the cycle (review / check) entails top management's annual diagnostic of how HK is being used to manage and achieve the company's strategic goals. The annual review gives valuable information that influences the choice of strategic breakthrough goals for the following annual cycle (da Silveira et al., 2018).

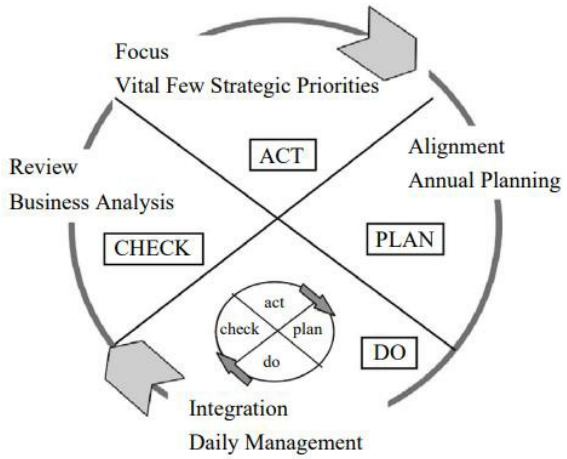

***Figure 1**: The "FAIR" model or PDCA cycle of HK (Witcher and Chau, 2007)*

The organisation's vision, strategy and breakthrough goals developed by the top management are cen- tral for the whole organisation and all its departments (Kudernatsch, 2019). However, important during the process of defining the annual goals, is the engagement with all levels ("cascading down") and goal transformation on all levels. This process illustrates the importance of feedback loops – the catchball process – within the organisation or business unit, to align the goals as effectively as possible by means of vertical (top-down and bottom-up) and horizontal (between departments) integration within the or- ganisation. The 7-step hoshin planning model by the GOAL/QPC Research Committee (1994) in Figure 2 depicts the stages within the hoshin planning process and is often referred to in academic literature (Jolayemi, 2008; Barnabé and Giorgino. 2017). Within this planning process model, the stages begin- ning from the organisational vision to the annual review are illustrated, including the catchball process during the deployment of objectives to departments (phase 4) and FAIR/PDCA cycles during the actual implementation and regular progress reviews. Depending on the annual reviews, the organisational vi- sion, 3-5-year plan, but most definitely the annual goals may be adjusted.

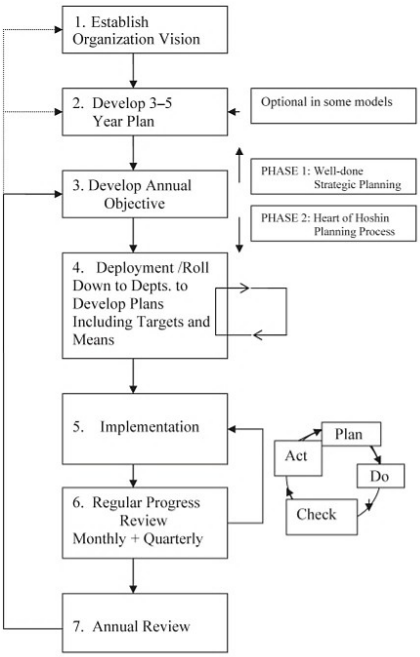

***Figure 2**: The hoshin planning context by the GOAL/QPC Research Committee (1994).*

The FSSD

The FSSD is a framework for strategic sustainable planning and aims to support organisations and institutions in their efforts to become sustainable. The FSSD provides organisations with a common language and a knowledge of the sustainability issue. It is founded on a sustainability vision, which is bounded by sustainability principles; starting from the vision, an organisation follows a backcasting approach (Robèrt 2009). The five levels of the FSSD by Robèrt et al. (2002) are (1) the system, which focuses on the ecosphere, (2) success, which defines the goal / outcome, i.e. the state sustainability within the ecosphere, (3) strategic guidelines, meaning the process to reach the outcome, (4) actions,i.e. concrete measures that comply with the principles for the process to reach a favourable outcome in the system, and (5) tools to monitor and audit the relevance of actions with reference to principles for the process and/or monitoring the status of the system itself, and impacts or reduced impacts, as a con- sequence of strategically planned societal actions. The FSSD principles by Broman and Robèrt (2017, p. 23) state that "in a sustainable society, nature is not subject to systematically increasing 1) concen- trations of substances extracted from the Earth's crust, 2) concentrations of substances produced by society, 3) degradation by physical means, and people are not subject to structural obstacles to 4) health, 5) influence, 6) competence, 7) impartiality, as well as 8) meaning-making". The operationalization of the FSSD is carried out through the so-called ABCD process. It is a four-stage iterative tool which integrates all the levels of FSSD (Broman and Robèrt 2017, p.7), including learning about the sustainability issue and – principles, and collectively developing the organisation's vision (A), a baseline as- sessment of the actual state of the organisation's sustainability (B), co-creating possible solutions and actions to achieve the organisation's vision (C), and deciding on which solutions are viable and feasible (D). Here, the solutions are prioritized, whether they are likely to help achieve the organisation's sus- tainability-framed vision (Broman and Robèrt 2017).

2. Methods

The first step is to gain a comprehensive background on operational excellence, sustainability, and HK. For this, an explorative literature review to operational excellence, HK (integrating TQM and LP) and sustainability is performed. In a second step, a conceptual framework is proposed. From this basis of this theoretical paper, future steps will include expert feedback, a case study approach, and iterative refinement processes.

2.1. Literature review

Data were collected from an electronic database search for the literature review. As proposed by Web- ster and Watson (2002), the search was undertaken by topic rather than by (top) journal to include 'all' published publications in this field. The search terms used in searching the scientific databases were divided into three theme groups focusing on operational excellence, (corporate) sustainability and hoshin

kanri. The key words in each group were associated with the Boolean OR operator to create a search string for the respective group. Also, the group search strings were associated with the Boolean AND operator to develop combined search strings (Vrontis and Christofi, 2019). Further keywords used were policy deployment, and strategy deployment (for hoshin kanri), sustainab*, operations manage- ment. Primary data bases that were used were Web of Science and Scopus; Google Scholar was added for supplementary reasons, as few search results were achieved when combining all three keywords (sustainab*, operational excellence, and hoshin kanri). The data from Google Scholar were extracted with Harzing's 'Publish or Perish' software (v7.33.3388.7819) in September 2021 and repeated in No- vember 2021 (version 8.0.3590.7978). Not only academic journals were included, but also conference proceedings and other grey literature by reputed publishers that may help overcome publication biases in literature (Hopewell et al., 2005). To achieve meaningful results, the timeframe as well as geograph- ical context were kept non-specific. The initial sample of possibly relevant articles were subject to ad- ditional evaluation based on different criteria. First, the search did not focus on publications in peer- reviewed academic journals with full texts. Thus, non-academic articles, such as book chapters, edito- rials, conference papers, extended abstracts, book reviews were included. Second, articles available in English were included and others excluded. This decision should bring focus on the common scientific knowledge base represented by most scientific journals and is employed by other researchers as well (e.g., Crossan and Apaydin, 2010; Vrontis and Christofi, 2019). Further filter steps after the removal of duplicates included title and abstract screening. The remaining publications were then subject to a full-text screening. The dataset after screening includes 90 publications. (The total number of publications for analysis is subject to change, due to additions of further filter steps (e.g, according to the number of citations) as well as of further identified references.) Journals, conference proceedings, books/chapters, and working papers are among the publishing types extracted.

2.2. Framework development

Based on the information retrieved as well as the findings on previously depicted frameworks, namely the Framework for Strategic Sustainable Development (FSSD) and HK, a conceptual framework was developed. HK as a management system links strategy and implementation in the long-term. HK can be viewed as key to achieving superior organisational learning and that it can be employed "to manage about anything that moves" (Jackson, 2006, p. XII), for example to integrate value stream activities within a single plant, office, hospital, etc. or integrating a total value stream involving multiple suppli- ers. While HK was still relatively unknown years ago, more and more western companies, especially in the USA and Europe, are introducing HK, mostly under the term 'policy deployment' (Kudernatsch, 2019). The FSSD was developed through several iterations within a 25-year-long learning process that involved scientists and practitioners alike (Broman and Robèrt, 2017). The FSSD has been applied in various companies, e.g., IKEA, Interface, Electrolux, but also to municipalities and for educational guidance. Through years of practice, there have been experienced benefits through applying the FSSD mentioned in a myriad of cases (Broman and Robèrt, 2017). Due to its practicality, its clearly defined sustainability principles, and planning process as well as combination possibilities with other manage- ment methods and tools, the

FSSD was chosen as the framework for sustainability to be combined with HK.

3. Results and Discussion

The results are structured two-fold: in (1) the key insights from the literature review, and (2) conceptual framework development.

3.1. Literature review

Operational Excellence, Sustainability and HK

According to Sony (2019), for an operational excellence program to be sustainable, the three main conceptual viewpoints of social, economic, and environmental factors should be imbedded in the organisational culture. An organisation's agility also plays a key role for the sustainability of operational excellence programs (Sony, 2019). Agility can be defined as an organisation's ability to identify changes in its business environment and provide its stakeholders with focused and rapid responses by rearrang- ing its resources, processes, and strategies (Mathiyakalan et al., 2005; Carvalho et al., 2019). Analysed influencing factors from literature for the successful implementation of operational excellence as well

as sustainability are leadership and strongly engaged top management (da Silveira et al., 2017; Morsing and Oswald, 2009; Shingo Institute, 2014); organisational culture; organisational agility (Sony, 2019; Carvalho et al., 2019); organisational learning and continuous improvement (Souza and Alves, 2018; Sawhney et al., 2020), organisational capabilities (Thürer, et al., 2019; da Silveira et al., 2018), as well as employee involvement and communication. However, in research the mechanisms associated with these factors are seldom addressed – for example, how management exercises leadership and communi- cates. The HK methodology is one of those mechanisms which evolved alongside TQM and Lean (Nicholas, 2016). HK may act as enabler for enterprises to achieve agile capabilities (Jackson, 2006; Carvalho, 2019). HK may provide a basis for implementing sustainability strategy within an organisa- tion and fill gaps between sustainability strategy and its actual implementation in day-to-day business. Attributes of operational excellence involve dynamic capabilities, alignment and synchronization of resources, continuous improvement, efficiency, effectiveness, and an enabler-focus (Jaeger and Matyas, 2016).

TQM, Lean and HK

TQM and Lean are both management approaches associated with business and operational excellence and often researched with regards to corporate sustainability. One of the goals of lean operations is to use fewer resources to generate the same outcome. As less materials are used in production, and quality improvements reduce rework, scrap, power/water consumption, and pollution costs, environmental ben- efits are observed (e.g., Rothenberg et al., 2001). However, lean operations could be criticized for fo- cusing on resource efficiency and issues that are not aligned with addressing wider scale problems and sustainability benefits lean operations can affect have generally been mostly limited to environmental performance (Mollenkopf et al., 2010; Miller and Sardner, 2012; Prasad and Sutharasan, 2012). A re- curring issue in sustainable

operations literature is the focus on environmental aspects (Walker et al., 2014). There is a great demand for sustainability models that consider economic, social, and environ- mental perspectives, also within the implementation of management systems and lean manufacturing systems (Souza and Alves, 2018). The aims of Six Sigma are to improve process performance and achieve high levels of quality by investigating and eliminating the root causes of defects and minimizing process and product variability (Cherrafi et al., 2016). Research attention has increased on combining lean, six sigma and sustainability. Lean Six Sigma is the combination of lean and Six Sigma philoso- phies (Sheridan, 2000), which aims to overcome the shortcomings of both methodologies as well as to increase potential improvement (Bhuiyan and Baghel, 2005; Snee, 2010). However, organisations are facing difficulties in managing the complexity of integration process and high amount of human and financial resources (Nunhes et al., 2017) and the necessary tools, to integrate such systems into an organization (Souza et al., 2018). Research by Souza and Alves (2018) introduces the Lean-Integrated Management System for Sustainability Improvement, which is based on the rational use of resources and energy while engaging and empowering people. In their research, many correlations and synergies exist between Corporate Sustainability standards and requirements (ISO 9001:2015, ISO 14001:2015, OHSAS 18001:2007, ISO 26000:2010) and HK and/or qualities associated with HK (such as Kaizen and Kanban). The survey by Nicholas (2016) finds HK in theory potentially provides much of what the published research says is important to lean production success.

Tools for strategy formulation and deployment – the Balanced Scorecard and HK

HK, the BSC, and other operational excellence frameworks, provide a structure and a set of procedures to align strategy throughout the company and to measure and manage progress towards corporate strat- egy achievement (da Silveira et al., 2017). The BSC, for example, is strong in defining what should be done, but it has little to say about how this should be done (Witcher, 2013). The key to linking strategy to action is therefore not the balanced scorecard itself, but the underlying procedures that make it func- tion (Witcher and Chau, 2007). HK emphasizes singular techniques such as feedback cycles between different levels of an organisation, i.e., the before described catchball process, on what should and what can be achieved and, above all, how it can be achieved (da Silveira et al., 2018). HK proposes the catchball process for better sharing the strategies and involving all employees. By contrast, the Balanced Scorecard (BSC) system introduced by Kaplan and Norton (1992) is based on a more top-down ap- proach. Within the BSC, starting at a corporate level, senior managers set strategies for the market and deploy these strategies for the different business units and levels of the organisation (Chiarini, 2016). The Sustainability Balanced Scorecard (SBSC) developed by Figge et al. (2002) includes environmen- tal and social aspects within the BSC; research in this field considering HK have not been developed thus far. However, the SBSC subsumes sustainability within the goals of companies and does not link sustainability objectives to economic performance which may constrain companies the kind of deep transformation and radical shift necessary to contribute towards a more sustainable future. From a social and economic perspective, HK enhances an integrated workplace, but also drives forward company performance. At the same time, HK as a TQM/Lean system shows environmental benefits, due to saving resources in production and through quality

improvements (Piercy and Rich, 2015). In Table 1, a sum- mary of the attributes of operational excellence, associated management systems (TQM, Lean, Six Sigma) and key tools (BSC, HK) as well as (potentially) integrated sustainability aspects are depicted.

Table 1. *Selected management systems and tools integrating OE attributes and sustainability aspects.*

	Attributes of operational excellence						**ed Sustainability Aspects**		
anagement Systems	Dynamic capabili-ties	Alignment of goals and resources	Continuous improve-ment	Effi-ciency	Effec-tiveness	nabler focus	Envi-ronmen-tal	Social	Eco-nomic
TQM			✓	✓		✓	✓	(✓)	✓
Lean Manage-ment / Produc-tion	✓		✓	✓		✓	✓	(✓)	✓
Six Sigma	✓		✓	✓	✓	✓	(✓)		(✓)
Key Tools									
nced Sco-recard	✓		✓	✓			(✓)	(✓)	✓
Hoshin Kanri	✓	✓	✓	✓	✓	✓	(✓)	(✓)	(✓)

OE attributes based on Jaeger, A., & Matyas, K. (2016); Sustainability aspects in OE based on Sony, M. (2019)

: identified in literature; (□): potential for integration

3.2. Framework combining sustainability with operational excellence

A conceptual framework for linking sustainability with operations in Figure 3 combines the deployment process of goals (Barnabè and Giorgino, 2017) with the FAIR-model (Witcher and Chau, 2007) as well as includes the FSSD levels and principles (Broman and Robèrt, 2017); additional questions were added for clarification and guidance purposes (Kudernatsch, 2019). Sustainability objectives can be included within the targets, based on the vision, mission, values as well as the business model of an organisation (core capabilities and competencies) (Figge and Schaltegger, 2002). The framework provides an over- view on how sustainability objectives can be aligned throughout an entire organisation.

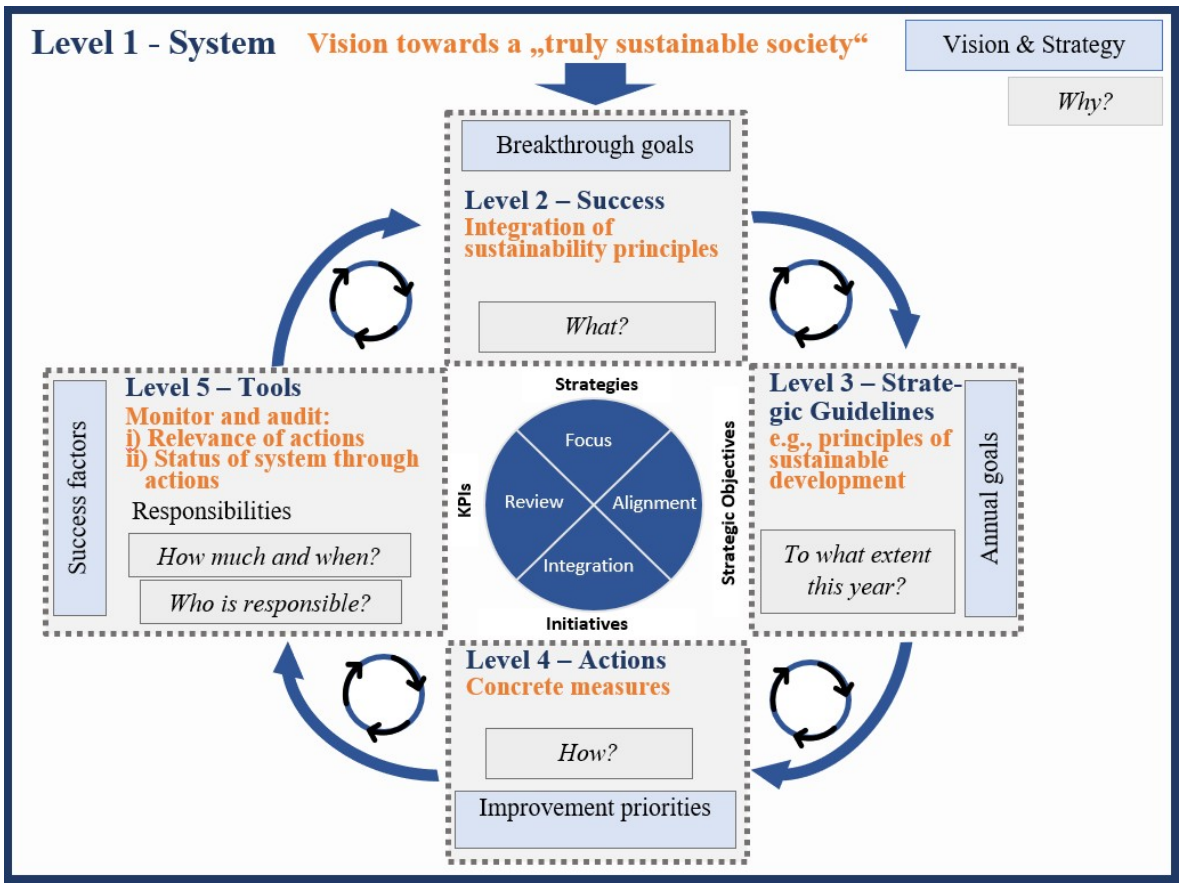

***Figure 3**. Framework for Linking Sustainability in Strategy with Operations. Structure based on Barnabè and Giorgino, 2017; FAIR based on Witcher and Chau, 2007; Levels and sustainability aspects based on Broman and Robèrt, 2017)*

In Level 1, the system level (Why?), focuses on the ecosphere and should be incorporated in the vision as a "truly sustainable society". Here lies the foundation of the purpose of an organisation, and its con- tribution towards sustainability. In the second level, success (What?), the goal or outcome is defined, i.e., the state of sustainability within the ecosphere; here the sustainability principles from the FSSD can be integrated. The framework includes the breakthrough goals (3-5) of a certain company or busi- ness unit (i.e., Strategies), divided in a scheme of quality, cost, delivery, and education objectives (Kudernatsch, 2019). Sustainability principles can be aligned with the general goals or be formulated as stand-alone sustainability objectives that are accordance with the sustainability principles of the FSSD. In the third level, that of strategic guidelines (What and to what extent this year?), which con- stitutes the process to reach the desired outcome, the principles of sustainable development are inte- grated. In the framework, the strategic guidelines can be included within the annual goals (i.e., strategic objectives). Level 4 (How?), actions, i.e., concrete measures that comply with the principles for the process to reach a favourable outcome in the system. Within the framework these measures will be integrated in the improvement priorities section (i.e., initiatives/tactics). Level 5 (How much and when?) focuses on tools to monitor and audit (i) the relevance of actions with reference to principles

for the process and/or monitoring (ii) the status of the system itself, and impacts or reduced impacts, due strategically planned societal actions (Broman and Robèrt, 2017). In the framework, this level aligns with success factors (i.e., KPIs). Within the actions, accountability / responsibility concerning the different goals and tasks defined (i.e., Who is responsible?). The catchball process is highlighted throughout all levels, as the breakthrough goals integrating sustainability principles should be redefined through the alignment with the annual goals, the setting of concrete measures as well as the definition of tools and success factors.

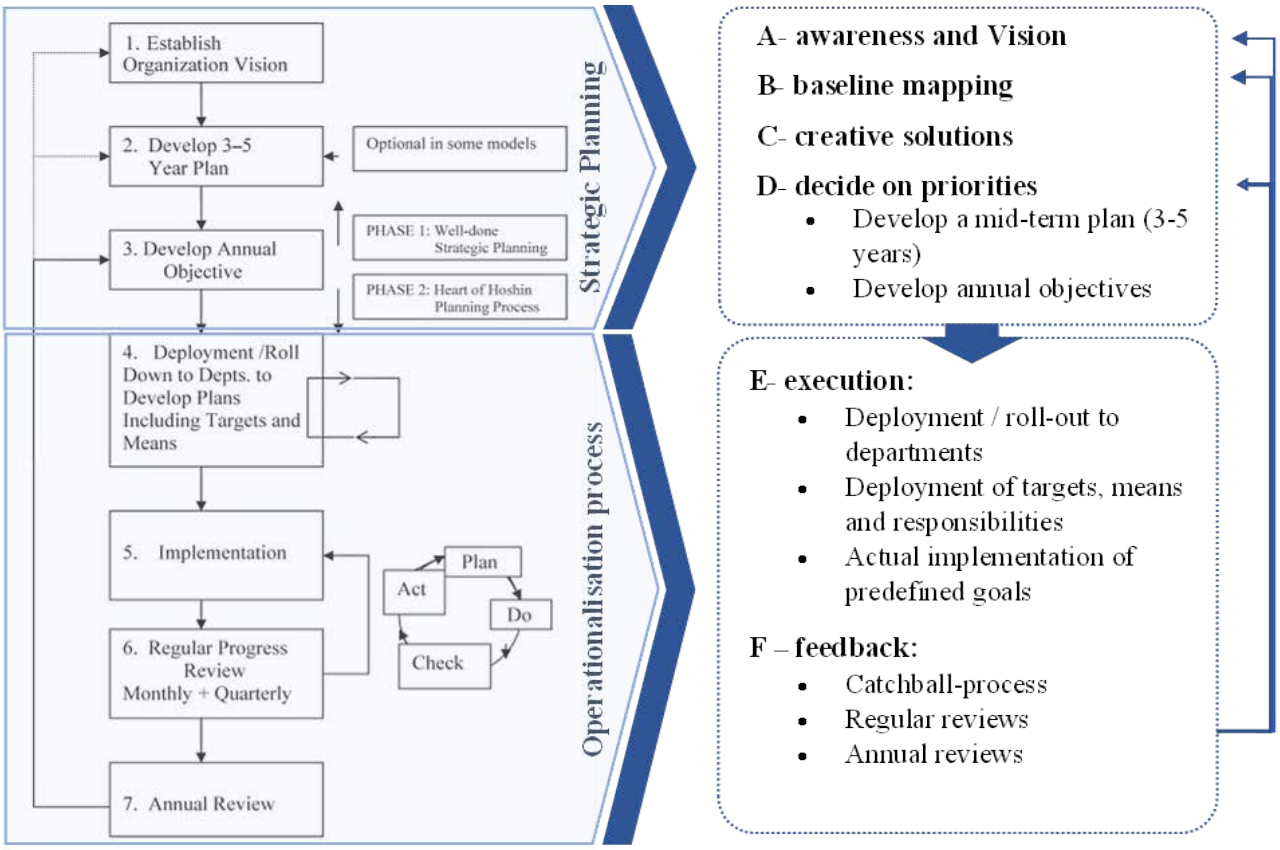

***Figure 4**: The proposed ABCDEF-process framework (adapted ABCD planning method (Broman and Robèrt, 2017) through alignment with the hoshin planning context by the GOAL/QPC Research Com- mittee (1994)).*

An implementation process framework shown in Figure 4 was derived by combining both the hoshin planning process as well as the FSSD's ABCD strategic planning method. Here, the seven steps of the hoshin planning context presented in GOAL/QPC Research Committee (1994) was used as a basis to provide an adapted ABCD-method from the Framework for Strategic Sustainable Development by Bro- man and Robèrt (2017). The FSSD strategic planning method was complemented with additional exe- cution and feedback phases, proposing an ABCDEF-method towards deploying an FSSD. Steps 1-3 (A, B, C, and D) include the classic strategic planning process for sustainable development, provided with the FSSD. However, these visions and strategic goals still need to be implemented/deployed within all

levels of the organisation. This process should be supported through stages execution and feedback. Steps 4-7 (E and F) focus on the (successful) deployment of the defined strategic goals. The previously proposed strategy deployment framework acts as a guide to supporting goal alignment throughout the whole organisation, namely the breakdown of strategic goals on all levels to their measurement on operations level (up to the definition of KPIs).

4. Conclusions

The results obtained should be able to give insights about sustainable operational excellence, relation- ship between operational excellence, HK and sustainability and fill gaps in literature topics, especially concerning frameworks for sustainable operational excellence. With this research, contributions to- wards the identification of possible links between operational excellence and sustainability, as well as challenges and benefits for implementing HK should be achieved. As a strategy deployment framework, HK is promising and has already shown many positive results when properly implemented. HK has the potential of linking strategy with operations, hence linking sustainability on a strategic level to its im- plementation in daily management. The developed framework should prove exactly that – a framework combining sustainability and operational excellence towards an integrated framework through HK. The present study serves as a theoretical foundation for further research process. For validation purposes, empirical data will be collected from practitioners and experts in the field of operations management. Another research opportunity arises by then applying the theoretical findings of a further validated framework in a later stage to a case study. These would help discover further insights, limitations and help develop the framework further. In this context it would be of interest to analyse the influencing factors for implementation, such as the level of maturity and size of a company, the organisational structure and culture, pre-existing lean production, or other management systems as well as tools for strategic planning and implementation. Limitations of this study are, that the literature review and re- sulting framework provide a theoretical finding. Another limitation is the strong focus on HK, as it is not as well known in western countries as in Japan; as a result, it may be difficult to implement due to cultural differences. However, as stated within the study, examples of companies exist that prove oth- erwise and which have integrated and rearranged HK to fit the companies own organisational culture (e.g., Texas instruments, IBM). The sustainability framework used itself, the FSSD, may also show potential for improvement; however, it provides a holistic yet practical framework that has proven to be useful in a myriad of cases and has been developed throughout decades of practical experience and research efforts.

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Posters

Breaking the glass ceiling for women: Is it the recipe for sustainability management in companies?
Vanessa Prieto-Sandoval, Andrés Mejia-Villa and Luz Elba Torres-Guevara

CSR disclosure in the automative industry
Vera Ganhão and João Simão

Voluntary sustainability standards for corporate social responsibility
Kario Fernandes Martins, Denilson Teixeira and André C.S. Batalhão

(1) Pontificia Universidad Javeriana Bogotá — Facultad de Ciencias Económicas y Administrativas — Carrera de Administración de Empresas

(2) Universidad de La Sabana — Escuela Internacional de Ciencias Económicas y Administrativas

CYTED

(1) Vanessa Prieto-Sandoval, julieth-prieto@unisabana.edu.co
(2) Andrés Mejía-Villa, andres.mejia@unisabana.edu.co
(2) Luz Elba Torres-Guevara, luz.torres3@unisabana.edu.co

Breaking the glass ceiling for women: Is it the recipe for sustainability management in companies?

This research focuses on analyzing the characteristics and capacities linked to sustainability management and the dominant women profiles in areas of sustainability.

1 Research Goal & Hypotheses

Research Goal

- Identify the characteristics of women's involvement in corporate sustainability management

Hypotheses

- **H1:** Women have greater participation in sustainability management than men
- **H2:** Sustainability management positions are related to professional vocation and "soft" skills.

2 Research question

Which is the role of sustainability managers, especially women in these positions that lead to social and environmental sustainability in companies?

3 Method

Census

- 300 persons among managers, bosses, coordinators, and sustainability analysts.
- Reference method and snowball technique
- People were contacted reference method or snowball technique

Survey

- Questionnaire: 35 questions (16 based on a Likert scale)
- Qualtrics (Online survey services)
- Response rate: 18.6%

4 Findings

Sociodemographic characteristics:

44 respondents

- 54% women & 46% men
- 57% live as a couple
- 71% postgraduate studies
- Wages: >50% 1200 € , 14% between 2000 and 4000 €, and 11% more than 4000 € per month

H1: Confirmed

Women occupy 72% of middle and high positions in sustainability management.

Management focus on:

- Leading the sustainability team
- Designing, coordinating and executing the environmental and social management strategy

H2: Confirmed

80% spend a large part of their time leading: the work team dedicated to sustainability and communication with the managers of each company area. In addition, 77% spend part of their time designing the environmental management strategy, and 66% spend part of their time designing the social management strategy.

5 Conclusions

- Sustainability managers lead to sustainability in a balanced way in social and environmental matters at the same time, which is why they require resources and capacities for both areas of work.
- 80% affirm that one of its main functions is the training and awareness of the staff. However, 75% of sustainability leaders say they coordinate and execute sustainability strategies themselves, and only 25% have more room to delegate. This is contradictory because more than 75% have a role related to senior management, which suggests that they have small work teams. In addition, more than half must manage to obtain environmental and social certification.

- The participants, in general, consider the companies to which they belong to be diverse and equitable and believe that their promotions are due to merit systems and not gender. However, this may indicate a limitation in the sample since they are all companies with sustainability areas.

CSR disclosure in the automative industry

STUDY

How the automative industry disclosure social responsibility issues to their stakeholders?

WHY THIS SUBJECT?

- 4 million direct jobs (Papatheodorou & Harris, 2007);
- Contributes to traffic jams on roads (Meister, 2019);
- Increased emissions of polluting gases into the atmosphere (Meister, 2019);
- Social status symbol (vintage automobiles) (Meister, 2019);
- Current and present problem around the world.

TEORY

Social Responsibility – companies must have social concerns

Stakeholders – individual or group of individuals who affect or are affected by the company (Freeman, 2010)

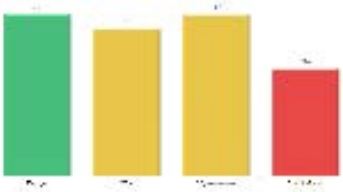
Legitimacy – desirable actions within a society (Suchman, 1995)

METHODOLOGY

- Qualitative data
- 16 sustainability reports
- Fiscal year 2019
- Car manufacturing companies
- Likert scale with 5 levels
- Quantitative data analysis

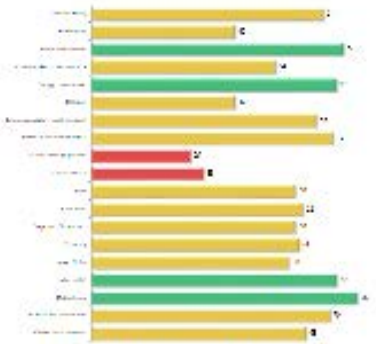
RESULTS

- 14 of 16 companies use GRI and 14 of 16 companies use ISO
- 12 of 16 companies refere SDG
- Philanthropy theme was the most mentioned followed by water consumption. On the other hand, the topics of toxicity to the population and land use are the least explored topics.

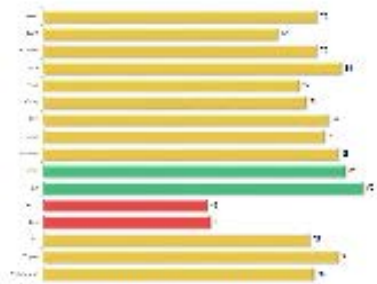


Graph 4 – Disclosure of Social Responsibility by region of the globe.

Graph 1 – Frequency of SDGs in sustainability reports.



Graph 2 – Disclosure of Social Responsibility by theme.



Graph 3 – Disclosure of Social Responsibility by company.

CONCLUSION

Companies use sustainability reports as a form of communication and as a form of publicity in order to legitimize their activity with society.

Stakeholders are present in the reports, especially the dialogues between them and the company.

The reports are not uniform, which makes their analysis and comparison difficult.

Finally, the existence of reports is a step towards sustainable development, however it is necessary to bear in mind that there are differences between what is disclosed and what is actually done by companies.

Vera Ganhão[1] & João Simão [1,2], [1] Universidade Aberta, Lisbon, Portugal & [2] CAPP- Center for Administration and Public Policies / Universidade de Lisboa, Lisbon, Portugal and Track 5a CSR and sustainable entrepreneurship

Voluntary Sustainability Standards for Corporate Social Responsibility

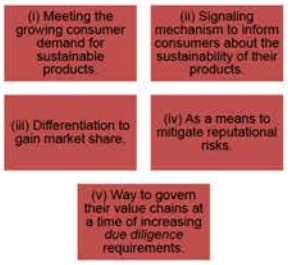
Introduction

Increasingly, social and environmental issues and the demands of consumers and large global businesses for products that present a better environmental performance throughout their life cycle have demanded from companies more commitment and responsibility to minimize the impacts of their activities. These pressures coming from the market and consumers have led to an increase in the demand for sustainable certification of processes and products, making the Voluntary Sustainability Standards (VSS) a present issue in business and Global Value Chains (GVCs).

The United Nations Forum on Sustainability Standards (UNFSS) conceptualizes the VSS as special rules that ensure that the products we buy do not harm the environment and the people who make them (UNFSS, 2018).

The adoption of voluntary standards also provides mechanisms to face the external forces experienced by companies in increasingly global environments that comply with the principles of Corporate Social Responsibility (CSR).

For Galati et al. (2017) such mechanisms correspond to:



Objective: to link the Voluntary Sustainability Standards to Corporate Social Responsibility, making an overview, through a literature review, of standards, global trade, and CSR, bringing contributions and challenges on these very current issues and present in the global market.

Voluntary Sustainability Standards (VSS)

The Voluntary Sustainability Standards (VSS) have emerged as global regulatory mechanisms to address sustainability, quality, health, and safety in organizations and their value chains (Büthe; Mattli, 2011). Consequently, private actors such as Non-Governmental Organizations (NGOs), industry associations, and transnational bodies have emerged and developed rules to govern various management practices (Castka; Corbett, 2015).

Main Voluntary Sustainability Standards and applications.

VSS	SECTOR/ PRODUCT
4C	Coffee
Better Cotton Initiative	Cotton
BONSUCRO	Sugarcane
Cotton Made in Africa	Cotton
Fair Trade Certified	Agricultural production
Forest Stewardship Council	Forest
Ethical Trading Initiative - ETI	Labor practices
GLOBAL GAP	agricultural production
Organics International Standard - IFOAM	organic crop production
Program for the Endorsement of Forest Certification - PEFC	Forest
ProTerra Foundation	agricultural production and feed
Rainforest Alliance *	Forest
Round table on Sustainable Palm Oil - RSPO	Palm Oil
Round Table on Responsible Soy - RTRS	Soy
Travelife Award of Excellence	Tourism
USDA National Organic Program - NOP	Organic Products
Union for Ethical BioCommerce - UEBT	Agriculture, Floriculture, Horticulture

Source: ITC/Standards Map (2021).

Corporate Social Responsibility (CSR)

Studies on the topic of Corporate Social Responsibility (CSR) gained importance and greater popularity internationally during the 1970s and 1980s, but their origin dates back to the late nineteenth century due to pressure from society towards the industries with the Industrial Revolution.

Dahlsrud (2008) states that there is no universal understanding of the meaning of CSR. Benabou and Tirole (2010) say that CSR definitions emphasize that companies sacrifice profits for the social interest.

However, when the company sets a standard to achieve only limited corporate goals, such as improving its image, no benefit can be expected.

VSS Contributions to CSR

- Boost workers' earnings (Bennett, 2018);
- In the CSR strategies, they may be stronger in quality control, health, safety, and environmental management than in employee compensation and benefits (Kortelainen, 2008);
- International Labor Organization (ILO) Standards focus on horizontal wage equity, for example, equal pay for equal work (Bennett, 2018);
- Improving rural livelihoods (Ting et al., 2016).

Main challenges VSS and CSR

- VSS can be problematic when addressing areas that are already covered by technical regulations.
- The real effect of these norms on international trade and, especially, on exports from developing countries.
- The rules or international agreements that can be applied to the frame or provide incentives and disincentives for these standards.
- The growing number of VSS available on the market.
- Need to have adequate information about VSS and its effects on the national market
- Lack of transparency in the disclosure of data.

Conclusion

The new paradigm of corporate social responsibility and accountability needs to be actively supported by changes in the governance structure to provide fair competition in the global economy.

Adopting sustainable certification, producing sustainably, and communicating all of this to customers is a strategy to improve the corporate image, differentiate products, add value, and position or reposition itself in the market.

There are many similarities in the characteristics of the VSS and CSR themes: multidimensional and multidisciplinary nature; qualitative nature of most structures; voluntary nature; the presence of themes related to the dimensions of sustainability and concepts related to sustainable development. Furthermore, both themes are constantly changing both in nomenclature and in their concept.

It is concluded that the certifications based on internationally recognized standards and CSR concepts are tools that can chart paths to achieve sustainable development.

Kairo Fernandes Martins[1], Denilson Teixeira[1], and André CS Batalhão[2]
[1]UFG – Federal University of Goiás, Goiânia, Brazil
[2]CENSE – Center for Environmental and Sustainability Research, NOVA University Lisbon, Caparica, Portugal.

5/2/2022

5. Production, consumption and innovation

5b. Design for sustainability

Abstracts

Co-designing Measurement and Reduction of Food Loss and Waste: A case study of developing and refining tools

Associate Professor Simon Lockrey, Mr Allister Hill, Ms Lauren Rigbye, Ms Margaux Monnier-Penny, Associate Professor Karli Verghese

RMIT University, Melbourne, Australia

Abstract

Food is a fundamental tenent related to human rights, as it sustains people. Food also helps shape economic, political, performative, and social institutions i.e. we 'mingle' when we eat. In short, food is fundamental to humanity. As such, food loss and waste has been framed globally as a multibillion-dollar issue, adding to food insecurity and damaging attempts to curtail widespread hunger, not to mention the vast associated environmental impacts. Remedying food loss and waste requires organizations to accurately quantify their waste issue. Accurate estimates or measurements of the quantity of food loss and waste produced, and related costs, are necessary if society is to transform food systems to be more sustainable. It is hard to fix what you cannot measure.

This paper documents the development of a tool that assists organizations to measure and act upon food loss and waste. The tool was co-designed with industry, a creative participatory approach, to; be user friendly, and fit with business systems and workflows; and align to relevant data. Our primary contribution is detailing the co-design approach taken during product development, to inform how such tools may be developed or enhanced in the future. We achieve this research by analyzing four case studies of stakeholders who trialed the tool. Both small and large companies participated, for a spread of organizational contexts from which to provide data on tool strengths and areas for change. We assessed what made sense to participants within the initial tool prototype, and what could enhance the functionally of the tool for users. This was loosely based on an action research approach. By taking this approach we grounded our research in a real tool development project, to assess methods for food loss and waste measurement, novel user interfaces, and business readiness of the tool i.e. synergies with business data, systems and workflows.

Results show important features of the tool tested were; alignment to global standards for trust and data integrity (i.e. the global Food Loss and Waste Standard, or ISO14051 for mass cost flow accounting); simple data entry, or indeed data entry automation; graphical and tabulated data on both benchmarked and prospective scenarios; hot spot measures and visualizations of the mass and costs of waste at various supply chain stages; modularity with business systems; mapping effects of change, such as comparing future scenarios to benchmarks; and being able to download results. Improvements identified during the co-design process included; allowing automatic saving of models to avoid data loss; better guidance/ nudging of data/ work flows; and the ability to bring outputs from a life cycle stage across as an input to the next stage.

We conclude by discussing areas for future research, with a focus on implications for teams developing or improving food loss and waste tools. This has implications for organizations in how they may co-design related solutions to reduce food waste across disciplinary bounds, creatively, a pursuit which is central to United Nations Sustainable Development Goal 12, Target 12.3, of reducing food loss and waste by half by 2030.

Track
Track 5b Design for sustainability

Connect the Dots by Digits: How can complementors link themselves to existing business models in sustainable ecosystems?

Professor Pejvak Oghazi[1], Dr Maximilian Palmié[2], Mr Lucas Miehé[3]

[1]Södertörn University, Stockholm, Sweden. [2]University of St.Gallen, St. Gallen, Switzerland. [3]Copenhagen Business School, Copenhagen, Denmark

Abstract

Digitization entails opportunities and challenges for many firms, stimulating business model innovation. While scholars have so far mainly focused on how dominant firms in ecosystems can innovate their business model in response to digitization, we take a different approach and examine how digital service providers can inject themselves into an ecosystem and connect themselves to the business model of the dominant firm. For an ecosystem to be sustainable, the business models of the involved firms need to interact and be aligned. Although the literature on the digitization of business models has grown enormously, the implications of digitization for such interaction and alignment across firms and business models remain under-researched (as pointed out by Kohtamäki et al., 2019; Paiola & Gebauer, 2020; Kapoor & Agarwal, 2017 and many others). Moreover, existing research has mostly dealt with the business models of the central and dominant firms in ecosystems (e.g. Iansiti & Levien, 2004; Williamson & de Meyer, 2012). However, as ecosystems consist of multiple firms and only one or a few can be dominant and central in each ecosystem, many firms will often assume a complementary, rather than a dominant or central role in ecosystems. Based on an exploratory qualitative study of four cases in mobility, we develop an archetype model of sustainable injection strategies. Our findings illuminate complementor strategies in ecosystems and show that the dominant firms in ecosystems do not necessarily have to make cumbersome changes to their business model to accommodate digitization. Rather, they can also cooperate with digital service providers to do so. Our findings add important contributions to the business model innovation with a focus on sustainability and ecosystem literature.

Keywords: Digitalization, digitization, business model innovation, sustainable ecosystem, complementor strategy, meta-organizational design.

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Track

Track 5b Design for sustainability

Does Collaborative LCA Improve Engineering Competencies for Sustainability? A comparative analysis

PhD student Lou Grimal[1], PhD Nadège Troussier[1], PhD Inès di Loreto[2]

[1]INSYTE/CREIDD, Troyes, France. [2]LIST3N/Tech-CICO, Troyes, France

Abstract

Engineering activities have been actively participating in the over-coming of planetary boundaries by developing technological artifacts and infrastructures without systematically considering environmental and social issues. Engineering activities are supported by specific IT tools for design and production. In this article, we are interested in those tools and the impact they can have on engineering activities for sustainability, more precisely on engineers themselves.

For a couple of years, students we train are rejecting engineering tools that are dedicated to sustainability, such as life cycle assessment or ecodesign. There are several reasons for this attitude, the main being that those methods and tools seem to act at the product level and not at a systemic level, with no chance to bring macro change. Thus, they are questioning the relevance of learning to master those tools. The authors want to develop knowledge on the impact of those engineering tools on engineers regarding the knowledge, skills, and competencies for engineering for sustainability they can develop. Also, we are wondering if a change in the way we use those tools can help improve engineering competencies for sustainability.

The aim of this work is to better understand how engineering tools for sustainability impact engineers themselves. We have done the hypothesis that more collaborative tools can improve engineering for sustainability competencies. This collaborative aspect is lacking in most engineering tools for sustainability, for instance in life cycle assessment (LCA) tools. Thus, we conducted an analysis to know if adding collaborative aspects in the learning and use of LCA tools has an impact on the development of engineering competencies for sustainability. A comparative analysis has been deployed between a “classic” life cycle assessment and a more collaborative way of practicing LCA. For this comparative analysis, we are observing the evolution of competencies of engineering for sustainability - which are well defined in the scientific literature - and the evolution of students’ understanding of LCA’s relevance for a sustainable transition.

With this study, the contribution is twofold. First, we yearn to better understand the impact LCA tools have on engineers (the evolution of their competencies, students’ understanding of LCA). Second, we are exploring a more collaborative way to use LCA tools and the impact this new feature has on students' competencies - specifically engineering competencies for sustainability. Through this study, we aim to better understand the relationship between engineering for sustainability and the associated engineering IT tools.

Track
Track 5b Design for sustainability

Hacking the Campus: Art and creative engagement to design a sustainable environment

PhD Sofia Lundmark, PhD Romina Rodela

Department of Natural Sciences, Environmental Studies and Technology at Södertörn University, Huddinge, Sweden

Abstract

Cities are becoming increasingly complex as a multitude of interests, needs, values and ways of living converge. For this reason, it is important to understand this diversity and explore how it could be captured by planning and governance processes. This is commonly done in participatory spatial planning processes where well-educated, adult, and economically stable citizens would commonly provide input to the process. Younger demographic groups as children and youth are rarely involved. In 2022 Sweden, however, passed an act that states that children and youth shall be part of spatial planning when they are to be affected by given interventions.

There are many diverse good examples of youth participation that offer valuable insights and grounding to this new turn. Yet, youth is not an easy catch. Youth is a very diverse group, and more often than not, they are critical of the status quo, and thrive most when challenged on tasks that they find interesting. Engaging youth in classical workshop sessions with experts discussing maps or models might not work at all. Here some have suggested that art, crafting, and novel technology could help to develop meaningful participatory processes.

In the study presented here, we report on an attempt to explore a novel method. We introduce an activity where 52 students at a media and design bachelor program at a Swedish university explored the use of art and design methods to 'hack' their campus in a post-Covid-19 scenario. The students were asked to work with the design materials – paper and cardboard – to give shape to alternative ideas about how to hack the campus environment. They were asked to develop a "sustainable artefact" representing a solution to the challenge of returning after the pandemic. They were asked to critically look at the current infrastructure and think about what they would like to change to make it a more sustainable place.

The data set for this study consists of 52 assignments including tangible material representations of the work in the form of images of i) the resulting designed artifact (details, work-in-progress, final prototype), ii) of montage images of the designed artifact contextualized and placed into the campus environment, as well as iii) written reflections about the task at hand. The assignments were analyzed using a thematic content analysis and analysis of the sustainable artifacts.

The designed artifacts were created from a range of different ideas and observations. Some were made with the purpose to reduce stress, others to promote mental and physical health, or to boots social gatherings and togetherness. The typology of these spans from artifacts that are inspired by furniture that promotes meetings and social interaction, collective gardening areas, bird nests, litter containers, green houses, training equipment, tools to provide feedback, interactive screens and power stations both for bikes and phones.

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 adults in their own social and urban environment.

Track
Track 5b Design for sustainability

Integrating Sustainability in Industry of the Future Technological Learning Programs: A platform to co-create and mutualize course experiences

Associate Professor Maud Rio[1], Associate Professor Tatiana Reyes[2], Associate Professor Yacine Baouch[3], Associate Professor Vincent Robin[4], Researcher, Dr. Catherine Perpignan[4], Associate Professor Tom Bauer[5], Associate Professor Alexandre Mege-Revil[6], Researcher William Bernaud[7], Engineer Elie Lemarquis[2], Student Paul Saada[8], Professor lecturer Romain Colon de Carvajal[8]

[1]Univ. Grenoble Alpes,G CNRS, Grenoble INP, Grenoble, France. [2]UTT - Université de Technologie de Troyes, CREIDD, INSyTE, Troyes, France. [3]UTC, Department of Mechanical Engineering, Roberval Institute, Compiègne, France. [4]INSPE d'Aquitaine, Université de Bordeaux, Bordeaux, France. [5]ENSAM, Chambéry, France. [6]Centrale Lille Institut, LaMcube, CNRS, Villeneuve d'Ascq, France. [7]Coexiscience, Villeurbanne, France. [8]INSA, Lyon, France

Abstract

This research paper presents the work conducted in a French National Research Agency supported project to overcome the issues faced by engineering lecturers willing to integrate socio-ecological aspects of their engineering teaching material. The paper investigates the adapted support, content, and context to integrate sustainability into engineering courses aligned with sustainable future requirements for industries. The literature review identified two main barriers to the dissemination of knowledge on sustainability to higher education lecturer. Firstly, there is a plethora of course materials. However, their format and content are not adapted to properly fit the existing technological courses covered by teachers. Secondly, available courses on sustainability are scattered in several platforms. Concerned with a lack of time, and with very limited guidance support, higher education lecturers are therefore struggling to choose the training material in sustainability that would fit their discipline. The sequence to start with and the level of socio-ecological issues to address are unclearly prescribed. Thirdly, the existing materials rarely allow teachers to share their own skills, and compose their course efficiently. To face them, a collaborative proposition has been formulated by the twelve academic researchers and collaborators involved in this project. The proposition confers three objectives: to facilitate the diffusion of sustainability issues in engineering courses for higher education, to develop and maintain a sharing platform, and to secure a contribution and co-learning network of contributors. The paper presents the first experimentations conducted with teachers and students, covering the basic-level one-sustainability skills for engineers of system thinking, prospective vision, ethic, change, and action. The skills-based framework contains has been developed on a creative common software available on a sharing platform hosted in France by the S.mart community in engineering design. Results show that behind the French engineering community involved in sustainability issues, the sharing principles are strong values to develop and maintain sustainability trainings over the year.

Track

Track 5b Design for sustainability

Life Cycle Assessment of a Newly Lightweight Automotive Component Design: Linkage of design for sustainability and the sustainable development goals

Ms. Margarida Gonçalves[1], Mr. Marco Estrela[1], Mr. Zach Georgeou[2], Mr. Kai Köhler[2], Ms. Carlota Arenillas[3], Mr. Michele Tedesco[4]

[1]R&Di unit of Low Carbon & Resource Efficiency, Instituto de Soldadura e Qualidade, Porto Salvo, Portugal. [2]Salzgitter Mannesmann Forschung GmbH, Duisburg, Germany. [3]Gestamp, Bizkaia, Spain. [4]Centro Ricerche Fiat S.C.p.A., Turin, Italy

Abstract

Lightweight materials have the potential to reduce vehicle fuel consumption and greenhouse gas emissions, thus in line with the Sustainable Development Goals (SDG) 13 "Take urgent action to combat climate change and its impacts". Novel 3rd generation advanced high strength steels, based on medium manganese, were developed and integrated into a newly designed component of the Jeep Renegade vehicle. The goal is to compare the environmental performance of the novel ecodesign component with the current Jeep Renegade component based on advanced high-strength steel alloy. To support the Design for Sustainability (DfS) a Life Cycle Assessment (LCA) methodology is conducted following two approaches, namely a cradle-to-gate, to quantify the potential environmental impacts of the production of the component, and a cradle-to-wheel, to evaluate the potential environmental benefits of the new steel alloys at the vehicle use stage. The LCA results show that, depending on the life cycle stages included in the assessment, the DfS results changed for some environmental impact categories, i.e., if the approach was a cradle-to-gate or cradle-to-wheel. The component production with the current steel alloy is the best environmental solution, with an exception for the freshwater eutrophication impact category. However, when coupling all the life cycle stages together, namely material production, manufacturing, and vehicle use stage, the best environmental solution switches to the novel advanced high strength steels based on 3rd generation medium manganese, with an exception for the mineral resource scarcity impact category. Since the use stage is more significant to total impacts than the other life cycle stages, the novel steel alloys production impacts are mitigated. It can be concluded that merely based on a climate change mitigation strategy (e.g., SDG 13; SDG9+Target: 9.4), the results corroborate the application of lightweight materials as a way to reduce carbon emissions. However, when considering the sustainability concept in a broader and more inclusive scope (e.g., SDG 15; SDG11+Target: 11.4,+Target 12.2 and 12.4) conclusions regarding the best environmental solution are involved in some ambiguity since environmental impacts trade-offs are identified when other impact categories are considered beyond greenhouse gas emissions and energy consumption. For the novel steel alloys production, the pickled hot-rolled flat steel production is identified as an environmental hot spot. To improve their environmental performance measures should be implemented to mitigate the mineral resource scarcity impact result.

Track
Track 5b Design for sustainability

Supporting Product Planning for a Circular Economy: Evaluation of a case study within the white goods industry

Anna Díaz-Tena[1], Tatiana Reyes[2], Prof. Rupert J. Baumgartner[1]

[1]University of Graz, Graz, Austria. [2]University of Technology of Troyes, Troyes, France

Abstract

The circular economy paradigm is increasingly regarded as a means to achieve sustainable development goals in private sector organisations. This is done through the implementation of value-retention strategies during the design of products, which allow to increase resource-efficiency during production and reduce material throughput during consumption by readjusting consumer behaviour and products lifecycle management. Often, these design modifications are intertwined with competitive strategy elements of the company (e.g., the business model), and thus, designing for a circular economy entails strategic decision-making. Current product development processes often integrate sustainability-oriented requirements once strategic aspects are already discussed upon, and thus, the design space does not allow for implementing transformational circular economy strategies. This research set out to evaluate the performance of computer-based support aiming to improve the effectiveness of value-retention strategy implementation during product development. The computer-aided tool is based on general morphological analysis and describes 6 process factors necessary to integrate high-value retention strategies into the design of products and compiles a range of conditions under which each factor can be implemented, providing product planners the building blocks of their circular economy-oriented product development roadmap. Thus, the tool has been applied and evaluated during strategic product planning in a case study on the white goods industry. The evaluation was based on an experimental design that compared the product planning outcomes (product proposal and implementation roadmap) of development teams where support was either present or absent and measured the impacts of the tool on 15 process effectiveness indicators. The findings of this study shed light on the intra-organisational resources that need to be mobilized for integrating high-value retention strategies during the development of products, thus contributing to expanding the knowledge on circular economy implementation in private sector organisations.

Track
Track 5b Design for sustainability

Sustainable Fashion and Textile: Contemporary Scenario

Mr. Siddharth Siddharth, Ms. Pooja Kapoor, Ms. Jyoti Pal, Mr. Chetan Chiller, Ms. Kanika Jolly, Ms. Deepshikha Deepshikha

National Institute of Fashion Technology, Delhi, India

Abstract

Textile and apparel industry contributes significantly towards creating employment and revenue generation, globally. China occupies 50% of the apparel manufacturing sector followed by India, Mexico, Philippines, Indonesia, Bangladesh and Srilanka. The industry is also one of the major sources of land, water and air pollution with over 20,000 chemicals being used are carcinogenic in nature. The paper reviews types of sustainable practices in fashion and apparel industry being followed globally; case studies of popular brands that follow sustainable practices for textile and apparel production in India and around the world; certifications that industries have acquired for sustainable production; and a questionnaire based study with entrepreneurs and consumers about sustainable fashion. Qualitative analysis of the response received from entrepreneurs suggest that they are eager to work on a line of products created purely out of sustainable methods as part of their existing portfolios. They are also optimistic about incorporating sustainable practices in their day to day operations to reduce harmful impact on the environment and acquiring certifications that may benefit their business. The study conducted with young consumers between the age group of 20-40 years reveals that they readily purchase from environmentally conscious labels and intend to increase their share of sustainable fashion in their existing wardrobe for a better impact. The paper concludes with trends for sustainable fashion, textiles and accessories domain for the near future.

Track
Track 5b Design for sustainability

Traditional Indian Textile Crafts and Paintings: A sustainable heritage

Mr. Siddharth Siddharth, Ms. Pooja Kapoor, Ms. Jyoti Pal, Mr. Chetan Chiller, Ms. Kanika Jolly, Ms. Deepshikha Deepshikha

National Institute of Fashion Technology, Delhi, India

Abstract

Textile traditions and paintings of India have a rich lineage that represents cultural indigeneity. Textile crafts of India may be broadly classified as woven, printed, painted and embroidered. Many of these crafts employ natural dyeing, painting and printing for preparation of handcrafted textiles. Similarly traditional paintings of India are rich in material wealth, stories and visual creativity. The paper reviews few folk paintings of India, such as Madhubani, Warli, Pithora, Patachitra, Miniatures, Phad, Pahari, Ragamala, Tanjore and craft practices such as Pichwai, Batik, Block Printing Tie-dye, Kalamkari and their usage of natural dyes. Further the authors approached educators, entrepreneurs, students and consumers for their views on sustainable dyeing, printing and painting methods and usage. Qualitative analysis of study conducted reveals that while educators are keen on inculcating sustainable practices in teaching curriculum and their students, entrepreneurs believe in bringing the theoretical knowledge to fruition via local and global retail. Study conducted with young consumers on buying preferences for sustainable products reveals that although natural and sustainable production may render the product expensive, their purchase is high on value and aesthetics and hence constitutes a desirable place in their wardrobe and home interiors. The paper concludes that the future of sustainably produced textile crafts and paintings is quite popular in demand and will continue to remain an essential part consumers' buying preferences. Authors also report few initiatives that may be undertaken that could prove beneficial for the traditional practices, such as online retail, online trade shows specifically for sustainable products, training programs for students and entrepreneurs to incorporate sustainable practices into their learning and product lines, bridging the gap between artists, craft persons, students and enthusiasts by connecting them via virtual or physical workshops.

Track
Track 5b Design for sustainability

What a Waste – A norm-critical study on how waste is understood and managed through integrating perspectives

Senior Lecturer Anna-Sara Fagerholm[1], Senior Lecturer Karina Göransson[1], Senior Lecturer Henrik Haller[2], Associate Professor Per-Olof Hedvall[3]

[1]Mid Sweden University, Sundsvall, Sweden. [2]Mid Sweden University, Östersund, Sweden. [3]Mid Sweden University, Lund, Sweden

Abstract

In previous research waste is described as a design flaw, as the processes that generate waste are a result of poor design (Anastas & Zimmerman, 2006; Ordónez, 2017). Ekberg (2009) points out that waste is what is left behind when imagination fails and this also reflects a reconsidering of waste as resources if given another context.

In a globalized world with international trade, there is a greater range of products on the market and the amount of waste is constantly increasing (Avfall Sverige, 2021). A challenge is therefore to reduce the amount of waste. De Laney (2018) points out that there is a huge opportunity to reduce landfill waste and improve consumer habits through design. In this process, we must learn to include new and more inclusive ways of thinking and acting that support long-term social sustainability through design (Wikberg Nilsson & Jahnke, 2018).

More than forty years ago, Dilnot (1982) emphasized that through design, we humans give shape, direction and meaning to our individual and collective existence in the world. Today, there are different design solutions for household waste and recycling and Vollaard and van Soest (2020) argue that reducing unsorted waste normally requires little in the way of capital investment beyond buying a set of in-home recycling bins. Although, many times consumers aren´t aware of the impact of their disposal decisions and many facilities for local waste disposal and recycling have processes that are unique to them that could cause confusion (De Laney, 2018). In accordance, we must find a way to get consumers to care and to motivate a change in habits.

The research question of this study is how waste is understood and managed and this is explored through a case study with a local housing company and waste management company, interested in improving waste sorting. In order to answer the research question, interviews are conducted with people living in the specific buildings belonging to the housing company, respondents from the local housing company and the waste management company and results are presented on perceptions of waste and what the barriers are to improve waste sorting. This is complemented by a literature review to provide a better understanding of universal design and waste.

This paper presents a norm-critical aspect on universal design and waste in a collaborative research project with the objective of creating more inclusive solutions for waste systems. The overall ambition of this study is to build on knowledge of the role of design as an activity of shaping the human surroundings and as an expression of the culture to which it belongs (Skjerven & Reitan, 2018).

The study is related to global goal number 2.5: by 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

Track
Track 5b Design for sustainability

Full papers

Sustainable Redesign Process of Foldable Plastic Crate Suitable to Grape Transport

A case study of design optimization end material reduction

Lucia Pietroni[1], Jacopo Mascitti[2], Daniele Galloppo[3]

[1]*University of Camerino, lucia.pietroni@unicam.it*
[2]*University of Camerino, jacopo.mascitti@unicam.it*
[3]*University of Camerino, daniele.galloppo@unicam.it*

Abstract

The transport and logistics system of many fruit and vegetable products, is strongly linked to the production of crates, which mainly use virgin plastics or materials of cellulosic origin, such as wood and corrugated cardboard. Despite the availability on the market of reusable containers, in many countries, such as in Chile and the rest of South America, disposable types continue to be used. To aggravate the environmental burden, there is also the poor management of plastic waste in these territories. In fact, in the new report - drawn up by The World Bank Group - South America prefers landfills (68.5%), but the abandonment of materials on the street is also not uncommon (26.8%). However, signs of change are also taking place in these countries: legislation that restricts the use and distribution of single-use plastics is evolving in Latin America, but the path is still long and complicated. According to one of the latest studies conducted by the Ellen MacArthur Foundation, "current efforts to eliminate plastic remain focused on replacing with other plastic or paper" but also redesigning single- use products and reducing their weight - often by reducing thickness. - represents a valid alternative for manufacturing companies, which do not intend to replace the starting material. The proposed paper intends to describe the process of research and environmental redesign of a disposable plastic tray, foldable and Collapsible, intended for the transport of grapes. The project, developed for the Chilean company "Wenco S.A." from the Spin-off of the University of Camerino EcodesignLab in collaboration with the Italian company “SCS Stampi”, had as a priority objective the reduction of the material used to produce packaging. The product is characterized by innovative technical-formal solutions capable of increasing resilience, drastically reducing the use of polypropylene, and improving its ergonomics for the stacking and transport of the individual boxes. In the first phase of the project, preliminary and benchmarking research was started, aimed at analyzing the technical characteristics of the boxes used for transporting grapes. Through the photographic survey of the product supplied by the company, its weighing and FEM structural analyzes, optimization strategies were identified to reduce the amount of polypropylene used. At the end of the analysis phase, a new proposal for a collapsible box was generated, developed according to the design criteria of the DfS and optimized to ensure optimal

conservation of the grapes during all stages of transport. The redesign process has led to a reduction of polypropylene by 17%, up to 25% in the advanced version of the box. Considering the annual production of approximately 4 million pieces, the results obtained represent an important contribution in terms of reduction of resources and environmental impacts attributable to the production of virgin material. In conclusion, the paper presents a case study in line with the SDG 12 objective, which made it possible to obtain both a significant reduction in consumption and an increase in company know- how, in terms of the manufacturer's DfS.

Keywords: foldable plastic crate, sustainable design, design for reduction, structural design

1. Introduction

The current scenario of the transport and logistics system of most fruit and vegetables is strongly linked to the production of crates, which mainly use virgin plastics, materials of cellulosic origin - such as wood and corrugated cardboard - and in some cases bioplastics. The wooden crates, mainly used in the past, represent the traditional tool for the storage and handling of goods; on the other hand, cardboard models are used for light goods, therefore their application is limited. Plastic crates have been available on the market since the 1990s (Conai, 2018) and, thanks to their production and performance versatility, they have acquired a significant presence on the market, becoming the main choice of large-scale distribution for the transport of food goods over long distances. These containers have the main objective of protecting and guaranteeing the integrity of the goods shipped during the transport phase and at the same time simplifying their handling, in the unloading and storage phases.

A 2021 life cycle comparative assessment study aimed at quantifying and comparing the environmental impacts of plastic crates, corrugated cardboard and wood - according to ISO 14040 and ISO 14044 - will demonstrate that the adoption of the plastic crate is environmentally advantageous - compared to other types - only when there is the possibility that it will be reused several times, thus avoiding the high impacts of production (Del Borghi A. et al., 2021). Despite the availability of reusable containers on the market, in many South American countries - such as Chile - disposable types made with virgin material, generally polypropylene or high-density polyethylene, continue to be used. This choice is mainly determined by their low cost and production efficiency, compared to reusable or bioplastic crates, but also by the lack of responsibility of producers for managing the end-of-life of the product. Much of the production, in fact, is shipped abroad, outside the continent, and only a small portion is used for the internal market, for which it still represents a significant environmental problem. Most of the crates are still destined for landfill disposal, and only rarely are they sent to a recycling chain. In addition to causing serious damage to the subsoil - especially during long periods of exposure - the piles of plastic crates in the streets, together with other waste, feed the image of degradation in the territory and for communities in general. The results of the research

conducted by The World Bank Group confirm the environmental emergency of the end-of-life scenario of plastic waste in South America.

The report contains some data, particularly significant for this geographical area: more than two thirds of waste (equal to approximately 68.5%) is disposed of in some type of landfill, half of which in sanitary landfills (with or without controls environmental and social), or burned, and finally 26.8% end up abandoned on the street (World Bank, 2019).

However, signs of change are also taking place in these countries: legislation that limits the use and distribution of single-use plastics is evolving in Latin America; however, the path is still long, complicated, and far from the models developed by European environmental policy.[1] A first step towards this evolution is represented by the Chilean Pact for Plastics (PCP), of April 2019, promoted by the "Fundación Chile" and the "Ministry of the Environment", and whose objective is to rethink the future of plastic in this country, through the involvement of all the actors of the value chain such as companies, public bodies and NGOs. The initiative is part of the "Plastics Pact Global Network", launched in 2018 by the Ellen MacArthur Foundation in the UK.

Therefore, despite the food transport crates market presents a wide range of reusable product types, most of them made of virgin polypropylene, some large-scale distribution companies present in South American countries, such as Chile, still prefer crates single use. Despite the recent technical and commercial developments in post-consumer plastics and the change in regulations to allow the transport of food in containers of recycled material, there are still many restrictions that limit the development of these types of packaging. In fact, the crates made with regenerated material, can only be used with specific foods that are already equipped with their own natural protective casing (such as garlic, chestnuts, bananas, hazelnuts etc.) and consequently, they are not suitable for the transport of others fruit and vegetables, such as grapes, important for the Chilean market. Therefore, the substitution of the material as the best design solution is not always feasible. However, considering the economic aspects and the criticalities of end-of-life management in these territories, it is necessary to undertake a careful life cycle design, mainly aimed at reducing the raw materials used.

According to one of the latest studies conducted by the Ellen MacArthur Foundation: "Current efforts to eliminate plastics remain focused on replacing them with other plastics or paper"; however, also the redesign of disposable products, and the reduction of their weight - often reducing thickness - represents a

[1] The waste production sector is a strategic sector of environmental policy, identified as such, by the European Union, in agreement with all member states, and establishing - in particular for waste deriving from packaging - the principle of the “Extended producer responsibility”, i.e. attributing the responsibility to those who place the packaging on the market (“polluter pays”), whether they are producers or importers of the same.

valid alternative for manufacturing companies, which do not intend to replace the starting material (Ellen MacArthur Foundation, 2021). For example, the beverage industry - water producers in the first place - has taken a leading role in the packaging market, introducing important innovations in reducing the weight of packaging. The latest generations of polyethylene terephthalate (PET) bottles are 50% thinner and lighter than in the past, maintaining in general the same starting performance through new design and structural optimization solutions.

This paper presents the environmental research and redesign process, conducted by EcodesignLab spin- off of the University of Camerino, of a disposable plastic crate, both foldable and collapsible, intended for the transport of grapes. The project, developed in collaboration with SCS Stampi (Italy) for Wenco S.A. (Chile), had as its objective the reduction and rationalization of the material used. Through a Life Cycle Design approach, and the adoption of analysis tools for structural optimization, a new concept of foldable and collapsible crate, with reduced environmental impact, was developed. The product is characterized by innovative technical-formal solutions capable of increasing its resilience, while reducing the use of polypropylene and improving its ergonomic aspects and to facilitate stacking and transport.

2. The phases of the research: activities, methods, and results

The first activity of the development process of the new crates was characterized by the framing of the design brief, which had, as its main objective, the design of a disposable plastic crates for transporting grapes, which was foldable and collapsible, paying particular attention to both the reduction of material used and the improvement of functional and use performance. Through the definition of the brief, it was possible to understand that the redesign of the crates would have entailed - in addition to economic benefits for the manufacturer - also a significant advantage in terms of environmental sustainability, throughout the entire life cycle of the product. Therefore, the methodology adopted to achieve the objectives inherent in the brief was divided into four macro-phases:

1. historical and benchmarking analysis of the reference product;
2. technical-functional analysis of the collapsible crates model, produced by Wenco S.A (Chile) and survey of environmental criticalities;
3. identification of strategies for material reduction - through the support of the FEM Finite Element Method - and optimization of the transport phase;
4. development and optimization of a new model of foldable and collapsible crate for the transport of grapes produced in Chile.

The first macro-phase was characterized by two important research and in-depth activities: the first focused

on the historical evolution of the grape transport crates, and the second on benchmarking analysis of the products of the main competitors. Through the first research, it was possible to learn how the typological evolution of the crates used for the transport of grapes was strongly influenced by the method of use of the transported goods: for wine grapes, in fact, containers in wooden slats were used, carried on the shoulders to the cellar - or in case of long distances, on the back of mules - while, the table grapes - intended for consumption - were harvested in baskets, or cane and wicker containers.

Towards the end of the nineteenth century, the increase in the demand for fruit consumption, the progress of transport technology and finally, the birth of the canning industry, have strongly changed the dynamics of the fruit and vegetable trade worldwide, and have pushed the market of crates to the development of types of products capable of responding to different requests. The evolution of this product is still today a sensitive design issue for many companies, especially for those that transform plastic, and who are interested in innovating and developing new types of crates, in response to new market trends. Although there is already a wide range of products, diversified mainly by transport capacity and type of material, there is a need to implement catalogs through the development of reliable products, suitable for the most recent regulations, and environmentally sustainable, especially in the scenario of their end-of-life. The second activity foreseen in the first phase of the project focused on benchmarking research and on the definition of the state of the art of plastic crates for transporting grapes. The objectives were to identify the main competitors and describe the technical characteristics of the products. To organize the data, product sheets have been developed, in turn divided into three sections: description of the manufacturer's brand and image of the reference product; material and dimensional characteristics (load capacity); structural and ergonomic analysis of the crates.

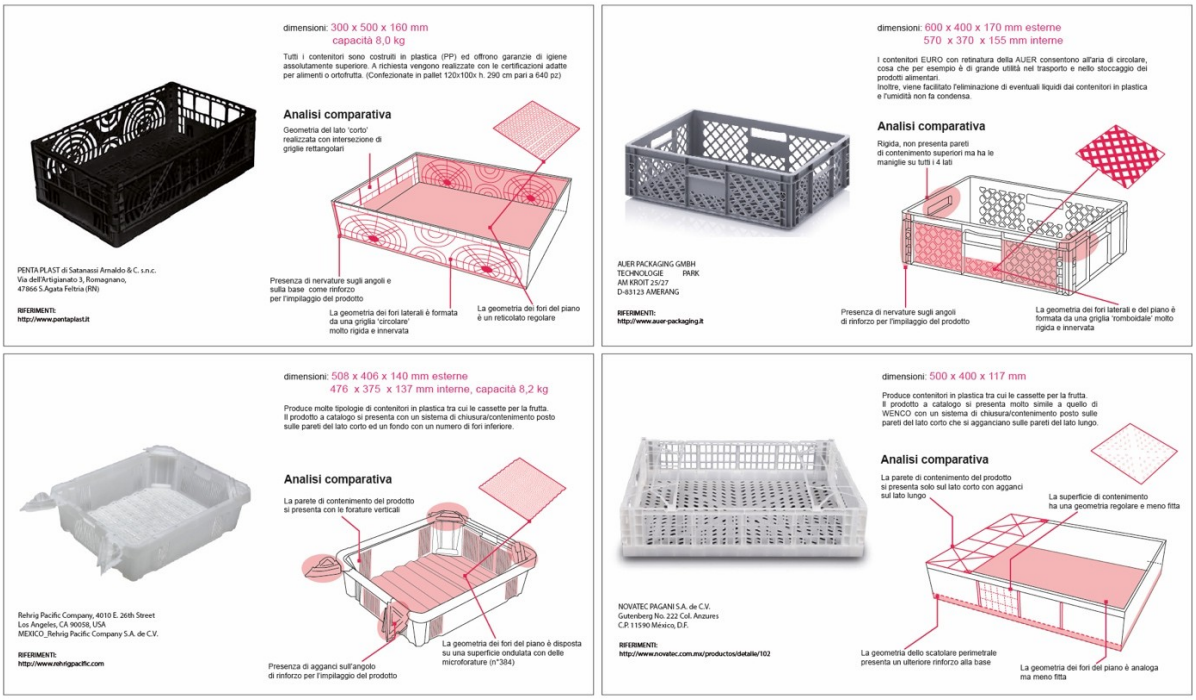

Figure 1. *Examples of product sheets elaborated in benchmarking research activity.*

From the benchmarking study (Figure 1) it was possible to extrapolate a series of final observations and reflections:

- most of the products are made of polypropylene (PP) and high-density polyethylene (HDPE);
- the polymers used for the crates intended for the transport of grapes are mainly virgin, resulting from the main reference regulations (e.g., EC no. 1935/2004);
- injection molding is the only transformation technology used for these types of products and, considering high annual production batches, complex molds are developed with multiple handling for the management of undercuts (this also implies implications for energy consumption and consequent CO2 emissions);
- the transport and handling of the fruit-filled crates by the operators is an underdeveloped aspect and only the non-collapsible types have clearly developed grip points and handles within the containment structure;
- most of the crates use standard mesh, rectangular or rhomboid layouts.

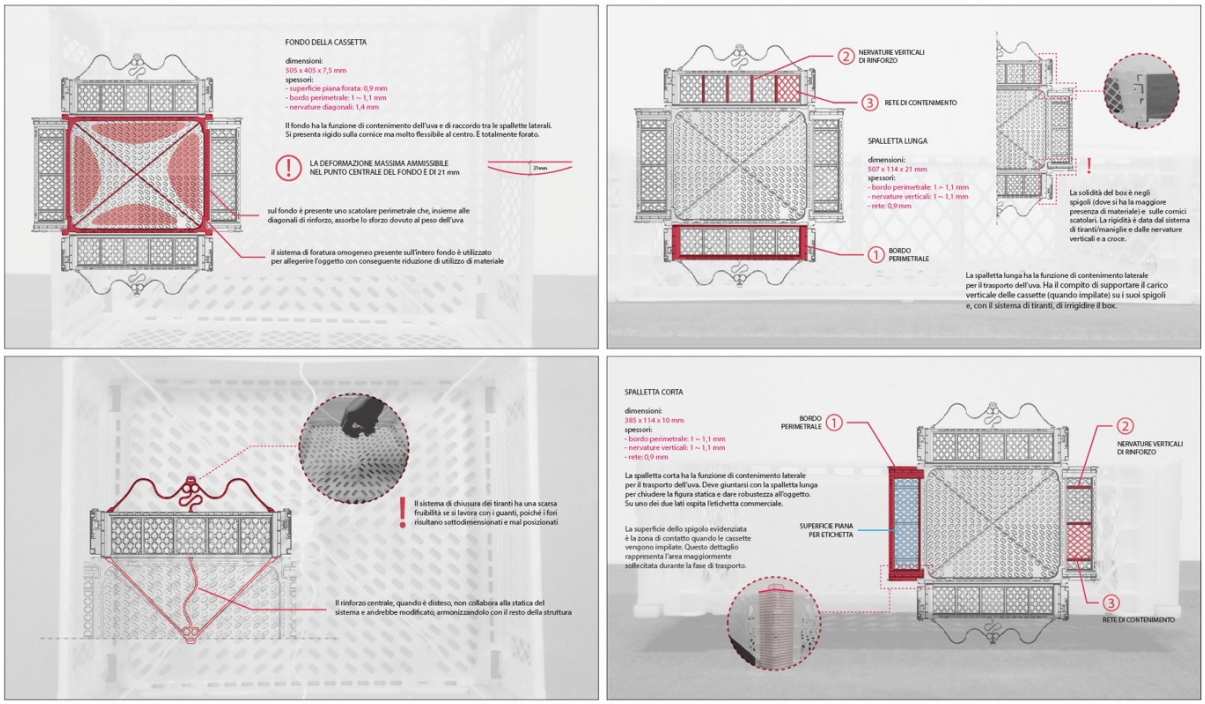

***Figure 2**. Functional and structural analysis of the product Wenco G9-54117A.*

The second macro-phase was intended to describe and analyze the technical-performance and structural characteristics of the plastic, disposable, foldable and collapsible crates for transporting the "WENCO G9-54117A" grapes, highlighting the critical issues. The product has a maximum size of 508x406x117 mm, its transport capacity is 9.2 ~ 9.5 Kg of grapes and has a total weight of 365 g. The crate is single material, made of polypropylene (100% virgin), with injection molding technology, and with an expected annual production of about 4 million pieces. The product has been developed to be stackable vertically (up to a maximum of 17 elements) and stackable, both on the long and on the short sides, to optimize the storage and transport phase. Furthermore, the crate is tested to withstand a compression force of about 440 Kg for 3 hours at a temperature of 20 °C under static load conditions. The containment structure is made up of five elements - two long sidewalls, two short and a bottom - joined together by plastic hinges, to create a single piece, molded in PP. The fund is structurally divided into three parts: a perimeter structural frame (1.1 mm thick); a containment surface (thickness 0.9 mm); two diagonal reinforcement ribs (1.4 mm thick). The containment surface is characterized by a pattern of rectangular and rounded holes and has the function of retaining the grapes and connecting the lateral sidewalls. The maximum deformation admissible in the central point of the bottom is 21 mm, since beyond this value there is a risk of damaging the fruit when the crates are stacked together. The mesh is homogeneous, and the dimensions of the holes are designed to lighten the object and at the same time avoid compromising the integrity of the berries. The two long

sidewalls mainly consist of three functional areas: a structural frame (1.1 mm thick); a containment net (thickness 0.9 mm); four vertical reinforcement ribs. These have the function of lateral containment and help to support most of the vertical load of the crates loaded with grapes when stacked during storage. In fact, they have - on the edges - small connectors to facilitate the centering and stacking of the crates on top of each other. Furthermore, on the short sides, there are both the connection system and the tie rod system, designed to brace and give greater rigidity to the entire crates. This system offers a single gripping point with poor usability - especially if you work with gloves - since the holes are undersized and poorly positioned. Furthermore, it has been observed that the central reinforcement of the tie rod does not cooperate with the statics of the product and is therefore to be considered superfluous and not very functional, with the general statics of the crates. The short sidewall is structurally articulated like the long one and has the function of lateral containment and a joining and closing element for the entire crates system. In addition, on one of the two sides there is an area intended to house the commercial label of the transported product.

In conclusion, from the structural analysis of the crate (Figure 2) it was observed that:

- the solidity and resistance of the crate is mainly generated by the edges and structural frames of the individual elements, in which the greater presence of plastic material was also detected;
- a part of the rigidity, even if minimal, is given by the system of tie rods / handles, and by the vertical and diagonal ribs;
- the edges of the crate represent the critical points, being most stressed during the transport phase;
- the crate mounting system is characterized by a reversible connection system, albeit inconsistent with the end-of-life of the product, which is destroyed and disposed of at the end of its use.

Through the data collected from the structural analysis, it was possible to make a first estimate of the environmental footprint of the product production phase (Table 1). For a batch of four million pieces, 1460 tons of polypropylene are needed. The production of this quantity of polymer requires 262,800 cubic meters of water and approximately 10.6 GWh of energy, which generates approximately 2.6 t of

CO_2 equivalent emissions.[2] Therefore, optimizing only the production phase and reducing - albeit in small percentages - the amount of material through appropriate design strategies, would still imply a significant reduction in the use of environmental resources and impacts associated with the product life cycle.

[2] Considering that to produce 1 ton of plastic it takes 21.4 barrels of oil, 180 cubic meters of water, 7,600 kWh of energy and 1.84t of CO_2 (2020, BIR).

Table 1. *Main impacts and resources for 4 million pieces production.*

	material (ton)	water (mc)	energy (GWh)	CO_2 emission (ton)
4 mln pz.	1,460	262,800	10.6	2.6

3. Macro-strategies for material reduction and transport optimization: experimental tests and FEM analysis

Following the preliminary research and the definition of the brief, with the identification of the design requirements, a first design phase was started for the reduction of plastic material, through the definition of a series of lightening strategies. This preliminary analysis and product architecture improvement work was supported by experimentation and FEM analysis activities, aimed at validating the solutions developed. To achieve the set objectives, a series of structural optimization interventions have been proposed appropriately reasoned on each functional element of the crate.

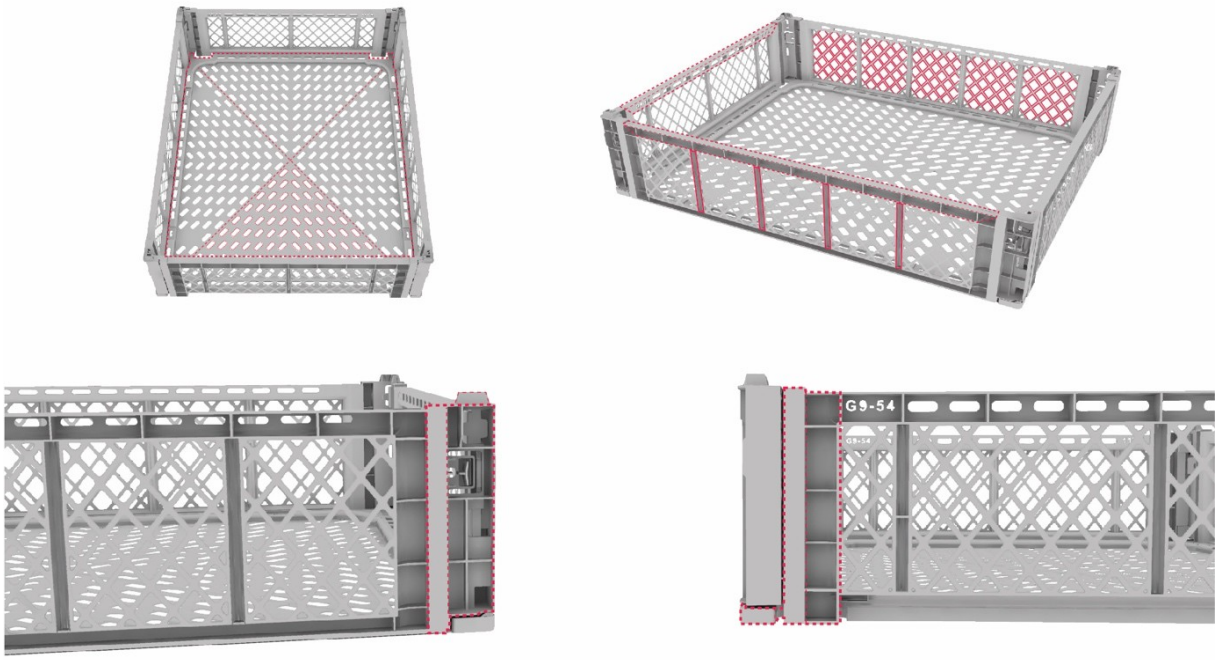

Figure 3*. Overview of the structural optimization interventions.*

Starting from the lateral sidewalls (Figure 3), four macro-strategies have been identified, three focused on the containment parts and one on the reversible interlocking system of the corners:

1) the geometry of the perimeter crate can be optimized by varying the pattern of the ribs and holes: it has

been noted in fact that the pitch of the ribs is always the same, regardless of the effective resistance required - especially for those areas that are not very stressed (for example, in the intermediate sections between the center and the edge of the folding sidewall the bending stresses are less);

2) the rhomboidal mesh containment surface can be redesigned on the basis of the most stressed areas and reduced in thickness in the least critical points;

3) the vertical ribs can be integrated within the containment surface avoiding significant thicknesses. Furthermore, it is reasonable to rethink a single reinforcement solution, positioned in the most stressed point (for example developing a single rib system in the center of long sidewalls);

4) the connection between the sidewalls can be simplified, passing from a reversible 90° joint to an irreversible snap-fit, given the disposable nature of the product.

Through the redesign of the layout and geometry of the interlocking system for the long-sidewall/short-sidewall connection, it would be possible to reduce some thicknesses and the amount of material used with the same performance. For the bottom of the crate, three macro-strategies for lightening and structural optimization have been identified:

1) the geometry of the structural frame - as well as that present in the sidewalls - has a series of uniformly distributed ribs that can be optimized, based on the loads and stresses that the product undergoes throughout its life cycle;

2) the plastic hinges for the overturning of the sidewalls develop along the entire perimeter of the bottom, but a portion of the hinge would be sufficient to obtain the same performance. For example, three short hinges can be developed along the edge, rather than one that is continuous. Furthermore, the position of these generates along the edges a sort of double wall between the sidewalls and the bottom, therefore this doubling and waste of material could be avoided by reconfiguring the position of the hinges;

3) the pattern of the holes in the bottom, can be redesigned and programmed, based on the most stressed areas.

In fact, it was observed in the tests that the perimeter areas are those that are most affected by the stress, compared to the central portion. Once the main macro-strategies for the optimization and reduction of the plastic material were defined, analysis of resistance to static stresses was carried out, first on the starting physical product, and then on the digital model, through a FEM calculation software - (Finite Element Method). The test on the physical model had the purpose of verifying the ability to resist the design load, and to fall within the deformation limits established for the bottom of the product. In the first test, with 9.5 Kg corresponding to the weight of the bunches of grapes, the crate showed no criticality. In a second test - with double load compared to the previous one - the mechanical resistance of the bottom still appeared

sufficient. Instead, the critical deformation of the surface was highlighted, beyond the limit of 21 mm established in the design brief. A second phase of analysis was carried out using the FEM software, on the subcomponents of the crate (tilting sidewalls and bottom) with the aim of verifying the behavior to bending stresses generated by the weight exerted by the grapes. Four scenarios were analyzed for the sidewalls: three in bending and one in compression. The models verified by the FEM are described below:

- a sidewall that presents the structural frame with a series of ribs arranged according to a diagonal layout;

- a sidewall that presents a reduction in the number of vertical ribs, to two large ones arranged in the center of the bank;

- a rhomboidal containment net, with the mesh section rotated by 90° (also valid for the bottom mesh of the crate);

- a sidewall with a snap-fit interlocking system, with reduced use of material, subjected to a compressive stress (to simulate the 17 stacked crates).

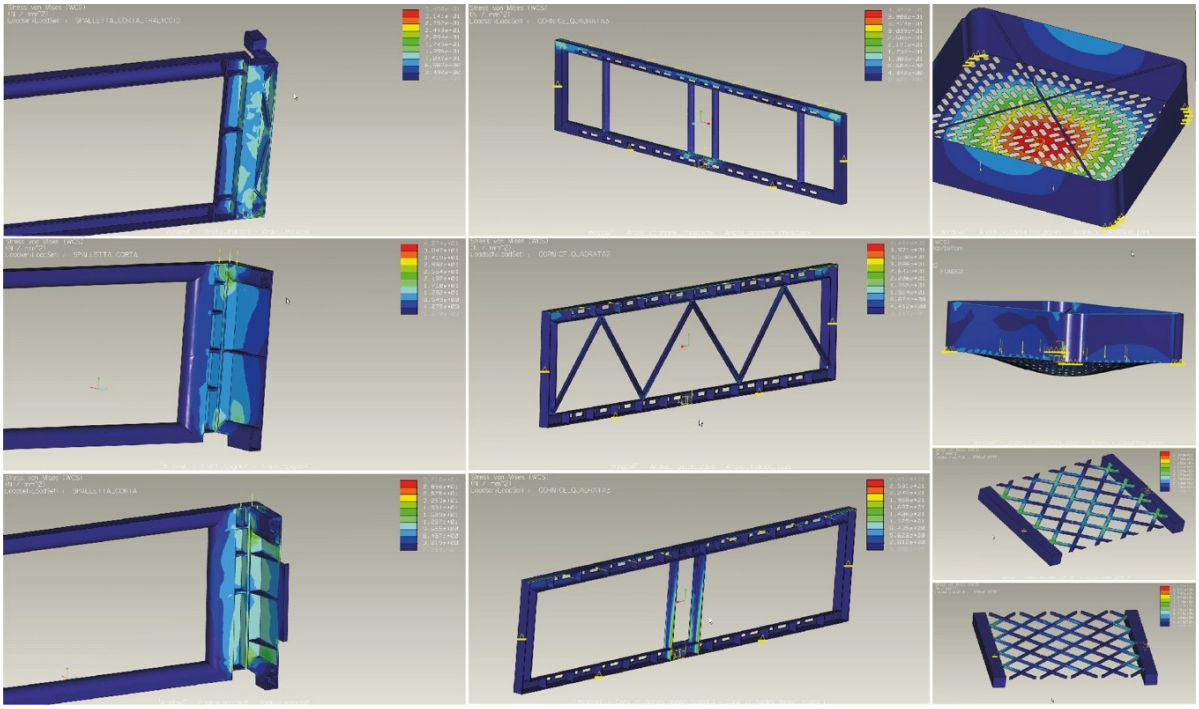

***Figure 4**. Preliminary FEM analysis.*

From the results elaborated by the software (Figure 4) it was possible to deduce that:

- the development of two large central ribs has improved and reduced the deformation phenomenon, generated mainly by the flexural forces which manifest themselves in a marked way in the central point;

- the structural frame of the sidewalls, with the system of ribs arranged according to a diagonal layout, has

proven to be able to increase the general performance of the structure, with less use of plastic material;

- by moving the attachment system from the corner, and studying a new layout of ribs, suitable for resisting the compressive forces, it is possible to use less material, obtaining the same resistance;

- the rhomboidal mesh significantly increases its flexural strength performance if the section is 90° rotated compared to the traditional one.

However, it should be considered that a section of this type risks generating a "blade effect" and damaging the fruit, especially at the bottom of the crate.

4. Design of a collapsible crate for the transport of grapes with reduced use of plastic material

Considering the results obtained from the tests, and therefore verifying the mechanical resistance performance offered by the new analytical models, optimized according to the macro-strategies identified, a design phase was carried out for the elaboration of a new concept of collapsible crate, with reduced consumption of plastic material for transporting grapes.

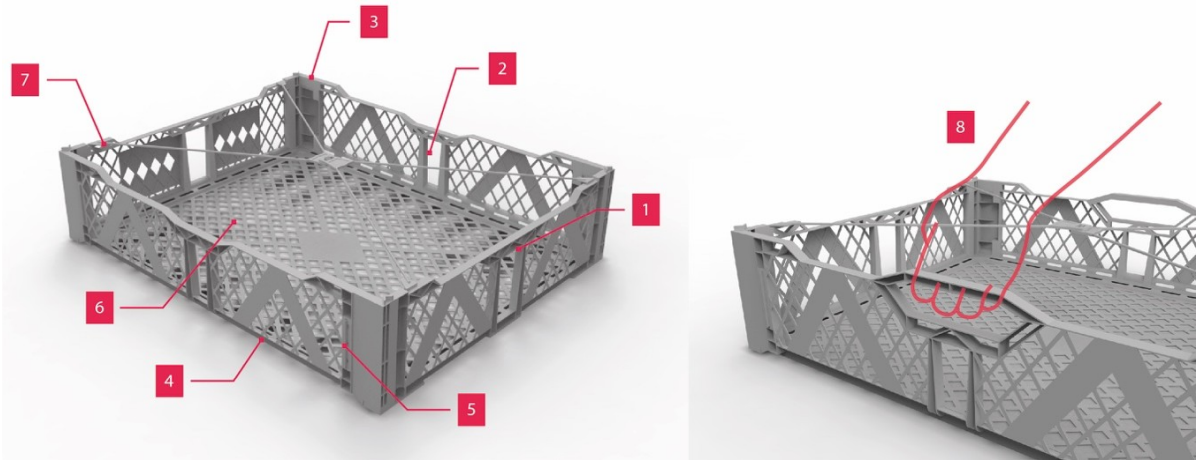

***Figure 5**. Overview of the eight design solutions.*

The product conceived (Figure 5), in addition to guaranteeing the same transport and folding capacity, and perfectly responding to the design requirements defined in the brief, presents an innovative design, characterized by the implementation of eight new design solutions, which distinguish it from the previous model:

1) a perimeter structural frame with a system of ribs arranged in a diagonal layout, inserted in specific portions of the product with higher resistance requirements;

2) a lowering of the long sidewall of 12 mm in the central section, to further reduce the deformation of the product, especially when it is loaded with fruit;

3) a trellis system (Figure 6), positioned in the center of the containment sidewalls, and optimized to withstand the flexing stresses generated by the weight of the grapes during transport and storage;

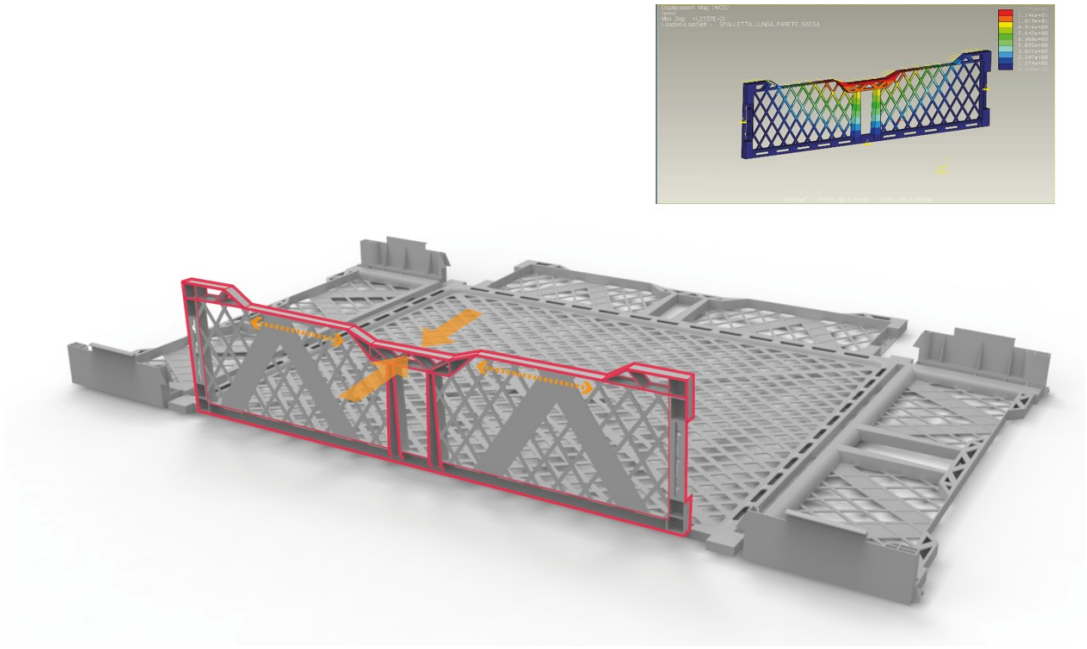

***Figure 6**. The new sidewall trellis system and its structural behaviours.*

4) a system of plastic hinges, reconfigured with respect to the traditional product, which reverse the direction of overturning of the sidewalls - to avoid the doubling of material - and which present, on the short side of the crate, (the structurally less critical one) two lightening slots;

5) a new connection system (Figure 7) with an "L" layout, characterized by a snap-fit joint, with high mechanical resistance and reduced use of material;

6) a new containment net of the bottom, characterized by a rhomboid pattern, and with an optimized cross ribbing, to better resist bending, through the development of a "T" section;

7) an optimized bracing system, without the use of central tie rods, in order to further reduce the amount of plastic material;

8) a carrying handle, integrated into the trellis system of the long sidewall - not included in the brief - but which significantly improved the ergonomics of the product.

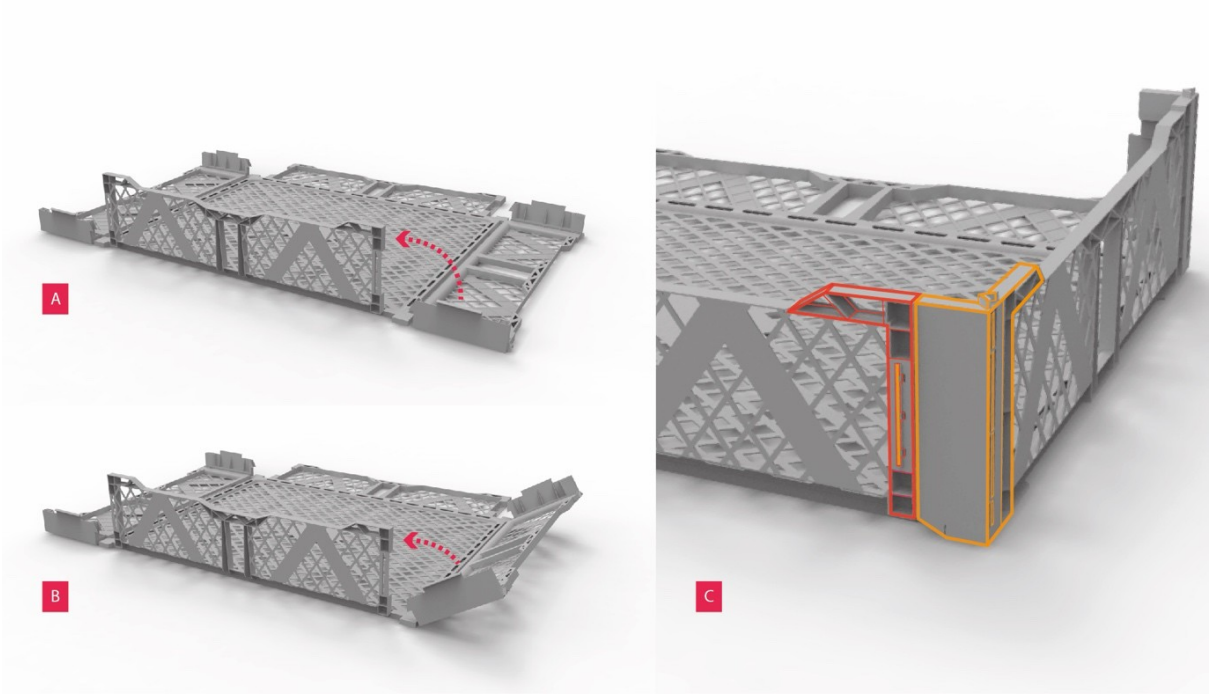

***Figure** 7. The new irreversible connection system "L" shaped.*

In addition to the characters listed above, the new product has maintained some important design aspects, already present in the previous version: four connectors for centering and stacking the product; an area on the short sidewall, intended to house the label for the information of the goods; the connection of all the components, in order to generate the product through a single molding process; geometries that do not involve the generation of undercuts or additional mold movements. The analytical model of the new crate was further verified at the FEM, to confirm the results obtained in the preliminary analyzes, and to evaluate the performance achieved, compared to the old model. A comparative analysis of the deformations between the old and the new layout of the bottom of the crate was carried out first, and then a static evaluation of the new sidewalls was carried out. The design solutions developed have led - each with different contributions - to a significant reduction in the quantity of plastic material. In fact, with the same volume and transport load, the new version of the crate has an estimated theoretical weight of 304 g, which is about 17% less than the old model. Furthermore, the version of the crate with the integrated handle does not generate any material increase; on the contrary - in addition to optimizing the transport and use phase of the users - it generates further structural and static benefits in the stacking phase.

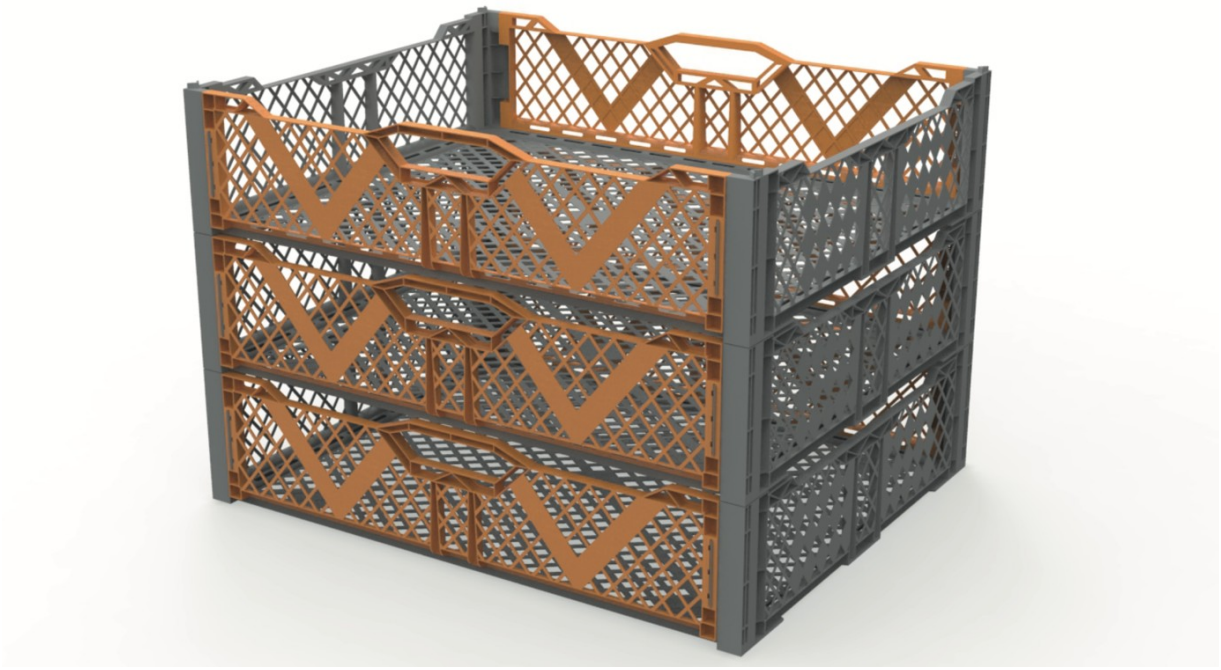

***Figure 8**. Rendering of stacked crates.*

Indeed, as shown in figure 8, the handle in the central part of the sidewall can get stuck under the crate, further reducing the possible deformation of the long sidewall. Through the optimization and reduction strategies of the plastic material, it was also possible to reduce the environmental impacts associated with the production phase of the crate. It has been estimated that the saving of 61 g of polypropylene also generates a considerable reduction in the consumption of raw material, resources and energy associated with the production of plastic material, with estimated values shown in Table 2.

***Table 2.** Estimated reduction of impacts and resources thanks to the new design.*

1,460 t	10.6 GWh	262.800 mc	310 GWh	2.6 ton
1,212 t	8.8 GWh	218,124 mc	190 GWh	2.1 ton
PP material	energy	water	in.moulding	CO_2 emission
-17%	-17%	-17%	-16%	-17%

It should be considered that the reduction of plastic material, obtained with the new design, also implies an

optimization of energy consumption, associated with a lighter product (Vezzoli, 2017). In fact, it is possible to estimate: a reduction associated with the energy of the injection molding press, around 16%, or about 116 GWh less per year (considering the batch of 4 million pieces); a reduction in the energy used to transport the raw material to the gate of the plant; a reduction in transport associated with product distribution and end of life. Finally, for the new concept of collapsible crate, aesthetic and structural variants have been developed, mainly referring to the design of the containment mesh present both on the bottom and on the four sidewalls. The second version of the bottom (Figure 9), involves the development of a pattern of ovoid-shaped holes, characterized by a "T" section to increase mechanical performance but without generating sharp edges, which can affect the state of conservation of the grapes. Unlike the sidewalls, we opted for a mesh solution, which has a reduced thickness section, and which is rotated. Although the latter solution could represent a cutting edge, its location on the sidewalls of the crate does not represent a critical issue for the goods. Finally, it is estimated - based on the values derived from the digital model - that the solutions developed for this second version could reduce the consumption of plastic material by up to 22%. Therefore, a further economic and environmental improvement of about 5% would be obtained, compared to the advantages already estimated for the first version.

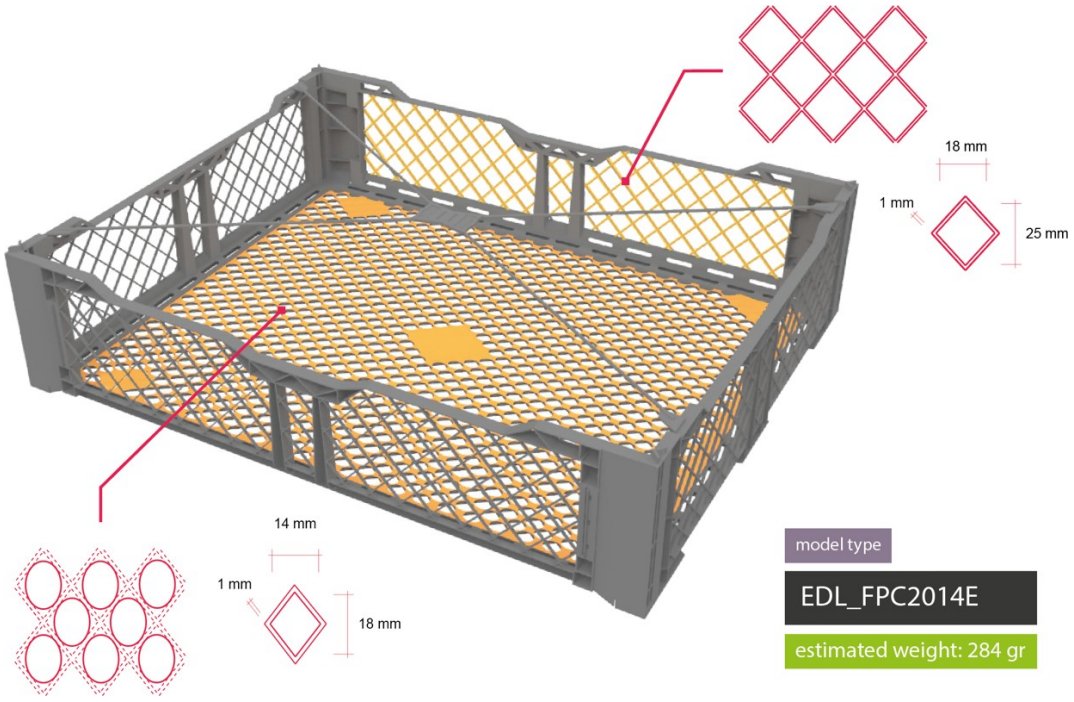

***Figure 9**. Bottom and sidewall mesh solutions of the second version.*

5. Conclusions

The results presented in the paper, showed in Table 2, were achieved through the methodology shown, applying the DfS criteria, to the development of a new concept of collapsible and stackable crate for the transport of grapes. The considerable advantages compared to the starting product "Wenco G9-54 117 A" can be summarized in:

- rationalization of the plastic material, through new structural layouts;
- optimization of the technical-production aspects of the individual functional elements and in particular of the interlocking connection system;
- design of new formal and functional strategies, to make the crate easily transportable in all phases of use.

The macro-strategies of the DfS, mainly aimed at rationalizing the material used, have shown that it is possible to reduce the use of polypropylene, guaranteeing the same starting performance and - in this specific case - even improving some aspects of the usability of the product, making it, therefore, more eco-efficient. [3] In conclusion, the DfS strategies, assisted by the use of the FEM software, mainly adopted as a tool for critical reading of the morphology and static analysis of the product, have allowed the development of a new concept of collapsible crate, which uses between 17% and 22% less plastic material. The material reduction strategies, as described in the paper, have resulted in both economic benefits for the company and a considerable optimization of the environmental impacts of the production, transport and - to a small extent - even the end-of-life phase of the product. The encouraging results open the scenario to further development of this type of product, whose potential for innovation has been demonstrated, through the strategic lever of eco-design. The results obtained are significant and demonstrate the potential for innovation that the DfS offers to designers and companies interested in developing products that are sustainable and competitive.

[3] The term "eco-efficiency" indicates the relationship between the value of a product (intended as satisfaction of the service and performance offered) and the corresponding associated environmental resources.

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Posters

Application of social cohesion cards tool for mental health in graduate context
Wellington Minoru Kihara, Aguinaldo dos Santos and Ana Lucia Alexandre de Oliveira Zandomeneghi

Implications of design for sustainable behavior strategies applied to cooking appliances in the Brazil context
Karla Scherer, Daniela Hartmann and Aguinaldo dos Santos

Application of social cohesion cards tool for mental health in graduate context

Introduction

There is a growing demand for quality mental health services. Many goals set by various countries for mental health have not been resolved at 2020 (Mental health atlas, 2020). There is an urgent need to increase investment in mental health services and it was possible to notice that COVID-19 pandemic has aggravated this situation (United Nations, 2020). In the context of graduate mental health, the scenario is alarming. In Brazil, about 44% masters (M.Sc) and 56% doctorate (Ph.D) degree reported excessive psychological suffering. These sufferings affect different areas of their lives, not only academic, but also social and professional areas (Costa & Nebel, 2018). There are still few studies focused on the mental health of graduate in Brazil (Viana & Souza, 2021). It's a complex problem that creates opportunities and demands efforts from the Design creative process. It can be said that social cohesion can contribute to alleviating symptoms of psychological distress in the graduate context. It's a prerequisite for people to obtain a minimum level of well-being. And, it's the way to build a more sustainable society (SANTOS et al., 2019). In this sense, this study aim to apply a Service Design tool in order to understand how the values of social cohesion can contribute to the mental health in graduate context.

Method

This study it`s a Research phase of the method by Stickdorn, Hormess, Lawrence & Schneider (2020), This is Service Design Doing (TiSDD). The cards tools were created through an unsystematic review of literature. The tool used was the cards with a focus on the values of social cohesion, such as: trust, humility, reciprocity, freedom, fraternity, equality, honesty, loyalty, tolerance, courtesy, optimism, perseverance, respect and solidarity (Dempsey, 2009; Search for Common Ground, 2016; Santos et al., 2019). In total, 14 cards were created.

Figure 1 - Examples of social cohesion cards tools.

Conclusion

Cards helps in the discussion, structuring of thought and generate ideas (Service Design Tools, 2021). The tool was applied during a workshop, in Brazil, entitled Graduate Mental Health. Among the results obtained, it can be noticed that each value is relevant and can contribute to the mental health of graduate context. However, these aspects need to be shared and experienced by the academic community. Cards with a focus on social cohesion helps to understand the relevance of each value, but it still requires improvement. For example, a guide for application the collected data and the participation of members of the same group to better understand the sharing of values. Such aspects can contribute to advance to the Ideation phase of Service Design. The tool proved to be relevant to point out paths to be explored, especially when dealing with a complex problem such as mental health. This abstract contributes to the sustainable development goals (SDG) 3, target 3.4.

Table 1 – Examples of ideas through social cohesion cards tool

Social Cohesion values	Ideas
Trust	Self-esteem tends to increase, there is security in the development of the proposed tasks, expansion of creativity and proactivity.
Reciprocity	From the perspective of the other, I can value myself and understand that there are several types of knowledge in the integral field of my partner.
Fraternity	Provide opportunities for speaking and active listening for the development or improvement of the fraternity.

PhD candidate Wellington Minoru Kihara, Paraná Federal University, track 5b Design for sustainability
Research professor Aguinaldo dos Santos, Paraná Federal University
Research professor Ana Lucia Alexandre de Oliveira Zandomeneghi, Maranhão Federal University

Implications of Design for Sustainable Behavior Strategies applied to cooking appliances in the Brazilian context

INTRODUCTION

Cooking activity has incorporated new values and practices, in addition to meeting physiological needs. Thus, concomitant with the search for healthier eating, there is an interest in more intimate gastronomic experiences, which invite spending more time with friends and family and as a therapeutic activity. In the present study, the integration of Design for Sustainable Behavior strategies is analyzed through the model proposed by Bhamra et al. (2011), which includes strategies oriented to the user's greater or lesser control in decision making during product usage.

METHOD

The survey research was adopted to identify good practices and gaps in cooking major appliances regarding Design for sustainable Behavior Strategies (Bhamra et al., 2011). The benchmarking process evaluates its repercussions in a sample of 151 products, stoves, and cooktops, manufactured in Brazil by the eight industries members of the Brazilian Association of Electrical and Electronic Manufacturers (ELETROS).

RESULTS AND DISCUSSION

COMPANY (ELETROS)	COOKING APPLIANCES w/ DfSB	DfSB STRATEGIES (Bhamra et al., 2011)	USER CONTROL (Lilley, 2007)	BEHAVIORAL CHANGE INTERVENTION	INDIVIDUAL ACTIONS	GENERAL ACTIONS
Atlas	-	-	-	-	-	Recommendations to save energy and to ensure security by instruction manual
Electrolux	6	Clever Design	Low	Ensure	-	Recommendations to save energy and to ensure security by instruction manual
LG	-	-	-	-	-	-
Midea	5	Clever Design	Low	Ensure	6	Recommendations to save energy and to ensure security by instruction manual
Mueller	3	Clever Design	Low	Ensure	3	Recommendations to save energy and to ensure security by instruction manual
Panasonic	1	Eco-information	High	Guide	1	Recommendations to save energy and to ensure security by instruction manual
Tramontina	1	Eco-choice	High	Guide	1	Recommendations to save energy and to ensure security by instruction manual
Whirpool	2	-	-	-	1	Recommendations to save energy and to ensure security by instruction manual

CONCLUSION

Despite the several technological resources applied on the cooking appliance interfaces and the continuous industrial concern in using materials, processes, and resources that generate less environmental impact, few efforts are addressed to influence more sustainable behaviors in the products' use phase, representing a theme with great potential to guide innovation agendas in the sector.

MSc. Candidate Karla Scherer, Daniela Hartmann & Aguinaldo dos Santos, Ph.D.
Federal University of Paraná (UFPR), Curitiba, Brazil
Design for Sustainability

5. Production, consumption and innovation

5c. Circular Economy

Abstracts

A Critical Analysis and Comparison of Circular Economy Policies in three European Cities

Martin Calisto Friant[1], Katie Reid[1], Peppi Boesler[1], Walter J.V. Vermeulen[1], Roberta Salomone[2]

[1]Copernicus Institute of Sustainable Development, Faculty of Geosciences, Utrecht University, Utrecht, Netherlands. [2]Department of Economics, University of Messina, Messina, Italy

Abstract

The Circular Economy (CE) concept has recently become a popular discourse in the public, private, academic, and social sectors alike. However, the concept remains contested, often unclear and ill-defined, thus its practical implementation remains a large societal challenge. Cities and urban areas play a central role in the CE as they are directly in charge of key sustainability policies, such as waste management, water provision, transportation, housing, industrial development and energy and infrastructure provision. Urban circular economy policies thus have a key impact on the metabolic stocks and flows of resources, waste, capital, labour, knowledge, energy, and materials that societies process (the so-called urban metabolism). Considering that urban areas currently consume 60–80% of the world's natural resources, produce 50% of global waste and 75% of greenhouse gas emissions, CE policies at the city level are crucial to address the manifold social-ecological challenges of the 21st century. In this context, European cities have developed a wide diversity of new CE policies and projects, with many different, and often contrasting, CE discourses and perspectives. Yet these initiatives remain poorly researched, compared, and critically analyzed. This research thus aims to address this research gap by analyzing and comparing the CE policies and discourses in different European cities to draw key lessons and recommendations. It does so by first conducting a critical literature review of academic research on CE policies at the city level in order to develop a new conceptual framework to analyze CE discourses and policies. This framework is then used to critically analyze and compare the CE policies of 3 European cities at the forefront of the CE transition: Glasgow, Amsterdam, and Copenhagen. Results show a diversity of approaches to circularity, with each city having a different scope and vision, especially regarding social justice and equity considerations. Moreover, approaches to CE based on technology and economic growth appear dominant in the chosen case studies. These findings thereby suggest that more diversity and plurality is needed in CE policies, especially including post-growth and post-development approaches to circularity. This research concludes by providing key policy recommendations to improve CE implementation at the city scale, which are valuable for practitioners and academics alike and can contribute to SDGs 6 (water and sanitation), 9 (infrastructure), 11 (cities), 12 (production and consumption), 13 (climate change), and 15 (life on land).

Track
Track 5c Circular economy

Adapting Circular Packaging Design from an Absorptive Capacities Perspective - theoretical perspectives and practical insights

M.Sc. Lukas Stumpf, PhD Josef-Peter Schöggl, Prof. Rupert J. Baumgartner

Graz University, Graz, Austria

Abstract

An increasing number of circular product design guidelines (CDGs) has become available in the packaging sector in the last years., while their uptake in practice remains low. Considering this emerging omnipresence of external knowledge represented in these CDGs, barriers to their implementation into corporate decision-making may hinder their more widespread application. While several studies define barriers for design for sustainability/circularity (DfS) in different areas, a detailed account of these barriers for the packaging sector is missing. Moreover, most of such barrier-related studies don't build on organizational theories. Therefore, potential causalities and interdependencies between the different barriers sometimes remain uncertain. This study aims to identify barriers to the uptake of CDGs in the packaging sector from an absorptive capacity (ACAP) perspective. ACAP theory is considered well suited for this study as it focuses particularly on the recognition, assimilation, and application of external knowledge, including antecedents and moderators.

The determination of ACAP-based barriers builds on a three-step approach: (1) A systematic literature review of DfS barriers and circular packaging design literature, including grey literature, was performed to understand the sector's circular economy engagement. Next, (2) qualitative semi-structured interviews with senior executives of companies responsible for packaging design were conducted. (3) Finally, the barriers were synthesized in the ACAP model, and potential interdependencies, causalities, and ways for overcoming the barriers were described qualitatively.

Preliminary findings can be logically separated into two steps: (i) deciding which external knowledge to absorb and (ii) its operationalization.

Step (i) largely depends on antecedents and moderators, such as previous collaborations or external involvement. Furthermore, if CDGs are only considered if all other KPIs are equal (shelf life, etc.), while the industry continues to develop composites with superior functionality, CDGs might not be prioritized. Such decisions may essentially be dependent on managerial experience, organizational strategy, organizational priorities, or perceived usefulness (i.e., recyclability vs actually recycled material). Following a passive approach and passing responsibility on in the supply chain might lead to a chicken-egg problem, reinforced by supply chain power structures.

For step (ii), operationalization, internal capabilities, and organizational ties and collaborative relationships are decisive for successful knowledge integration. Consequently, if a company does not possess the capabilities to integrate CDGs (e.g., due to a lack of communication or priority, or because its integration requires management approaches unknown to the company, such as close cross-departmental or supply-chain wide collaboration to test prototypes), it will fail to acquire, assimilate, transform, and exploit CDGs.

The study concludes with recommendations to overcome the identified barriers for both companies in the plastic packaging supply chain (to enable them to recognize and integrate CDGs) and CDG developers (to ease managerial uptake and valuation).

This research contributes explicitly to SDGs 14.1 (reduce marine pollution of all kinds), 17.16 (enhance multi-stakeholder partnerships for sustainable development), 12.2 (sustainable management of natural resources), 12.4 (sound management of chemicals and waste), 12.5 (reduce waste generation). It relates to

2022's ISDRS topic by addressing corporate innovation and culture as a lever for sustainable resources management.

Track
Track 5c Circular economy

Assessment Model of Circular Economy Implementation: A proposal for Latin American SMEs

Dr. Andrés Mejía-Villa[1], Dr. Luz Elba Torres-Guevara[1], M.Sc. Rafael Mora-Contreras[1], Dr. Vanessa Prieto-Sandoval[2]

[1]Universidad de La Sabana, International School of Economic and Administrative Sciences, Chía, Colombia. [2]Pontificia Universidad Javeriana, School of Economics and Business, Bogotá, Colombia

Abstract

Currently, it is widely accepted that a circular economy (CE) is key to facing many economic, environmental, and social issues worldwide while contributing to the achievement of the SDGs. Due to its relevance, some Latin American governments are promoting and supporting the implementation of CE. Colombia is one of the regional leaders that has made the most progress in implementing CE initiatives, thanks to the National CE Strategy that the government launched in 2018. The record of the CE implementation progress oversees the National Administrative Department of Statistics, which has produced four reports at the country level. However, a report that evidences the CE implementation at an organisational level and allows companies to make decisions has yet to be developed.

For this reason, this research aims to propose a model for the CE implementation and a virtual tool to capture information, produce diagnostic reports to help the SMEs to become circular enterprises and support sustainable decisions based on special key performance indicators (KPIs). To achieve this objective, we worked with ten Colombian companies representing different economic sectors and levels of implementation of the CE. All this with the financial support of the Chartered Institute of Management Accountants (CIMA). A mixed methodology (qualitative and quantitative) based on visits to the companies, interviews and accounting data collection were used to construct the KPIs. The results show that this model represents an opportunity for SMEs to identify their level of maturity and, therefore, to define future actions that allow them to advance in CE implementation.

Track
Track 5c Circular economy

Assessment of Circular Economy Scenarios in the Mineral Water Production Sector

Dr. Erik Roos Lindgreen[1], Prof. Roberta Salomone[1], Prof. Tatiana Reyes[2]

[1]University of Messina, Messina, Italy. [2]UR INSYTE, Troyes, France

Abstract

The mineral water sector is responding to changes in legislation and consumer demand by evaluating the introduction of different circular economy (CE) strategies. In order to assess the (environmental) sustainability impacts of such strategies, the newly designed CE assessment framework Strategic Circular Economy Impact Assessment (SCEIA) is tested in a pilot case setting with an Italian mineral water company. Applying the life cycle assessment (LCA) method for the environmental assessment results in the baseline sustainability impacts of the company. Subsequently, the selected methods are used in a subsequent sustainability assessment of three potential CE strategies: (i) the increased use of recycled PET (rPET) in its packaging, (ii) the increased use of reusable glass bottles, (iii) the use of on-site generated electricity from solar PV. The results show that all three CE strategies can lead to significant reductions in greenhouse gas (GHG) emissions, as well as other environmental impact categories. Applying the SCEIA framework shows to lead to useful results, even though challenges in its application remain. The impact results for the CE scenarios should be considered first estimations, and strongly depend on the underlying assumptions. Further research will provide more detailed impact results, and can advance the company's assessment maturity level by extending the inclusion of the social- and economic dimensions of sustainability.

Track
Track 5c Circular economy

Can Circular Economy (CE) Promote the Sustainable Development Goals (SDGs) and vice versa: Investigating the interactions between the CE and SDGs in the EU?

Mélissandre Houbeaut[1], Dilip Khatiwada[1], Anne Warchold[2], Prajal Pradhan[2]

[1]Division of Energy Systems, KTH - Royal Institution of Technology, Stockholm, Sweden. [2]PIK - Potsdam Institute for Climate Impact Research, Potsdam, Germany

Abstract

2015 is a turning point in the common history where the 2030 Agenda has set 17 Sustainable Development Goals (SDGs). The same year, the European Commission adopted its first Circular Economy Action Plan to be implemented with a concise milestone: closing the loop. This inspiring concept of shifting to a Circular Economy (CE) in opposition to a linear economy is now gaining tremendous attention worldwide in the light of the emergency of redesigning our society to accelerate the journey towards a sustainable development. This study scrutinizes the interconnections between the CE targets and the SDGs targets using unique pairs of indicator time-series from 2000 to 2019 for 28 member states of the European Union (EU). Firstly the correlations are disentangled into synergies for positive correlations and trade-offs for negative correlations using the Spearman's rank correlation. Secondly this study aims at going further in the interpretation by examining causality in correlations found through a Transfer Entropy (TE) model measuring the power of coupling strength for two possible causal directions: SDGs towards CE or CE towards SDGs. Broadly, the outcomes highlight a stronger causality in the interconnections in the direction CE towards SDGs and overall the results show more positive interconnections than negative ones. The highest share of positive impacts of the CE on the SDGs is found with SDG 7 (Affordable and Clean Energy), SDG 3 (Good Health and Well-Being), and SDG 15 (Life on Land). In contrast, the highest share of negative impacts of the CE on the SDGs is found with SDG 2 (Zero Hunger), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 10 (Reduced Inequalities). Additionally, the study identifies various speeds of development between countries in the alignment of their SDGs progress and CE implementation. United Kingdom, Spain, and France gather the best results in term of positive interconnections, while Italy, Latvia, and Luxembourg appear to have the highest share of negative interconnections. To succeed in both commitments, identified synergies should be leveraged and trade-offs efficiently tackled.

Track
Track 5c Circular economy

Circular Value Stream Mapping (C-VSM): Rethinking production process in the agri-food sector

Florencia Kalemkerian[1], Dr. Javier Santos[1], Dr. Martín Tanco[2], Dr. Elisabeth Viles[1]

[1]TECNUN, University of Navarra, San Sebastian, Spain. [2]CINOI, University of Montevideo., Montevideo, Uruguay

Abstract

It is estimated that one-third of the food which is produced is lost or wasted as flowing through supply chains. Therefore, the Circular Economy (CE) constitutes a promising strategy to deal with food loss and waste by providing actions and solutions to reintroduce wastes into the production process. Although there are many frameworks proposed, the dominant interpretation of CE is mainly promoting a reductionist perspective, losing the idea of value creation through waste by rethinking the production process. Following this reductionist path, the green Value Stream Mapping (VSM) has been widely implemented in the production process to manage resources through the elimination of waste. Nevertheless, the implementation of this tool proves to be an efficient way to improve both operational and environmental performance in a linear production model.

However, the CE requires a new way of thinking. Therefore, reformulating the traditional green VSM to incorporate the principles of CE will constitute a powerful approach for companies to rethink the production process, and make a more sustainable management of resources. Since in the agri-food sector, there is a lack of simple and clear tools to analyze the production process under the lenses of the CE, the main aim of this paper is to present a circular-VSM (C-VSM) for this sector. Although some studies presented a C-VSM none of them redesign the traditional VSM, which is also another aim of this study.

To that end, a four-step methodology was followed. Firstly, a review of literature on circular strategies in the agri-food sector was conducted. Secondly, an initial tool was presented based on the input-output approach following the traditional scheme of the VSM. Then, a workshop with stakeholders from the sector was conducted to get new insights and therefore, revise, modify, and adjust the initial tool. Based on that, the final C-VSM was presented. Finally, as part of continuity for this work the tool will be tested in a company that produces artichoke. The C-VSM aims to easily identify opportunities for improvement that will guide companies towards a more sustainable way of production. The implementation of this tool consists of six steps: (1) system definition, (2) value flow description based on the input-output approach, (3) identifying opportunities for improvement, (4) identifying lean tools and circular strategies, (5) sustainability assessment, (6) developing the final C-VSM.

Based on the above mentioned, the results of this study are aligned with SDG 12: Sustainable Production and Consumption. Particularly with targets, 12.2 that focuses on achieving the sustainable management and efficient use of natural resources, and 12.4, which calls for an environmentally sound management of chemicals and all wastes throughout their life cycle, and 12.5 aims to substantially reduce waste generation. The originality of this work is that it presents a new tool to analyze the production process based on the idea of continuous improvement and rethinking these processes by focusing on value creation activities. Therefore, this study contributes to achieving sustainable development in companies, which is one of the main topics of this conference.

Track
Track 5c Circular economy

Colombian Consumers' Perspective on Circular Economy Paradigm for Attaining Sustainable Development

Dr. Luz Elba Torres-Guevara, M.Sc. Rafael Mora-Contreras, Dr. Andrés Mejía-Villa

Universidad de La Sabana, International School of Economic and Administrative Sciences, Chía, Colombia

Abstract

To contribute to the literature on sustainable production and consumption behaviour, this study aims to investigate the behaviour and adoption of CE activities by Colombian's citizens towards sustainable development. To achieve this goal, the study conducted a 16 items online questionnaire survey that investigate consumers' behaviours and attitudes, which was open from September 1st to October 15th, 2021. The sample consists of 1317 respondents and includes citizens from both genders with different education and income levels by age groups. The results show that more than 90% of consumers surveyed consider important to take care of the environment and carry out selective waste collection activities to produce new goods and prevent the depletion of natural resources. However, the percentage of respondents who carry out CE activities is very low, especially in mobility and the disposal of batteries and light bulbs at collection centres. It is also found that the number of consumers performing separate waste collection activities in households is still insufficient. In addition, a little more than half of respondents consider that the rental system compared to the ownership of goods represents a financial benefit; therefore, there is still much work to be done to transform the perception and purchase intention about circular business models.

Track
Track 5c Circular economy

Coming at the Circular Economy from Different Angles – a text-mining and contingency-based analysis of 3000 projects

PhD Josef-Peter Schöggl, MSc Lukas Stumpf, Prof. Dr. Rupert J. Baumgartner

Christian Doppler Laboratory for Sustainable Product Management, Institute of Systems Sciences, Innovation and Sustainability Research, University of Graz, Graz, Austria

Abstract

While the scientific literature exhibits an exponential growth of circular economy research, empirical studies based on large, global, and cross-sectoral samples are still scarce. To address this research gap, the study at hand analyses a dataset of 3015 circular economy implementation projects worldwide. The database was compiled by members of the Circular Economy Club (CEC), a non-profit organisation that connects CE professionals and organisations in 280 local clubs in 140 countries. For each of the 3015 documented projects, the CEC database describes the sector, the type of organisation, the country, and the main CE strategy followed. Utilising this data, the present study addresses the following two research questions. **(RQ1)** Do circular economy strategies significantly differ between sectors, types of organisations and countries? **(RQ2)** What are the main CE practices implemented in different sectors?

The first research question was answered using contingency and correspondence analyses of CE strategies, sectors, organisation types and regions. The results show that the CE strategy depends on each of these characteristics as indicated by significant chi-square tests ($p < 0.001$ in each case) and that the effect sizes are medium (0.34-0.41) based on corrected contingency coefficients. The correspondence analyses visualise the contingencies and allow interpretations.

To answer the second research question, the project descriptions were analysed using multiple correspondence analysis and hierarchical clustering applied to terms extracted from the descriptions using a natural language processing routine. More specifically, topical clusters are illustrated and compared for six sectors (manufacturing, consumer goods, fashion, food, cities, others) in general and per CE strategy (e.g. product life extension, waste as a resource, business model or design). The results underscore the statistical finding of significant differences between the sectors and substantiate it by detailing which specific CE practices are pursued in the different sectors and how they relate to the overarching CE strategies. For instance, while projects in the manufacturing sectors frequently focus on recycling, waste and process-related CE practices, projects in the consumer products sector focus more often on circular product design and, besides recycling, also on repair. Higher-order R-strategies are also found in the fashion sector, where besides recycling and recycled material use, also reuse is more often in the focus.

In summary, this study provides a comprehensive overview of the global CE engagement. It contributes to understanding how SDG 12 is approached in different regions and by different types of organisations. Among the eleven targets of SDG 12, insights are mainly provided regarding targets 12.2 on sustainable management and use of natural resources, 12.3 on halving food waste, 12.5 on substantially reducing waste generation and 12.6 on encouraging companies to adopt sustainable practices. Concerning the conference theme, the study particularly highlights the cultural dimension of sustainability as it compares the CE engagement of 50 different countries from all continents, providing space for mutual inspiration.

Track
Track 5c Circular economy

Exploring Circular Economy Criteria of EU's Taxonomy for Sustainable Activities

Dr. Sigurd Vildåsen

SINTEF, Trondheim, Norway. NTNU, Trondheim, Norway

Abstract

In August 2021, the EU Commission's advisory body launched the first draft of circular economy (CE) criteria for sustainable economic activities. This is part of a taxonomy scheme enabling Europe´s Green Deal, i.e. a policy to ensure net greenhouse gas emissions by at least 55% by 2030.

The rational behind the taxonomy is to classify which activities that substantially contribute to a CE in addition to doing no significant harm to other environmental objectives. Such a systemic perspective aims to minimise the risk of adverse effects on climate change and ecosystems when implementing CE strategies, e.g., recycling and reuse.

The manufacturing sector has been given a special attention in the Green Deal policies because of its essential role in production and consumption systems. This is evident in the proposed CE criteria from August 2021, and the research presented here aims to analyse the scientific foundation of the criteria while at the same time exploring implications for industrial contexts.

The scope of research is the activity called "Design, manufacture, remanufacture, and reselling of furniture" classified under NACE code C31 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006. It includes manufacture of office and shop furniture, of kitchen furniture, of mattresses, and of other furniture.

Three specific CE criteria are addressed, namely A "Resell, refurbish and/or remanufacture furniture already used by a customer", B "Design and produce new furniture in a way that supports extended lifespan through durability, reuse, refurbish, repair and remanufacturing", and C "Design and implement a business model that extends furniture lifespan in practice".

The empirical grounding is based on three-year transdisciplinary R&D project owned and managed by a bed producer in Norway. Three suppliers and a reseller are involved in addition to a university and research institution. An exploratory research setting was conducted by introducing and discussing the three CE criteria in workshops and follow up conversations.

The findings point to the importance of circular business models (CBMs) as the cognitive frame of reference as well as tool for implementation of CE strategies. This is supported by a growing scientific literature on CBMs as an area within the larger CE debate. However, the taxonomy treats CBM development as a separate criterion somewhat detached from design, production, and marketing strategies which makes little sense from both an industrial and academic perspective.

A possible explanations for confusion around the CBM concept seems to be that the taxonomy emphasises product-as-service models, while the scientific literature adopts a much broader and nuanced perspective on CBMs. Thus, this research proposes generic clarifications and practical recommendations on how to apply the CBM concept in accordance with the systemic CE perspective adopted in the taxonomy, while securing a better scientific anchoring to the established CBM literature.

Track
Track 5c Circular economy

Flexible Circular Index for Responsible Cities

Pasqualina Sacco, Elena Rangoni Gargano, Alessia Cornella, Maria Aida Cavalera

Fraunhofer Italia Research Scarl, Bolzano, Italy

Abstract

Circular economy stands as a development model that combines competitiveness, innovation, and sustainability: a new vision of the economic system, taking an increasingly central role within governments, local institutions, and companies. In cities, circular economy plays a decisive role, as most of the resources produced are consumed there. Imagining a new development model for cities means envisaging it for the entire planet. In this perspective, a "circular city" must respond to a holistic view that combines technological innovation as well as economic, environmental, and social impacts.

The authors aim to map European best practices in the field of circular economy, identifying opportunities and barriers, as well as recognising actors and sectors involved. Moreover, the authors will outline the services offered by circular city models - in terms of infrastructure, training, financing - and citizens' need. From this analysis, the authors want to identify the actions needed for a circular economy model of cities and define a circularity index. In addition, tools used in other European cities that are effective in stimulating engagement with the territory, businesses and its citizens are presented.

To do this, the research will focus on the current state of Italy through an analysis of the maturity of Italian cities moving towards a circular model thanks to circular actions, new governance models, sharing economy, training, and awareness.

The authors' final objective is to define a flexible circularity index that can be customised according to the size of the city, the type of territory and the resources used. A first literature search was conducted by using Scopus and Web of Science for academic literature in different languages. Different combinations of key words were utilized and, considering the cross-sectoral nature of circular economy, no restrictions in the disciplinary scope of the journals were applied. Then, the search was extended on a conventional web search engine to include contributions non-Scopus indexed. This allows to have a more complete base of sources, given the evolving status of the topic.

This study, through a systematic literature review, becomes the place to reflect on the opportunities offered by circular economy models in Europe, considering their applicability and flexibility to define a responsible and sustainable territorial strategy. To achieve these results, scholars from different fields have been involved: from natural sciences to economics, philosophy, and social sciences.

In conclusion, cities are places where the contradictions of our modern life come to the surface. Contradictions that can only be resolved by using innovative shared and responsible solutions. To do this, our article aims to investigate not only the "classical" ecological, economic, and social dimensions of sustainable development, but also the ethical/cultural dimensions, which are considered crucial to unhinge the linear capitalist system and begin the transition to a circular system.

Considering the 2030 Agenda, the proposed excerpt refers especially to SDG 8 (Target: 8.2; 8.4), SDG 9 (Target: 9.1; 9.4), SDG 11 (Target: 11.3; 11.6; 11.7; 11.a; 11.b), SDG 12 (Target: 12.2; 12.5; 12.8) and SDG 13 (Target: 13.3).

Track
Track 5c Circular economy

How can the Financial Perspective Facilitate the Transition towards Circular Business Models? Insights from a literature review

Amal Kanzari, Fredrik Ingelsson, Josefine Rasmussen, Henrik Nehler

Linköping University, Linköping, Sweden

Abstract

Sustainable development has urged companies to change their way of doing business by transitioning from linear to circular business models (CBMs). Practitioners and academics have outlined financial benefits driving the transition, but also identified barriers hindering it. To facilitate the transition towards CBMs, there is a need to understand why financial barriers occur and how they hinder the transition. When transitioning to CBMs, companies generally pass through three innovation phases: ideate and design; implement and test; and finally, evaluation and improvement. Following these phases, managers and decision makers face challenges as they navigate against their usual practices. However, while a number of literature reviews have been conducted on CBMs, there is to the authors' best knowledge no review that holistically reviews the financial discussion and the financial barriers related to CBMs while simultaneously taking a transition process perspective. Hence, we aim to fill this gap. We provide a state-of-the-art of the field and delineate where more efforts are needed, providing detailed directions for future research, pinpointing required efforts for each phase in the transition process.

The systematic literature concerned papers published until fall 2020 and the final sample includes 25 papers published in 39 academic journals. Based on content analysis, these papers were grouped in three categories corresponding to the three transition phases. Financial perspectives including costs, revenues, performance indicators, risks and so forth were identified and coded.

The results show that there is a lack of financial studies in the early phase of CBM design. Predicting CBMs´ design outcomes is difficult due to their context dependency, the long-term perspective of the outcomes, and their dependency on market data. In addition, the design of the revenue model often happens after CBM implementation, which make it difficult to predict profitability. For CBM implementation, companies struggle with financing their new CBM and covering their upfront costs. CBMs experimentation is a solution for the implementation gap, however, there is a lack of empirical evidence on how to use experimentation to assess and predict the financial outcomes. CBMs are evaluated with a linear mindset, constrained by short-term reporting obligations and traditional accounting practices. Last, financial indicators, usually used in linear business model, are suggested both for prospective and retrospective evaluation. Nevertheless, there are no guidelines on how to use these indicators in the circular context. Based on this study, future research is therefore suggested to investigate how to develop financial forecasting capabilities and to deal with risk and uncertainties in long term perspective. Future work could also provide guidelines on the use of financial performance measurement for CBMs.

Through analyzing the financial barriers and suggesting future research paths, this study aims to encourage companies adapting sustainable practices and so contributes to SDG 12.6. It specifically contributes track 5.c Circular Economy, and sheds light on required efforts necessary to go beyond traditional practices, thus also contributing to the overall aim of the ISDRS conference.

Track
Track 5c Circular economy

Lessons on Extended Producer Responsibility in the Context of Circular Economy

Mr Kieran Campbell-Johnston[1], Dr Walter Vermeulen[1], Dr Sabrina Dermine-Brullot[2]

[1]Utrecht University, Utrecht, Netherlands. [2]UTT, Troyes, France

Abstract

Policy is a crucial driver for circular economy (CE) practices, creating a business baseline and direction. Many European Union (EU) policies focus on different aspects of production, consumption and waste processes. Current policies build on infrastructures and ideas that have developed and evolved over the previous 20 years relating to material efficiency and social and environmental protection from harm caused by waste processing. This presentation draws on the lessons and experiences from established CE policies and practices.

This presentation synthesizes the work and outputs of a PhD project that focuses on organizing and applying extended producer responsibility (EPR) in the context of CE in the EU and aims to reflect on the lessons learnt. EPR is a long-standing policy approach to product management, where post-user responsibility for a product is transferred to the original producer (of their representative) and away from local authorities. These systems have effectively promoted lower CE R-strategies (collection and recycling) through specified take-back requirements and obligations. However, the degree to which the decision-making processes and mechanisms for determining higher R-strategies, waste prevention and reduction can be improved remains a continuous challenge (both organizationally and theoretically). Drawing on the experiences and detailed case studies conducted in Italy, France and the Netherlands, this presentation presents the key observed weaknesses of the organization of EPR (nationally and globally) and reflects on potential pathways forward. The drive for CE and many sub-goals of the Sustainable Development Goals require a shift from recycling to more integrated decision-making processes. Such processes consider the responsible management of resources, waste reduction, prevention (SDG 12.2 and 12.5) and further operationalization of the cascading principle. These goals provide a broader perspective for this presentation.

Track
Track 5c Circular economy

Textile and Metal synergies: Two potential sectors for sectoral industrial symbiosis implementation in Portugal

Mr. Juan Henriques[1], Muriel Iten[1], Prof. Paulo Ferrão[2]

[1]Low Carbon & Resource Efficiency, R&Di, Instituto de Soldadura e Qualidade, 4415-491, Vila Nova de Gaia, Portugal. [2]IN+ Center for Innovation, Technology and Policy Research, Instituto Superior Técnico, University of Lisbon, 1049-001, Lisbon, Portugal

Abstract

Since 2004 Portugal has made important strategic and operational efforts to implement the Circular Economy. It has even promoted an ambitious, Plan of Action for the Circular Economy (PAEC), with the main objective of redefining the concept of the end of life of the linear economy, and promoting the concepts of reuse, repair and renewal of materials and energy. One of the most promising approaches for the implementation of the circular economy in the industrial sectors is Industrial Symbiosis (IS). This circular business model proposes symbiotic exchanges or synergies between companies that are developed in an industrial ecosystem.

The literature suggests that the manufacturing sectors are among the sectors with the highest potential for Industrial Symbiosis. In the strategic perspective of Portugal (PAEC), various priority sectors have been identified for the implementation of the circular economy in the Portuguese context, among these sectors we can highlight the textile and metal sectors. In Portugal, the metal (metallurgy and metalworking) sector was responsible, in 2017, for 7.9% of the turnover, and 5.7% of the jobs created in the national economy. On the other hand, the Textile and Clothing sector, represents a total of 19% of employment and 8% of turnover in the manufacturing industry.

In order to achieve this transition for a circular economy in the industrial sectors, it is necessary to address the potential sectors of the economy and identify their current status and potential for the implementation of this model. The main objective of this study is to characterize comprehensively the textile and metal sector within the scope of industrial symbiosis implementation, facilitating a database of substitution synergies between cross-sectorial supply chains. This characterization is based on enabling practices, implemented measures, and stream exchanges (wastes and by-products). The main results of this study are a comprehensive characterization of existent synergies in the two sectors (in a national and international) and the identification of the potential valorization scenarios for Portugal. The information presented in this study can be a useful tool for companies that intend to start sectorial and intersectoral symbiotic exchanges in those sectors since these results provide companies with efficient and understandable knowledge to promote their implementation, especially companies with a lack of background in industrial ecology.

Track
Track 5c Circular economy

Ultimate Producer Responsibility for e-waste Management - a proposal for just transition in the circular economy based on the case of used European electronic equipment exported to Nigeria

Mr Kaustubh Thapa[1], Dr. Walter Vermeulen[1], Dr. Pauline Deutz[2], Dr. Olawale Olayide[3]

[1]Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, Netherlands. [2]Department of Geography, Geology and Environment, University of Hull, Hull, United Kingdom. [3]Department of Sustainability Studies, University of Ibadan, Ibadan, Nigeria

Abstract

European secondhand electric and electronic equipment are imported to Nigeria. Although e-waste imports in Nigeria are illegal, research shows it is an ongoing practice through various loopholes. These exports from Europe and imports in Nigeria have sustainability and circularity implications for both. Collaborative actions between Nigeria and European Union is essential for a more circular and fair export and import of secondhand products with consideration for value-adding, value-retaining and curbing illegal e-waste exports. Using a transdisciplinary approach, we identify existing practices and challenges and co-create actionable solutions towards a more sustainable, circular e-waste management in Nigeria and towards a just export/import relationship between Nigeria and the European Union. Seeing the multiple-use cycle of electronic and electric equipment in multiple countries, we show the limitations of national or regional extended producer responsibility and propose a more inclusive and internationally functional ultimate producer responsibility. Using our findings, we reason why ultimate producer responsibility is essential to achieve: i) a just transition in the European circular economy considering the international dimension and ii) for countries like Nigeria who already have or are designing extended producer responsibility but also rely heavily on the imports of secondhand products.

Track
Track 5c Circular economy

Full papers

Agility within the Scope of Bio Refineries: Identifying main characteristics and key factors for agile bio refineries

Juan Henriques[1], Rui Dias[1], Doroteya Vladimirova[2] and Marco Estrela[3]

[1]*Low Carbon & Resource Efficiency, R&Di, Instituto de Soldadura e Qualidade, Rua do 8 Mirante, 33, 4415-491 Grijo, Portugal*

[2]*Institute for Manufacturing, Department of Engineering, University of Cambridge, 17 Charles Babbage Road, Cambridge CB3 0FS, UK*

[3]*Low Carbon & Resource Efficiency, R&Di, Instituto de Soldadura e Qualidade, Av. Prof. Dr. Cavaco Silva, 258, Taguspark, 2740-120 Oeiras, Portugal*

Abstract

In the last 20 years, the development of biorefineries has been increasing around the world. This increase is mainly due to the potential benefits presented by this type of plant, namely, the reduction of raw materials, reduction of operational costs, and its adaptability that allows valorization of diverse feedstocks. Nevertheless, the implementation of biorefineries still faces some significant challenges such as appropriate availability of raw materials (quality and quantity), feasibility in the product supply chain, economies of scale, and the difficult territorial anchoring. Some of those problems are related to the current approach taken to implement biorefineries that frequently lay in the perspective of developing a large-scale plant under a single large-scale investment. An interesting approach to solve some of those problems is the introduction of the agility concept in biorefineries, i.e. the promotion of agile biorefineries (AB). Agile biorefineries are flexible plants, where a reconfiguration of the process is achieved by switching equipment inside a single standalone plant, therefore they achieve this agility by adapting configurations, varying feedstocks, and even changing operating conditions throughout time. Despite relevant efforts that have been made to promote a definition of agile biorefineries, the authors consider that it is still necessary to contribute to a common definition of this concept by identifying its main characteristics, which have not been clearly established. This study has two main objectives, firstly to contribute to the common definition of the AB concept and the identification of its core characteristics. Secondly, to identify the key factors in the process of implementing an Agile Biorefinery. To achieve these objectives, this study is based on a mixed approach that joins a systematic literature review with expert consultation. The main results of this study are: (i) contribution for the common definition; (ii) identification and description of the fundamental characteristics of an agile biorefinery; and (iii) a framework of key factors (enablers and challenges) in the implementation

process of AB. The results presented in this paper could be a valuable tool for stakeholders that intend to implement agile biorefineries, especially for those who have no previous experience in this area.

Keywords: Agile bio refineries, agility, circular economy, key factors.

1. Introduction

In recent years the implementation of biorefineries has increased in the world. One of the most accepted definitions of biorefining was given by the International Energy Agency defining biorefining as "the sustainable processing of biomass into a spectrum of marketable products and energy" (Bauer, Coenen, Hansen, McCormick, & Palgan, 2017). The IEA Bioenergy also defines bio refineries as "the sustainable processing of biomass into a spectrum of marketable bio-based products (food/feed ingredients, chemicals, materials) and bioenergy (biofuels, power and/or heat) Factory (Ree & Jong, 2019).

The implementation of biorefineries presents several benefits in various areas such as environmental, social, and economic. Among these benefits are reduction of raw materials, reduction of operational costs, and its adaptability that allows valorization of diverse feedstocks, among others. Nevertheless, the implementation of biorefineries still faces some significant challenges such as appropriate raw material availability (quality and quantity), feasibility in the product supply chain, economies of scale, and difficult territorial anchoring. Despite the increase in biomass processing projects and initiatives over these last two decades, the development of biorefineries is significantly slowed down because of several constraints (Houngbé, Barthe-Delanoë, & Négny, 2019).

A promising approach to overcoming these challenges and promoting biorefineries is the implementation of agile biorefineries (Houngbé et al., 2019). Agile biorefineries have been defined as flexible plants, where a reconfiguration of the process is achieved by switching equipment inside a single standalone plant, therefore they achieve agility by adapting configurations, varying feedstocks, and even changing operating conditions throughout time.

The current approach to biorefining is through a large-scale plant under a single large-scale investment. However, this appears to be a difficult approach to replicate. The new cases and associated process technologies of de-constructing and re-constructing biological feedstocks allows us to design and build new, lower cost, agile bio-refineries that can take in a variety of inputs and create a variety of outputs. Rather than a single, large-scale plant dedicated to a specific waste stream, we now imagine a set of independent manufacturing plants that can collaborate and compete to maximise the total value (economic, environmental & social) of a waste stream. Furthermore, there are no existing examples of agile bio-refineries globally and our research seeks to make the first step towards identifying key parameters and requirements for the creation

of an agile bio-refinery, as well as outline the key barriers that need to be overcome by industry and wider society.

This study has two main objectives, firstly to contribute to a common definition of the AB concept and the identification of its core characteristics. Secondly, the paper aims to identify key factors involved in the process of implementing an Agile Biorefinery. In order to accomplish these objectives, the paper poses the following research questions:

RQ1: What is a common definition of an Agile Biorefinery and what are the fundamental characteristics of an agile biorefinery?

RQ2: What are the key factors (enablers and barriers) in the implementation of AB?

This paper is structured into four sections, a first and an introductory section for the approach and objectives of the research. A section to present the methodology followed in this study. A result section to present the common definition of AB, main characteristics, and implementation key factors. In the last section, conclusions are drawn.

2. Methodology

Research strategy

The first step in this study was to define methodology research that would allow the achievement of the proposed objectives. Figure 1 represents the proposed methodology.

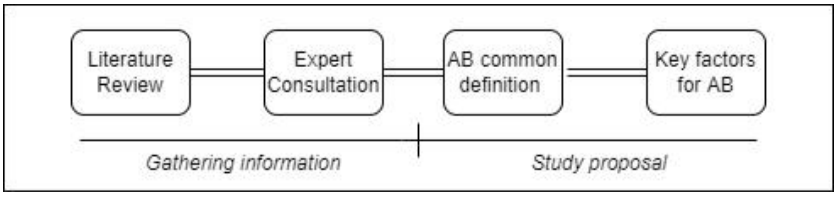

Figure 1 Levels of the literature review

This study adopts a research strategy that combines a literature review and expert consultation to identify a common definition for AB and the key factor in its implementation process.

Literature review and expert consultation

The objective of the literature review is to reveal the common trends between AB and other concepts (such as biorefineries, modular biorefineries and integrated biorefineries) (i); the possible enablers and barriers within

the scope of AB (ii); and the contribution of other concepts to AB (iii). A search was conducted in the search engines Scopus and Web of Science on three different levels. Figure 2 shows the different levels of the literature review with the subject addressed and the number references identified.

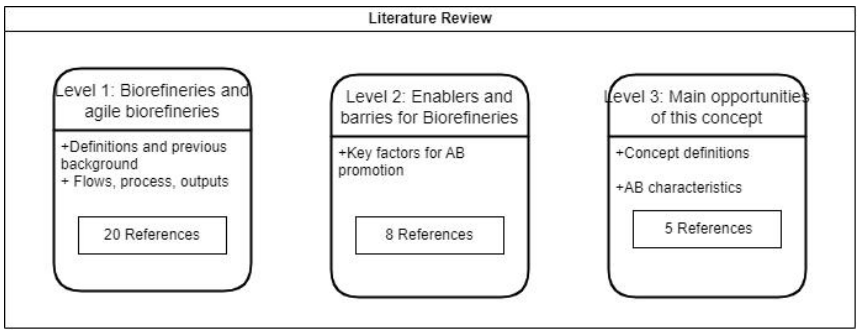

Figure 1 Levels of the literature review

Our main information source for the case studies characterization was based on scientific peer-reviewed journal articles. A complementary search was also developed through Internet searches for technical reports and technical documentation of European initiatives, such as European projects and reports. In addition, an expert consultation was performed.

In parallel to the literature review, an expert consultation was designed and performed. In this process have been interviewed 3 experts related to the field of implementation of bio refineries. The three experts selected have a similar profile, with a strong technical background in the practical implementation of biorefineries. This consultation was performed through an interview of approximately one hour. In this interview we address 4 main topics: the concept proposal for AB (i), the main characteristic of AB (ii); key factors for the AB implementation process (enablers and barriers) and the main opportunities of this concept. This consultation enabled the identification of critical aspects that were not registered in the scientific literature and provided important insight for our research.

Identification of key factors

Once the common trend and concept of agile biorefineries were identified, the next step in the research was to identify the potential key factors involved in the implementation process of agile bio refineries. For this purpose, the identification of enablers and barriers (Key factors) was developed through a methodology of 3 sequential steps to identify which were the enablers and barriers associated with the AB concept:

- Identify key factors in the agile bio refineries. Establish a state of the art in key factors regarding similar concepts (For instance Bio refineries and modular bio refineries)

- Use expert consultation as a gathering information method
- Use comparative analysis in order to identify the key factors for AB

3. Study Results

A common definition for Agile Bio refineries (AB)

Taking into account the previous background in the definition of agile bio refineries and the inputs of our research, the authors consider that an AB is a flexible plant, where a reconfiguration of the process is achieved by switching equipment inside a single standalone plant, therefore they achieve this agility by adapting configurations, varying feedstocks, and even changing operating conditions throughout time.

In this sense agile restorative biorefinery involves a relatively low capital investment modular (adaptable) facility, deployed locally (uses local, short-distance available resources), capable of utilising different feedstocks (flexible), including wastes, in a small-scale but high yield production, which works in tandem and focusing in generating value across all stakeholders. In the following section, the core characteristics will be addressed.

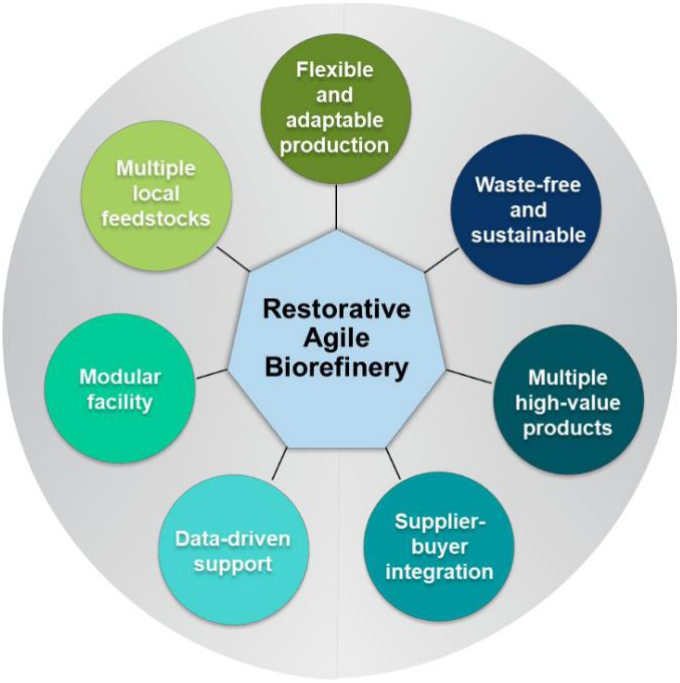

Figure 3 Restorative agile biorefinery concept characteristics

Flexible and Reconfigurable

From a manufacturing standpoint, flexibility attains the capacity of how fast the company converts its process(es) from making an old line of products to producing a new product. Early definitions are based on the notion of adaptability to uncertainties (ElMaraghy, 2005), which still retains much of the essence given to flexible manufacturing systems. The ability to change a production schedule, modify a part, or handle multiple parts. The ability to rapidly increase or decrease production levels of shift capacity from one product to another. The reconfigurable manufacturing paradigm was introduced as a necessity to cope with relatively large fluctuations in product demand and mix caused by market disturbances (Koren et al., 1999).

To successfully construct the concept of agile biorefinery, one must take these factors into account and consider their integration into the design, planning and operational management of biorefineries. Biorefineries need to be designed for flexibility so that they can adapt easily to changes in feedstock supply and/or demand for value-added products (Villemont et al., 2017).

Feedstocks and technology selection for agile

A biorefinery is typically defined by the type of feedstock and conversion process applied (Ubando, Felix, & Chen, 2020). The first-generation feedstocks are already very compromised due to global food supply shortages and have been reported to increase the prices of food and animal feed (Sims, Mabee, Saddler, & Taylor, 2010). This tendency is being aggravated by the climate crisis and increased human population, thus not allowing concomitant use for sustainable biorefining.

In this sense, the authors consider that efforts should be directed towards non-food competing feedstocks, which means using biowastes and by-products from several agro-food and non-agro-food sectors in cross-sectorial exchanges. Among those, stream materials such as lignocellulosic materials, green fertilizers, and other farm residues, kitchen waste, agro-food waste, industrial waste, and forestry wastes can be highlighted (Naik, Goud, Rout, & Dalai, 2010). A waste biorefinery is said of capable producing fuels, power, heat, and value-added products (Nizami et al., 2017). For example, the use of lignocellulosic materials allows different platforms to be deployed for the extraction of intermediate products such as lignin, and hemicellulose, which could be further processed for value-added products such as bacterial cellulose, biopolymers, and bio solvents (Takkellapati, Li, & Gonzalez, 2018). Consequently, these have several uses by different industrial sectors such as the medical, pharmaceutical, textile, chemical, among others.

To take advantage of the relatively low processing capacity (due to scale), the production system needs to be highly efficient in terms of value-added. The production processes and thus, technology selection needs to be carefully selected, to allow the production of high-margin products at minimal resource use. There are reports

of reduced capital costs in these integrative multi-productive systems (Olguin-Maciel, Singh, Chable-Villacis, Tapia-Tussell, & Ruiz, 2020), and of effectiveness in maximising biomass yield and efficiency (Pinales-Márquez et al., 2021). Not all technologies are appropriate for agile biorefining, and consequently, a key design requirement is to effectively optimize chosen supply (raw material) and the portfolio of products to be produced. The biochemical pathway seems promising from a small-scale and low-cost standpoint (Igbokwe, Ezugworie, Onwosi, Aliyu, & Obi, 2022). Several studies also consider the use of biomass fractionation technologies to optimize efficiency (Sun et al., 2018; Xu et al., 2020).

Small-scale, modularity and decentralisation

Larger centralized processing plants benefit from economies of scale due to reduced marginal costs, better processing yields, and returns on investment. For these reasons, small-scale processes greatly defy economies of scale. However, (Bruins & Sanders, 2012) argue that economies of scale may not be as important in the biomass-based sector as it is in fossil-based sectors due to the sparsity of biomass energy density and reduced cost of technology.

Some of the advantages of small-scale processes are outlined in terms of reduced transportation costs through the use of local resources, farmer benefits, storage, and logistical ease, and better capabilities in re-using waste and heat (Bruins & Sanders, 2012). These are expected to have lower initial investments and operational costs, lower energy requirements, and less capital-intensive technology (Susmozas, Moreno, Romero-García, Manzanares, & Ballesteros, 2018).

Small-scale biorefineries are typically deployed locally (near feedstock sources) and in rural areas. This contributes to the decentralization of the processing chain and possibly establishes deeper collaboration bonds with farmers and suppliers of biomass. It is this alignment and close cooperation that enables the agility capabilities of the system (company, supply chain).

The single large-scale facility can be split into several smaller ones by leveraging local sources of feedstock and creating an interconnected network of biorefineries. Using distributed manufacturing to promote decentralization by addressing location and scale in terms of technology, processes, systems, and business strategies (Vladimirova et al., n.d.). Collaborative approaches may facilitate production escalation by downstream integration and processing of flows (Günther et al., 2014).

The modularity comes into play as several production units can be added to up-scale the production process as needed, and removed, to de-scale the process. Designing a modularity system may favour agility by implementing several singular low-cost but highly effective modules (Bramsiepe et al., 2012). These modules

can be (re)deployed depending on the locally available biomass and contain new conversion processes adapted to the product being produced. This can be linked with the micro-factory concept which integrates automatised production of customised products, delivered on-demand, in which capacity is increased by embedment in a network with other micro-factories (Okazaki, Mishima, and, & Ashida, 2004).

Role of IoT and Information Technologies

Information technologies are fundamental tools for agile systems, as it allows the integration of processes, technology, people, and organizations (Gunasekaran, 1999). Those technologies promote the creation of virtual-based systems, essential for deepening supply-buyer collaborations, and forecasting and satisfying market demands. An agile biorefinery urges to be in constant awareness of the state of the supply given its scale and localized production. Data analytics and the use of I4.0 to sustain and validate operations are likely to have a significant role in streamlining the biorefinery supply chain and operations and optimising purchasing and production activities.

A good example of these synergies is the HereWear H2020 project ("HereWear: Bio-based local sustainable circular wear," 2022) which works exactly in integrating digitalised production at a local scale for on-demand textile production and clothing goods. It may have a glimpse of what is required to successfully integrate and transition to agile and restorative biorefining.

Key factors for Agile biorefineries: enablers and barriers

Since the literature diverges in the definition of key factors, two concepts that limit the boundaries of the enablers and barriers have been followed. An enabler is a factor that facilitates and supports the concretization of symbiotic synergies. On the other hand, a barrier is a factor that hinders or obstructs the development of symbiotic synergies (Henriques, Ferrão, Castro, & Azevedo, 2021). Enablers and barriers can be presented in various dimensions and levels. For the purpose of this study, five fundamental dimensions have been suggested where the enablers and barriers can take place. These fundamental dimensions are policy & regulation, environmental, social, business, and logistics & management.

Main enablers for AB

Regarding the identification of the enablers, our results present 10 different enablers, distributed in 4 fundamental dimensions (environmental, social, business and logistics & management).

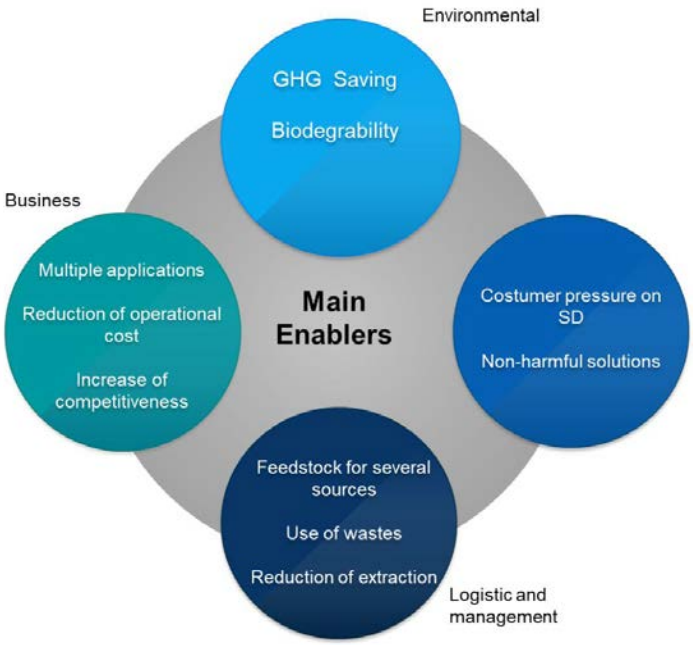

Figure 2 Main enablers for Agile bio refineries

Business

Among the main enablers that can be highlighted in the business category for agile biorefineries, is the multi-applicability that this plant will have. Since, due to the nature of the proposed concept, these plants can process and value various streams/ feedstock and convert them into biofuels, fuels, energy, and other products, thus presenting multiple applications (Ghatak, 2011). One of the main motivations that drive the increase in the promotion of biorefineries in recent years has been the ability to generate income and reduce costs that this type of unit presents. It is expected that the AB also has the potential to reduce operational costs such as feedstock cost reduction and also has the ability to create value through the development of high value products (Lane, 2020). Another fundamental aspect of this dimension is the increase in competitiveness since, similar to biorefineries, the competitiveness of this plant is based on the balance between the production of bio-products and bio-materials of high value/low volume and high volume/low biofuels value (LNEG, 2019).

Environmental

In the environmental dimension, the main enabler presented is the contribution to the reduction of greenhouse gas emissions (GHG), for the reduction of organic waste deposition in landfills. Nevertheless, there are other GHG saving opportunities, for instance, GHG saving associated to the production of heat and electricity and other bioproducts (LNEG, 2019). On the other hand, another important factor is the high biodegradability of potential feedstocks to be valorized. Those biomasses are generally low or non-toxicity, and biocompatibility,

not causing risks to the environment and animals, plants, and humans, which increases their potential to be used in various products.

Social

The growing consumer awareness and especially the custumer pressure on sustainable development are one of the major enablers in the social. A growing consumer preference for 'green' products is observed, coupled with a growing awareness of the need for action regarding carbon emission reduction (European Commission, 2021) (European Commission, 2019). Another relevant enabler in this regard is the non-harmful solution that this plant presents since Bio-based chemicals are sometimes considered non-harmful, and non-toxic since they originate from nature. Some bio-based solvents are non-toxic and harmless.

Logistics and management

The use of feedstock from several sources, such as agro-food and non-agro-food sectors in cross-sectorial exchanges (Lignocellulosic materials, green fertilizers, and other farm residues kitchen waste, agro-food waste, industrial waste, and forestry wastes) represent a major enabler for AB. The use of waste, reduction of GHG emission, and reduction of raw materials extraction also represents a considerable advantage.

Main barriers for AB

Regarding the identification of the barriers, our results present 10 different barriers, distributed in 4 fundamental dimensions (Policy & regulations, social, business, and logistics & management).

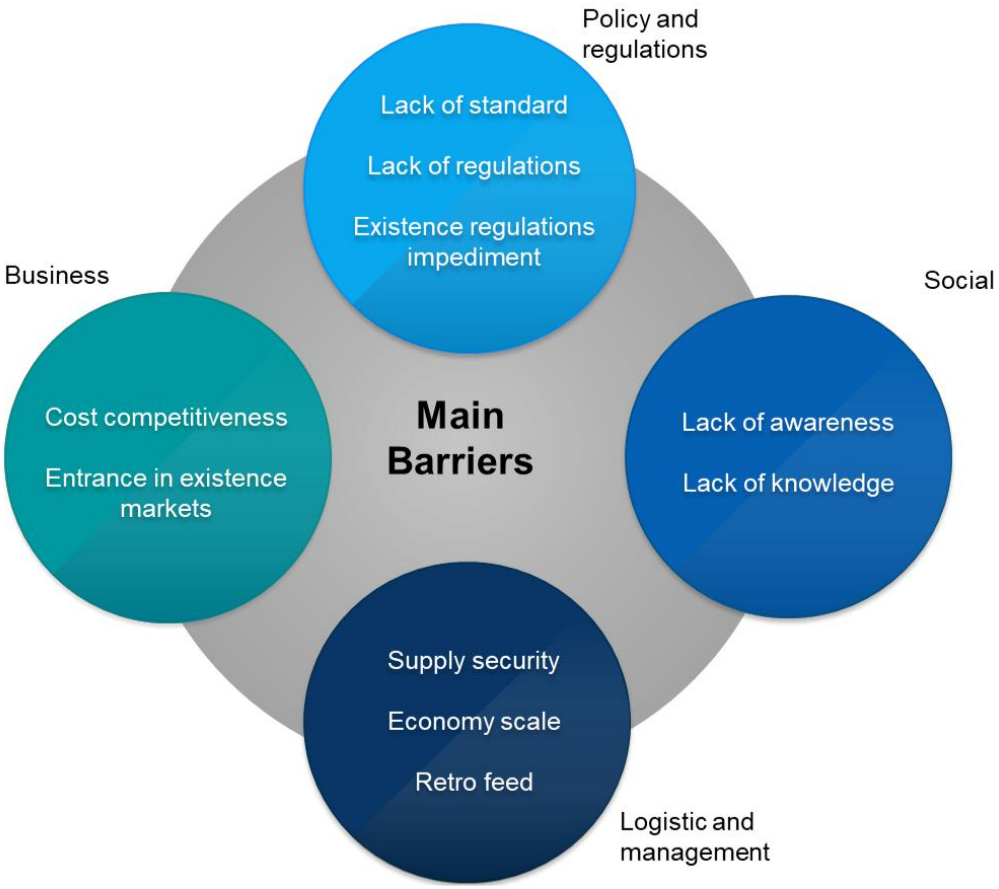

Figure 3 Main challenges for Agile bio refineries

Business barriers

Concerning business barriers, the lack of cost competitiveness for some EU countries due to higher labor costs affecting CAPEX and OPEX, higher taxes, higher energy costs, and limited low cost biomass feedstocks compared to some other regions in the world, is one of the major barriers in this category (Charles et al., 2013; European Commission, 2021). Another issue emerges is the entrance in existing markets since many of the potential feedstock are already valorized locally or are directed to waste management and landfilling.

Policy and regulations

Among the main regulatory barriers that various countries face in the implementation of biorefineries is the lack of standards and lack of regulation (European Commission, 2021), which ends up hindering the appropriate promotion of these plants, especially in the initial phase (planning and creation). The result of this study suggests that ABs face similar impediments due to the nature of the concept.

In the same line of thought, one of the problems that we consider will be common in the promotion of these plants, is the existence of regulations, which are an impediment to the recovery of wastes (Ladu, 2018). The waste streams usually have a non-uniform classification, due to the diversity of materials such as waste, residue, or coproduct. This fact leads to loopholes that cannot be addressed by national legislation alone. The ABs will function from the recovery of various feedstock, many of which will be classified as waste. We foresee similar regulation barriers to those faced by other models such as industrial symbiosis and the circular economy in the industry.

Social

Since the concept of AB is still new, our research suggests that in the initial phases of promotion, a major barrier is the lack of knowledge and awareness especially in the benefits that this plant can produce (economic and environmental benefits), especially by SMEs. On the other hand, the lack of technical knowledge and technical expertise required to develop AB will be an important barrier to overcome in this process.

Logistics and management

All bio-based product pathways, to varying degrees, have near-term concerns about feedstock supply and mid-long term concerns over feedstock availability (European Commission, 2021). One of the major concerns that emerge in this dimension is the supply security due to the variability of the availability.

4. Discussion and conclusions Discussion

Regarding the first research question that refers to the common definition for AB, the paper achieves a contribution to the common definition of AB and identifies the fundamental characteristics of AB. The authors achieved a first draft of a common definition for AB and its main characteristics. The authors consider that Agile biorefineries are flexible plants, where a reconfiguration of the process is achieved by switching equipment inside a single standalone plant, therefore they achieve this agility by adapting configurations, varying feedstocks, and even changing operating conditions throughout time. An agile biorefinery involves a relatively low capital investment modular

(adaptable) facility, deployed locally (uses local, short-distance available resources), capable of utilizing different feedstocks (flexible), including wastes, in a small-scale but high yield production, which works in tandem and focusing in generating value across all stakeholders. Seven characteristics of AB were identified, namely: Multiples local stocks (i), Flexible and adaptable production (ii), waste-free (iii), multiple high-value products (iv), supplied buyer integration (v), data-driven support (vi), and modular facility (vii).

Regarding the second research question that refers to the key factors in the implementation process of AB, through our research 10 enablers and 10 barriers were identified that could potentially appear in the implementation process of agile biorefineries. These 20 key factors are distributed in various fundamental dimensions such as Policy & regulations, environmental, social, business, and logistics & management.

Conclusion

An agile biorefinery is a biorefinery that is built to strive in an uncertain environment, benefitting from small-scale localized production with easy to implement technologies that are feedstock flexible. Working in a small-scale environment requires a closer connection between the sourcing of materials and wastes and the production steps at the biorefinery. A network of localized biorefineries is formed through information systems and integrated with downstream industries for the concomitant production of value-added products and biofuels on a global scale.

This paper achieves the first common definition of this concept that was built by the main characteristics addressed. In the second part of the paper, the key factors (Enablers and barriers) for the implementation process of AB were identified and addressed.

Without disregarding the results obtained in this study, we consider that this study had some limitations due to its nature. The definition of AB, fundamental characteristics, and key factors was based on methods such as observation, literature review, and expert consultation. The authors consider that a real case validation will strengthen the results presented in this study.

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A Transition Management Methodology Framework towards a Circular Economy in Industrial Contexts: Reflections on the Humber Region scenario

Rincón J.[1], Velenturf A.[2], Jaca C[3], Ormazabal M.[4]

[1]*University of Navarra, TECNUN, School of Engineering, San Sebastian, Spain, jrincon@tecnun.es*
[2]*University of Leeds, School of Civil Engineering, Leeds, United Kingdom, A.Velenturf@leeds.ac.uk*
[3]*University of Navarra, TECNUN, School of Engineering, San Sebastian, Spain, cjaca@tecnun.es*
[4]*University of Navarra, TECNUN, School of Engineering, San Sebastian, Spain, mormazabal@tecnun.es*

Abstract

Industrial activities are responsible for most of the use of natural resources and the generation of waste. 50% of greenhouse gas emissions are attributed to the production of materials and products. The circular economy (CE) has been established as a model that can change the way we produce products by cycling back materials as a route toward the recovery of waste. Implementing projects efficiently using resources in a system can be helped through governance tools that evaluate and facilitate a transition. The Transition Management (TM) framework can be used as an analytical approach that contributes to governing such transition. This framework aims to influence, facilitate, stimulate, and organise processes that contribute to the transition towards a circular model. The objective of this study is to analyse how the transition to a CE is developing since the emergence of industrial symbiosis (IS) in the Humber region. The study seeks to describe the main features that allow the region to make progress towards a CE, whether there are some stakeholders essential to this process, and to analyse whether the activities initially implemented are still relevant to transition towards a CE. The region was examined through a qualitative case study. The case was constructed and analysed through two types of data: documents and interviews. The document review included desk research of the Humber region to establish an understanding of CE strategies. The semi-structured interviews were carried out with stakeholders providing insight into how this region approaches CE as well as the activities that are currently taking place. The data was analysed under the TM theory approach. This was done through the MAXQDA software for qualitative and mixed methods research. The data collected gave an overview of how the industrial strategies used to operationalize IS in the Humber Region are transforming towards a CE system. The results would serve to refine the TM methodology framework by understanding the dynamics of this context that might help to frame the process conditions needed to transition towards a CE system through IS.

Keywords: transition management, industrial symbiosis, circular economy, sustainable development, case study.

1. Introduction

Industries are substantially responsible for the world's resource usage and waste creation and are hence liable for contaminating and damaging the environment (Prieto-Sandoval, Jaca, Santos, Baumgartner, Ormazabal, 2019). Nonetheless, industrial systems have sought to attain sustainability through various modifications and reformations, such as resource optimization at the input stage and good waste management at the output stage (Gopinath, Bahurudeen, Appari, & Nanthagopalan, 2018). Thereby companies have tried to convert materials that would otherwise turn into waste at the end of their lifetime, into resources for other companies (Prieto-Sandoval et al., 2019) or processes (Velenturf, A. 2017a) to reach a (CE) model.

This CE model incorporates IS. While CE aims to reduce resource input into the economy and to keep products and materials in use for longer, IS focuses on turning wastes and by-products from production processes into resources for other industries. IS is considered a useful strategy for supporting the transition from a linear to a CE model (Abreu & Ceglia, 2018; Merli, Preziosi, & Acampora, 2018; Prosman, Wæhrens, & Liotta, 2017). IS-related circular models have developed on self-organised, facilitated, planned models various paths in China and Europe, which account for the majority of case studies of applying solutions to create these systems (Rincon-Moreno, Ormazabal, Álvarez, & Jaca, 2020). Countries in Europe have developed secondary materials markets that can compete and minimize reliance on primary resources (European Commission, 2015; McDowall et al., 2017; Zink & Geyer, 2017).

However, one of the problems related to an extended IS adoption is explained by Petit, Sablayrolles, & Yannou-Le Bris (2018) as the impediment to incorporating organisational perspectives with other components of IS (e.g. material flow analysis) due to a higher focus on IS adoption more related to technicalities (Cerceau, Mat, & Junqua, 2018). So far, a large proportion of research treats technical aspects (e.g., supply chain, waste, energy, emissions), whereas aspects that might deal with collaboration with different stakeholders such as information, sustainable development, and networks are not being treated equally as a typical topic in an IS (Abreu & Ceglia, 2018). Authors such as Mortensen & Kørnøv (2019) have similarly stated that one of the critical factors in IS adoption lies in organising this process to establish synergistic relations and initiate partnerships.

Moreover, regardless of existing technical suitability and potential financial and environmental gains obtained in implementing IS (Doménech & Davies, 2011), scaling it up would require extensive collaboration with industry and other stakeholders (Velenturf, A. 2017b). So, moving away from a linear model goes beyond turning waste into valuable materials, including a deep knowledge and understanding of relevant stakeholders (Hein et al., 2017a). This creates obstacles to a systemic IS adoption, hence it is vital to define what type of strategy would bring together diverse stakeholders to implement this solution.

To address this type of systemic flaw, changes must be fundamentally restructured via transitions. Transitions are defined as "processes of structural change in social sub-systems" that occur when dominant structures are put under strain, either by external changes or through an endogenous innovation process to offer direction for the wicked challenges that we are presently confronted with (Peterson, Baker, Aggarwal, Boyer, & Chan, 2021). Since industries are fairly liable for depleting resources, they are critical in playing a significant role in social transitions between the corporate environment and the larger environment to create a sustainable production model within a society (Bidmon & Knab, 2018). So, CE can be considered as a unified socio-technical system involving the change of industrial processes, with IS serving as a pillar to become the dominant industrial system used by many countries (Schot & Kanger, 2018).

Loorbach & Wijsman (2013) have recommended further research into this societal viewpoint of business as a driving factor in addressing social and environmental challenges. This insight has fuelled research into new kinds of governance, which have been generally labelled as TM or transition governance. The word "management" is derived from an overtly normative orientation of sustainability: specifying where we want to be, what should be done, and how it should be done (Peterson et al., 2021).

Therefore, the purpose of this study is to integrate and use concepts and learnings from the emerging area of TM to systematically investigate how to shift from a linear system to a more sustainable mode of production. To that end, the paper's specific objectives are as follows: a) apply concepts from the TM literature to past transitions in the Humber Region in the UK to develop a conceptual framework for TM of IS systems; (b) describe the main features that allow the region to make progress towards a CE, whether there are some stakeholders essential to this process to explore future transitions; and (c) analyse whether the activities initially implemented are still relevant to transition towards a CE. The structure of the paper covers a literature review, methods, and results consecutively, concluding with a framework that proposes how to create spaces for experimentation and collaboration, how and which actor networks to mobilise, and what action strategies to recommend implementing. These insights could then be applied to other regions in developed and developing countries, to avoid becoming entrenched in unsustainable management as they expand industrial outputs.

2. Literature review

Industrial Symbiosis

IS enforces an approach that takes inspiration from how industrial systems mimic natural ecosystems, and it can simulate the distribution of materials, energy and information flows (Mallawaarachchi, Sandanayake, Karunasena, & Liu, 2020). IS aids in the transition to a CE by minimizing dependency on virgin resources

(Abreu & Ceglia, 2018; Nasir, Genovese, Acquaye, Koh, & Yamoah, 2017; Saavedra, Iritani, Pavan, & Ometto, 2018). For example, China's CE growth is built on policies that aim to construct a broad supply chain through regional industrial parks aimed at CE development (Fraccascia, Giannoccaro, & Albino, 2019; Mathews, Tan, & Hu, 2018). In the European Union, on the other hand, the circularity in production processes is focused on building secondary materials markets to minimize reliance on virgin resources, which has helped the expansion of IS efforts in some countries (Bassi & Dias, 2019; Petit-Boix & Leipold, 2018).

The European Commission (EC) considers that circularity in production processes has the potential to produce significant material savings throughout value chains and industrial processes, as well as generate additional value via the facilitation and implementation of IS (European Commission, 2020). As a result, the EC has set a new action plan to boost circularity in production processes at the supra-national level (European Commission, 2020). By doing so, the EC contemplates circularity in production processes as a critical component of a broader industrial transition toward net-zero goals carbon neutrality and long-term competitiveness.

However, despite the efforts of the EC to promote a CE, only a few nations in Europe are following CE concepts in which IS now plays an important role that may be regarded as effective in tackling the difficulties of CE according to the European Union criteria (Mazur-Wierzbicka, 2021). The expansion of IS has been discordant in Europe due to enacting policies at the country level, allowing the proliferation of IS activities in only certain countries (Bassi & Dias, 2019). Moreover, IS remains a niche approach with several obstacles (e.g., legal, legislative, and financial impediments, organisational concerns) (Ormazabal, Prieto-Sandoval, Puga-Leal, & Jaca, 2018) and has been embraced in a some industries (Brown & Bajada, 2018; Cramer, 2020a; de Jesus & Mendonça, 2018).

As a consequence, IS deployment in some industries is unknown, despite being demonstrated as a potential strategy to promote the CE transition (Yu, Yazan, Bhochhibhoya, & Volker, 2021). Most of the reasons for lagging in implementation are attributed to a hesitant industry ecosystem willing to embrace the transition (Kirchherr et al., 2018). Likewise, experimental cases demonstrating implementation are not a widely extended practice (Kalmykova, Sadagopan, & Rosado, 2018). Such a low level of implementation is a drawback to the advancement of CE (Panwar & Niesten, 2020). According to Abreu & Ceglia (2018), implementing CE through IS initiatives is critical to engaging corporate and non-business actors to achieve complex synergies. Collaboration amongst stakeholders such as enterprises, governments, and institutions to enable the transition can support solutions from an IS viewpoint (Saavedra et al., 2018).

Transition Management

The literature has recently reported adopting a system perspective rather than firm perspectives to implement IS business models focused on the system's governance and the stakeholders involved that made up that particular circular system (Fraccascia et al., 2019). This focus on a system perspective helps to understand how IS firms are incentivised, motivated, or forced to change through the various mechanisms and how different stakeholders' interest needs to be studied in future research within their context (Yuan, Evans, Wen, & Ma, 2019). Transitions research offers insights to mobilise transformative capabilities from the current system toward a more sustainable production and consumption system known as socio-technical systems (Geels & Schot, 2010). The results obtained during the transition process can be upscaled to the mainstream level starting from the strategic level to a more operational one (Elia, Gnoni, & Tornese, 2020; Jurgilevich et al., 2016).

Loorbach, Frantzeskaki, & Avelino (2017) suggest TM research as a proxy for a deliberative process to accelerate change through a shared strategic vision. TM is a multi-actor process including stakeholders from many socioeconomic groups such as government, non-governmental organizations (NGOs), businesses, academics, and intermediate organisations. The fundamental aspect of TM is to facilitate transitions by gathering stakeholders to develop a cooperative instead of a competitive relationship (Köhler et al., 2019). Through constructive conversations, they conceive, negotiate, and discuss to change their understanding of and attitude to challenges (Dóci, Rohracher, & Kordas, 2022).

The elements of the TM framework distinguish four levels: arena, agenda, experiments, and monitoring (Figure 1). This process contains four management tasks that may not occur in sequential order but might occur in parallel with a continual back and forth between them. These components or transition fields can help solve societal processes, persistent problems, fundamental change, and innovation processes such as the challenge to create circular systems. Likewise, the TM framework provides a set of tools that develop transition-based governance strategies, including a broader range of governance instruments (Loorbach et al., 2017).

Figure 1 *Transition management framework*

The four levels of the framework are explained below (Loorbach & Wijsman, 2013):

- **Transition arena:** long-term activities in which the future is jointly deliberated and envisioned.
- **Transition agenda:** activities aimed at the medium and long term, with a focus on changes in existing organisations, institutions, rules, and physical or financial infrastructures.
- **Transition experiments:** short-term activities that focus on experiments and actions that practice, test, and exhibit alternative ideas, practices, and social interactions.
- **Transition monitoring:** activities targeted at learning about the system's current state and dynamics, as well as probable future states and the path from present to future: These include continual operational, tactical, and strategic actions that provide (collective) learning.

In the literature, Cramer (2020a) has dealt with this issue by focusing on CE implementation built upon TM theory and processes that may indicate change orientation. The author advocates implementing CE initiatives as a continuous transformational change process to influence initiatives that speed up changes and can be scaled up towards a full CE in a local context. As the adoption of IS as an enabler of the CE has been slow and among many reasons the lack of strategy in the regions is one of them, it is relevant to unfold implementation activities. Industries are reasonably accountable for depleting resources, they play a pivotal role in societal transitions between the business environment and the wider environment to achieve a sustainable model (Bidmon & Knab, 2018). Case studies describing the creation of regional symbiotic networking strategies are among the gaps in the literature that should be filled. Consequently, studies that allow comparisons under the umbrella of the TM process to generalize outcomes are valuable (Cramer, 2020b).

3. Methods

The Humber Region in UK is studied through a qualitative case study using the conceptual TM framework **(**Figure 1**).** The conceptual framework was described and analysed through interviews and developed to generate action strategies to recommend implementing it.

Case study research

Transitions study, when viewed as processes of change with complicated chains of causation, multiple players, and changing framework conditions, arguably necessitates process-oriented approaches to analysis (Geels & Schot, 2010). Typically, how transition processes are analysed has been in the form of comparative meta-analyses, case studies, and surveys (Köhler et al., 2019). The substantial dependence on case-based approaches has more to do with the process than with outcome or indicator-oriented modes of theorising. Thus, for this study, the case study approach will be used as it reconstructs transition processes over decades, leading to a better knowledge and explanation of transition dynamics (Köhler et al., 2019). Case studies are a well-accepted method of inducing theory from qualitative material buried in practice (Yin, 2003). Case study research is frequently employed in novel areas and when aiming to explore and comprehend rather than quantify and confirm (Yin, 2009). Given the relative novelty and emergence of industries engaging in initiatives related to an IS within a CE, case studies are thought ideal for investigating this phenomenon.

The Humber region was selected for this study for the opportunity to learn about early actions done by one of the first UK IS initiative, the Humber Industrial Symbiosis Programme (HISP) which was first attempted to start in 2000. This effort sparked the adoption of similar programs in other parts of the UK (National Industrial Symbiosis Programme (NISP) as well as the completion of smaller projects in the Humber area (Cervo et al., 2020). Cases were created and analyzed using two different forms of data: documentation and interviews.

Document review: To gain knowledge of the Humber region's initiatives, documents such as sustainability agendas and environmental programs were analysed. A literature review was carried out to gather information about IS over the last 10 years. The first step involved a search in the scientific literature database Web of Science Core Collection (WOS), the most commonly used and robust source for literature review (Kamalski & Kirby, 2012) to carry out this analysis. WOS's Cited Reference Search tool was used as a starting point for selecting relevant publications. This step allowed it to generate a list of 1113 records that mentioned the keyword "industrial symbiosis". Likewise, the search was limited to peer-reviewed journal articles, review articles and book chapters (all published in English) as this is the dominant mechanism for quality control in conducting unbiased knowledge synthesis in most scientific disciplines (Bornmann, 2011). This step led to an output of 893 relevant publications.

Then, to select literature in the final sample, the publications were assessed to meet two criteria of eligibility (Gottinger, Ladu, & Quitzow, 2020): (i) the study addresses IS in the UK; (ii) the study deals with the Humber region. After excluding literature that did not meet the criteria, a full selection of 93 studies was selected. The studies in the sample were published between 2011 and 2021. The bottom-up change was also explored with the interviewees to build a more integrated vision of how the transition has emerged in the region.

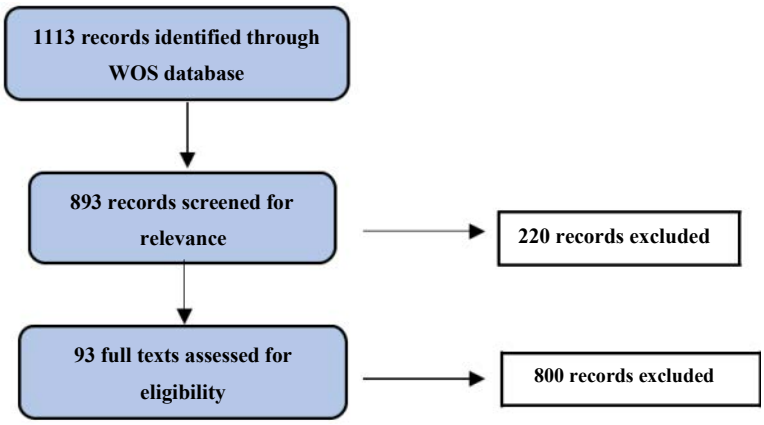

Figure 2 *Literature review process*

Semi-structured interviews: eight semi-structured interviews were performed with a different group of stakeholders (business, business association, local and regional administration and agencies, and research institutions) in the Humber region to gather insights into how different stakeholders have been working in the region ever since the HISP was initiated. At least one actor from the stakeholder's type (Table 1) involved in IS in the region was interviewed to provide insight into how the region approached IS as well as the initiatives that are currently occurring. This not only guarantees that the information gathered is similar but also allows an interviewer to pursue an intriguing line of questions (Kvale & Brinkmann, 2009). The purpose of this type of interview is to learn about interviewees' organisational experiences in a focused and detailed manner, revealing perspectives, feelings, intentions, and actions, as well as the context and organization of their activities, to better understand the reality within organisations (Saunders, Lewis, & Thornhill, 2009). Stakeholders were specifically questioned about efforts centred on by-products to promote resource efficiency and value creation from waste.

Table 1 *Overview interviewees*

Stakeholder type	Role	Organisation type
Business	Environmental manager	Chemical
	R&D manager	Manufacturing
	Company Manager	Services
	Director	Renewable energy
Business association	Program Manager and Energy Hub board member	Services
Local and regional administration and agencies	Climate Change Manager	Services
Research institutions	Researcher	Services
	Lecturer	Services

Data analysis

The interviews in this study were video-recorded and subsequently transcribed to assure the accuracy of the data. The interview transcripts were reviewed and classified separately. An explanation-building strategy, albeit iterative, was utilized as a deductively based analytical way to evaluate a theoretical notion (Yin, 2003). While gathering and analysing data, an attempt was made to construct an explanation by initially matching certain categories obtained from prior research and literature to develop a transition towards CE (de Souza et al., 2020).

The coding approach produced results that aided in comparing initial categories and iterating this process until a satisfying explanation for links between IS activities and stakeholders were obtained (Yin, 2003). The created codes were then analyzed using the MAXQDA software, which is widely used in qualitative research to investigate the relationships between multiple responses (Saunders et al., 2009), and in this study to seek new insights on how specific experiments and actions towards the CE can be deepened, broadened, or upscaled to a cleaner mode of production.

4. Results and Discussion

This section shows the results obtained in the Humber region. The observations obtained during the literature review phase were contrasted with the responses obtained in the interviews to generate new information that

would allow us to apply the concepts from the TM literature to develop a conceptual framework. And to describe the main characteristics that would allow the region to move towards an efficient resource management model through the analysis of the activities initially implemented and their relevance for the transition.

Transition arena

The first component is establishing a transition arena where goals and modes of collaboration with local stakeholders are developed. Based on information gathered from literature and interviews, the need to establish a governmental zero waste to landfill policy and the commitment to promote IS were key in establishing a common goal for this transition. One reason why the success of IS in its early days is attributed to the landfill tax, is because this forced companies to change their strategy from sending waste to increasingly expensive landfills. By doing so, the UK policy framework supported the establishment of IS networks by providing a necessity for businesses to enhance their environmental performance (Jiao & Boons, 2014). A private entity initiated the facilitation of industrial symbiosis to help companies reduce costs and risk, and open new business opportunities. They helped companies to find partners who could use their waste as raw materials to grow synergies between companies (Abreu Ceglia, 2018; Costa, Massard, & Agarwal, 2010). Eventually the UK government funded pilot initiatives including in the Humber region, before the National Industrial Symbiosis Programme (NISP) was established.

Factors such as institutional framework, governance arrangements, and solid commercial potential were deemed crucial (Abreu & Ceglia, 2018; Lombardi & Laybourn, 2012), and different programme attributes influenced the development of the IS programme in the Humber region (Table 2). Although many companies expressed interest, the sense of commitment to the program, as well as the degree of contact among them was initially low. In addition to limiting the opportunities for material networks, weak technological compatibilities within sectors were linked to organisational cultures with low degrees of experience with inter-firm cooperation, which has resulted in some reluctance to participate in the program in its origins (Mirata, 2004). This was the result of fragmented industrial development, and it depicted, a technical environment with limited opportunity for synergies to emerge within various sectors. Similarly, Humber facility managers' restricted decision-making powers were another factor holding back the program. So, agreements presented and facilitated by a consultant and voluntary participation in the program with no fees charged but paid for by the government in services such as opportunity identification improved NISP’s effectiveness (Jensen, 2016).

Table 2 *Characteristics of the IS in the Humber region (Mirata, 2004)*

	Industry structure	Position of coordinating body	Project championship	Original institutional and framework	Awareness raising and commitment
Humber region	Difficult to integrate due to technicalities	No clear coordination	No industry-led frontrunners	Low level of cooperation	Fragmented

Likewise, IS network development and operational characteristics were influenced by several interrelated elements. The coordination tended to place too much emphasis on initiatives, which was incompatible with the important and valuable intention of engaging industries from various sectors in the program. The most prevalent tasks of coordination were mostly assisting with informational and organisational concerns, as well as obtaining various types of support for the programs, including financial support. A few crucial aspects and their possible impact on IS networks are summarised in 5 categories: 1) technical, 2) political, 3) economic and financial, 4) informational and 5) organizational and motivational. So, the Humber area has established great knowledge in waste-to-resource technologies as a result of its involvement in initiatives to promote IS for over a decade (Jensen, Basson, Hellawell, & Leach, 2012; Mirata, 2004; Velenturf, A 2016). Facilitating such synergies between companies played a key role for as long as the funding has lasted. Since 2012, public organisations and local administrations involved in the development of IS in the Humber region have either lost public financing – most notably NISP itself – or has been dissolved or faced substantial funding cuts (Velenturf, A. 2016). As a consequence, the feasibility of maintaining a collaborative culture based on these processes and the role public actors could play in IS projects outside entities like NISP became more of a hurdle.

The UK government withdrew from the NISP initiative, expecting it to be mostly driven by the private sector. It was thought that because NISP was so successful, companies would start paying for the service. Alternatively, established actors such as waste managers could facilitate industrial symbiosis. However, in the more than 10 years since the programme stopped receiving public funding, private actors have generally not facilitated new symbioses between companies. The fact that it was government-funded alleviated some of the inherent skepticism that businesses had about working together since they recognised that it was overseen by an impartial authority.

The challenge for companies has been to find commercial viability to the symbiosis model as the waste exchange was free for customers and recipients, which helped drive the IS model. A problem faced by businesses and local authorities is that much of the waste is not being monitored as there is no obligation to

do so, which prevents symbiosis based on an understanding of the industrial diversity of the area and its materials to determine the possibilities for symbiosis. Although there have been cases where companies have continued to promote IS and have made it a strategic element in their business model. Markets such as biodiesel production developed through NISP have seen an opportunity and have grown because of this.

So far, nothing has come forward to fill the void when the government money runs out. This, according to interviewees, proposes a new vision of IS in which the context should be based on the diversity of materials over any geographical distance. Given externalities such as Brexit and Covid-19, local authorities see IS as a cost-effective way forward. Currently, authorities are once more interested in facilitating IS as they see it as an opportunity to accelerate a regenerative economy that supports local economies. Nevertheless, interviewees argue that there is a need for staff on the ground to talk to businesses and connect with different points in the value chain to realise symbiosis. Another problem that has been highlighted in the interviews has been the slow pace at which environmental regulations are not evolving at the same pace as technological innovations.

Moreover, the industrial landscape has changed and many elements that were successful in the past may not be successful if they were to be implemented again as the industrial ecosystem evolves according to the interviewees. Yet, the companies consulted agree that the future of sustainable industries will only move forward if they make business sense and are supported in their early stages by government intervention through incentives such as public procurement or subsidies, otherwise, their momentum in a 2.0 program is unlikely. But, due to the lack of continuity in the programme, expert knowledge will be less because of the retirement of the people involved in the development and evolution of the program. Though, it has been mentioned that social innovations must be part of the model to gain social acceptance from different parties and that they must have greater consumer involvement to push for more sustainable modes of production.

At this early stage of the transition, it appears that the very elements that brought the creation of symbiosis to life are the elements that are impeding a long-term vision of transition (**Figure** 3). A commitment sustained solely by a commercial objective has meant that a lack of support and continuity of public policy, especially funding, can be seen as the elements that have not allowed the initial vision to continue in this part of the transition. This is reflected in the fact that only two types of stakeholders are defined: a) those who finance initiatives that facilitate the symbiosis and generate the regulatory framework, represented by local and national governments, and b) the stakeholders who receive the money to carry out the implementation of the IS programmes, represented by companies and business associations. Other authors such as Rincón-Moreno et al., (2021) and Hein et al., (2017) have highlighted the same problem and the need to include another group of stakeholders that collaborate in the achievement of the IS. In that sense, authors such as Ghinoi et al., (2020) have created a wider group of stakeholders that can help consolidate the transition and support the already established roles of companies and governments. Stakeholders who play a less economically driven role could

serve as trusted third parties as coordinating functions must be maintained to achieve the required continuous increase in network performance. However, the commercial viability of the projects should be considered relevant.

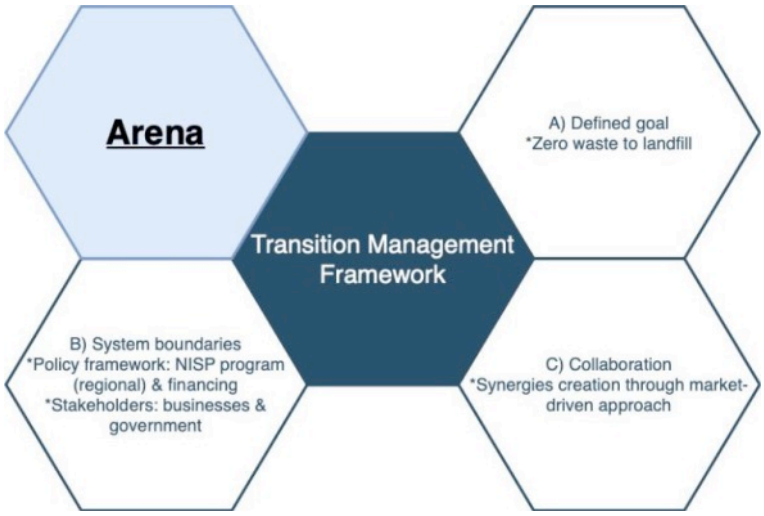

Figure 3 *Transition Arena analysis*

Transition agenda

The second component of the TM framework is called Agenda. The agenda is built on a shared awareness of the problem's persistence, the need for a transition or drastic change, and a set of guiding principles for the envisioned transition. The emphasis here is on linking the long- and short-term, as well as anchoring new visionary visions in agendas, programs, and potential regulations. Furthermore, the transition agenda is reflected in changes to institutional structures and framework circumstances, such as new governance structures that promote cooperation and self-organization, new alliances, or new finance possibilities. The agenda has a special function in TM by serving as a "compass" for the "search and learning process" that lies ahead (**Figure** 4). Throughout the innovation process, government agencies play a significant role (Frantzeskaki, 2022; Kumar, 2021; Peterson, Baker, Aggarwal, Boyer, & Chan, 2022).

Building on the industries present in the region, this “compass” involves energy supply, manufacturing, and agriculture activities and carries out waste-to-resource exchanges in a network that provides bio-based developments in the energy sector and optimises material and energy flows, including waste The public and private drive to implement waste-to-resource innovations in the bioenergy industry made the Humber region ideal to contribute to innovation progress towards IS between agriculture, waste aggregators, biodiesel

production, and construction, all of which have a wide range of inputs and outputs, were determined to be extremely central, along with the port, a critical link in supply chains, and industries that cycle materials from waste product to resource (Penn et al., 2014).

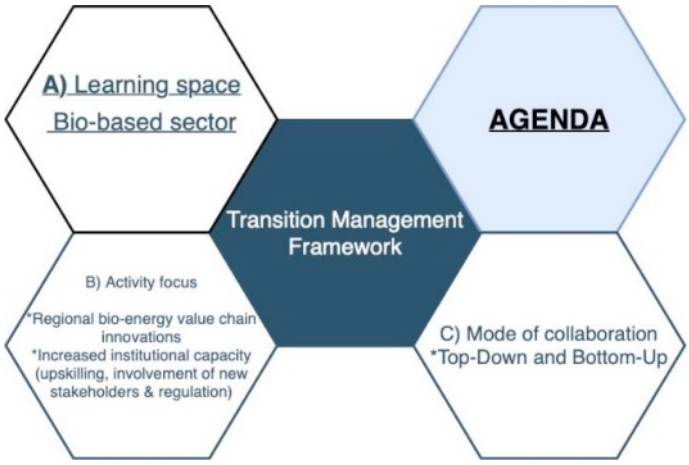

Figure 4 *Transition Agenda Analysis*

However, since 2012, the governance network in the Humber region has diminished due to funding cuts in a context wherein a lack of strong policies on environmental regulation and climate change adaptation weakened the governance capability to play an active part in the regional network. Currently, the regional governance system has a limited capacity to participate in planned collaborations and operationalise national government objectives and plans. Nowadays, local entities are trying to re-enforce IS through the CE strategy proposed for the region. The role of regional government in terms of planning and environmental licenses, as well as luring investment, appears to be underscored (Velenturf, A. 2016).

Some local authorities believe that their role should be more associated with building capacity to support companies to seek opportunities among themselves. Flexible progressive participatory frameworks in which companies and regulatory agencies co-produce plans for the implementation of regulatory objectives have been used in for example the water sector (Breman, Pleijte, Ouboter, & Buijs, 2008) and could also be used for waste-to-resource developments. Velenturf, A.(2016) suggests that regional governance actors should devote resources to attracting expert knowledge on both technical and social aspects of biowaste-to-resource innovation, as well as training regional governance officers in emerging technologies, to increase regional capacity.

This increase in institutional capacity has been referred to by interviewees as an additional issue to the financing of IS initiatives, making them crucial actors through strong government policies that comply with the execution of value-creating IS and promote collaboration through intermediary stakeholders.

However, stakeholders such as the research institutions (RI) consider that there is a need to obtain facilitation services, for small and medium-sized enterprises to amplify the benefits of adopting a IS through innovative waste solutions. It has also been argued by the interviewees that it is the existing stakeholders in symbiotic relationships that should secure funding through local enterprise partnerships because they can access regional development funds supported by local consultancy services that bridge the gap between companies. According to interviewees, the role of the facilitator or a trusted partner who should be a third party is mentioned as a crucial component in the development of IS by seeking to bring together and target companies with similar waste streams to achieve synergies aided by established digital solutions and a waste database. It has also been mentioned that this role should be composed of local people who build trusting relationships between the parties. One of the roles that this new stakeholder should play is to know in real time the volumes, quality, and reliability of waste collection to build confidence in the supply chain.

Unfortunately, this role is not defined as it has not been funded by the government for the last 10 years. Although it has been stated in the literature that enterprises in an IS can self-organise, as has been the case in the Humber region, as one of the ways in which symbiotic relationships can be developed (Yazan, Romano, Albino, Fraccascia, & Giannoccaro, 2016), in the ca. 10 years without government support, these symbioses have generally not materialised. To overcome this problem, Velenturf (2016) mentions that governance in the Humber region should be focused on: a) improving regulatory 'landscape' integration and flexibility across government departments; b) improving connections between national and regional government organisations, as well as within the Humber region; and c) investing in regional governance actors' knowledge, skills, and operational capacity.

On a similar note, Velenturf (2017) argued that actors who serve as network brokers for industrial symbiosis should be better understood due to their commercial interests in resource synergies. Incentives have played an important role but clearly IS has been lagging without a facilitator to link top-down policy targets with bottom-up processes. (Velenturf, A. 2016). Regarding transition theory, transition brokers can improve regional change processes, build alliances, help generate the required preconditions, and launch meaningful circular projects as an intermediary, impartial players without being regarded as working in their self-interest. They function as a conduit between businesses and other necessary parties to help prepare, negotiate, and seal a circular contract, as well as scale up and mainstream these activities (Cramer, 2020c).

Transition experiments

Transition experiments refer to day-to-day activities such as innovative experiments in which spaces for experimentation and collaboration can be created, how and which actor networks can be mobilized, and what action policies and strategies can be recommended to bring about change (Kumar, 2021; Peterson et al., 2021).

An experiment is a multi-actor approach, which means that the local government is also one of the participants. Transition experiments provide new avenues for proactive engagement with actor role shifts, both deliberate and unintended (Dóci et al., 2022).

As mentioned in the previous sections, funding for NISP has stopped and no government initiatives on symbiosis have been promoted for approximately 10 years in England. However, some initiatives continued because a) there was a clear commercial incentive to pursue them and b) there were defined collaboration roles among the various stakeholders that made symbiosis possible. Table 3 recaps the types of experiments developed by the different stakeholders and those in which they have been indirectly involved. The following list of experiments (Table 3) is not intended to be an exhaustive list of all the IS projects underway in the Humber region, but as many of the interviewees are still closely linked to the original program either directly or indirectly, their responses reveal a snapshot of what the transition has been and what it could become.

Companies and government entities stand out as the type of stakeholders that have led the highest percentage of transition experiments (90.32%) in the region. The experiments that have been promoted most by the companies have been related to partnerships in the chemical and manufacturing sectors such as cooperation to carry out projects or to establish a cooperation framework that allows synergies to be implemented. Also, pilot projects in sectors such as bioenergy that serve as examples to be scalable or demonstration projects in the glass industry that can be useful in the cement industry are among the symbiosis projects that are in the works.

Table 3 *Transition experiments in the Humber region*

		Chemical	Industry-wide	Manufacturing	Renewable Energy	Services
Businesses	Innovation project	1.6%			1.6%	
	Landfill diversion					1.6%
	Methodology					1.6%
	Partnerships	3.2%		6.5%	1.6%	
	Pilot project		1.6%	3.2%		3.2%
	Procurement			1.6%		

	Remanufacturing project			1.6%		
	Reports					1.6%
	Research project			8.1%		1.6%
	Technological innovation	1.6%			3.2%	
	Training					1.6%
	Waste characterisation			1.6%	1.6%	1.6%
	Waste market	1.6%		3.2%		
	Waste recovery project	3.2%	3.2%		1.6%	
	Workshops					1.6%
Business associations	Grants		1.6%			
Local administration	Economic incentive scheme	1.6%				
	Grants		1.6%			3.2%
	Partnerships		1.6%			4.8%
	Procurement		1.6%			
	Reports		1.6%			
	Research project			1.6%		
	Training		3.2%			
	Waste recovery project					1.6%
	Workshops		1.6%			
Research institutions	Partnerships		1.6%			
	Pilot project		1.6%			
	Technological innovation		1.6%			
	Waste characterisation		1.6%			
	Waste market		1.6%			

Other types of experiments that have been mentioned are research projects, mostly carried out by universities or consortia of research centres. Typically, these types of experiments seek to find potential uses for certain

materials that can be recirculated within the business fabric. Typically, the experiments were developed on a laboratory scale to test the feasibility of these wastes having a better use than being sent to the landfill, without yet considering whether they have any commercial applicability. On the other hand, the experiments that refer to waste recovery projects allude to materials that already have sufficient volume to have commercial scalability. Thus, using the methods already established in companies, new alternatives are emerging for waste management such as obtaining biofuels from food waste or obtaining 'green chemicals' in the lime industry.

On top of that, the experiments carried out by governmental entities are related to partnerships, which makes sense given their role of being a key participant in the transition. This type of experiment is focused on achieving regional economic development through this type of governmental strategy and as a stakeholder that guarantees collaboration between companies. Thus, it is also understandable that if governments are involved in partnership issues, they will be involved in experiments such as grants, since one of its main roles is the money, it invests in different initiatives aimed at impacting the greatest number of organisations to create synergies.

Similarly, experiments such as training through support programs for companies and increasing the capabilities and skills of the workforce in industries such as the turbine blade manufacturing plant in Hull stand out. The experiments shown here demonstrate how local governments and businesses have been the major promoters of experiments. As the objective of any transition is to bring together those stakeholders who can enable the transition, having only two major stakeholder groups would suggest that they are not yet mobilising the necessary actors for this stage to bring about change.

Therefore, to understand how the experiments are being mobilised among the different stakeholders, a comparison of the experiments carried out with and without cooperation across actor types is made. Table 4 shows that research institutions have the highest percentage of cooperation with companies. As shown in Table 3, these types of experiments are more related to research projects with possible industrial application. Likewise, business associations collaborate exclusively with local governmental agents. This is explained by the reason for the existence of the business associations, which serve as a bridge to funnel local funds to businesses.

Table 4 *Collaboration between stakeholders*

	Businesses	Business associations	Local administration	Research institutions	No cooperation
Businesses	34%	10%	5%	15%	37%

Business associations	0%	0%	100%	0%	0%
Local administration	40%	27%	13%	7%	13%
Research institutions	80%	0%	0%	20%	0%

Likewise, 34% of businesses collaborate with other businesses, while 37% of the experiments in IS are conducted without any cooperation between different type of actors. As could be expected in the absence of an overarching facilitator, the experiments currently being conducted in the Humber region are fragmented and without much multi-stakeholder traction. Transition experiments (**Figure** 5) identify areas for experimentation and cooperation, how and which actor networks can be mobilised, and what initiative policies and strategies can be recommended to effect change (Frantzeskaki, Hölscher, Bach, & Avelino, 2018). As an iterative process that can be executed in parallel, the TM framework could suggest that from the transition of arenas, the goals set for the region could be rethought to create a transition with a broader multi-stakeholder group that would allow for joint goals to be set. It is a simple but effective activity that can be used as a jumping off point for learning and to demonstrate a visible action that is accessible, encourages debates and discussions that change people's thoughts and perceptions, and can be adopted and owned by the community (Peterson et al., 2021). This in turn would result in experiments that show a higher percentage of collaboration between the different stakeholders and would ensure a more effective transition.

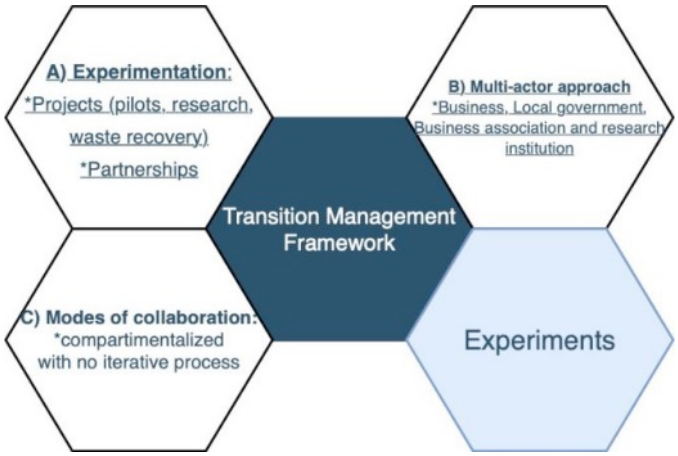

Figure 5 *Transition experiment analysis*

Transition monitoring

Monitoring is an important aspect of the transition process. This level should not be segregated from the others (arenas, agenda, experiments) because it is an intrinsic part of governance processes and should feed into activities at the other three levels (Wittmayer, Steenbergen, Frantzeskaki, & Bach, 2018). Monitoring, assessing and learning from the transition experiments, as well as revising the vision, agenda, and coalitions, are all part of this phase (Frantzeskaki, 2022). It also assists actors in continually adjusting their aims and behaviours by understanding and accounting for changes at all levels. Short- and long-term monitoring and evaluation are crucial in the last step of this iterative cycle to measure the effectiveness of the transition process, which then feeds back into further adoption and development, influencing the larger landscape dimension (Kumar, 2021). Adaptations can be made in the desired direction of the system, in different experiments, or the transition agenda based on monitoring insights (Peterson et al., 2021).

Table 5 *Suggested monitoring indicators by interviewees*

Stakeholders	Sector	Monitoring
Businesses	Services	Tonnage moved of waste
Business associations	Services	Carbon emissions Waste diverted from landfill
Local administration	Industry-wide	Number of new products designed

In this part of the analysis of the transition in the Humber region, monitoring and evaluating are based on the lessons learned from the experiments, followed by any necessary adjustments to the vision or agenda (Dóci et al., 2022). Therefore, once funding for the program stopped, there was no further evaluation of previous processes or experiments that would allow changes to be made to the agenda or arena.

However, in this study, stakeholders have been asked about the monitoring indicators (Table 5) that they propose or have used to evaluate the progress of the experiments. Monitoring indicators suggested or used by stakeholders such as LCA or carbon emissions tracking could be used in a cross-cutting manner if they were to become part of the transition evaluation. As there is a disconnect between the experiments and the rest of the stages of the transition as they were not conceived from the beginning, adjustments to the agenda and vision do not seem to have been impacted (**Figure** 6).

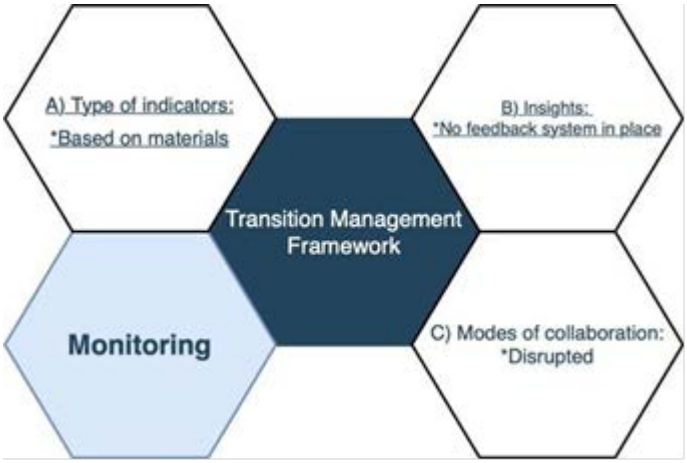

Figure 6 *Transition monitoring analysis*

5. Conclusions

This study has aimed to integrate and use concepts and learning from the emerging area of TM to systematically investigate how to move from a linear system to a more sustainable mode of production. The concepts of the TM framework have been applied to analyse IS in the Humber region. The four cycles of the TM framework have been used to analyse the emergence, decline, and re-emergence processes that have taken place in the region. It could be argued that under the lens of the transition arenas, goals, boundaries, and collaborations were crucial for its initial success. But issues such as more funding and the commitment of more stakeholders to participate in the visioning process could help strengthen the transition.

Key to the process could be the integration of more stakeholders that fulfil the role of brokers, with a less commercial profile and a more social nature that engages more actors and offers trusting and long-lasting relationships. In the last parts of the framework (Experiments and Monitoring) there have been many projects in a symbiosis that have sometimes been consolidated but have not been evaluated to generate and/or evidence substantial changes towards a transition.

As can be seen, the IS programme in the region was a success as long as funding lasted for an independent third-party facilitator, and for government agents to have capacity to collaborate on these initiatives. The activities initially implemented are still relevant if a transition using the TM framework were to be considered. The opportunities offered by an iterative process such as the TM framework would lead to a more solid foundation in the region to ensure and accelerate the transition to a cleaner and more efficient industrial system. It is expected that these findings might subsequently be extended to other locations to improve industries in developed economies, and to help prevent emerging economies from becoming entrenched in unsustainable management as industrial outputs increase.

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Circular Bio-based Materials for Sustainable Buildings: A literature review of case studies and assessment methods

Dinh Linh Le[1], Roberta Salomone[2], Quan T. Nguyen [3], Giovanni Mondello[4], Teresa Maria Gulotta[5]

[1]*PhD candidate in Sustainable Development and Climate change, University School for Advanced Studies IUSS Pavia, Italy, dinh.le@iusspavia.it*

[1]*Department of Economics, University of Messina, Italy; dinh.le@studenti.unime.it*
[1]*Faculty of Construction Economics and Management, Hanoi University of Civil Engineering, Vietnam, linhld@huce.edu.vn*

[2]*Department of Economics, University of Messina, Italy, roberta.salomone@unime.it*

[3]*Faculty of Construction Economics and Management, Hanoi University of Civil Engineering, Vietnam, quannt@huce.edu.vn*

[4]*Department of Economics, University of Messina, Italy, giovanni.mondello@unime.it*

[5]*Department of Economics, University of Messina, Italy, tegulotta@unime.it*

Abstract

Buildings consume an enormous amount of primary energy and are responsible for a large share of greenhouse gas (GHG) emissions, causing global warming and climate change. In order to limit their negative environmental impacts, concerted efforts have been made to cut off GHGs emissions, especially CO_2. Nonetheless, to date, most discussions and solutions are focused on the building's operation phase, whilst construction materials may account for up to half of the overall CO_2 footprint of new buildings. Additionally, the buildings and construction industry consume approximately half of the natural resources extracted for materials worldwide, putting significant pressure on global resources. These have highlighted the need to reduce the negative impacts of materials used in buildings. Recent studies suggest that circular bio-based materials (C3BMs) may represent a coherent solution. Indeed, C3BMs can be defined as "materials resulting from by-products and biowaste of plant or animal biomass that may be utilized as a raw material in construction and decorating items, as well as building materials". Hence, their utilization can improve the environmental performance of buildings (e.g., reducing embodied GHGs emissions, sequestering CO_2 emissions, etc.) and may bring social and economic benefits. There are many studies on using bio-based materials to develop building components or install them into buildings. Nonetheless, these studies are still fragmented due to the difference in types of material and their biological origin, research objectives, and methods employed to assess the sustainability of the case studies. Therefore, the need for systematic categorization is more than evident to equip stakeholders in the building sector with a comprehensive picture of this emerging approach. In this context, the present study aims to fill the gap by undertaking a systematic and bibliometric literature review of relevant studies. The paper categorizes case studies in the extant literature into different levels and reviews methods used to evaluate their sustainability. For this to be achieved, the analysis uses research questions to guide the process, searches guidelines for choosing

case studies to analyze, and assesses identifying criteria for determining what information to extract. The reference sample of scientific papers is extracted from online databases, including Web of Science and Scopus, and analyzed using Microsoft Excel, VOSviewer, and Biblioshiny R application. This study reports the preliminary outcomes of the literature review conducted. A more detailed systematic analysis will be developed beyond this paper for future publications.

Keywords: Circular bio-based building material (C3BM), Sustainability, Circular economy, Sustainability assessment method, Building sector.

1. Introduction

Buildings account for almost 35% of worldwide energy consumption, 55% of total global electricity use, 25-30% of solid waste, and 38% of global CO_2 emissions (United Nations Environment Programme, 2020). Hence, a recent report of the Intergovernmental Panel on Climate Change has stated that "*1.5 °C-consistent pathways require building [GHG] emissions to be reduced by 80–90% by 2050"* (Heleen de Coninck et al., 2018). In addition, the built environment places enormous strain on global resources. Indeed, the construction industry (CI) greatly depends on virgin materials (United Nations Environment Programme, 2020). Only buildings and infrastructure, especially in developing nations, consume between 40% to 50% of resources extracted for global materials (Marc de Wit et al., 2018). Plus, with the need for new housing and infrastructure to meet the requirement of population and economic growth, the construction materials demand is expected to continue increasing. By 2060, the materials consumption globally is forecasted to be more than double, and the materials consumed by the CI will comprise a third of this rise (United Nations Environment Programme, 2020). Moreover, approximately 15% of materials in the CI are wasted annually, and this figure is still rising (United Nations Environment Programme, 2020). These facts may cause the depletion of nonrenewable natural resources and a wide range of environmental impacts globally (United Nations Environment Programme, 2020).

Targeting to lower the non-renewable material and GHGs emissions footprint of the CI, different initiatives have been proposed. Among them, transforming the built environment from linear to circular economy (CE) models, and applying a bio-economy (BE) model in the sector, are determinant strategies (United Nations Environment Programme, 2020). Many definitions of CE exist, and its precise meaning and scope remain the subject of debate (Cecchin et al., 2021). However, CE can be defined as "*a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops"* (Geissdoerfer et al., 2017). Meanwhile, BE is defined as the *"production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy"* (European Commission, 2012). The former, in the CI, can boost the material efficiency strategies,

which might help to cut total life cycle emissions from buildings and construction works, especially residential ones, by up to 35-40% in Group of Seven (G7) countries (IRP, 2020), for instance. Likewise, the latter provides opportunities to substitute conventional materials with renewable and lower GHGs emissions materials (Carus and Dammer, 2018).

It is noted that CE and BE are two different yet complementary approaches, and their intersection is defined as a "circular bio-based economy" (CBE) (Carus and Dammer, 2018). Other scholars argue that the CBE is a CE where *"nonrenewable […] inputs to industrial systems are replaced by renewable biological resources"* (Temmes and Peck, 2020), or the application of the CE concept to biological resources, products, and materials (European Commission, 2017). Thus, the utilization of Circular bio-based building materials (C3BMs) within the CI can help to combat climate change and the other environmental impacts in the sector. Indeed, this solution may help reduce the amount of waste in landfills (Rabbat et al., 2022) and can bring opportunities to convert C3BMs into heat, energy, alternative fuels, and materials at their end-of-life (EoL), which can create considerable revenue. This alternative is anticipated to reduce thousands of tons of CO_2 emissions and save a tremendous quantity of fossil fuels (Rabbat et al., 2022). However, using these materials may cause critical issues if lacking a comprehensive approach to properly dealing with their EoL (Rabbat et al., 2022).

It should be highlighted that no specific definition for C3BMs or even "circular bio-based material" (C2BM) could be found in the literature. Nonetheless, C2BMs can be understood as bio-based materials that fit the context of CBE. The bio-based materials are defined as "*materials wholly or partly derived from materials of biological origin*" (European Committee for Standardization, 2014), while the CBE context refers to the potential reusing in cascading and organic recycling of by-products and biowaste of the biomass flow (Carus and Dammer, 2018). Hence, within the CI, C3BMs could be defined as "*materials resulting from by-products and biowaste of plant or animal biomass that may be utilized as a raw material in construction and decorating items, as well as building materials*". This definition is in line with the research done by Silva et al. (2021). Indeed, although the authors have not proposed a definition, they stated that particleboard made from waste is one kind of C3BMs (Silva et al., 2021).

According to the above definition, many kinds of C3BMs have been developed and presented in the literature. Notably, they are very heterogeneous in size, composition, shape, function, and biological origin. Nevertheless, they can be classified into three major groups: i) circular bio-based insulation materials (C2BIMs), ii) new concrete or binder and filler for concrete used for structural purposes, and
materials for indoor applications (e.g., ceiling, flooring, and furniture). It is found that C2BIM is the largest group, which encompasses a variety of types, such as particleboards (Silva et al., 2021), agro-concrete blocks (Azunna et al., 2019), etc. The dominance of this group is understandable due to C3BMs typically exhibiting comparatively low mechanical strengths. Consequently, they cannot be commonly employed as a material to form load-bearing members of a building (Amziane and Sonebi, 2016). The second largest group is C3BMs utilized for indoor

applications, mainly shaped as boards and composites like bio-flexi HDF fibreboards (Horn et al., 2018), and woody-like composites (Platnieks et al., 2020), etc. The last group includes concrete that uses fine aggregate, additive, or cement replacement originates from agricultural residue like rice husk ash (Gastaldini et al., 2014).

Noticeably, the last group is rarely mentioned as bio-based materials in the previous studies because the quantity of biologically derived materials is not significant in their total composition. However, they are partly derived from agricultural by-products, and their contribution to dealing with environmental crises related to the CI is vital (He et al., 2017; Hossain et al., 2018). Thus, they are referred to as C3BMs in the present study.

Existing studies of bio-based building materials, most of which are focused on the production and performance testing of these productions (Rabbat et al.,2022). For instance, (Maraveas, 2020) review the production of construction materials using agricultural wastes, while (Tlaiji et al., 2022) brief thermal and mechanical behavior of straw-based construction. Others focus on the development of binders for bio-based building materials (Bumanis et al., 2020) or fire-resistant biocomposites (Madyaratri et al., 2022), etc. Regarding the assessment methods, only a few articles have reviewed the methods used, mostly life cycle assessment (LCA), to assess the environmental impact of C3BMs. For instance, (Amziane and Sonebi, 2016) brief on the application of LCA for hempcrete, whereas (Miller et al., 2019) focus on concrete using rice-based ash and point out the limitation of studies on LCA and sustainability assessment for this type of material, etc. However, none of these studies reviews the methods to evaluate other sustainable dimensions, the sustainability or the circularity of circular bio-based solutions (C2BSs) in the CI in general and buildings in particular.

To the best of found knowledge of the authors, the present study is the first research that proposes a specific definition for C3BM and reviews case studies and methods to assess the sustainability of C2BSs at different levels in the building sector. To achieve these goals, this study uses a systematic and bibliometric literature review analysis of relevant studies. First, a definition for C3BM is proposed according to the existing definition of bio-based material and CBE. Afterward, the study categorizes case studies into different levels, then reviews assessment methods applied on each level. The study aims to provide a deeper insight into the current state-of-the-art research topic and the necessary bases for future studies and practices in assessing the sustainability of C2BSs in the building sector.

2. Methodology

A review of current scientific papers was conducted to analyze bibliometrics, the usage, and methods to assess the sustainability of C2BSs at different levels of case studies. The study adheres to a structured protocol to accomplish consistency, robustness, and transparency in the research. Indeed, the present review was carried out based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA) (Page et al., 2021).

2.1. Search strategies

A thorough literature review was conducted utilizing research databases to discover relevant scientific publications and papers. Several keyword combination searches were conducted to obtain relevant published papers from Web of Science (WoS) and Scopus (SP) - two of the most reputable and respectable research databases. Because the term C3BM has not been mentioned in the previous works, the search keywords in this study were defined based on the proposed definition for C3BM. Particularly, the search terms: *("building material*" OR "construction material*") AND ("food waste" OR "agr* waste" OR "food residues" OR "agr* residues" OR "forestry residues" OR "agr* by$product" OR bio$based)* was utilized to find the relevant literature.

The searches were restricted to the title, abstracts, and using the Boolean connectors "OR" and "AND" in search fields labeled "Topic" for WoS and "Title-Abstract-Keywords" for SP. There were no filters used in this phase to avoid database, publication, or language bias. Plus, to explore the big picture of the research topic, the keywords "case studies" and "assessment methods" were not included in the search query because they may not appear in the previous studies' titles, abstracts, and keywords.

2.2. Sample realization

The searches were conducted on February 5, 2022. Initially, the implementation of the described search strategies brought in 814 publications on SP and 381 on WoS, respectively. This resulted in a total of 1,195 papers, comprising all sorts of publications, such as research articles, reviews, editorials, book chapters, and others, being taken into account. The related literature data then was exported to the reference management program Endnote, identifying 78 duplicates.

The remaining 1,117 records were screened to only those written in the English language and published in peer-reviewed journals, allowing to eliminate 21 articles written in other languages and 293 conference proceedings, conference papers, book chapters, or grey literature. Hence, the 803 remaining articles were being evaluated for further screening.

Reading the abstracts of these papers allows for eliminating articles that are non-coherent with the search strategies. Particularly, the study did not consider papers that are not relevant to C3BMs or focus only on their development and performance testing. Consequently, 702 publications were excluded, and the remaining 101 articles were checked through the eligibility criteria. The criteria applied are "the authors assessed the sustainable dimensions, the sustainability or the circularity of C2BSs at different levels (e.g., materials, components, buildings, and building stock)". Because three papers could not be accessible, the full text of 98 articles was downloaded and checked, allowing to exclude 47 articles that did not fulfill eligibility criteria. Figure 1 displays the PRISMA framework implementation in the present review.

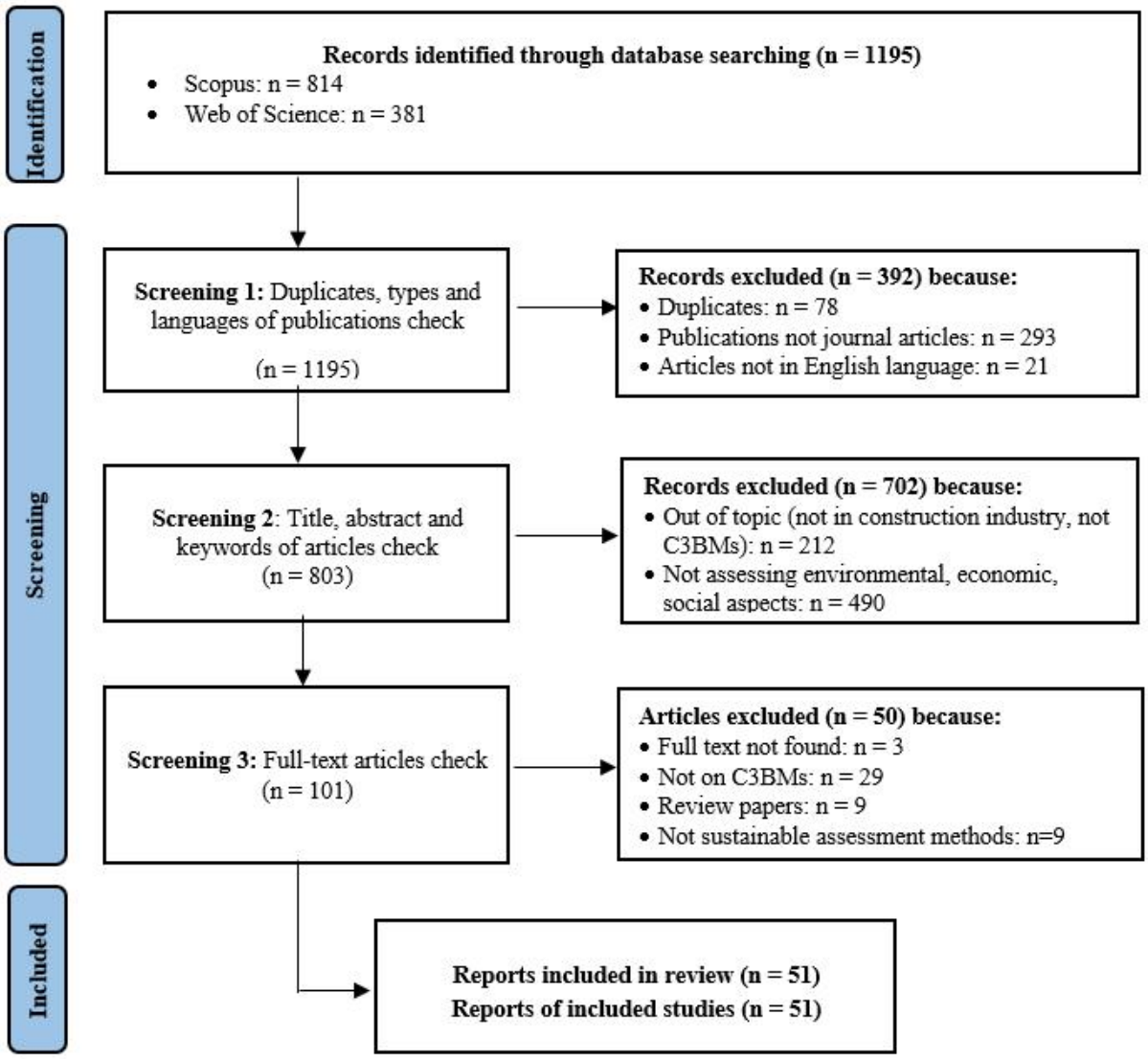

***Figure 1**. Sample selection framework (based on PRISMA guidelines).*

3. Descriptive analysis

This research is not focusing on the specific time frame for the papers. The year-wise distribution of publications' primary purpose is to understand the number of articles in a year selected and fulfill the review criteria. Figure 2 depicts the year-base graph of literature.

The oldest research paper found was published in 2014 (Pretot et al., 2014), and the number of records has risen dramatically yearly since 2018. Indeed, the figure for 2018 is nearly triple that of 2016 or 2017. The year 2021 contributed the highest number with fifteen articles, followed by 2020 with twelve documents. The graph also displays that more than half of the sample has been published in the last two years (2020–2021).

Noteciblely, the figure for only the first two months of 2022 (January and February) equals the whole year 2016 or 2017 and triple that of 2015. These reflect a very rapid increase recently in interest in the research topic.

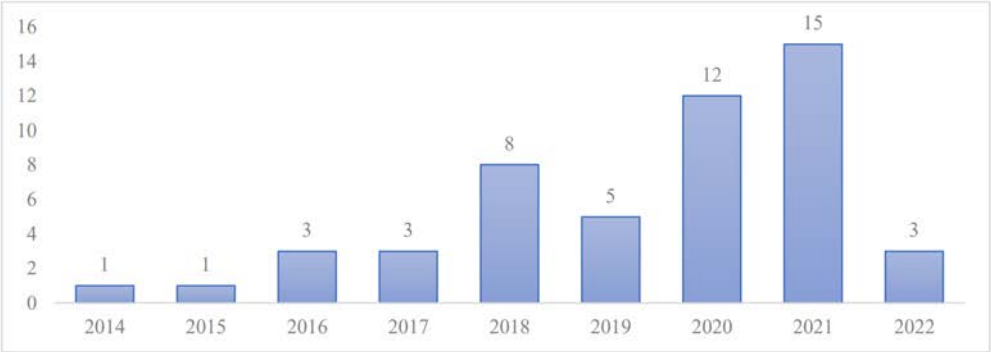

***Figure 2**. Distribution of literature year base articles.*

The journal-based publication analysis is carried out for the current study and realizes that the research works of the inventoried sample have been published in various journals. Indeed, 51 papers are distributed to 26 different journals. The "Journal of Cleaner Production" and "Construction and Building Materials" journals contribute the highest publications. The former accounts for about 19.6% (10), while the latter contributes 13.7% (7) of the inventoried sample. These are followed by the "Sustainability (Switzerland)" journal with the contribution of six papers, accounting for 11.8%. The two journals "Building and Environment" and "Resources, Conservation and Recycling" contribute equally to the sample, with four articles in total. The remaining journals altogether account for 47.1%.

Figure 3 presents the results of the research paper selected from each journal.

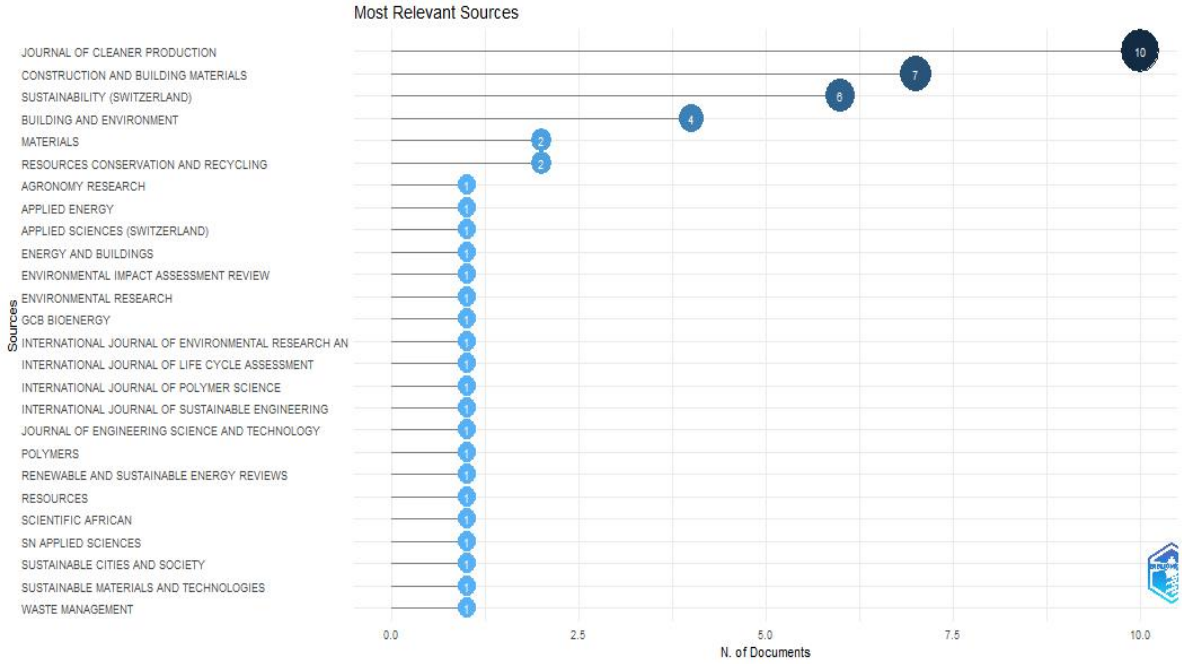

***Figure 3**. Contribution of literature journal-based articles.*

The co-occurrence network map is elaborated using VOSviewer (Cobo et al., 2012) and shown in Figure

The map depicts correlations among the leading author keywords used in the sample. Plus, the thickness of the lines indicates the strength of the correlations between the nodes, i.e., keywords, calculated by counting the number of articles in which the two keywords occur together (Gulotta et al., 2022). The test is performed only on the author's keywords reworked to harmonize the topics. The network clearly demonstrates connections among the keywords investigated. In particular, the map illustrates the centrality of the keywords "life cycle assessment", highlighting that most of the collected studies use the LCA approach to evaluate the performance of C2BSs.

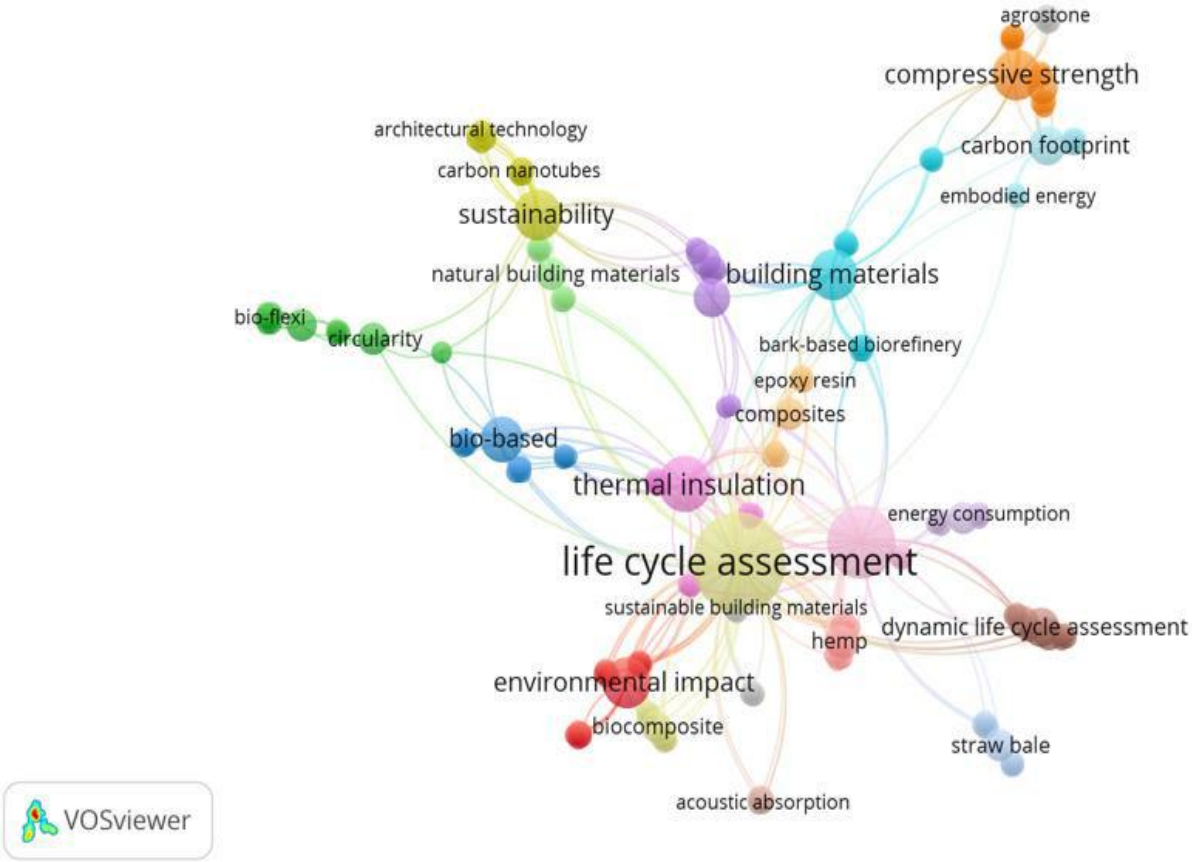

Figure 4. *Author keywords co-occurrence in the published articles of the sample.*

In order to illustrate more precisely the occurrences of keywords, the present study carried out an analysis using RStudio and Biblioshiny tools. Figure 5 shows the most frequent words among the author's keywords. The keywords "life cycle assessment" has the highest occurrences at 19 times, followed by "bio-based building materials" (10 times). The keyword "thermal insulation" has noticeable occurrences six times, indicating that C2BIMs are a popular research object. Moreover, the keyword "environmental impact" (5) plus "carbon footprint" (2) is higher than "sustainability" (5), reflecting that the environmental pillar of the case studies drew more research interest than the other sustainable dimensions or the sustainability. Furthermore, it should be highlighted that the occurrence of the keyword "circular economy" expresses the close link between C3BMs and the CE in the CI.

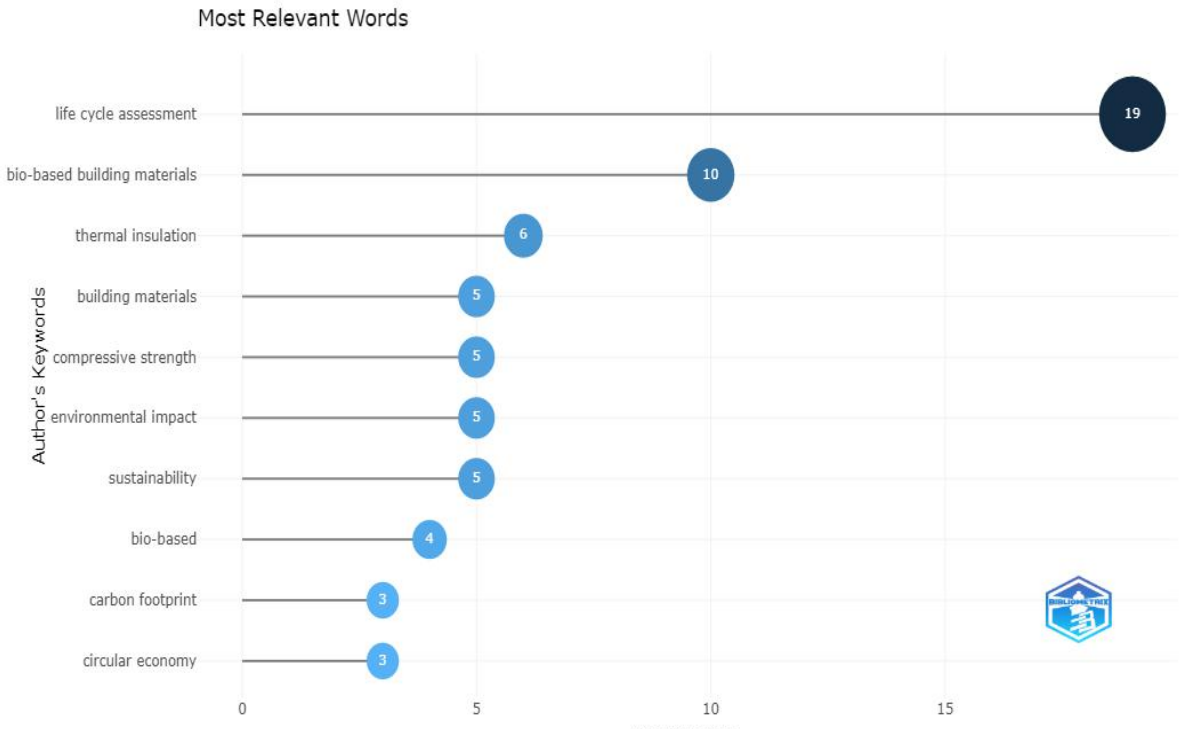

Figure 5. *The most frequent keywords.*

4. Classification and discussion

Literature from selected criteria is classified based on the case studies and assessment methods they have applied. The below sections explain the detailed literature classification accordingly.

4.1. Case studies

Case studies that have been analyzed in the inventoried articles are very heterogeneous. However, they can be divided into four levels: i) C3BMs, ii) building components (e.g., walls), iii) buildings and iv) the building stock. Among these, most works focus on C3BMs, with 26 papers, followed by buildings
and the component level (7). Only two articles consider the building stock level. Plus, it should be noted that Saeli et al. (2022) evaluate both the C3BMs and building levels. The following sections highlight the details for each level.

4.1.1. Circular bio-based material level

The C3BMs are very diverse in type, composition, and usage. For instance, they are diverse from concrete with composition partly derived from coconut shell (Azunna et al., 2019), bio-based biocomposite (Khoshnava et al., 2018; Miller, 2018), etc. Nonetheless, they can be categorized into three main groups corresponding to their using purposes: i) insulation materials, ii) new concrete and binder/filler for concrete and mortar

mixtures, and iii) indoor application materials (e.g., flooring, furniture, and other finishing purposes). The classification details are shown in the following table.

Table 1. *The classification of C3BMs appeared as case studies in collected articles.*

Names of C3BMs	Wholly or partly derived from	Source
Group 1: Circular bio-based insulation materials		
Coconut shell concrete	Coconut shell	(Azunna et al., 2019)
Cork boards	Cork wastes	(Silvestre et al., 2016)
Fired clay bricks	Wheat straw, olive stone flour	(Bories et al., 2016)
Particleboards	Pinus and eucalyptus wastes	(Silva et al., 2021)
Biocomposites	Hemp	(Sinka et al., 2020)
Hemp fiber, flax, and miscanthus	Hemp, flax, and miscanthus	(Schulte et al., 2021)
Linoleum	Plants, pine resin, linseed oil, wood, cork flour	(Rosso et al., 2020)
Composite boards	Flax, hemp, coir, jute, shredded cotton fibers	(Quintana et al., 2018)
Lightweight brick	Oyster shells, rice straw	(Liu et al., 2020)
Bio-based panel	Residual coniferous bark	(Barrio et al., 2021)
Bio-based panel	Pineapple by-products	(Arellano-Vazquez et al., 2020)
Biocomposite	Oil palm fiber	(Khoshnava et al., 2020)
Bio-epoxy composite board	Flax fiber, recycled cellulose, sheep wool waste	(Quintana-Gallardo et al., 2020)
Bio-based wall panels	Wood chips, starch, jute mesh, flax, mycelium	(Cascione et al., 2022)
Mortar	Spent coffee grounds	(Scalia et al., 2021; Saeli et al., 2022).
Group 2: New concrete or binder/filler for concrete/mortar		
Coconut shell concrete	Coconut shell	(Azunna et al., 2019)
Concretes containing rice husk ash (RSH.)	Rice husk	(Garas et al., 2021)
CoRncrete	Corn starch	(Kulshreshtha et al., 2017)
Filler or binder in concrete and mortar	Waste wood	(Doudart de la Gree et al., 2016)
	Potato starch	(Bumanis et al., 2020)
Group 3: Circular bio-based materials used for indoor applications		
Bio-flexi HDF fibreboards	Straw	(Horn et al., 2018)
Woody-like composites	Recycled cellulose	(Platnieks et al., 2020)
Bio-based wood flooring coatings	Corn, soy	(Montazeri and Eckelman, 2018)
Bio-based biocomposite	Hemp linen, jute burlap, hemp burlap textiles	(Miller, 2018)
	Kenaf bast fiber, oil palm fiber	(Khoshnava et al., 2018)
Ultralight particleboards	Wood residues from sawmills and corn	(Ganne-Chédeville and Diederichs, 2015)

As displayed in Table 1, C2BIMs are dominant compared to others. Indeed, 15 articles focus on this category, accounting for nearly 60%. Within these, the insulating materials vary from agro-concrete (Azunna et al., 2019), new kinds of bricks (Bories et al., 2016), and biocomposites (Sinka et al., 2020) to raw materials for developing insulation materials (Scrucca et al., 2020), etc. On the other hand, only a few works take into account C3BMs for indoor applications (6) and new types of concrete, binder/filer for concrete used for structural purposes (5).

It is to be noted that some C3BMs can be utilized for different purposes. For example, coconut shell concrete can be used as insulation material or for constructing structural components (Azunna et al., 2019). Of course, for different purposes, the replaced percentage of fine aggregate by coconut shell has to be different. Likewise, bio-based biocomposite can be installed into buildings for either insulating or indoor applications like flooring (Khoshnava et al., 2018; Miller, 2018).

Regarding the ecological origins of materials, most of the C3BMs here are wholly or partly derived from various agricultural or forestry wastes and by-products, i.e., origin from plants. However, hemp, straws, and cork wastes are mainly applied compared to others. Otherwise, only two works investigate the potential of using animal-related waste or by-products for developing C3BMs, including oyster shells (Liu et al., 2020) and sheep wool waste (Quintana-Gallardo et al., 2020).

4.1.2. Building component level

As mentioned, only seven articles consider the influence of C3BMs on the performance of buildings components. Interestingly, all case studies in these papers are circular bio-based walls. It is understandable because all these works aim to evaluate the potential of using C3BMs to boost the thermal productivity of buildings. More details are depicted in the following table 2.

Table 2. *Details of case-study building elements in collected articles.*

Components	**C3BMs**	**C3BMs derived from**	**Purpose of C3BMs**	**Source**
Miscanthus concrete walls	Miscanthus blocks	Miscanthus	Insulation	(Ntimugura et al., 2021)
Bio-based wall	Wood and straw	Wood and straw	Insulation	(Zieger et al., 2020)
Rice straw wall	Straw	Straw	Insulation	(Quintana-Gallardo et al., 2021)
Hemp concrete wall	Hemp concrete	Hemp	Insulation	(Heidari et al., 2019; Pretot et al., 2014)
Exterior walls	Light clay straw, straw chips, reed mat; hempcrete, hempcrete blocks	Straw, reed, hemp	Insulation	(Pittau et al., 2018)
10 cm thick hollow Agrostone wall	Agrostone	Water Hyacinth, Bagasse, Grass	Insulation	(Degu, 2021)

4.1.3. Building level

Seventeen studies use buildings as case studies, and most of them are residential buildings, except for building-like cubicles presented by Torres-Rivas et al. (2018; 2021). Moreover, the buildings are very heterogeneous in type and location; for instance, a one-story house with brick walls in Italy (Barreca et al., 2019), and a high-rise building in China (Guo et al., 2020), etc. Noticeably, all these buildings utilized C3BMs to boost the insulating performance, i.e., saving energy during the operational phase. Interestingly, sixteen buildings have walls using C3BMs, while the remaining one has the roof installing hemp-plasterboards. Brief information of the buildings, of the C3BMs being used, and other relevant information is shown in Table 3.

Table 3. *The classification of case study buildings in collected articles.*

Type of buildings	Component	C3BMs	C3BMs derived from	Source
A hypothetic one-floor house	Walls	Agglomerated cork; Giant reed	Cork residues, giant reed residues	(Barreca et al., 2019)
Straw buildings	Walls	Straw bale	Straw	(Guo et al., 2020; Krasny et al., 2017)
A single-family house	Walls	Cob; Light straw clay	Cob, straw	(Ben-Alon et al., 2021)
A case study room	Walls	Hemp concrete	Hemp	(Bennai et al., 2022)
A residential building	Roof	Hemp-plasterboard	Hemp	(Charai et al., 2021)
Three reference buildings	Walls	Prefabricated straw bale	Straw	(Yin et al., 2020)
Building-like cubicle	Walls; Roof	Bio-based insulators	Wool, wood, cork, corn, hemp, cotton	(Torres-Rivas et al., 2021)
	Walls	Bio-based insulators	Cotton, cellulose, cork, corn, hemp, wool, wood	(Torres-Rivas et al., 2018)
A building in Iraq	Walls	Bio-based insulators	Reeds	(Simonini et al., 2021)
A two-bedroom residential dwelling	Walls	Hempcrete	Hemp	(Shang and Tariku, 2021)
A virtual building	Walls	Bio-based mortars	Spent coffee ground	(Saeli et al., 2022)
The Val Melaina I complex in Rome	Retrofit walls	Bio-based insulators	Straw and hemp	(Rosso et al., 2021)
An office	Walls	Bio-based composite	Sawdust, palm fibers	(Opoku et al., 2020)
A low-cost house	Walls	Waste-based bricks	Cotton, paper, RSH waste	(Joglekar et al., 2018)
A four-story building	Walls	Latent heat storage biocomposites	Coconut, palm oil, palm and soy wax, rice husk biochar	(Jeon et al., 2019)
A multi-story building	Walls	Hemp-lime	Hemp	(Florentin et al., 2017)

As shown in Table 3, most of the C3BMs installed in the case studied buildings originate from agricultural waste and by-products. Plus, hemp and straws, once again, are two of the most popular biological sources of C3BMs used in these case study buildings.

4.1.4. Building stock level

It can be seen from the sample that the dynamics of using C3BMs at a large level are not yet well known. Indeed, only two papers demonstrate the potential of utilizing C3BMs at the building stock level, according to only 3.9%. In particular, while Göswein et al. (2021) evaluate a new residential building stock, Pittau et al. (2019) take existing housing into consideration. It is understandable because Göswein et al. (2021) consider the context of a city in a developing country with a high demand for new buildings. On the other hand, Pittau et al. (2019) focus

on the European Union Member States context, where more than 80% of residential buildings were built before 1990 (Volk et al., 2014).

Therefore, the focal points of these studies are different.

4.2. Assessment methods

This section discusses the preliminary findings from the analysis of assessment methods applied in the collected articles according to the levels of case studies and the sustainable dimensions. Results are summarized in Table 4.

Table 4. *Methods applied to assess the sustainable dimensions of analyzed case studies.*

Dimensions	Methods	Source	Total
I. The C3BM level			
Environment	Life Cycle Assessment (LCA)	(Silva et al., 2021), (Khoshnava et al., 2018), (Miller, 2018), (Bories et al., 2016), (Sinka et al., 2020), (Silvestre et al., 2016), (Rosso et al., 2020), (Quintana et al., 2018), (Arellano-Vazquez et al., 2020), (Khoshnava et al., 2020), (Quintana-Gallardo et al., 2020), (Cascione et al., 2022), (Kulshreshtha et al., 2017), (Montazeri and Eckelman, 2018), (Ganne-Chédeville and Diederichs, 2015), (Bumanis et al., 2020)	16
	Life cycle inventory analysis	(Platnieks et al., 2020)	1
Economic	Simple cost analysis	(Azunna et al., 2019), (Doudart de la Gree et al., 2016)	2
Environmental and Economic	LCA and Life cycle costing (LCC)	(Schulte et al., 2021)	1
	Carbon inventory and cost-benefit analysis	(Liu et al., 2020)	1
	VIKOR and TOPSIS methods	(Scalia et al., 2021)	1
	Multi-criteria approach	(Saeli et al., 2022)	1
Sustainability	Life cycle sustainability assessment (LCSA)	(Barrio et al., 2021)	1
	Sustainable Decision Support System model	(Garas et al., 2021)	1
	Bio-Inspired sustainability assessment method	(Horn et al., 2018)	1
II. The building component level			
		(Ntimugura et al., 2021), (Zieger et al., 2020) (Alberto	

Environment	Life Cycle Assessment (LCA)	Quintana-Gallardo et al., 2021), (Pretot et al., 2014), (Heidari et al., 2019)	5
	Dynamic LCA	(Zieger et al., 2020), (Pittau et al., 2018)	2
Economic	Simple cost analysis	(Degu, 2021)	1
III. The building level			
Environment	Energy performance assessment	(Barreca et al., 2019), (Bennai et al., 2022), (Charai et al., 2021), (Yin et al., 2020), (Simonini et al., 2021), (Saeli et al., 2022), (Rosso et al., 2021), (Opoku et al., 2020), (Jeon et al., 2019), (Guo et al., 2020)	10
	Life Cycle Assessment (LCA)	(Ben-Alon et al., 2021), (Shang and Tariku, 2021), (Florentin et al., 2017)	3
Environmental and Economic	Multi-objective optimization	(Torres-Rivas et al., 2018)	1
	Energy performance assessment and simple cost analysis	(Krasny et al., 2017)	1
	Combinations merges building simulation, Data Envelopment Analysis, and LCA.	(Torres-Rivas et al., 2021)	1
Sustainability	MultiCriteria decision analysis	(Joglekar et al., 2018)	1
IV. The building stock level			
Environment	Material flow analysis and LCA	(Göswein et al., 2021)	1
	Material flow analysis and LCA	(Pittau et al., 2019)	1

As displayed in Table 4, up to 41 studies assess only the environmental impacts of case studies, accounting for 80.4%. These papers distribute to the C3BM level (19), component level (7), building level (13), and the building stock (2). It is followed by studies that simultaneously consider the environmental and economic dimensions, with four and three papers distributed to the C3BM and building levels, respectively. Only three articles consider the economic pillar individually, with two at the C3BM level and one at the component level. Likewise, only four studies evaluate the sustainability of case studies, three for the C3BM level and only one for a building. No paper that considers the circularity or only the social pillar could be found.

With respect to the methods, it has to be noted that they are very varied. For instance, focusing on the environmental dimension, five different approaches have been implemented to evaluate the environmental impacts of C2BSs, and their contribution is depicted in Figure 6. It can be seen that the LCA is the most exploited method, exhibiting 61%, followed by the energy performance assessment with 26%. Other methods altogether accounted for only 13%.

On the other hand, for assessing the economic aspect, all three papers use the simple cost analysis, while various methods have been utilized to analyze both the economic and environmental pillars or the sustainability of C2BSs. However, the majority of these methods are proposed by authors based on the multi-criteria approach. For instance, this approach has been applied by Joglekar et al. (2018), Saeli et al. (2022), and Torres-Rivas et al. (2018). Nonetheless, it should be noted that these methods are applied individually in each research study, and the potential for their wide application may be limited.

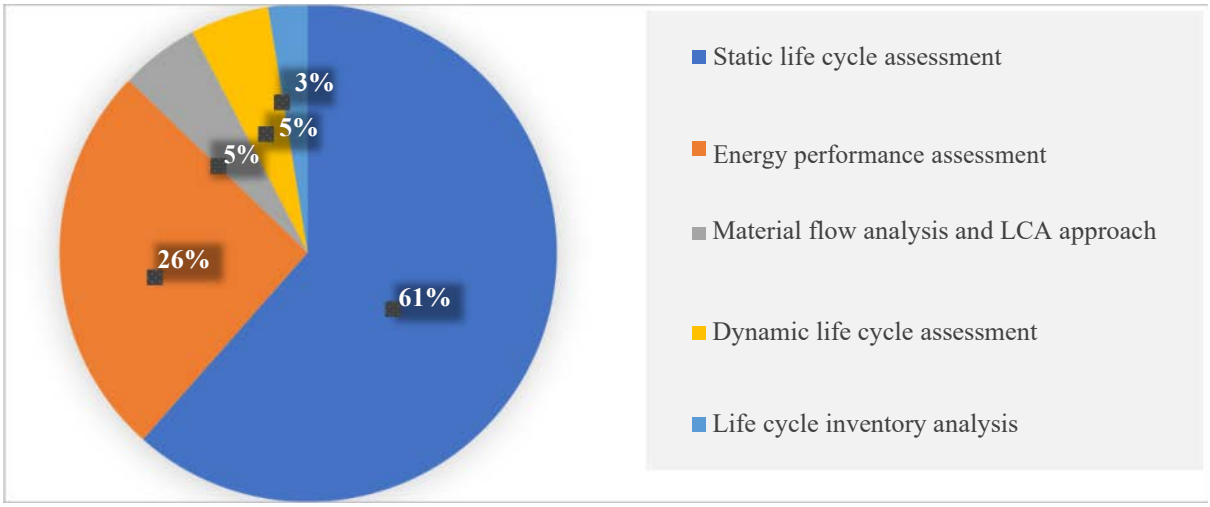

Figure 6. *Methods exploited to evaluate the environmental dimension.*

5. Conclusion

Summing up the conducted literature analysis allows the present study to answer the research questions. Indeed, this study focused on two significant objectives, using a systematic literature review and bibliometric analysis. The first was to classify case studies in the analyzed articles related to C3BMs and their sustainability assessment. To achieve the first objective, the present study proposed a specific definition of circular bio-based material in general and C3BM in particular because these could not be found in the extant literature. Afterward, the eligibility criteria were proposed to focus only on relevant studies on the research topic. Conducted research showed quality work in assessing the environmental sustainability of C3BMs and their influence when being used in buildings. Economic dimension, social pillar, sustainability, and the circularity assessment of C2BSs were also part of the review. The case studies were classified into the related levels, including C3BM, component, building, and the building stock level. Most of the past research focused on the C3BM level, followed by the building level and building component level. On the other hand, the building stock level was less common. Moreover, most C3BMs appeared in the case studies are used for insulating purposes.

The second objective of this research article was to review the methods used to evaluate the sustainable aspects of C2BSs at different levels. The results indicate that the past research was mainly distributed to the environmental impact assessment of products. It is followed by works assessing economic and environmental dimensions or only economic performance. Only four records were attributed to assessing case studies' sustainability, three for C3BMs and one for the building level, respectively. Regarding the approaches used to evaluate the environmental dimension, LCA is the most popular and mostly applied in the C3BM and building component levels. For the building level, energy performance evaluation using commercial software is the most used approach. On the other hand, most studies evaluate the sustainability of case studies using their own proposed methods, except utilizing the life cycle sustainability assessment method. No work taking into consideration only the social aspect or the circularity of C2BSs could be found in the literature.

However, this study considered only literature extracted from the WoS and SP. Plus, the analysis of assessment methods is just in the preliminary phase. Future research should expand data sources and focus on critical discussion of the methodological aspects of methods used to evaluate the sustainable aspects of C2BSs. Furthermore, further study should point out the pros and cons of using C2BSs in the construction industry.

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Circular Economy Practices in the Agri-food Sector: A literature review

Federica Scandurra[1], Roberta Salomone[1], Sandra Caeiro[2], Giovanni Mondello[1]

[1]Department of Economics, University of Messina, Italy
[2]Department of Science and Technology, Universidade Aberta, Lisbon, Portugal

Abstract

The Agri-food sector (AFG) is now facing relevant challenges. Population growth is increasing global food demand, despite hunger and poverty are far from defeated. The AFS has a crucial role in promoting human wellbeing by ensuring fair access to food and water. To do so, the sector must address environmental issues, thus a conversion towards sustainability is needed. In the last decade, circular economy (CE) has drawn worldwide attention as a powerful tool to implement sustainable development (SD). CE promotes a cyclical model, in which waste becomes resources and efficiency is maximized. Thus, CE might be the right solution for restoring the AFS, aligning its production and consumption models to sustainability. In literature, there are several examples of CE implementation in the AFS. Nevertheless, CE's sustainability in this sector is far from assessed. SD indeed requires addressing challenges from an economic, environmental, and social point of view., if circularity is not able to do so it could exacerbate the planet-people nexus. The present study aims to explore the inter and intra company experiences of circularity in the AFS, adopting empirical case studies as the unit of analysis and a micro and meso perspective. The investigation emphasizes the characteristics of circular activities, classifying them in terms of process and goals, as well as the level of innovation. Finally, it is examined the link of CE implemented in the AFS with other sustainability narratives. The study presents a bibliometric analysis of the existing scientific literature extracted from the databases Scopus and Web of Sciences (WOS), covering the time frame 2015-2021. This enables to understand how the topic has evolved after the introduction of the European action plan for CE (EU,2015). The analysis allowed to establish a database of CE activities and best practices of the sector, promoting awareness on the topic, stimulating new insights and perspectives, and encouraging practitioners to implement circularity solutions in the AFS. the analysis contributes to several Sustainable development goals (SDGs), especially number 12, which promotes responsible production and consumption models and number 2, which encourages initiatives to ensure zero hunger.

Keywords: Circular economy, Agri-food sector, Sustainable development, Bibliometric analysis

1. Introduction

The agri-food sector (AFS) has a central role in the actual worldwide productive context primarily because it relates to obtaining and distributing the primary source of livelihood for mankind: food. Despite its centrality, this sector is not exempt from the aggressiveness of the linear paradigm -take, make, waste- which causes, only in Europe, 700 million tons of waste every year, affecting the environment and threatening the biodiversity of the ecosystem (Fortunati et al., 2020). At the same time, the AFS is characterized by the so-called "food paradox", namely having food waste in a world still affected by food insecurity (Ciccullo et al., 2021). Indeed, Food Losses and Wastes (FLW) represent 25% of food production worldwide (Fassio and Tecco, 2019). By FLW it meant any reduction in quantity or quality of food resources along the value chain. In particular, food loss occurs from the harvest to the retail phase, whereas food waste occurs from retail to consumption (FAO, 2019). The current scenario is further challenged by the population increase expected for 2050 when the global production system is going to deal with 2 more billion people's food demand (Toop et al., 2017).

To face such challenges, the AFS needs a new root, which is environmentally, socially, and economically sustainable in the long term. In the last decade, the Circular Economy (CE) has gained global attention as a valuable tool to reach sustainable development (SD) (Kirchherr et al., 2017). CE is based on the concept of "eco-efficiency", which minimize input use and waste production by improving the efficiency of productive systems (Ghisellini et al., 2016). It can be implemented at various levels: macro, when dealing with cities, regions, or countries; meso, when considering eco-industrial parks or symbiosis networks; micro, when involves companies or products (Ghisellini et al., 2016). The implementation of CE in the AFS is ancient, indeed circularity principles were embodied in the agricultural dynamics even before the term was coined. Such practices were considered simply resource economy measures, before being recognized as circular (Fassio and Tecco, 2019). This suggests that the AFS is potentially mature in terms of CE application, thus it is relevant to comprehend how circularity is practically operated and embodied in the food system. To do so, case studies should be used as a measure of analysis, to find exhaustive descriptions of CE practices and capture their value and main features. In addition, considering that CE dynamics and synergies are present both at intra-and inter-company levels, both levels of analysis should be considered: the first dimension can be evaluated by analysing the characteristics of single organizations through a micro perspective, while the latter by considering the inter-firm dynamics employing a meso perspective, configured as Industrial symbiosis (IS). Furthermore, CE and IS have as their primary goal to reach SD, this makes it relevant to understand if these practices and exchanges are first sustainable in the long term for the environment, the society and the economy. In this context, several reviews explore the implementation of CE principles in the AFS (Esposito et al., 2020; Hamam et al., 2021; Chiaraluce et al., 2021; Barros et al., 2020; Stilitano et al., 2021). Nevertheless, these studies do not examine the whole AFS and do not

examine the inter and intra-business synergies in detail, considering the adherence to sustainability narratives.

Given this lack in the literature, the proposed research focuses on the meso and micro level of circularity by addressing the research question (RQ) and sub-questions: What kind of Circular Economy practices and experiences are present in the agri-food sector at meso and micro level? a) Are these circular practices innovative or traditional? b) Are these circular practices in line with the concept of sustainability? c) Are these circular practices related to other sustainability narratives, such as industrial symbiosis? If yes, what is the link between circular economy and industrial symbiosis in the food sector?

The study here presented shows only the preliminary results of the literature review analysis conducted in the proposed research. Here it is described the systematic protocol applied to determine the sample of articles and the bibliometric analysis carried out to map the scientific knowledge, evaluating the evolutionary trend of the field (Donthu et al., 2021). The complete analysis, as well as the methodological issues identified, will be discussed in future publications.

2. Methods

The present study does not answer all the RQs previously mentioned but allows for a partial answer to the first sub-question. Bibliometric analysis was chosen as a research tool for its capacity to map systematically research outcomes. It enables us to analyse how the research interest of the topic has spread, evaluate the time trend of publications, the journals most interested in the research field as well as capture the multidisciplinary nature of the CE, which interests journals with very different areas of interest. Bibliometric information is thus essential to frame the phenomenon under evaluation in specific space-time coordinates, generating a solid base for following systematic analysis.

The consistency and robustness of the present study are guaranteed by the adoption of a systematic protocol articulated in a) identification of the articles according to the information in the title, abstract, and authors' keywords; b) application of exclusion first and eligibility criteria after to consider the studies in line with the aim of the research; c) collection of the articles found; d) discussion and synthesis of the results of the analysis. Scopus and Web of Science (WOS) databases were selected to identify and collect contributions in line with the research question of the study, given the quality of articles included in such databases. The analysis was carried out by using a combination of Boolean operators and keywords linked to the AFS, in all the possible written forms, CE and case studies. The present analysis was performed on 31 December 2021. To refine the search process some exclusion criteria were adopted. The primary criteria identified were the timing of the analysis, the typology of contribution, the publication stage, as well as the area of research and the language. The starting point of the analysis is 2015, given the introduction of "Closing the Loop: An EU Action plan for the Circular

Economy Package" by the European Commission (EC, 2015) in the same year. Afterwards, all the duplicates were selected and deleted. Then secondary exclusion criteria were identified and applied. Information regarding title, abstract and keywords was analysed to understand which studies were in line with the research question Afterwards, the full-text evaluation of the articles of the sample was performed. At this stage, some eligibility criteria were selected to refine further the spectrum of analysis. The final sample includes 42 contributions. The research procedure followed by the study is illustrated in Figure 1. To summarize the research evidence, the bibliometric analysis was performed classifying information according to the publication period, journal and research area covered by the journal. The first enables to identify any possible trend or discontinuity in the publication rate of the field. The second allows to determine which journals contribute more to the topic, finally exploring the journals' research are it is possible to understand which areas and subjects are interested in circularity in the AFS. In addition, systematic information regarding the geographical context of the study is included to understand where these practices are settled, and which areas or countries are involved.

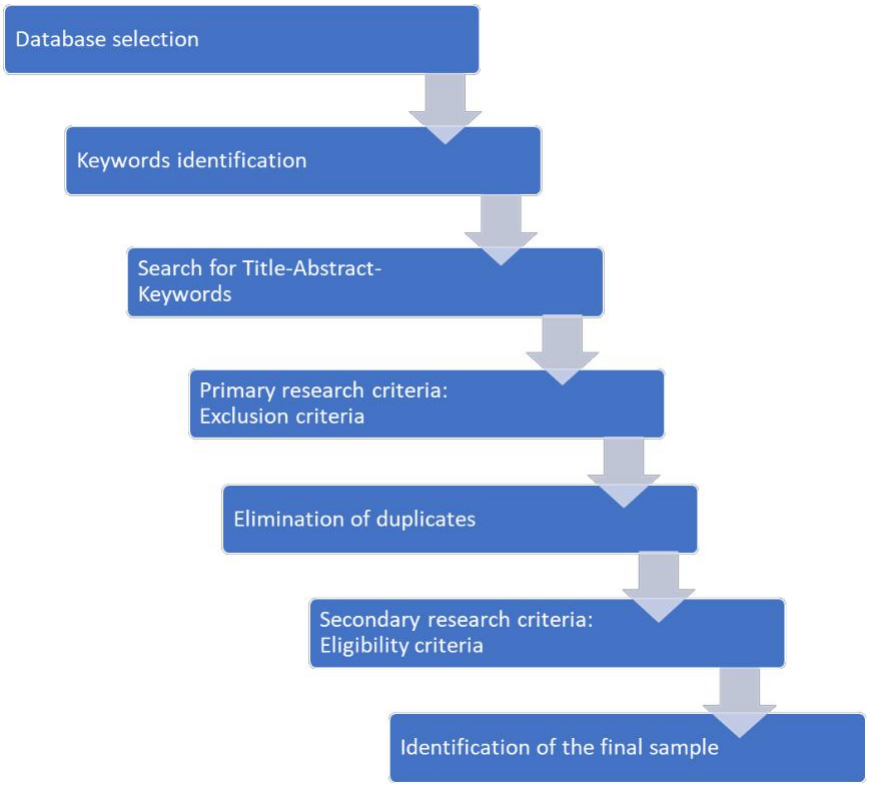

Figure 1: Literature search procedure diagram.

3. Results and Discussion

Considering the publication period, 42 contributions were identified over 2015-2021 according to the present criteria of research. From a chronological point of view, the contribution pattern is unstable from 2015 to 2017. Indeed, in 2015 3 articles were published on the topic, while in 2016 only 1 study is present (Maaß and Grundmann,

2016). The trend is growing again in 2017, thus 2016 can be considered an exception, probably linked to the eligibility criteria selected for the study. The following 2 years, namely 2017-2018, present a slight increase of 1 unit in the number of publications, which remains stable. The real turning point is the two years 2020-2021. Comparing 2020 with 2019 the number of publications is more than doubled. 2021 shows the highest number of contributions in absolute terms, publishing 15 articles. This confirms that there is increased attention on the CE in the agri-food context in the period under analysis. Nevertheless, the pattern shows consistent discontinuities, which make it difficult to assess a clear forecast for the future of the area. One possible explanation could be that the pandemic has raised more awareness of the insecurity and fragility of the food sector, encouraging scholars to move their attention to sustainable and circular solutions for such a key sector. Anyway, it is hoped that contributions such as the SDGs at the international level and the European Green deal (2019), through the Farm to fork strategy (EC, 2020) will boost and sustain the international interest in the topic.

Moving to the analysis of the journal source, 24 peer-reviewed journals published contributions to the argument. The full list of journal source contributions per year is presented in Figure 2. Considering that the sample includes 42 articles, the number of journals seems significant. The largest contributor in this field is the “Journal of Cleaner Production”, which published 10 articles on the issue. The distribution of publications for this journal is irregular from 2015 to 2019, (no studies were published in 2016 and 2019) but constant in the last two years, contributing to the topic with 2 and 4 articles respectively in 2020 and 2021. Afterwards, “Science of the Total Environment” and “Resource, Conservation and Recycling” published 4 studies each. The first contributed only in 2020 and 2021, with 1 and 3 articles, while the second one was the only journal to publish in 2016 but shows no publications in 2021. As already stated, the number of journals is relevant, indeed 18 out of 24 Journals published just one article. This suggests the fragmentation of the sector, thus the AFS is approached with different views and perspectives, it is not linked to a specific journal or set of journals, but it is quite spread.

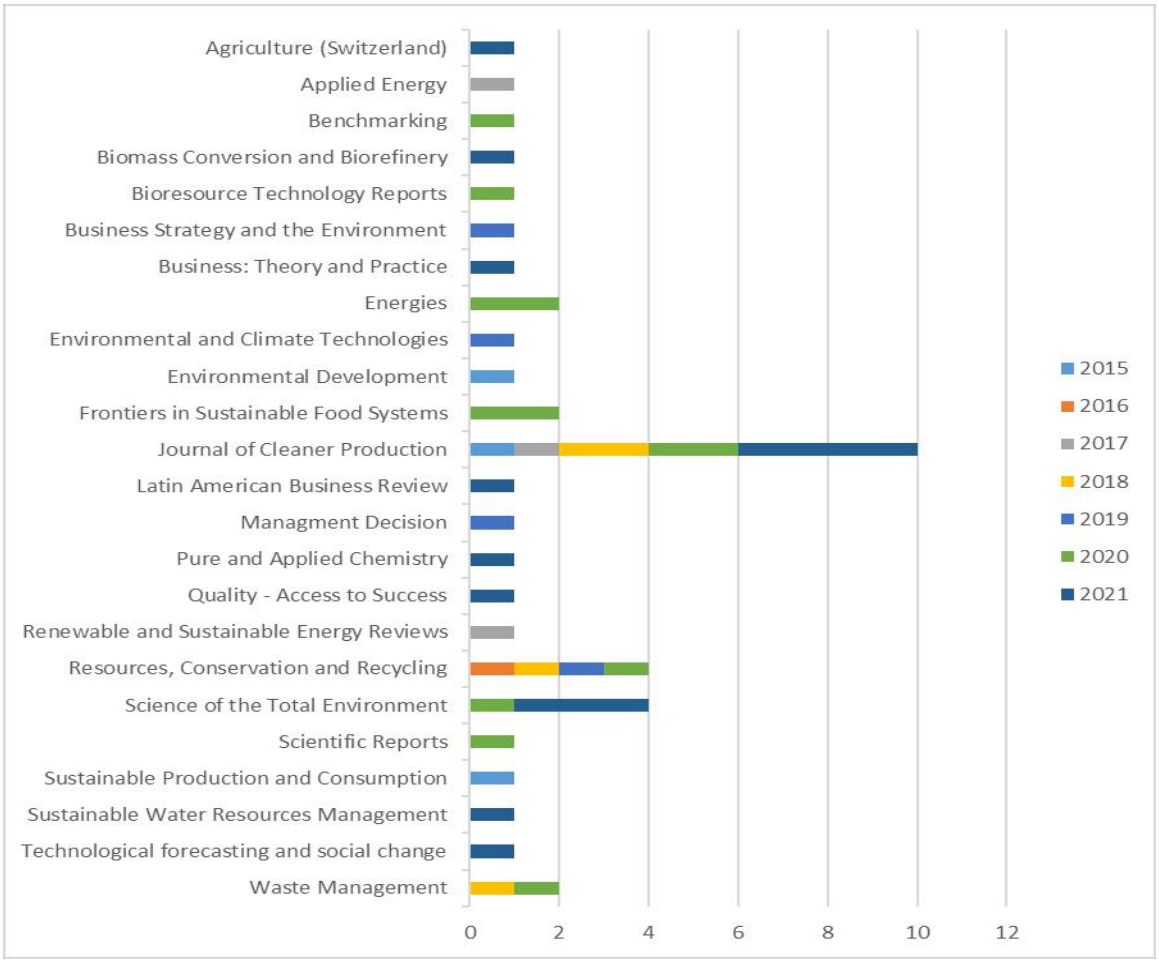

Figure 2: Number of contributions per journal and year about CE in AFS, according to the defined criteria.

Finally, by identifying the research area covered by the single journals it is possible to study the areas more interested in the topic and try to motivate the fragmentation encountered. Figure 3 indicates the most frequent research areas in the sample of journals analysed. At this stage, it is relevant to remember that the number of areas identified by this analysis does correspond to the number of articles included in the sample, given that a single journal may work on different research areas. The most relevant area of research is "Environmental Science", which represents 11 out of 46 units. Afterwards, "Energy" represents the second most important area, referring to 8 journals. Then, "Business, Management and Accounting" describes 5 journal areas of interest. Thus, the strong environmental vocation of the topic is clear, often directed to finding alternative energetic solutions that combine food waste and residues into renewable forms of energy. Nevertheless, an economic interest, especially in managerial terms, is present, probably to understand how to account and measure these practices or to offer

guidance to companies that are willing to start a path toward circularity. In general, the topics covered by the journals are various and spread from phycology to econometric and social sciences.

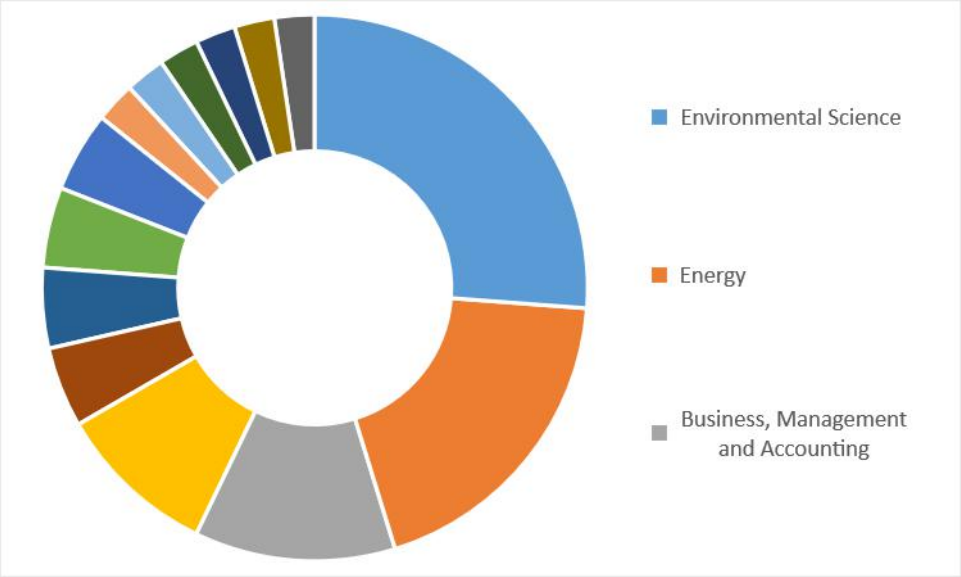

Figure 3: Research area per journal about CE in AFS, according to the defined criteria.

Moving to the geographical setting of the studies, 45 countries were identified. In Figure 4 the distribution of articles' setting per continent and country is shown.

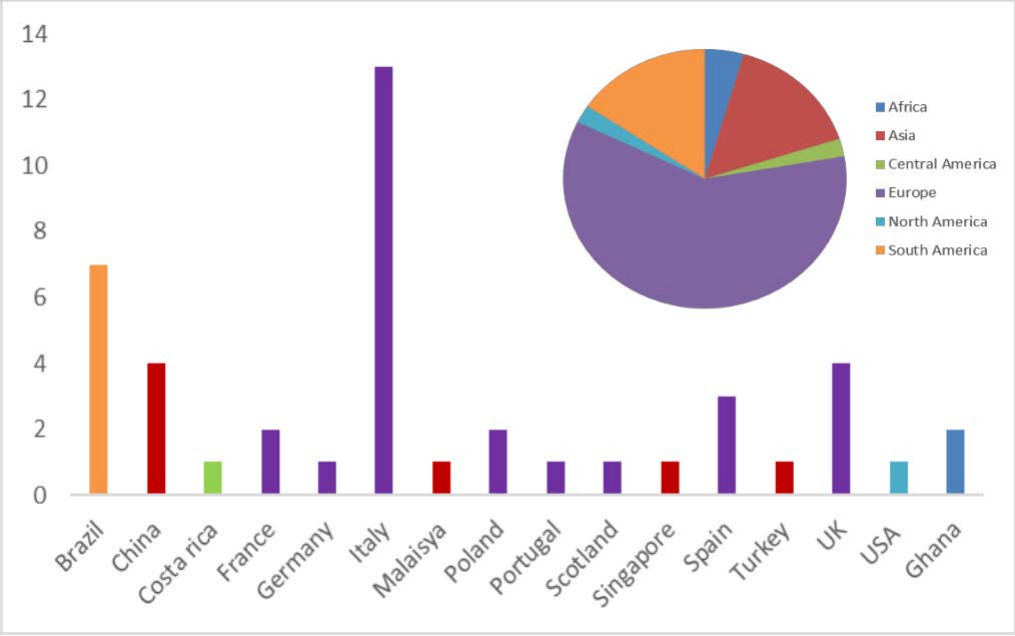

Figure 4: Geographical setting of the studies in terms of country and continent according to the defined criteria.

Some multi-country studies were encountered: Brazil-United Kingdom (De Vasconcelos et al., 2021), Italy-Spain (Jiménez-Benítez et al., 2020) and Egypt-Ghana (Patrizi et al, 2020). Only the first study undertakes a collaboration between companies of the two countries, exploring the fresh fruit supply chain to reduce FLW, exploiting stakeholders' desire pressure for sustainability. In general, European countries and areas are the most interested in implementing CE solutions in the AFS, representing 60% of the countries involved in the sample. Italy presents the highest number of studies with 12 contributions, followed, with a considerable distance, by Spain with 4 contributions on the topic. After Europe, Asia and South America represent both the 16% of the study setting. The presence of Asia among the most common continents for CE implementation does not surprise, given that China was the first country to introduce CE as a national policy (PRC, 2008). Most Asian studies indeed involve China, nevertheless, there are contributions on the topic also from Singapore, Turkey, and Malaysia; thus, CE is not exclusively a Chinese policy, and it is now spreading over Asia. Despite China's leading role in the adoption of CE, its interest in the AFS application is stable, but no growing trend was observed in the last two years. China presented indeed studies on the topic in 2015 (Yu et al., 2015), but no articles were settled in the country in the last two years. Two years are not enough to define if the country's interest is in decline, nevertheless, the country may have moved its attention to another sector for CE. South America, precisely Brazil, is a relevant contributor to the AFS. It presents a wide variety of studies, moving from sharing economy practice in rural communities (Rodrigues et al., 2021), to strategies of value recovery for large businesses (Sellitto and Almeida, 2019), or examples of waste recovery solutions on university campuses (De Sousa et al., 2021), showing interest on the topic from different perspectives and levels of agglomeration. Among the non-European countries, Brazil shows the highest number of contributions. Analysing the temporal trend of such studies, they were all published in 2020-2021, precisely 1 in 2020 and 6 in 2021. This demonstrates the increased interest in the topic as well as how much CE is spreading globally. The outcomes of the present study will be further discussed in a future contribution, which will allow answering all the RQs presented in the introduction section by conducting a systematic literature review, supported by content analysis techniques.

4. Conclusions

Since 2015, the AFS has progressively increased its attention toward circularity. Even if at the beginning unsteadily, the last two years demonstrate the growing awareness shown by businesses and organizations in the sector. A wide variety of journals are interested in the field, especially those focused on environmentally and energy topics, together with others interested in managerial insights. From a geographical point of view, European areas are the most interested in implementing CE as a guide for their food system. Mediterranean countries, such as Italy and Spain are the most committed to the cause, trying to direct their food production systems towards sustainable

development. Among the non-European countries, Brazil presented the highest number of contributions, involving a variety of stakeholders and perspectives of analysis. This demonstrates that the interest is growing both in terms of publication and countries, CE has now reached a global scale and this tendency is going to increase in the following years, especially considering the level of increase registered by the present study. Implementing CE in the food context is necessary to promote a real transition to SD, given the social role of the AFS, which express human interactions with the environment. This paper presents some limitations due to the choice of specific keywords and the time limits imposed, nevertheless, it gives a clear idea about how the AFS is evolving in terms of CE, the temporal pattern, the source of the journal more interested, the subject areas that are now expanding their interest to CE as well as the territories that already exploit CE solutions in their food systems.

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Circular Indicators for Agri-food Sector: Test and validation

Prof. Alessandro Ruggieri, Prof. Stefano Poponi, Prof. Gabriella Arcese, Dr. Francesco Pacchera

Università degli Studi della Tuscia, Viterbo, Italy

Abstract

The complex agri-food system is at the core of the transition process undertaken by the European Union towards a climate-neutral, resource-efficient, and competitive economy. Therefore, pursuing a more sustainable and circular production system will bring economic, social, and environmental benefits, balancing the negative impacts generated by this sector. The transition to a sustainable and circular production and consumption model is not only an opportunity, but a necessary direction to follow through a guided path to manage change. This requires a monitoring system to measure progress through the application of Circular Economy principles. However, these tools need to be systematized to ensure that they can be more easily identified and applied to the specific field. There are many heterogeneous indicators for measuring the Circular Economy in the literature and few tools to support measurement in different application contexts. In previous research, we identified a Dashboard of circular indicators for the agri-food sector that combined the three areas of sustainability (economic, social, environmental), the spatial dimensions (micro, macro, meso), and the scopes (air, soil, energy…) in which they fall. The indicators were extracted from the scientific and grey literature on the Circular Economy in the agri-food sector and systematized within it. Starting with this Dashboard, the paper aims to test a selected number of circular indicators within scope, to evaluate the validity of the tool, and the related strengths and weaknesses of its application. The work highlights the implications for the researcher, policy maker, and manager regarding the use of this tool, as well as the future step of the research deriving the opportunity to define new indicators in the selected scope.

Keywords: Circular Economy, Agri-food, Indicator, Cross-sectional, Energy

1. Introduction

The transition to a sustainable and circular production and consumption model is not only an opportunity, but a necessary direction to follow through a guided path to manage change. The agri-food system is at the core of the transition process undertaken by the European Union towards a climate-neutral, resource-efficient, and competitive economy (European Commission, 2020). Therefore, pursuing a more sustainable and circular production system will bring economic, social, and environmental benefits, balancing the negative impacts generated by this sector (FAO, IFAD, UNICEF, WFP, & WHO, 2020). The over-consumption of natural resources, such as soil, energy,

and water, combined with the increasing use of chemicals (such as pesticides and fertilizers), generates significant environmental impacts with economic and social repercussions. Environmentally, the sector is responsible for 30% of Europe's greenhouse gas emissions (Crippa et al., 2021), and is a key player in soil and water pollution (accounting for 32% of global terrestrial acidification and 78% of global eutrophication) (Poore & Nemecek, 2018), and contributes significantly to the consumption of natural resources (30% of global energy consumption and 70% of global water withdrawal) (FAO, 2011b; Flammini, Puri, Pluschke, & Dubois, 2014). Another key issue is food waste, this contributes to the increase in environmental impact, generation of emissions, and consumption of resources (soil, water, energy), and has strong economic and social repercussions (UNEP, 2021). Considering the European food supply chain, it is estimated that 20% of agri-food production is wasted (Stenmarck et al., 2016).

To reduce these impacts and shift the agri-food production model toward more sustainable practices, it is necessary to implement the principles of Circular Economy (CE) (S Poponi et al., 2021; Velasco-Muñoz, Mendoza, Aznar-Sánchez, & Gallego-Schmid, 2021). This requires a monitoring system to measure progress through the application of CE principles, according to different areas and dimensions, and at each stage of the life cycle (ICESP, 2018). In the literature Elia, Gnoni, & Tornese (2017) highlights that system transition requires a model based on measurement tools. A database is needed to interpret changes in trends, aid understanding of the data, or intervene with policies aimed at stimulating circularity (Ruggieri, Braccini, Poponi, & Mosconi, 2016). Saidani, Yannou, Leroy, Cluzel, & Kendall (2019) associate the availability of appropriate and effective measurement tools with the ability to stimulate circular transition. Useful to support decision-makers (Cristóbal, Castellani, Manfredi, & Sala, 2018; Peña et al., 2021; Tadesse, Oenema, van Beek, & Ocho, 2019) and to identify criticalities at different production stages and strengths to invest in (Genovese, Acquaye, Figueroa, & Koh, 2017; Vasa, Angeloska, & Trendov, 2018).

However, these tools need to be systematized to ensure that they can be more easily identified and applied to the specific area. In the literature, there is not yet a defined framework for the use of indicators to monitor and measure CE across the different application dimensions. This gap is especially highlighted in the agri-food sector (Aznar-sánchez et al., 2020), characterized by a very complex value chain with several stages and actors (Notarnicola, Hayashi, Curran, & Huisingh, 2012; Notarnicola et al., 2017). To solve this gap, a Dashboard for the use of circular indicators in the agri-food sector was proposed in a previous study (Stefano Poponi, Arcese, Pacchera, & Martucci, 2022). It is the first reference framework for the application of indicators within the sector. A tool for companies to monitor the management system with a circular approach and at the same time a tool to support policymakers to guide them in stimulating the economic, social and environmental system toward the CE.

Starting with this Dashboard, the paper aims to test a selected number of circular indicators within a Scope, to evaluate the validity of the tool, and the related strengths and weaknesses of its application. The Scope “Energy”,

which considers indicators for energy performance, was selected for the test. This selection is motivated by the important role of energy consumption in the Agri-food sector. The Food System consumes about 30% of available energy globally, where most of the resources come from fossil sources (FAO, 2011a; Flammini et al., 2014). This significant dependence of the sector on non-renewable primary energy sources (e.g. oil, gasoline) generates uncertainty in supply (e.g. price volatility) and high GHG emissions (Monforti-Ferrario et al., 2015; OECD, 2017). For this reason, the study is an important first step in assessing the applicability of the circular indicators proposed by the dashboard in the agri-food Energy Scope.

The paper is organized as follows: the next section describes the method used, section 3 discusses the results of the study, and the last section presents the conclusions and implications of the work.

2. Methods

The study identifies and systematizes the indicators used for the CE in the agri-food sector based on an analysis of the scientific and grey literature. There are several definitions of CE, in this study, the definition of Kirchherr et al. (2017) is taken as a reference. For Kirchherr et al. (2017) CE can operate at the Macro level (nations, regions), at the Meso level (symbiosis), and at the Micro level (companies, products) and create economic, social, and environmental value. The Dashboard proposed combines the spatial dimensions (SD) (Micro, Macro, Meso) and the three Areas of sustainability (AS) (Economic, Social and Environmental) for the Scopes within which the indicator is applied (Air; Water; Soil; Energy; Waste; Cost-Value-Productivity; Equality; Knowledge and Innovation). It is a tool that highlights the gap in the literature (the lack of indicators for areas) and the presence of *Cross-sectional* indicators. These last indicators can be applied indiscriminately within the dashboard in the three Spatial dimensions (SD), for each Area of Sustainability (AS) (Stefano Poponi et al., 2022).

Based on Kirchherr's definition and the structure of the Dashboard, indicators related to the Scope "Energy" with *cross-sectional* characteristics were extracted. This allowed for the identification of four indicators as followed and included in Table 1.

The *Use of primary energy (PE)* indicator (1) quantifies the primary energy needed to produce a product or the entire production chain, considering renewable and non-renewable sources.

The *Use of primary renewable energy (PER)* indicator (2) quantifies the amount of primary energy from renewable sources needed to produce a product or the entire production chain.

The *Use of primary non-renewable energy* (PENR) indicator (3) quantifies the amount of primary energy from non-renewable sources needed to produce a product or the entire production chain.

The *Cumulative Energy Demand* (CED) indicator (4) allows for quantifying the amount of direct energy (conventional sources) and indirect energy (derived from the processes e.g. for fertilization, the use of pesticides, or machinery) needed to produce a product or the whole production chain.

The reference geographical area is Italy, where the agri-food sector is extremely competitive (CREA, 2021). The sector characterizes the entire economy of the country concerning the typicality of the productions, highly specialized, with an important role within the European market (FoodDrinkEurope, 2021).

Three case studies for Macro and Micro SD were used for the analysis. At the Macro level, Italy and the Lazio Region were selected. Lazio Region was selected for its agri-food position in the national economy and because the sector is included in the Smart Specialisation Strategy (S3) areas (Regione Lazio, 2016). Secondary data were extracted from reports and databases and collected through documentary analysis (Fitzgerald, 2012). In particular, at the Italian level, data from the National Energy Balance carried out using the Eurostat methodology were used (Ministery of Ecological Transition, 2018), and converted to MJ where appropriate. At the regional level, the data come from the Regional Energy Balance, converted into MJ, but referring only to the agricultural sector (ENEA, 2018, 2020, 2021). It was not possible to extract or define an allocation system to attribute the data to the whole food supply chain, so the reference area considered is agriculture.

The most complex indicator, the *Cumulative Energy Demand indicator (CED),* uses energy conversions extracted from literature (Biondi, Panaro, & Pellizzi, 1989; Jarach, 1985; Zucaro, 2011). The ISTAT database was used to extract data from the consumption of pesticides and fertilizers (ISTAT, 2021a, 2021b). In calculating the indicator, at the macro level, it was not possible to consider machinery, as the last updated data dates to 2002 and is therefore not usable (FAOSTAT, World Bank).

At the micro level, a micro-sized company was selected, operating in the Lazio region and specializing in the cultivation of durum wheat. The farm was selected for its ease of primary data extraction, thanks to its production focus, small size, and monoculture practice. The choice of the type of cultivation derives from the vocation of the Italian territory, which sees its main vocation in the production and consumption of pasta. Data collection was carried out through a structured interview with the owner of the company (Corbetta, 1999; Eisenhardt & Graebner, 2007).

The reference years for identifying micro-trends are 2015, 2018, and 2019. The most recent data for national or regional indicators are for 2019. The year 2015 represents the benchmark of the old European programming against the subsequent new strategy resulting from the European Commission's first Action Plan for the Circular Economy. The time comparison allows us to observe the impact that these policies have had on the

selected indicators. For the company the year 2015 is technically no longer available (as the company is not obliged to keep records).

Table 1. *Cross-sectional indicator in the Energy Scope.*

Dashboard Scope	Code	Cross-sectional Indicators	Unit of measure	Spatial dimensions: Micro - Meso - Macro / Areas of sustainability
Energy	1	Use of primary energy (PE)	MJ	
	2	Use of primary renewable energy (PER)	MJ	
	3	Use of primary non-renewable energy (PENR)	MJ	
	4	Cumulative Energy Demand indicator (CED)	J/year	

3. Results and Discussion

The study has tested and evaluated the *cross-sectional indicators* of the Macro and Micro spatial dimensions, for the area of sustainability 'Environmental', regarding the Scope 'Energy'. This has allowed us to understand energy performance, considering the energy inputs required for production, from the use of primary and secondary data, and generally assess the applicability of the Dashboard as a reference tool for circularity.

At macro level, the results allowed a comparison between two levels of analysis, national and regional. The results show a homogeneous trend in the indicators over the considered period. In particular, the PER indicator shows substantial stability. Nationally, it recorded a small decline in 2018, only to rise again in 2019. At the regional level, although it is not possible to detect the trend in 2018, it shows a situation of stability over the period considered.

The PENR indicator, at the national level, increases by 4% in the year 2018, to decrease again in the following year by about 5%. At a regional level, the indicator shows the same trend, but with more pronounced data. Indeed, from 2015 to 2018, the use of non-renewable primary energy sources increases by 54%, only to drop by 19% in the following year.

The PE indicator cumulates the results of the two indicators PER and PENR, expressing the energy requirements of the agri-food system. The national data shows a fluctuating trend, peaking in the year 2018 and then falling in the year 2019. Considering the period 2015-2019, the figure is stable, with a small decrease of 1%. It is on a regional level that the data is most significant, indeed in the period 2015-2019 the energy demand of the regional agricultural sector increases by 24%.

The analysis in the macro dimension at the national level does not show large deviations, it is at the regional level that the most marked variations are recorded. Lazio Region has a strong vocation for agri-food and has started a process of revising its Smart Specialisation Strategy (S3) through a repositioning of high-value-added production activities. Although the PER indicator remains constant over time, the PENR indicator has a marked increase in 2018, and then falls significantly in 2019. The effect of this change is partly attributable to the eco-investments in green products and technologies carried out within the Lazio Region in the period 2015-2019, involving more than 40,000 companies (Regione Lazio, 2020). This shows how the sustainability-oriented policies of organizations can significantly affect the values of energy indicators. The stability of the national indicator hides important variations at the regional level. Therefore, defining a permanent monitoring system of these indicators will contribute to and highlight energy deviations from the various regional policies implemented, allowing intervention with direct policies aimed at compensating for any imbalances.

The national Cumulative Energy Demand indicator (CED) shows an overall reduction in indicator values of about 3%. This was mainly due to a reduction in the indirect component (indirect energy) derived from the processes for fertilization, the use of pesticides, or machinery (ISTAT, 2021a, 2021b). Also, in this case, the year 2018 is linked to a gradual increase of 3% and a subsequent reduction of 6% in the year 2019. At the regional level, the situation shows an overall increase of 8% over the whole period. The most significant regional variations, as for the other indicators, are for the year 2018, with a 27% increase (10 times the national figure) and a 15% decrease in 2019.

The CED and PE results at the Micro level do not show any significant differences over the period considered. This is due to a continuity in the type of cultivation practiced and the related agronomic production techniques. The most significant aspect observed at the micro level, which is not directly observed, is the volatility of fertilizer and energy prices. This aspect has a direct impact on the sustainability of the entire business management system, against indicators that remain constant over time such as PE or CED. It requires the application of direct policies aimed at mitigating the effects of using non-renewable energy sources, which have direct repercussions on product prices or in the most extreme cases on the survival of the company.

Table 2. *Cross-sectional indicator in the Energy Scope in Italy.*

Scope Dashboard	Cross-sectional Indicator	Unit of measure	2015	2018	2019
Energy	Use of primary energy (PE)	MJ	1.48E+11	1.53E+11	1.46E+11
	Use of primary renewable energy (PER)	MJ	4.14E+09	4.11E+09	4.15E+09
	Use of primary non-renewable energy (PENR)	MJ	1.43E+11	1.49E+11	1.41E+11
	Cumulative Energy Demand indicator (CED)	J/year	1.96E+11	2.01E+11	1.89E+11

Table 3. *Cross-sectional indicator in the Energy Scope in Lazio Region.*

Scope Dashboard	Cross-sectional Indicator	Unit of measure	2015	2018	2019
Energy	Use of primary energy (PE)	MJ	6.57E+09	1.01E+10*	8.16E+09
	Use of primary renewable energy (PER)	MJ	4.19E+07	n.a.	4.19E+07
	Use of primary non-renewable energy (PENR)	MJ	6.53E+09	1.01E+10	8.12E+09
	Cumulative Energy Demand indicator (CED)	J/year	1.07E+10	1.37E+10	1.16E+10

**not consider renewable energy*

Table 4. *Cross-sectional indicator in the Energy Scope in Wheat Firm.*

Scope Dashboard	Cross-sectional Indicator	Unit of measure	2018	2019
Energy	Use of primary energy (PE)	MJ	1.60E+05	1.59E+05
	Use of primary renewable energy (PER)	MJ	0	0
	Use of primary non-renewable energy (PENR)	MJ	1.60E+05	1.59E+05
	Cumulative Energy Demand indicator (CED)	J/year	3.70E+05	3.69E+05

4. Conclusions

The study tested selected *cross-sectional* indicators of the Dashboard of Circular Indicators in the agri-food sector. The results highlight the importance of having a versatile tool that can systematize indicators by the level of application: Scope, Spatial Dimension, and Area of Sustainability.

The test in the Energy Scope allows us to interpret the energy data of the sector to be able to strategically address the future challenges of the ecological transition. The analyses, as well as highlighting the potential of this tool, have highlighted the national and regional imbalances that may arise from a biased reading of the data or a lack of secondary data (and discontinuous collection practices) in the Scope analyzed.

The complexity of the agri-food supply chain clashes with the difficulty of finding data at the regional level, where different collection systems do not allow an immediate comparison of results. The harmonization of energy-related data management systems, between national and regional data, can contribute to an immediate comparison, facilitating policy interventions aimed at correcting distortions in the production system or the market in general. Linked to these aspects is the difficulty of calculating certain indicators that do not make these tools accessible and user-friendly to all potential users. Hence the need, in line with the declarations of the European Commission, to have simple indicators that can express the degree of circularity, both at the macro and micro level (Stefano Poponi et al., 2022).

Analysis at the micro level is complex by the extent of detection over time (and the relative discontinuity in measurement). The testing of the indicators revealed the need to define structured systems for the internal monitoring of these data and to develop new *cross-sectional* indicators that can also consider the economic and social area as well as the product life cycle.

The indicators used showed a differentiated capacity for application concerning the different areas considered, revealing limitations in their application. The main criticality in their application occurs at the Macro level (Nation and Region) when considering the entire agri-food chain (agriculture and food industries). For the PER, PENR, and PE indicators, this criticality can be overcome at the national level, but not at the regional level. The different systems of data management and collection, as well as the timing of collection, make it complex to compare results, especially over a short time horizon. To overcome this critical issue, it is necessary to intervene in the harmonization of national and regional collection methodologies, building automatic mechanisms that can permanently and regularly monitor the trend of these energy indices.

A further critical issue is the calculation of the CED indicator at the Macro level. This is mainly due to the lack of data on the use of machinery or the presence of data that are too old, as evidenced in the literature by Ghisellini, Setti, & Ulgiati (2016). At the Micro level, this criticality is overcome by the direct collection of primary data and the use of software that facilitates its calculation.

The *cross-sectional* indicators of Scope Energy are only applicable to the area of environmental sustainability (Table 1). This entails a partial representation of Scope concerning the other areas of sustainability and implies the definition of new indicators to facilitate the measurement of circularity while also considering economic and social aspects.

At the research level, the main implications are related to the need to develop new indicators that can contribute to filling the gaps in the dashboard, especially the economic and social areas, which are the least investigated in the literature. The literature (see e.g. Corona et al., 2019; Moraga et al., 2019; Pauliuk, 2018) emphasizes the centrality of indicators with a life-cycle approach as a benchmark for evaluating circular practices. Indeed, the complexity of the value chain requires advanced analysis tools, including a life-cycle approach to assessing impacts within the three areas of sustainability (De Luca, Falcone, Iofrida, Stillitano, & Strano, 2015). The development of new indicators in this Scope must consider in addition to the *cross-sectional* characteristic the ability of the indicator to be used with a life-cycle approach.

At the managerial level, the use of indicators is the stimulus to adopt new circular business models. Monitoring the various Scopes allows for investment in critical points and increases the circular performance of companies.

At the policy level, the dashboard indicators can guide circular economy strategies in the agri-food sector through the coordinated use of several indicators, belonging to the different Scopes, for the redefinition of a more sustainable supply chain model.

The main limits of the work derive from the exploratory nature of the study, which considered a limited number of cases in this first test phase. Future steps will be aimed at broader comparisons within the same Spatial Dimensions or Sustainability Area, extending the analyses to international comparisons. This allows to test further the potential of the Dashboard and define the interconnection criteria between the indicators to assess the circularity of businesses in the agri-food sector. A further research step is to develop new indicators reflecting the above-mentioned characteristics, i.e. *cross-sectional* and life cycle. The last aspect of the research will be to promote the scalability of the model to further economic sectors.

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Closing the Loop in the Agri-food

A review of best practices of waste management in the wine sector

Giulia Abbati[1], Alessia Acampora[2], Maria Claudia Lucchetti [3], Olimpia Martucci[4]

[1,2.3.4] *Department of Business Studies, Roma Tre University, Rome, Italy,*

[1]*giulia.abbati@uniroma3.it,* [2]*alessia.acampora@uniroma3.it,* [3]*mariaclaudia.lucchetti@uniroma3.it,*
[4]*olimpia.martucci@uniroma3.it*

Abstract

The transition from a linear economic system to a circular one is considered today as an inevitable change to guarantee a sustainable future for the next generations. However, achieving this goal requires considerable effort in reconsidering all stages of the value chain according to a closed-loop approach which ultimately allows for the reintroduction of waste material into the production process. From this point of view, among the industrial sectors, the agri-food is the one in which waste management could lead to important results. Indeed, the production of waste in this sector is one of the major problems in all phases of the life cycle of food, causing very high economic, social, and environmental costs. For this reason, and especially in recent years, the practices for the sustainable management of waste in the agri-food sector have become of great interest, which in a transdisciplinary perspective make it possible to obtain "zero waste" agri-food production. In this sense, the research focus on the opportunities that come from the wine sector. Through an extensive literature review, the authors provide a mapping of the best waste management practices currently used along the different stages of the wine supply chain, categorizing them through the concept of Circular Economy.

Keywords: Circular Economy, Agri-food, Sustainability, Recycle, Waste Management

1. Introduction

Traditionally, the economy is based on a linear model, which can be summarised by the formula: extract, produce, use, dispose (Ferrara, 2018). Although this model has been for decades at the heart of industrial development and has generated an unprecedented level of growth (Ellen MacArthur Foundation, 2015), on the other hand, it has produced devastating environmental and social consequences. The rapid depletion of natural capital resources is a clear example. The latest estimates show that the global use of materials

extracted and used for production has almost quadrupled in the last 50 years, reaching 100 billion tonnes in 2019 (Circularity Gap Report, 2022).

The possible alternative to this unsustainable development is known from a while as the “circular economy” (CE). This concept refers to an economy designed to be regenerative, where goods at the end of their life cycle are transformed from 'waste' into new 'resources'. In this context, materials reintroduced into the economy are referred to as “second raw materials”. These by-products can add value to production systems, nourishing the economy always with new lymph. In this sense, the circular economy is a new paradigm that, closing the loops in industrial ecosystems and minimizing waste (Stahel, 2016), changes the logic and geometry of the traditional economy, shaping it from a linear to a closed-loop system.

The implementation of the circular economy as a model of production and consumption is particularly important in the agri-food sector. In fact, the agri-food sector alone produces a significant amount of pollution. According to the Intergovernmental Panel on Climate Change (IPCC), considering all the stages of the agri-food supply chain, estimated that the entire sector generates between 21 and 37% of total global pollutant emissions (IPCC, 2019). The most impactful activities in the supply chain come from the agricultural phase, land-use change, and the loss and waste of food throughout the life cycle of products. The production of waste in this sector is one of the biggest problems in all phases of the food life cycle. According to FAO, lost or wasted food amounts to 1.3 billion tons per year (FAO, 2011). In particular, about 14% of the produced food goes lost between harvest and retail, while 17% of global food production is wasted and thrown away at the final consumption stage (FAO, 2022). This loss of value causes very high economic, social and environmental costs. These costs would be avoidable through careful waste management, that consequently could generate fewer polluting emissions.

Moreover, the agri-food sector has experienced the effects of climate change due to pollution, loss of biodiversity, and water scarcity. One example is the decrease in agricultural yields: since 1970, despite improvements in technology and farming techniques, the increase in productivity of cereal crops has decreased by 66% (Mark Esposito and Soufani, 2015). Therefore, if we want to ensure the availability of safe and healthy food for the 9 billion people estimated by the FAO by 2050, we need to change current production and consumption patterns and make them more sustainable (FAO, 2018).

In this respect, the circular economy could yield a win-win situation guaranteeing food security today and, in the future, and moderating the environmental impacts of the sector by proposing actions and solutions to readmit waste and by-products into the supply chain (Chiaraluce et al, 2021).

Among the various food supply chains, the paper examines the wine sector. This industry occupies a prominent role in the agriculture and agro-industrial sectors around the globe (Ahmad B. et all, 2020).

According to the International Organization of Vine and Wine (OIV), excluding juices and musts, the world wine production in 2020 was estimated at 262 mhl, marking an increase of almost 4 mhl (+2%), compared to 2019 (OIV, 2021). Grapes are one of the most important fruit crops cultivated worldwide, and the residue generated form wineries are among the major cause for environmental deterioration (Musee, N. et all, 2007). On the other side, the waste produced can lead to a big opportunity thanks to the organoleptic properties of the waste produced in this industry. If correctly studied, considering all the phases of the supply chain, it is possible to re-think a "zero-waste wine supply chain". Moreover, considering an increasing demand from the final customer for wines produced organically and with green production processes, this sector has become increasingly interested in sustainability over the years (Moggi et all, 2020). The proof lies in the growing number of environmental labels and sustainable programs for the implementation of environmental-friendly practices by winemakers. Following this increasingly green trend, the paper intends to provide the first analysis of waste management from the CE perspective in this sector. Through a comprehensive approach, the authors searched in the literature the waste management practices currently used in this sector and categorized them into CE practices along the main stages of the wine supply chain.

2. Methods

As a strategy to support a sustainable development and circular economy conceptualization and development, the research tries to figure out how to implement principles of circular economy in the agri-food sector, particularly in the wine supply-chain. The objective of this paper is double: on the one hand, it seeks to contribute to the literature on circular agri-food, which is still developing a shared and common definition and practices, on the other hand, it seeks to be a useful and practical tool for the various stakeholders in the sector, who want to improve their environmental performance. The paper focus on how the circular economy can be applied to waste reduction along the stages of the wine supply chain. Starting from the European Union directive on the waste hierarchy (Directive 2008/98/CE), the authors produced a double entry table (Table 1). The phases of the wine supply chain have been inserted in the columns, while in the rows of the table have included the waste management practices of the circular economy. Each supply chain depends on the waste materials generated and may adopt different practices to deal with the waste, giving it new value as a resource within the same supply chain, or being cross-used in others. For this reason, the waste management framework had been divided into five different phases in order of priority: Waste Prevention, Reuse, Recycling, Industrial symbiosis, and Recovery of energy. Finally, the practices have been classified according to the stage of the supply chain and the CE practices to which they belong. Research on waste management practices was conducted through a timely review of the scientific and grey literature. The authors consulted three scientific databases Google Scholar, Scopus, and Research Gate for the scientific articles, while the grey literature was selected by research institutes. In this sense, the main source used is the ENEA Report "Uso

efficiente delle risorse vitivinicole", where the wine supply chain was analysed to identify the key elements for resource efficiency. The literature review was performed via keywords. These keywords are: “Circular Economy AND Wine”, “Waste Management AND Wine Sector”, “Circular Economy AND Wine Sector”, “Waste Management AND Viticulture”, and “Circular Economy AND Wine Production”.

The sources of waste management practices have been highlighted in the table by an identification number. For completeness, an "Annex 1" with all the consulted numbered sources has been attached at the end of the text.

3. Results and Discussion

The research seeks to understand whether the adoption of CE practices applied along the wine supply chain can lead to zero-waste production. To do so, the authors found waste management practices in the literature. Subsequently, the practices were separated following the stages of viticulture, production, packaging, and consumption of the wine supply chain. Finally, waste management practices have been classified according to an order of priority dictated by the highest added value obtainable according to CE practices. Table 1 below summarizes the results of the research.

Table 1. *Waste Management Framework for the wine sector*

	Viticulture	**Wine Production**	**Packaging**	**Consumption**
Waste Prevention	Precision Viticulture (1,20); Efficient pruning (1).	System washing only when necessary (1); Promoting employee awareness of water saving (1). Water fooprint (1)	Limit the volume of materials used for packaging (1,9,11). Use compostable material. Use packaging from renewable raw materials (1,11). Bag in box (1);	Awareness, Responsibility in consumption to avoid waste during use (1,14). Environmental labeling and packaging certifications (16)

Reuse	Use of wastewater for fertigation if compliant with legislation (1). Foliar fertilization (1)	Reuse the water from the cellar washing to clean the floors (1); Reuse the water coming from the bottling line for different uses (1); Reuse wastewater to test the tightness of wine barrels (1) Reuse of purified wastewater for irrigation, civil and industrial uses (1).	Recovery of labels for reuse on other bottles (1); Bottle reuse (1).	Creative reuse of glass bottles (8) Returnable glass bottle.
Recycle	Chopping of vine shoots in the field as fertilizers/soil improvers (1); Burial of crop residues together with manure in the surface layers of the soil (1, 3) and possibly enriched with mineral elements such as phosphorus and iron as fertilizers/amendments (1).	Direct spreading on land for agronomic use (direct agronomic use) of grape pomaces (1,21); Composting (indirect agronomic use) of grape pomaces (1, 21). Allocate the wastewater with the highest polluting load to anaerobic digestion plants to produce digestate to be reused as a soil improver in agriculture (1).	Separate waste collection of packaging (paper, glass, and plastic) (1,15).	Separate waste collection of packaging (paper, glass, and plastic) (15).
Industrial symbiosis	Use of leaves for food purposes (1); Recovery and characterization of grape leaves by extraction of bioactive compounds (1); Pelletization of biomass (1, 4, 5,17).	Use of grape pomaces in Distillery to produce food (grappa), alcohol for industry (1); Use of grape pomaces in biorefineries for Food industry for grape seed oil (19); and Zootechnical industry, in the preparation of feed (1, 12, 21); Use of grape pomaces in biorefineries to produce components in Pharmaceutical, cosmetic, chemical, packaging industry (1, 12, 21);	Use of glass sand for the ceramics and cement industry (10)	

Energy Recovery	Energy production from vine wood of heat (1,2,18); Energy production from vine wood of gas oil (1,2,18).	Anaerobic digestion plants for wastewater with higher polluting load for biogas production (1) Recovery, quantification and gasification of pruning vine shoots / grape pomace for energy purposes (biogas, thermic energy, biofuels) (6, 7); Use of grape pomaces in Distillery to produce bioethanol for transport (1,22).		

Legend: In annex 1 we provided the list of cited papers used to classify waste management practices in the sector. **Source:** Authors' elaboration based on literature review.

Viticulture

In the agricultural phase, the main crop residue are the leaves and vine shoots removed during winter pruning (Novello, 2015). These wastes, to date, do not have a well-defined disposal chain (Pedrazzi S. & Allesina G., 2020). However, these residues, if reused, can generate added value for businesses.

Waste prevention. In the scientific literature analysed, several practices are present to prevent and limit waste production in the agricultural phase. The first technique is related to the efficient pruning of plants. Pruning is considered the key practice for regulating vegetative-productive development and controlling production in terms of quantity and quality (Sposato et. al, 2018). In addition to stimulating plant productivity, it prevents the onset of diseases and thus safeguards the plant from pathogenic elements (Colapietra, M. et al, 2002). Together with the techniques of precision viticulture, which guarantee knowledge of the state, health, vigour, and physiological needs of the vines in specific areas of the vineyard, they make it possible to adapt cultivation techniques precisely to the needs of the plants. In this way, grape production is more sustainable, safe, and with fewer pruning residues to dispose of

Reuse. According to the scientific literature, two practices have been found for reusing agricultural residues from the agricultural phase: the first concerns the use of foliage as fertilizer (Sposato et. al, 2018). Plants can absorb nutrients through their leaves (Lalatta F., 1957). This method allows for to integrate and correction of some mineral deficiencies (such as calcium salts, magnesium, or boron deficiency). A further fertilization technique is obtained thanks to the reuse of wastewater from cellars (Sposato et. al, 2018). It is possible to reuse wastewater for agronomic purposes by spreading it into the ground, within the limits imposed by law

(Legislative Decree 152/2006).

Recycle. The techniques for recycling the pruning are different. The shoots rich in organic and nutritional substances are fundamental for the good and lasting fertility of the soil (Meglioraldi et all, 2007). In this sense, the recycling practices that concern them are different. First of all, it is possible to cut the vine shoots directly in the field. This practice can return a certain amount of humus to the soil annually, saving on fertilizers and management costs (Sposato et. al, 2018). Another technique for the recycling of pruning residues consists in using the wood chips in layers with the manure in heaps greater than 150 and left to ferment for 3-5 months (Meglioraldi et al, 2007). The generator fertilizer can also be enriched with additional mineral elements (phosphorus and iron).

Industrial symbiosis. In this phase of the supply chain, results from the literature review highlights two possible practices to be classified as "industrial symbiosis". The first concerns the use of grape leaves in the food industry (Sposato et. al, 2018). Grape leaves are used as a culinary ingredient in the kitchens of different countries (such as Italy, Greece, and Romania). The second opportunity is given by the vine shoots, which once placed in bales, and left to naturally dry in the air, are then ground for the production of pellets (Pedrazzi S. & Allesina G., 2020). In particular, the agripellets produced with raw materials with lower ash content, such as for vine pruning, have characteristics very similar to wood chips. This aspect promises an interesting potential for use as an alternative or reserve fuel in district heating systems, in rural users, or in industrial boilers (Toscano, 2013).

Energy recovery. The alternative and final use of vine shoots is their use of energy as biomass. According to Novello, pruning residues can amount to a few tons per hectare (Novello, 2015). With
4.25 kg of vine shoots, the heat generated by 1 kg of diesel is generated, while the gasification of the vine shoots can lead to yields of around 4.25 kW / ha (Corradi, 2006). This type of use of the residue generates a series of economic and environmental advantages. The pruning residues can be arranged in bales by the farm. If the bales are small, through special boilers inside the company, they can be transformed into energy, giving the farm greater energy autonomy. Conversely, if the bales are large, the vine shoots must first be chipped. For this reason, the biomass is sold outside (consortia). In this way, diversification of income sources and a general increase in employment is generated for the farmer (Sposato et. al, 2018). Furthermore, this practice guarantees an environmental gain in terms of pollution reduction.

Wine Production

During the wine production phase, the waste is mostly of two types: the residues deriving from the processing of the fruit and the wastewater deriving from washing the equipment. The former is essentially composed of the stalks obtained after pressing the grapes, the pomace resulting from the pressing phase, the lees obtained

following fermentation, and the filtration residues resulting from the clarification process (Bioactive-net, 2008). The volume of solid waste produced during the vinification phase represents approximately 20% of dry matter of the harvested grapes (Da Porto C., 2013). In this sense, the valorization of these residues is extremely important as it allows to obtain economic and environmental advantages (Sposato et. al, 2018).

Waste prevention. The actions to prevent the production of waste found in the scientific literature essentially concern the minimization of water consumption and the consequent lower production of wastewater. In this case, it is possible to act on multiple factors. First, it is possible to promote greater awareness of the importance of saving water resources for employees, directly acting on the prevention of wrong behavior (Sposato et. al, 2018). Secondly, good practices can be implemented directly on equipment and process lines. Examples concern the washing of the systems when exclusively necessary or the alternation of water jets with compressed air for washing the equipment. The latter practice involves a 50-75% reduction in water consumption compared to low-pressure systems (Sposato et. al, 2018). Thirdly, use the water footprint to monitor direct and indirect water consumption linked to the consumption of fresh water in the vineyard and the wine production process (Sposato et. al, 2018).

Reuse. The reuse practices related to the wine production phase mainly concern, also, in this case, the water resource. In fact, according to Aeneas, it is possible to reuse water:

- washing the cellar for cleaning the floors;
- washing in the bottling line through special by-passes, and reusing it in the same processor for cleaning tanks or tankers, or, for cleaning floors or irrigating fields;
- of wastewater to test the tightness of the barrels.

Recovering wastewater and reusing it in these different ways allowed, in addition to saving water consumption, to avoid its mixing with another wastewater. This could create difficulties in purification plants or reduce the potential for energy production (Sposato et. al, 2018).

Furthermore, wastewater, after having been purified (Decree 185/2003, Legislative Decree 152/2006), can be used for irrigation, civil and industrial uses.

Recycle. The practices analysed in the literature concerning the possibilities of recycling of by-products and waste deriving from the winemaking process within the same company concern the possibilities of spreading on the land, and their indirect use in agriculture from their composting and subsequent use as fertilizer. According to the literature, it is also possible to reuse wastewater with a higher polluting load as digestate to be used as a soil improver in agricultural fields (Sposato et. al, 2018). This practice takes place by sending the wastewater to anaerobic digestion plants, were once treated, they enhance the production residue by decreasing the environmental impact and the production of waste.

Industrial Symbiosis. The residues deriving from the vinification phase can be considered as by- products with high added value. They represent a considerable source of organic matter, polyphenols, nitrogen, and micro and macro elements. In particular, by processing the product in biorefineries it is possible to transform the biomass of production residues into a range of bio-products that can be used as raw material for various industries (Da Porto C., 2013):

- Food, Pharmaceutical, and Cosmetic. These industries can exploit bioactive compounds (nutrients, antioxidants, and antimicrobials) in their productions (Sposato et. al, 2018). These components are the raw material of other industries, an example concerns the production of food supplements (Da Porto, 2013), or the production of dyes through grape skins (Sposato et. al, 2018).
- Animal husbandry. The pomace, together with grape skins, can act as supplements/additives for animal feed (Sposato et. al, 2018).
- Chemistry, Biomedical, and Packaging. These industries can exploit the great opportunity derived from biopolymers (Da Porto C., 2013). An example concerns the production of Bioplastics to produce packaging (Da Porto C., 2013).

Sold individually in the distillery, the pomace and lees become the raw material to produce grappa, alcohol for food and industrial use, but also the production of bioethanol, dyes, and grape seed oil (Sposato et. al, 2018). This destination represents a double economic advantage for the agricultural entrepreneur. On the one hand, it is a source of income. Novello estimates an average price of 2.2 euros per quintal of marc and 4.5 euros per quintal of lees. On the other hand, sending production residues to the distillery represents an avoided cost related to waste disposal (Novello V., 2015).

Energy Recovery. The literature recognizes the fundamental role of waste deriving from the second phase of the wine production chain in the production of energy. The practices analysed are different and it is possible to recover all production residues. Biomass is a renewable energy source; therefore it gives rise to clean energies. First, the pomace can be used as a substrate for anaerobic digestion to produce biogas (Sposato et. al, 2018). Furthermore, the pomace can be further recovered after distillation and dried in pellets to produce heat and co-generation (Sposato et. al, 2018). Likewise, lees can be used for energy purposes to produce biogas together with other materials (Da Ros et all., 2014). It is also possible to recover energy even from wastewater with a higher pollutant load. They can be destined for anaerobic digestion plants to produce biogas (Sposato et. al, 2018).

Packaging

The waste produced in the third phase of the wine supply chain relates to the materials used in the packaging for the distribution and consumption of wine. Among these materials, we find glass, paper, Tetrapak, plastic,

cork, and aluminium.

Waste prevention. Wineries can use various practices to prevent the production of waste in the packaging phase. First, it is possible to limit the volume of materials used for packaging. In this sense, it could be useful to reduce the weight of the glass bottles or to replace the bottles with the Tetra Pak. Tetra Pak packaging is lighter than glass, which generates additional benefits such as lower product shipping cost, and thanks to the flexibility of the packaging, it is less likely to break, reducing product loss and damage. induced by the rupture (Thompson-Witrick A. et all, 2021).

A further practice to be implemented to favour the reduction of the quantity of waste related to packaging is the sale of bulk wine (or bag in box wine). The packaging of wine has continued to evolve over the years and the sale of wine, and the bag-in-box can be counted among the most significant changes in the distribution and sale of the product. Bag-in-box packages consist of a bag of plastic material enclosed in a rigid box (Thompson-Witrick A. et all, 2021). This practice allows to reduce the number of materials used for storage (Sposato et. al, 2018) and reduces packaging for the consumer to zero. According to the report "Bag-in-Box Market" published by Markets and Markets, the bag in box market is s projected to grow from USD 1.6 billion in 2019 to USD 1.9 billion by 2024, at a CAGR of 3.8%. So, also the industry would benefit of this growing trend.

Reuse. The practices concerning the reuse of packaging within the company are related to the recovery of empty bottles and the recovery of labels for reuse on other bottles (Sposato et. al, 2018). These practices make it possible to limit the number of raw materials to be purchased for the production of wine and also reduce the quantity of waste produced and therefore the related costs for their disposal.

Recycle. The best recycling practice for packaging is a separate collection. In addition, two of the materials present in the packaging, glass, and aluminium, can be infinitely recycled, bringing waste materials to new life.

Industrial Symbiosis. An example of industrial symbiosis comes from glass recycling. Glass treatment plants give rise to types of waste that appear in the form of sludge and dust containing large quantities of glass. The industries that use these wastes as raw materials for their productions are the ceramic materials industries, and the cement and road substrates industries.

Consumption

The last phase of the supply chain analysed from the place exclusively to the waste deriving from the packaging of the wine.

Waste prevention. The packaging is labelled such as to contain for consumption to read the instructions to facilitate the delivery of differentiated waste and recycling of organic waste. The environmental labels shown on the pack play an interesting role in talking to the consumer about the characteristics of the product and of the pack itself (Conai, 2021). Raising awareness among citizens and businesses is very important to obtain better results and spread the culture of recycling, to facilitate the transition to the new production model and the circular economy.

Reuse. The re-use activities adopted to date are limited to the possibility for consumers to practice the vacuum to return directly with companies. This practice favours a win-win situation, both for the consumer and for the producer. For the consumer, there is an economic saving, while for the producer a cost is avoided in the acquisition of the packaging necessary for the distribution of wine. Furthermore, in the literature, there are also practices of creative reuse of packaging by consumers. Once consumed, the packaging can take on a new life by acquiring added value (upcycling), for example in terms of aesthetic value for the person who reuses it (Wilson, 2016).

Recycle. The best practice for recycling products related to the wine sector is the separate collection. This practice makes it possible to adopt the waste in a differentiated way to the collection and recovery centers. In this way, the recycling of discarded materials is optimized.

4. Conclusions

The current context of resource scarcity, global climate change, environmental degradation, and rising food demand are major problems in our present and the future. In this sense, the circular economy represents a promising strategy to support sustainable, resilient, restorative, and regenerative agriculture.

Agriculture is one of the sectors in which it is easier to close the cycle of resources used for production. The great opportunities that derive from the various agri-food chains lie in its natural ability to produce a series of transversal by-products in different sectors: from the agri-food sector itself to the textile, cosmetic, pharmaceutical sector or, finally, many of these residues have the potential to become energy, as happens in biorefineries. This happens in the wine industry. Indeed, following the grape processing to obtain wine, a series of by-products and waste can be transformed into valuable products.

However, applying the circular economy means rethinking all the phases of the supply chain in a more sustainable way and researching and applying all the practices for managing the waste produced. This paper, following all the stages of the wine supply chain, has highlighted the best waste management practices, trying

to categorize them within the circular economy processes.

The results showed how the wine sector can be considered as a zero-waste industry. If correctly applied, waste management practices can not only reduce pollution and the impact on resource depletion, but also bring economic gains for companies in the sector.

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Information Challenges in a Circular Economy

An empirical investigation of the availability and quality of sustainability-related data in the manufacturing sector

Magdalena Rusch, Josef-Peter Schöggl, Rupert J. Baumgartner

Christian Doppler Laboratory for Sustainable Product Management enabling a Circular Economy, Institute of Systems Sciences, Innovation and Sustainability Research, University of Graz, Merangasse 18, 8010 Graz, Austria, magdalena.rusch@uni-graz.at

Abstract

To move from a linear to a circular economy, stakeholders along the value chain need sustainability-related data, e.g., about the composition of products and their state of health, from the entire product life cycle, and preferably in digital form. Manufacturing companies play a vital role in collecting and sharing data along the supply chain (in an automated way), enabling more transparent product life cycles and getting closer to creating so-called digital product passports. Furthermore, these sustainability-related data are essential for sustainability assessments and product compliance, i.e., fulfillment of product-related laws. However, data management along the product life cycle is challenging for several reasons, e.g., it requires a lot of time to collect data, and the willingness to share data is lacking. This study shows what sustainability-related data is already available, in what quality it is available, and what problems companies encounter when acquiring or using it. Our results demonstrate which kind of (high-quality) data is there in manufacturing companies and what challenges they face regarding collecting and using data internally and from their suppliers. Also, the advancing digitalization to find ways to ease the identified challenges is part of the discussion. The results could be the starting point for further research on how certain information challenges in a circular economy could be dissolved.

Keywords: Smart Circular Economy, Sustainability, Data Management, Digitalization, Survey

1. Introduction

The current way of extracting and processing primary resources cause around half of the total greenhouse gas emissions released and more than 90% of the biodiversity loss on the planet (IRP, 2019). How companies

create value and do business is an important factor and source of emissions and waste (Whiteman, Walker, & Perego, 2013). A promising approach for advancing the sustainability of value chains and value creation is the concept of a circular economy or circular economy business model where the consumption of (virgin) resources and the generation of waste is decreased by slowing, narrowing or closing resource loops (Bocken, de Pauw, Bakker, & van der Grinten, 2016; EMF, 2015).

One critical part of enabling a transition towards a more sustainable and circular economy is (consistent) data flows along the value chains (Luoma, Toppinen, & Penttinen, 2021). Data can be defined as elementary symbols that are based on the observation of events or objects (Rowley, 2007). Data needs contextualization to bring value or direct usability (Kristoffersen, Blomsma, Mikalef, & Li, 2020). For assessing and improving the sustainability performance of products, sustainability-related data about the product, its parts, or materials must be shared in a structured way with various stakeholders, from manufacturers, importers, and distributors to repairers, remanufacturers, and recyclers (European Commission, 2022). Also, the consumers should be able to make informed decisions about the product, e.g., increased transparency enables them to choose more sustainable products (European Commission, 2020). As soon as data is transformed by using techniques such as sorting, selection, aggregation, or interpretation, it becomes information (Kristoffersen et al., 2020; Rowley, 2007). For example, at the design phase, data about product characteristics and disassembly procedures are gathered, and by sharing it with different stakeholders along the value chain, it can be "transformed" into information that facilitates the repair of a product (Acerbi, Sassanelli, Terzi, & Taisch, 2021).

However, the current lack of sustainability-related data that are shared along the product lifecycle limits the ability to offer more sustainable products (European Commission, 2022). Sustainability-related data such as material composition, production processes, state of health, or transport distances are vital for sustainability assessments, e.g., Life Cycle Assessments (LCAs), to treat products in a sustainable manner and according to their intended purposes in a circular economy. For example, with increased and structured sustainability-related data, the product life can be prolonged by enabling predictive maintenance activities (European Commission, 2020). Thus, for manufacturing companies, sustainability-related data is essential for (data-driven) decision-making and process execution in a circular economy (Preut, Kopka, & Clausen, 2021). They depend on accurate, high-quality data from the entire product lifecycle to conduct LCAs and make informed decisions (Luoma et al., 2021). They need the product, material, and process data, hence data from their own activities and upstream and downstream stakeholders along the value chain. These data are not always available due to several problems regarding consistent data flows along a (circular) product life cycle. For example, other studies report a low willingness of the respective stakeholders to share data due to issues concerning the sensitivity or disclosure of data (Bressanelli, Adrodegari, Pigosso, & Parida, 2022), and if shared, it can be incomplete or incorrect (Grambow, Mundbrod, Kolb, & Reichert, 2015; Ingrao et al., 2021).

Different problems can also arise depending on the data source (e.g., internal or supplier data) or tasks that need to be done (e.g., data collection or utilization). Some companies have already implemented software solutions for data management tasks, and others collect the data in specific files (e.g., MS Excel) (Grambow et al., 2015). This implies that the variability of assessing (internal) data can be quite high and lead to large delays if the data is not yet available but must be gathered manually before sharing (ibid.). Although research on the importance of (real-time) data collection and sharing to enable a more sustainable and circular economy has received increased attention in the last few years (Fritz, Schöggl, Baumgartner, 2017; Ingrao et al., 2021; Luoma et al., 2021), research about the status quo of data availability and quality, in the manufacturing sector, remains scarce (Schöggl, Fritz, & Baumgartner, 2016). Therefore, the present study attempts to address the following research questions: 1) What data are available for companies' sustainable product management, and what is the quality of such data? And 2) What are the most common data acquisition and usage problems of companies?

This study aims to identify the status quo of the availability and quality of sustainability-related data in (manufacturing) companies and data collection as well as data utilization problems. The discussion section outlines the potential of digitalization advancements to ease information challenges, and further research issues are described.

2. Methods

Firstly, data acquisition and usage problems of sustainability-related data were compiled and analyzed from the literature. Secondly, a survey was used to examine the status quo of the data availability and quality as well as the most common acquisition and quality problems of sustainability-related data in companies. The telephone survey was conducted between February and December 2021. In total, 1549 manufacturing companies were contacted using a random sampling method. The survey was answered by 132 sustainability managers or CEOs from Austrian manufacturing companies which is a response rate of almost 9%. The survey questions can be found in Appendix A. In this survey, a 5-point Likert scale was used, ranging from "not available at all" to "fully available" for the data availability part and from "insufficient" to "very good" for the data quality part. The third part consisted of questions about the frequency of data acquisition and usage problems, and here the response options ranged from "never" to "always" (Table 1.).

Table 1. Scales development for the survey (full questionnaire see Appendix A).

Survey scales	Number of questions/items	Response options	Sources
Demographics	3		
Data availability	Internal: 6 Suppliers: 8 Use– and end-of-life phase: 3	1. not available at all, 2. scarcely available, 3. partly available, 4.largely available, fully available	(Schöggl et al., 2016) + own definition
Data quality	Internal: 6 Suppliers: 8 Use– and end-of-life phase: 3	1. insufficient quality, 2. low quality, 3. satisfactory quality, 4. good quality, 5. very good quality	(Schöggl et al., 2016) + own definition
Data acquisition and usage problems	Internal data collection: 5 Supplier data collection: 5 Data usage problems: 4 + open question about other data collection or management problems	1. never, 2. rarely, 3. sometimes, 4. oftentimes, 5. always	(Schöggl et al., 2016) + own definition

The data analysis and graphical depiction were done using descriptive statistical methods and the programs MS Excel and "R" (R Core Team, 2019). The sample characteristics are illustrated in Figure 1. Most companies belong to the machinery and metal goods industry, followed by companies from the chemical and food industries. Finally, companies with other industry affiliations than those shown in Figure 1a were summarized under the category "other" which includes companies that, e.g., focus on the production of sports equipment, furniture, printing equipment, or ceramics. Figure 1b and Figure 1c show that most companies in the sample are small companies with an annual turnover below 10 million euros and below 50 employees (46%). Middle-sized companies with 50-250 employees account for a share of 32%, and large companies with more than 250 employees account for 22%.

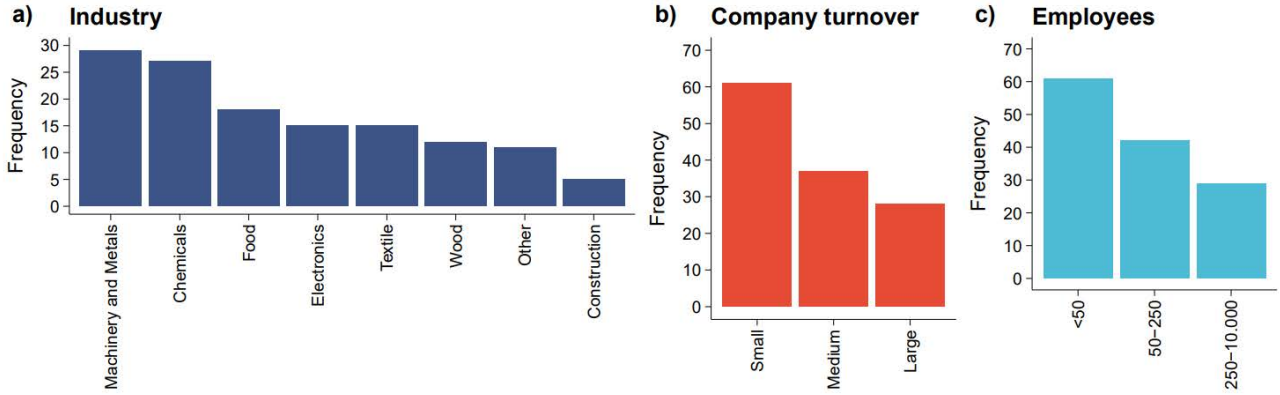

***Figure 1**. Characteristics of the companies in the sample. a) Distribution according to industry. b) Distribution according to company turnover. Small <= 10 Mio. Euros turnover, Medium <= 50 Mio. Euros turnover, Large > 50 Mio. Euros turnover. c) Distribution according to the number of employees.*

3. Results and Discussion

In our findings, the data sources were categorized into three areas: company-internal, supply chain, and the use- and end-of-life phase, to assess the data availability and quality. Additionally, questions about problems with the data acquisition (internally and from suppliers) and data utilization were included in the survey.

Company internal data availability and quality

As shown in Figure 2, the availability of data from internal company processes is considered already high in general and especially high for data about the total energy use (84% sum of all blue bars) and the waste generation (80%) of the companies. For the other three areas, at least 60% of the companies stated that data about the energy consumption per machine (65%), the recycling rate of the company (61%), and the total emissions (61%) are partly, largely, or fully available. The highest share of data that is not at all or only scarcely available is data about the companies' recycling rates (23%) and total emissions (22%). The highest percentage of answers about "missing knowledge" (colored in dark red) was reported when we asked about the companies' total emissions (n=23). An open question about other available data for sustainable product management showed that no other data was reported in almost all cases except in one case where a respondent from the electronics industry mentioned that the company has data available about the use of the building. Regarding the data quality, the results show that largely or fully available data are also there in very good quality (e.g., total energy use within the company). Data about waste generation is also there but less often of very good quality. Internal companies' data availability and quality are generally already high and good.

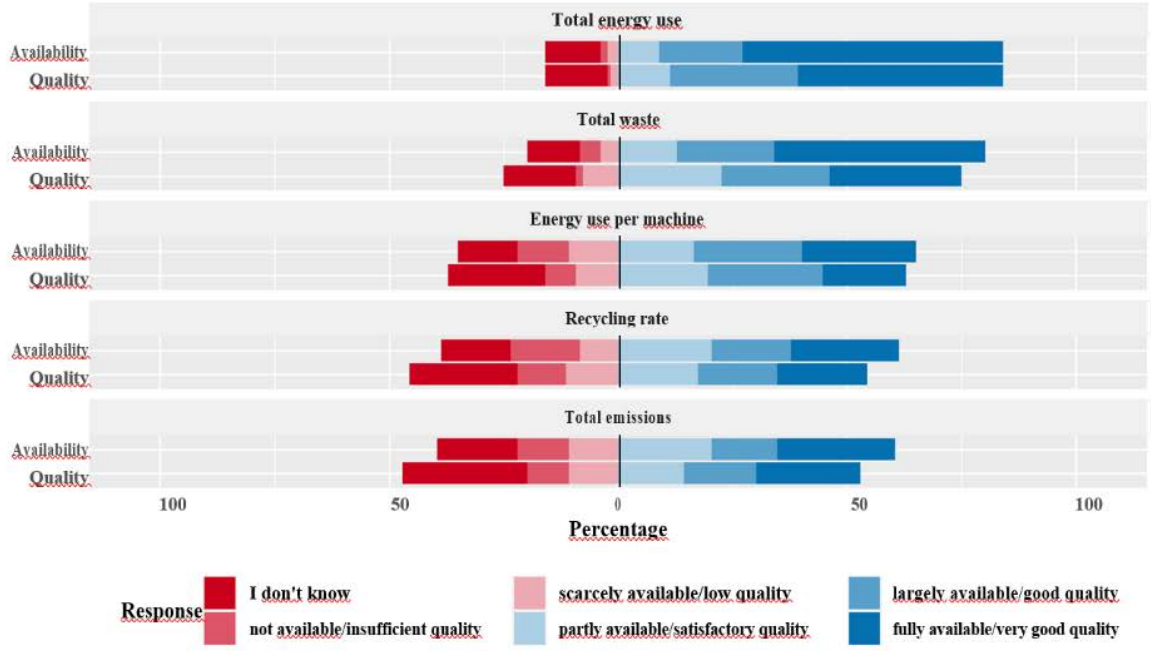

Figure 2. *Company internal data availability and data quality.*

Supply chain data availability and quality

Data from suppliers are primarily available for the material composition of products or parts of the product (79%, sum of all blue bars), and at the same time, the data are available in high quality (Figure 3). Interestingly, legally required data from regulations like registration, evaluation, authorization, and restriction of chemicals (REACH), restriction of hazardous substances (RoHs), or conflict minerals data are only available in 73%. However, a quite high number of companies (n=24) did not know if the data were available. This could mean that the regulations do not apply in their industry. Almost 69% of the companies have data available about the transport distances of their products and 67% about the production procedures employed in the supply chain, at least partially. The least data are available about the waste generated in the supply chain (46% are not at all available, and 0% are fully available). The data quality correlates positively with the data availability. The data quality is also the highest for the first four aspects with the best data availability. Respectively for the aspects: material composition of the product or its parts, compliance (legally required information), transport distances, and employed production procedures, the data availability and quality are high. The lowest data quality was reported to come from data about the waste generation and emissions within the supply chain, with 25% and 21% that say it is insufficient.

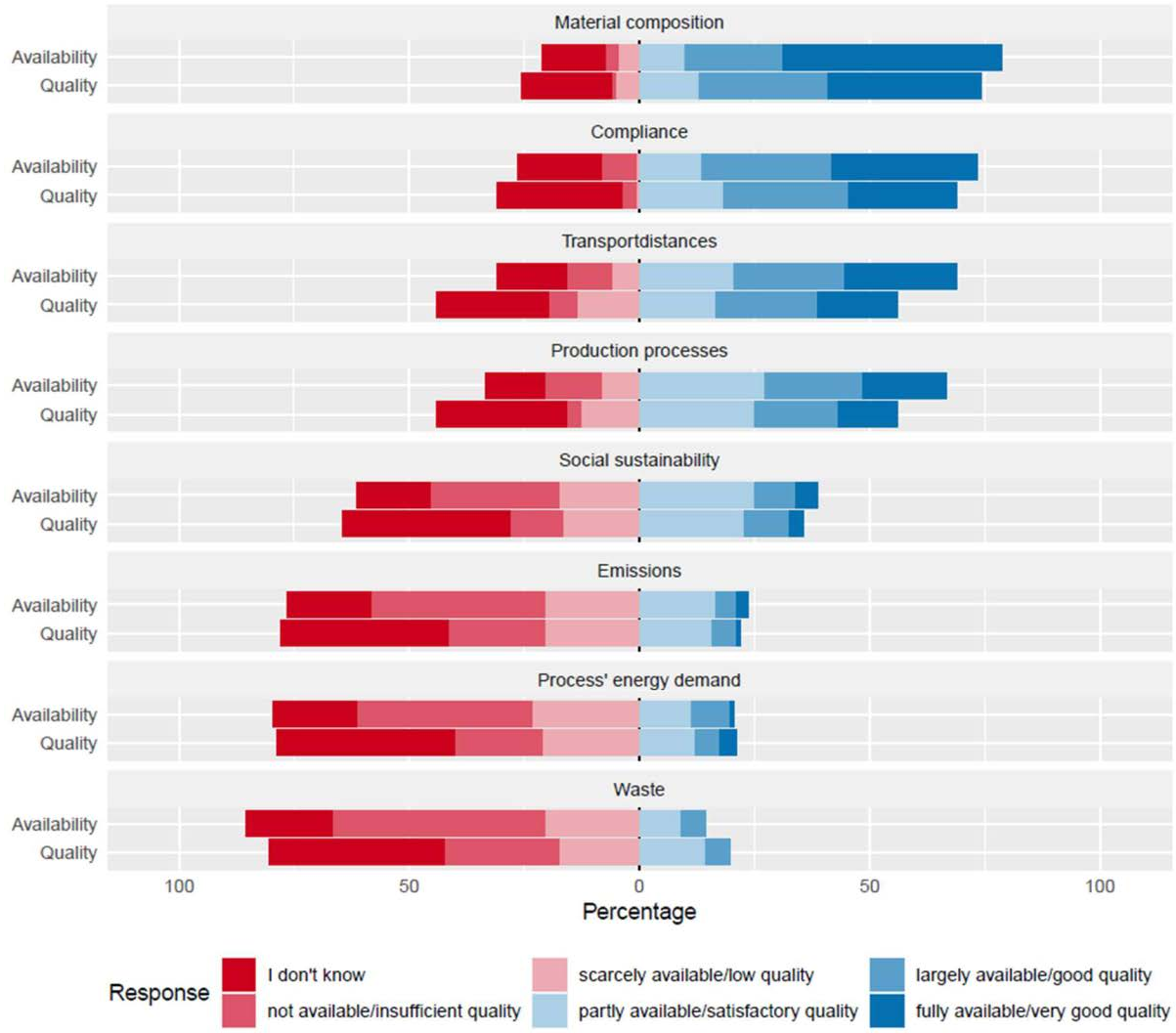

Figure 3. *Supply chain data availability and data quality.*

Use- and end-of-life phase data availability and quality

The companies were also asked about the data availability from their products' use- and end-of-life phases (Figure 4). Around 37% (sum of all blue three bars) of the companies in our sample have some data available about the energy demand during the use of the product but, in most cases, only partially. In 23% of the cases, such data is not available at all. Data about the end-of-life routes are available in 30%, and data about the recycling rates are available in 27% (sum of all three blue bars). However, the number of respondents who don't know if this data is available is the highest (n=36) for the latter aspect. The data quality is satisfying,

good, or very good in 33% for the energy demand in use, 29% for the end-of-life routes, and 23% for the recycling rates.

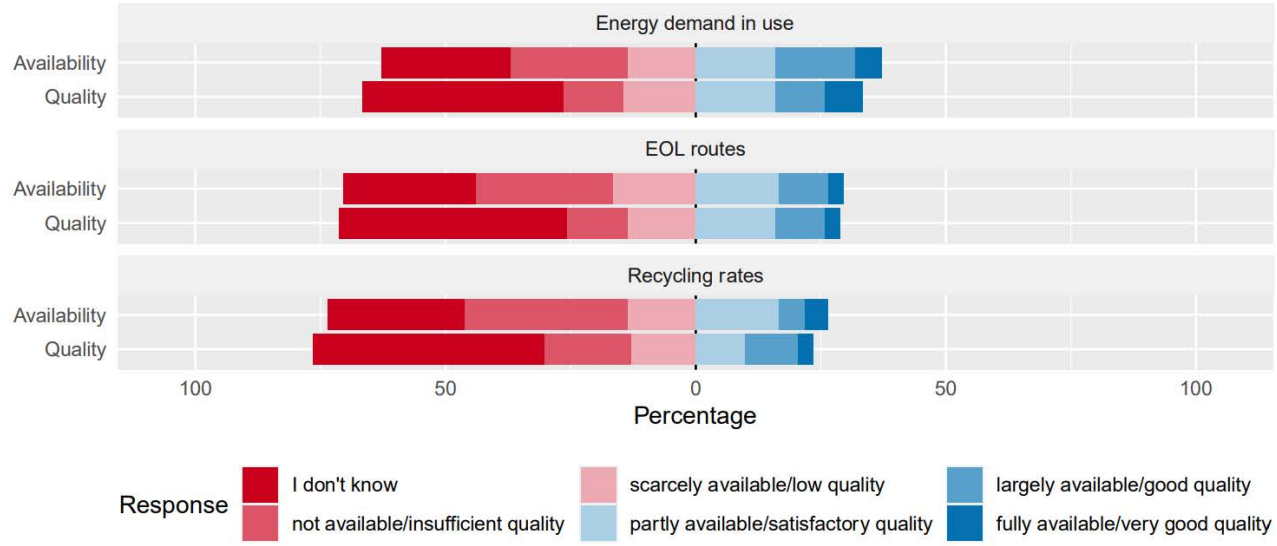

***Figure 4**. Use- and end-of-life phase data availability and data quality. EOL = end-of-life*

Data acquisition and usage problems

The most common problem for internal data acquisition is the required time for collecting the data (56%, the sum of all blue bars in Figure 5a). Additionally, 39% reported problems with internal communication between persons/departments. Other problems are data collection costs (35%), missing data (33%), and the data's confidentiality is only an issue for 11%.

Analyzing the data acquisition problems in the supply chain (Figure 5b) showed that 48% have issues with suppliers' insufficient knowledge about sustainability topics. Also, incomplete data is a problem in 42% of the cases. Missing data, confidentiality, and incorrect data are a problem for 31%, 30%, and 28%, respectively. In almost all cases, these problems are "sometimes" the case, and respondents rarely said this is "always" the case.

The sustainability managers/CEOs were also asked about the most common data usage problems (Figure 5c). They ranged from the time required for data usage/analysis (56%), lack of sustainability expertise of employees (49%), and a variety of sustainability assessment methods (44%) to the least often mentioned problem about the cost of data use/analysis (38%). An open question was included to give the possibility to add any other issues that sustainability managers face when collecting and managing sustainability-related data. However, no additional problems were mentioned by the 132 respondents of the survey.

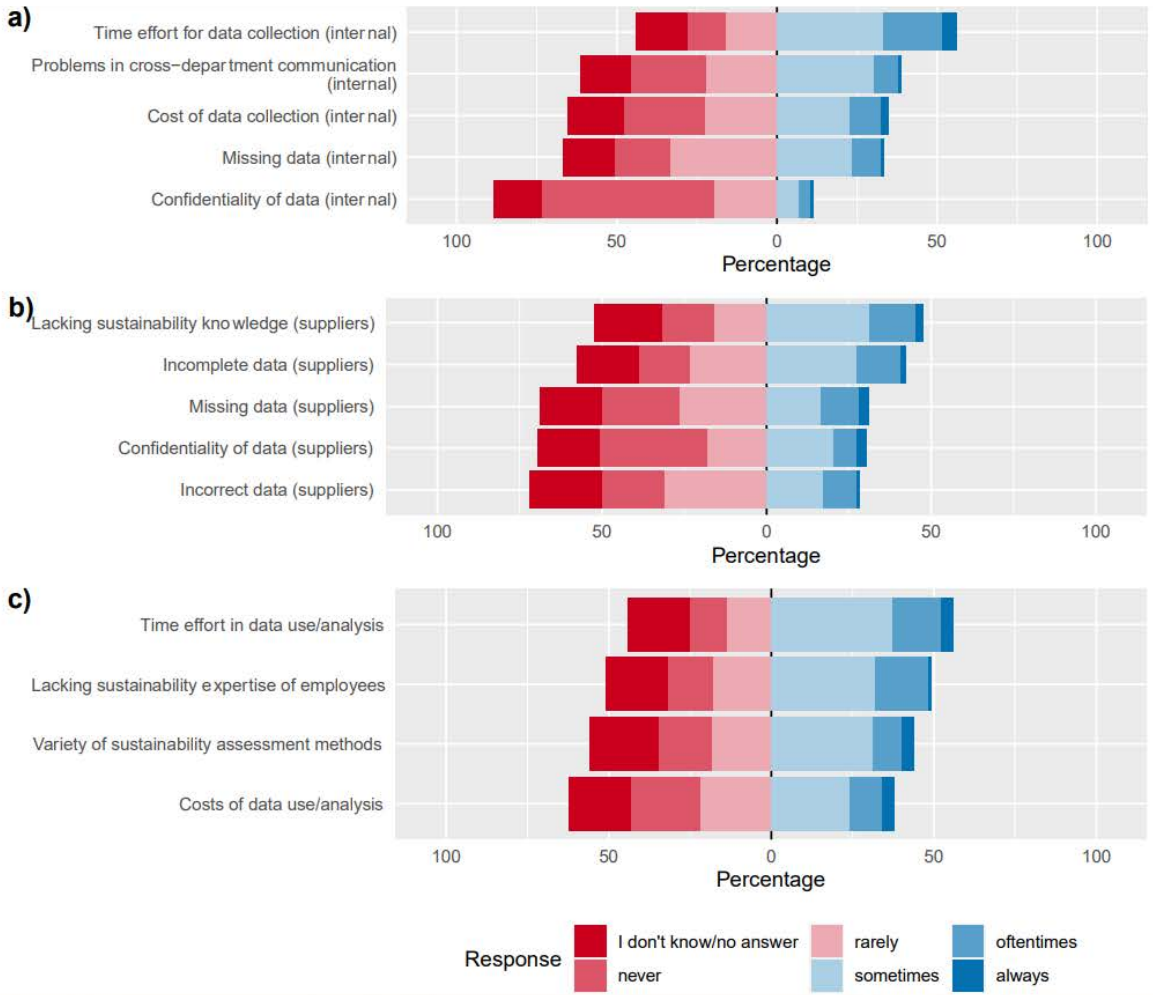

***Figure 5**. Data acquisition problems a) internally and b) from the supply chain. c) Data usage problems.*

4. Discussion

Most high-quality data are available from the companies' internal processes, e.g., energy consumption and waste generation. Even the energy consumption per machine, which is an important input for product LCAs, is already quite well known. However, there is a problem with internal data-sharing or cross-department communication. When we asked about data from suppliers, the availability becomes less, e.g., for the energy consumption of production processes or waste generation in the supply chain, and the suppliers' knowledge about sustainability topics is also lacking. Furthermore, very little data are available from product use- and end-of-life phases. Others also confirmed that the information flow often stops after the product is handed over to the user/customer (Preut et al., 2021). The lack of available data from stakeholders throughout the product lifecycle, including information about the materials used, design features, standards, or actual costs

of end-of-life treatment of products, makes it difficult for stakeholders to make informed decisions (Sachdeva, Araujo, & Hirschnitz-Garbers, 2021).

For example, at the end-of-life phase, stakeholders could treat products differently if they knew more about the materials used (for less complex products with limited parts) or the actual state of health of the product (for more complex products).

However, which data should be collected or how such data can be managed is not only an information technology (IT) oriented issue but a strategic (data management) question (Grover, Chiang, Liang, & Zhang, 2018). Before data are collected, a clear goal and purpose for why specific data are needed should be determined (Stryeck, Jean-Quartier, & Tschabuschnig, 2022). Otherwise, collecting, storing, and aggregating data that are never used could lead to high (economic and environmental) costs (ibid.). Unfortunately, when such a decision should be made, it is not always clear which data (type and format) will be useful in the future. This "data management/collection paradox" makes it even more challenging to decide early (e.g., in the product design or development phase) which data should be collected now or during the use phase of a product. For instance, it could be beneficial to gather information about how previous versions of a product were used and treated at their end of life to improve the current product design. By embedding sensors into new products and adding unique identifiers, data could be gathered to provide information for future design-for-circularity activities, and this could be passed on (digitally) to customers and end-of-life actors that can be helpful later to support the realization of different circular economy strategies.

As a starting point, a minimum requirement of data that needs to be shared along the value chain of products is defined in a proposal for the so-called "digital product passport" for various products in the European Union (EU) (European Commission, 2020). Structured information should be shared along the product lifecycle to help make informed and data-based decisions. For example, a product's sustainability impact or state of health could be assessed more easily with the means of a digital product passport and, at its end-of-life, it can help treat products in a circular economy according to their intended purposes (Lemos, 2020). Also, tracking the origin of a product and transparently storing and sharing information along the value chain by using blockchain technology for such a passport is discussed in the literature (Böckel, Nuzum, & Weissbrod, 2021; Saberi, Kouhizadeh, Sarkis, & Shen, 2019). Because of examples such as the latter, blockchain technology is described as a potential enabler to overcoming some information challenges in a circular economy.

Manufacturing companies will have to provide (sustainability-related) data to enable such a digital product passport. Therefore, they need a lot of data about their products and processes (e.g., it could become mandatory to report on the sustainability impact of a product). However, our assessment showed that companies often lack data, especially from the use- and end-of-life phase, as well as data from the supply chain (e.g., emission and waste data). And to derive valuable insights from these data, several dimensions of the data quality are

essential, e.g., completeness, timeliness, consistency, or accuracy (Grover et al., 2018). The quality of the supply chain data (e.g., about the waste generation, energy consumption, or emissions) is rather low in most cases of our sample. Here, the goal should be to define data quality standards to facilitate the data management of all stakeholders and enable the opportunity to use the collected data also for analytical tasks. Further research is needed on how the quality of sustainability-related data can be assessed and secured. For example, data science approaches could help enable automated plausibility checks of this data.

Among other things, the manufacturing companies also reported problems with the time required to collect data internally and incomplete data from suppliers. The advancing digitalization could facilitate collaborative action from the supply of raw materials to final disposal, allowing for a better analysis of environmental, social, and economic impacts (Siltori et al., 2021). The use of new digital technologies could facilitate the collection, management, and exchange of sustainability-related product data to further contribute to a circular economy (European Commission, 2020). For example, internet-of-things applications could help collect production or supply chain data (Gligoric et al., 2019). Tracking the origin of products is seen as a typical example of the use of blockchain technology (Böckel et al., 2021), and big data analytics has a considerable potential to support sustainability and circularity-related decision-making throughout a product's life cycle (Rusch, Schöggl, & Baumgartner, 2022). This could help manufacturing companies achieve their circular economy and sustainability goals by enabling the flow of materials and information (Di Maria, De Marchi, & Galeazzo, 2022). Nevertheless, good data availability and quality are only the starting point for generating valuable insights and knowledge for decision-making (Grover et al., 2018). Companies that want to reveal the value of data must also take care of skillful human resources and the right analytical tools (ibid.).

5. Conclusions

In this study, the availability and quality of sustainability-related data from the product life cycle and problems with the data collection and use were examined by conducting a survey with 132 sustainability managers from manufacturing companies. The results show that both the data availability and quality rank from high (internal data) to rather low (supply chain data) and low (use- and end-of-life phase). Thus, most companies still lack sustainability-related data, hence information about waste generation in the supply chain and the use- and end-of-life phase of their products and materials. However, to perform sustainability assessments like LCAs and for data-based decision-making in companies, high availability and high-quality data are necessary for a solid outcome. Based on our empirical findings, and as a next step, solutions to easing these data-related problems and information challenges are being developed. For example, applying digital technologies and data-science approaches could help reduce these challenges. However, more research is needed on how to use them to

facilitate consistent data flows along circular product lifecycles because closing information gaps along product- and material lifecycles is demanding but necessary in a circular economy.

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Appendix A: Questionnaire

Demographic questions

- Industry affiliation of your company?
- Sales per business year?
- Current number of employees in your company (or subsidiary in the case of a group)?

Data availability

Response options availability: 1. not available at all, 2. scarcely available, 3. partly available, 4. largely available, 5. fully available

***Table A 1**. Survey questions about data availability.*

R-code	Questions
	How would you rate the availability of the following data that you (can) use for sustainable product management?
dq	Total energy consumption in the company
	Energy consumption per production plant
	Waste generation in the company
	Total emissions in the company
	Recycling rate in the company
	Other data: .....
	How do you assess the availability of the following data from your suppliers that you (can) use for sustainable product management?
dq	Information required by law (REACH, RoHs, Conflict Minerals, ...)
	Material composition of the component/product
	Production processes used
	Energy consumption of the production processes used
	Waste generation in the supply chain
	Social aspects in the supply chain
	Transport distances
	Emissions in the supply chain
dq	**How do you rate the availability of the following data from your customers and the end-of-life/post-consumer phase that you (can) use for sustainable product management?**
	User behavior (e.g. energy demand during product use,...)
	End-of-life routes
	Recycling rates

Data quality

Response options data quality: 1. insufficient, 2. low, 3. satisfactory, 4. good, 5. very good

Table A 2. *Survey questions about data quality.*

R-code	Questions
	How would you rate the quality of the following data that you (can) use for sustainable product management?
dq	Total energy consumption in the company
	Energy consumption per production plant
	Waste generation in the company
	Total emissions in the company
	Recycling rate in the company
	Other data: .....
	How do you assess the quality of the following data from your suppliers that you (can) use for sustainable product management?
dq	Information required by law (REACH, RoHs, Conflict Minerals, ...)
	Material composition of the component/product
	Production processes used
	Energy consumption of the production processes used
	Waste generation in the supply chain
	Social aspects in the supply chain
	Transport distances
	Emissions in the supply chain
dq	**How do you rate the quality of the following data from your customers and the end-of-life/post-consumer phase that you (can) use for sustainable product management?**
	User behavior (e.g., energy demand during product use,...)
	End-of-life routes
	Recycling rates

Data acquisition and usage problems
Response options: 1. never, 2. rarely, 3. sometimes, 4. oftentimes 4. always

Table A 3. *Survey questions about data acquisition and data quality problems.*

R-code	Questions
dp	**What are the most common problems with internal data collection?**
	Missing data
	Confidentiality of data
	Time required for data collection
	Costs of data collection
	Problems with internal communication between persons/departments
	What are the most common problems with data collection from suppliers?
	Incomplete data
	Incorrect data
	Insufficient knowledge of sustainability issues among suppliers
	Confidentiality of data
	Missing data
	What are the most common problems in the use of data?
	Variety of sustainability assessment methods
	Lack of sustainability expertise
	Time required for data use
	Cost of data use
	Can you think of any other problems with sustainability data collection and management: …

Key-Drivers shaping Circular Economy Transitions

System dynamics method in the circular manufacturing systems

Manuel E. Morales [1], Lina Dagiliene [2]

[1] *School of Economics and Business, Kaunas University of Technology, Gedimino g. 50, 44029, Kaunas, Lithuania, manuel.morales@ktu.lt*

[2] *School of Economics and Business, Kaunas University of Technology, Gedimino g. 50, 44029, Kaunas, Lithuania, lina.dagiliene@ktu.lt*

Abstract

The complexity of circular manufacturing systems (CMS) plays a critical role in figuring out the best solution measures to accelerate and pave the transition pathway towards circular economy. The transition studies framework offers the ground to integrate Complex Adaptive Systems (CAS) and System Dynamics (SD) to build up a better transition towards a more circular economy (CE) in the manufacturing industry. The aim of this study is to identify the key-drivers that shape the value chain system's behaviour applying a multi-level perspective to better understand the CMS transition. The study uses a meso-level perspective to address value chain connectivity unfolding behavioural patterns between key-drivers in the Lithuanian CMS. Based on the systematic literature review, 12 key-drivers were identified as the causal enablers for the circularity transition. Moreover, empirical data was gathered from quantitative databases (OECD, Eurostat and Harvard Growth Lab) to further conduct interpretive systems dynamic modelling of the key-drivers' relationships. A panel of ten experts validated the key-drivers relevance, their direction and progression order, and set up the main challenges and the recommended solutions to engage a sustainable transition of CMS in Lithuania. Finally, the proposed CLD was validated by the experts' panel, and is expected to describe the behavioural patterns through feedback loops in the CMS. Interpretative analysis has pointed out the prescriptive divergences in comparison with the expected theoretical behaviour, therefore identifying the emerging challenges where the larger allocation of resources should be assigned to guarantee a successful circularity transition. Thus, the greatest challenges are expected to be addressed throughout the application of the solution measures proposed in the literature and adapted to the CMS for the Lithuanian national context. The originality of this study stands on taking a step back and trying to identify the causal drivers that shape the CE transition in the CMS, instead of looking independently at firms to disentangle the symptoms, barriers and business models in the micro-level.

Keywords: solution measures, multi-level perspective, complex adaptive systems, circular management systems, circular economy key-drivers

1. Introduction

Circular economy (CE) is understood as the regenerative system in which resource input and waste, emissions, and energy leakage are minimized while adopting cleaner technologies (Merli et al., 2018) and maintaining the value of products, materials and resources in the economy for as long as possible. The mainstream linear Manufacturing systems that run most economies in the world are orientated on the take-make-waste paradigm source of heavy pollution and resource-overconsumption, however without the systemic approach offered by the Circular Manufacturing System (CMS), traditional Manufacturing systems are not able to handle complexity issues and address unforeseen disruptions like the COVID-19 (Morales et al., 2022) or geopolitical conflicts like the Russian invasion in Ukraine that represent a risk for the value chain reliance (Herczeg et al., 2018; Ivanov & Dolgui, 2020; Kaplinsky, 2015). CMS entails a high level of complexity in terms of stakeholders interactions, physical, financial and information flows related to them. When value chain (VC) is approached as a system including the five CE building blocks: Waste management, Cleaner production, Intensifying and slow-down loops, Materials & eco-design and Vision strategies, identified in the literature (Galvão et al., 2020; Houssard et al., 2021; Werning & Spinler, 2020), the functional viability (Morales & Lhuillery, 2021), economic (Figge & Thorpe, 2019), environmental and social (Diaz Lopez et al., 2019) benefits get reinforced. Value chains entail interconnected supply chains able to withstand a disruption or series of disruptions when at the same time securing the provision of society and markets in a transition process (Chizaryfard et al., 2020; Morone, 2016), unfolding an ideal experimentation arena to quest on the behavioural patterns that frame the CE transition in the manufacturing sector (Bag et al., 2021; Magnusson et al., 2019).

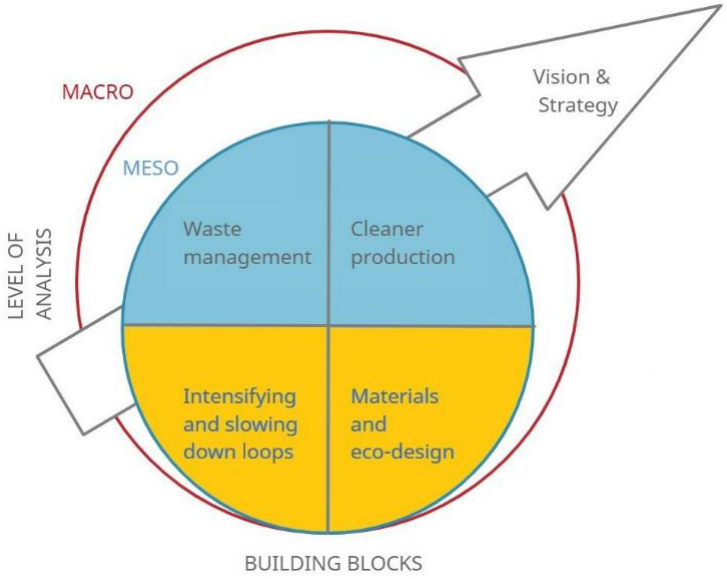

Figure 1. Introductory graphic abstract

Previous studies have already investigated how firms face the barriers of CE implementation (Diaz Lopez et al., 2019; Werning & Spinler, 2020); CE policy framework (L Milios et al., 2018); and, the circular key-drivers transition categorization in the manufacturing firms (Gusmerotti et al., 2019), but herein we look to reposition the research focus in the behaviour key-drivers of circularity (Gusmerotti et al., 2019; Tura et al., 2019) instead of the symptomatic barriers by asking questions about causal behaviours relationships (Guzzo et al., 2022; Morales & Lhuillery, 2021) of CE transition in the value chains. Transition from linear to a circular manufacturing ecosystem poses a major challenge for manufacturing companies because it requires them to be able to deal with complexity of coordinated actions and investments of multiple actors across the value chain (Ghisellini et al., 2016; Parida et al., 2019) and integrate the systemic approach that unfolds the existing behavioural patterns (Diaz Lopez et al., 2019). The aim of this study is to identify the key-drivers that shape the value chain system's behaviour applying a multi-level perspective to better understand the CMS transition. To clarify the objectives and improve the readability of this study, the definition of key concepts such as the multi-level perspective framework, the complex adaptive systems of the value chains and the systemic approach in the CMS are provided in the literature review section.

Herein, the socio-technical transition framework with a multi-level perspective offers a systemic approach that allows the authors to answer questions such as: 1) Does the causal key-drivers of CE transitions can be addressed with a systemic approach in the value chain?, 2) And, if that is the case, And, what challenges do the territorial context step up to shape the CE transition in the CMS? To answer these questions this study identifies the 12 causal enablers for the circularity transition, then empirical data was gathered from macro-scale quantitative indicators applying a multi-level perspective framework. Complex adaptive systems (CAS) and the systems dynamic (SD) approach imply that while not all aspects can be controlled (Morone, 2016), a better understanding of the value chain interconnection can be inferred conducting SD causal key-drivers analysis, interpreting the quantitative macro-scale indicators collected from the databases and validated by the panel experts. This study also intends to identify the direction and progression order of relationships among the key-drivers, and offers pragmatic insights about the main challenges identified in the concerned territory and the recommended solutions to engage the CMS transition in Lithuania (Geissdoerfer et al., 2017; Roggero et al., 2018).

Although manufacturing companies play a small role in a product's life cycle, they exert great influence on both the user and the product's end of life through product development and design (Bjørnbet et al., 2021). Therefore, in this study we are focusing on the CMS, one of the main CE research thematic areas (Morales et al., 2021) embedded in the closing and extending loops principles. However, we address the manufacturing sector without disregarding that, boundaries between sectors are blurring, and "manufacturing" increasingly represents the entire value chain of producing goods. Based on the existing literature about the key-drivers (Tura et al., 2019), authors identified the variables influencing CE transition in the Manufacturing systems, and using these findings as

conceptual ground, authors developed the systemic model under which behavioural relationships were structured based on key-drivers. Starting from a generalized investigation of the literature-based framework of CE key-drivers and the circularity of building blocks, the research method uses the information obtained from the systematic literature review (Morales et al., 2021) to understand the key-drivers interactions needed to build the Stocks and flows diagram that uses the statistical databases as inputs to assess the effect of business strategies and policy interventions on key-drivers presented in the Causal Loop Diagram (CLD).

2. Methods

The review of extant methods used in the literature identified the following five major methods for disentangling the complexity of the CMS key-drivers shaping the transition: 1) the indicators evaluation system framework (Marvuglia et al., 2018); 2) Discrete events multi-criteria framework (Vimal et al., 2019); 3) the Agent Based Modelling (Couto Mantese & Capaldo Amaral, 2017), 4) the Input-Output analysis (Li, 2012) and 5) the proposed System Dynamics (SD). SD is a method for studying complex non-linear problems able to embrace complexity and helps to understand how system structure leads to certain behavioural patterns, as shown by previous works such as J.J. Forrester in the book World Dynamics (1971), the famous work published by the Club of Rome, *Limits to growth* (Meadows et al., 1972) and System dynamics at sixty: the path forward published by Sterman (2018).

The present study is empirical (based on direct observations, experts panel opinions) and quantitative (statistical backward looking analysis of macro-scale indicators) to validate the causal relationship of macro-level behaviour in the CLD. Methodology includes relevant information obtained from the experts' opinions, composed by practitioners working in firms part of the VC and business managers and directors in Lithuania. The framework linking key-drivers with the CE building blocks aimed to define the relationship and structure of the CLD, which then set up the identified challenges in the territory and proposed the solution measures recommendations. The academic literature data sources confirm that quantifying the effects of CE initiatives and circular business models is difficult (Frishammar & Parida, 2019) as there is still a lack of suitable measuring tools.

As we can observe in Figure 2, the authors set the research protocol based on three consecutive stages:
Input, 2) Development and 3) Output. The input stage entails the design of the methodological boundaries of the CMS in Lithuania, the objectives, the systematic literature review, the quantitative macro-scale indicators, as well as the design of the Experts panel. In the second stage, the development of the research protocol includes Secondary data collection and Data analysis, using the inputs collected from secondary sources, Key-drivers relationship search, Panel of experts consultation and the CLD development. Finally, the Output stage entails the Causal Loop Diagram interpretative analysis, the key-drivers relationship validation, the proposal of a transition analysis framework linking key-drivers with interventions in the building block coping with measurable and objective

solution measures recommendations that tackle the most relevant identified challenges in the territory. The 3 stages methodology proposes means to measure qualitative and quantitative features in a reliable and replicable way to identify CE causal relationships in the manufacturing industry.

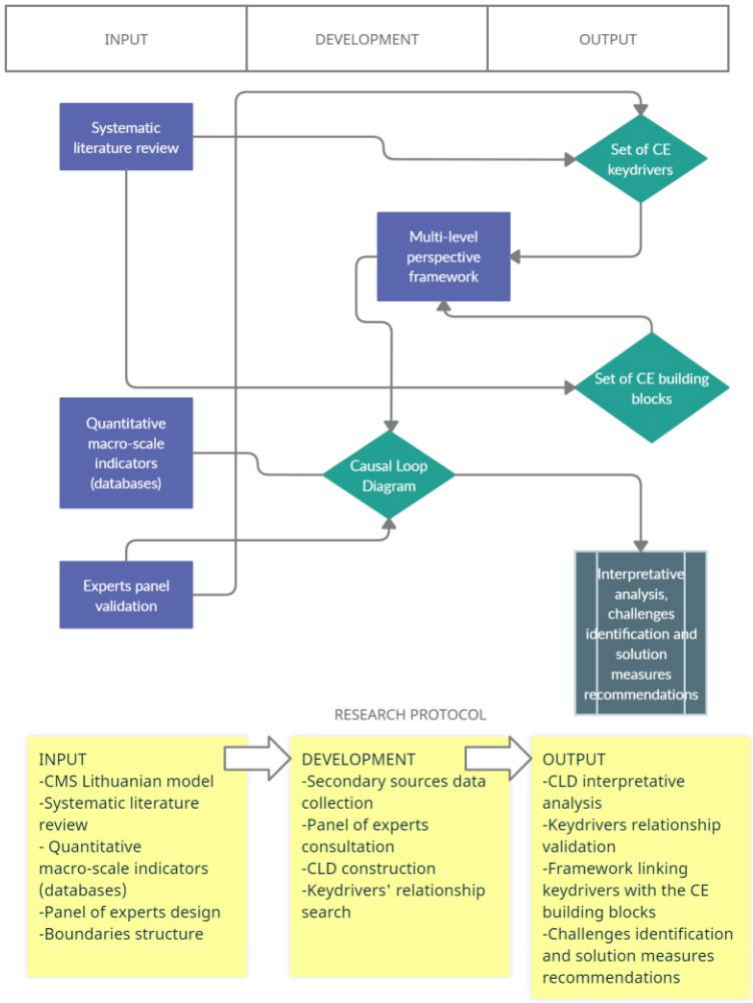

Figure 2. Research methodology steps

2.1. Key-drivers validation by the Expert panel

Figure 2 explains that one-step in the Input stage is the experts' opinions gathering. The research team followed the existing guides (Frost et al., 2020) and developed a robust expert identification and selection protocol to ensure the validity of outcomes and avoid potential bias. Following the protocol, the research team identified 20 experts potentially eligible. The study focused on Lithuanian experts to improve our understanding of the causal relationships and key-drivers of the CMS in the Lithuanian geographical and socio-economic outreach. Thus, rendering Lithuanian experts more eligible to participate. The study gather 2 groups of experts, one composed of 10 Lithuanian experts, inviting them to participate in the preliminary eligibility assessment step. And the second

group composed of 10 European experts to compare the Lithuanian circular manufacturing outlook with the overall European outreach and patterns. This preliminary step involved experts answering a few self-assessment questions to measure their familiarity and experience with the Circular economy phenomenon. Out of the 20 experts, 10 European and 10 specifically from Lithuania, 15 agreed to participate in the self-assessment step, out of whom 10 were identified as eligible to attend the expert panel meetings. As a result, ten experts participated in the expert panel-meeting step. Scholars and practitioners composed the experts, all with sheer experience collaborating with various Lithuanian programs and policies in related business contexts such as sustainable development, digital transformation, resilient smart economy, or circular economy.

Experts' opinions on the key-drivers of CE transformations were collected across the two online meetings. The nominal group technique (NGT) was used as the primary approach for idea generation and decision-making across the expert panel meetings. NGT offers various advantages, such as encouraging and offering fair opportunities for contributions from all experts, and its application has been widely acknowledged within the prior SD-based studies (Ghobakhloo, 2020). During the first meeting, the 12 key-drivers and their description identified across the systematic literature review were presented to the experts. Besides recommending a few minor corrections to the labelling, experts confirmed the overall structure and inclusiveness of the enablers. Experts further identified the contextual relationships among each pair of enablers across the second meeting too. Merely, the computation of macro-scale quantitative indicators is not sufficient, as it is essential to check whether the obtained outcomes are consistent or not with the observed reality.

2.2. Statistical backward looking analysis of quantitative macro-scale indicators

This section details the methodological approach. First, empirical analysis is employed using a 10 years dataset ranging from 2010 to 2019 for all variables except *High-technology manufacturing and knowledge-intensive high-technology services* only available with a span from 2012–2019, as reported by Eurostat (2022). Suitable statistical analysis considering this type of data is collected for Lithuania. The variation for each variable is analysed yearly and is considered as a yearly increase only if the comparison with the previous year is higher than the average inflation calculated for the 10 years period (2010-2019) inflation calculated at 1.84% according to the Bank of Lithuania. If the variable comparison between the previous year period and the present period is less than the inflation rate average 1.84% and more than a decrease of -1.84%, then we consider it a steady variable. The overall variation trend per variable in the period (2010-2019) is calculated by adding up every year trend to avoid overfitting bias, which occurs when the data fits too well if the variable shows low bias but high variance. Overfitting is often a result of excessively complex models, and it can be prevented by fitting multiple models and using validation or cross-validation to compare their predictive

accuracies on test data. Moreover, the most frequent tendency (increase, decrease or steady) is considered as the variation trend for the entire observed period.

Lithuanian CMS is an outstanding case study for analysis because it offers a strong vertical and horizontal interconnection in the VCs when it refers to comparing different CE enablers categories (economic, institutional, organizational, social and environmental) composing the VC in the CMS. Lithuania is a country which has done well in the last decade, moving up in the CE indicators ranking, especially on per capita waste production and recycling rate per country performance (Ecopreneur, 2019), even if the manufacturing system in the country is taking the role of follower, emphasizing the benchmarking of standards and regulations imposed from the leading members of the VC. The industrial sector contributes 25.5% to the GDP and employs around 25% of the active population. The main industrial sectors in Lithuania are electronics, chemical products, machine tools, metal processing, construction material, household appliances, food processing, light industry (including textile), clothing, and furniture. The country is also developing oil refineries and shipyards. The manufacturing sector alone contributes to 17% of the country's GDP (Dagilienė et al., 2021). To the best of our knowledge, systemic models have been previously used (Bocken et al., 2017; Wasserbaur & Sakao, 2020) to investigate the CMS in other specific value chains like plastics (Foschi & Bonoli, 2019) and biomass (Morales et al., 2022) through a macroscale approach, but none of them offer objective guidelines to the practitioners regarding the interventions (bottom-up/top-down) choices that reinforce the CE transition in the VC at the CMS. As emphasized by many scholars, the new challenge of the CE can only be addressed by having a comprehensive framework including all five building blocks.

2.3. System dynamics methodology

SD is a methodology able to define the boundaries of the value chain in the CMS and with that defining the complexity of the model according to the available resources to solve it. The SD models are able to describe the structure of the CMS, even when the behavioural decision variables coming from each one of the actors of the system are nonlinear. To do so, SD modellers need to integrate all the available quantitative and qualitative empirical data to corroborate the significance and validity of the variables involved in the CLD and its parameters, building confidence in its results. SD not only can deal with deterministic compartment models that represent individual agents, using discrete time and stochastic elements, but, it can also be implemented using continuous time and state variables representations and deterministic uncertainty, which is also compatible with the feedback information systems (Roci et al., 2022).

The SD method has recently attracted the attention of the scientific community (Alamerew & Brissaud, 2020; Franco, 2019; Wasserbaur & Sakao, 2020) and the broader society because of its ability to anchor itself in the

present and propose meaningful and viable scenarios to the future. Despite the advantages of SD methodology to analyse complex systems in the quest for complex non-linear solutions, this methodology has rarely been used to analyse macro-level transition drivers in the CE seeking to get a better understanding about CMS, with very few exceptions like the research design including a comparison of two countries published by Levänen et al (2018) that explores battery recycling in Finland and Chile. Some gaps have been identified when integrating the CAS and SD in a territorial approach, i.e. behavioural key-drivers shaping the CE transition in time and space. Evidence confirms that CE transitions in the Lithuanian manufacturing industries should be analysed from a meso and macro level perspective, acknowledging that VC and actors adapt each time according to the socio-economic context. Furthermore, Albino et al. (Albino et al., 2016) provide another system study that intends to understand the impact of behavioural transitions between multiple input and output suppliers/receivers. We observe in Table 1, the subset of drivers composing each one of the12 key-drivers that engage a systemic relationship in the CMS and are key for the understanding of the CE transition, according to the existing scientific literature. We use 12 indicators and proxies, one for each one of the identified key-drivers for the sake of simplification in the CLD. Among the concerned indicators and proxies we found traditional statistical sources (Eurostat, OECD database and one index from the Harvard Growth Lab). The outputs provided by the analysis of the macro variables are complemented in the discussion section with the insights obtained from the panel of experts to disentangle the structural behaviour of the CMS. There are some other variables identified in the literature but regarding the missing statistical data or proxies available and because they were not significant enough to change the causal relationships in the CLD, we decided not to include them in the calculations. Moreover, according to the experts' opinions those side variables are: Modular design, Company brand differentiation, Alternative finance and, Regulation & standards.

Table 1. Circular economy key-drivers composing the Causal Loop Diagram

CE CATEGORIES	KEY-DRIVERS	INDICATORS & PROXYS	MEAN	STANDAR DEVIATION	TREND	10 YEARS PERIOD (2010-2019) VARIATION
ENVIRONMENTAL	Materials circularity	Circular material use rate	3.95	0.4249	STEADY	11%
	Innovation	R&D expenditure (% of GDP) in the Business entreprise sector	0.3	0.0650	STEADY	22%
	Resource productivity	Resource productivity (ratio GDP/DMC)	1.33083	0.0718	STEADY	5%
	Competitivity	Economic complexity index	0.718	0.0703	INCREASE	10%
ECONOMIC	Value-added	Value added by Manufacturing in percentage	19.1691	0.7962	STEADY	4%
	Internationalization	Exports (million euros)	23757.07	3795.9078	INCREASE	16%
SOCIAL	Wages	High-pay wages level (thousand persons)	25.27	2.0447	DECREASE	8%
	Government revenue	General government revenue, (Thousand US dollars/capita)	9961.611	2005.8465	INCREASE	20%
	Taxation, incentives, and subsidiary policies	General government spending. Environmental protection+Education, % of GDP	5.672105	0.7148	DECREASE	13%
INSTITUTIONAL	Regulation and standards	Recycling rates of packaging waste for monitoring compliance with policy targets	60.97	3.8158	INCREASE	6%
	Skills Upgradability	High-technology manufacturing and knowledge-intensive services (percentage of total employment)	2.5125	0.3444	INCREASE	14%
ORGANISATIONAL	Skills and competences	Employment by tertiary level (% total employment of 25-64 year-olds)	89.48	1.4462	STEADY	2%

There are some other drivers observed in the scientific literature that are worth to be mentioned in this study even if they are not included in the CLD construction and are hard to grasp due to the lack of quantitative macro-scale data. The practitioners and the academic community need to be aware about the role played by the following cross-sectional drivers: 1) Consumer awareness, market expectations (Lieder & Rashid, 2016); 2) Overarching policy framework for product life upgradability (Leonidas Milios, 2021); 3) Change of mindset (Geissdoerfer et al., 2017; Sousa-Zomer et al., 2018); 4) ecological responsibility through modular design (Dangelico & Pujari, 2010; Mateus et al., 2020); 5) Company brand and structure differentiation (Sousa-Zomer et al., 2018; Tura et al., 2019); 6) New routines and processes (Parida et al., 2019) improving client satisfaction (Geissdoerfer et al., 2017; Seuring & Müller, 2007); as well as measures like 7) Brand company differentiation; 8) Modular design, 9) Alternative financing, 10) Partnership & collaboration; and 11) Technological and information drivers entailing Digital technologies for remanufacturing and reuse activities are relevant for the circular economy transition analysis in the Manufacturing sector (Parida et al., 2019).

3. Results and Discussion

Within the SD framework, Causal loop diagrams (CLD) can be thought of as sentences that are constructed by identifying the key variables in a system (the variables) and indicating the causal relationships between them via links (the loops). By linking together several loops, you can create a concise story about a particular problem or issue. A CLD consists of four basic elements: the variables, the loops between them and, the signs on the loops, which shows what type of behaviour the system, will have. By representing a problem or issue from a causal perspective, you can become more aware of the structural forces that produce conflicting behaviour.

Feedback processes governing key elements of a CE transition in the CMS. CLD makes use of arrows to indicate causal relationships between system variables. These relationships can be either positive (represented by a plus sign) or negative (represented by a negative sign). A positive relationship, known in SD as reinforcing feedback, implies that, if variable X is connected to variable Y, they move in the same direction (an increase in X will lead to an increase in Y, and a decrease in X will lead to a decrease in Y). A negative relationship also known as balancing feedback suggests that the variables move in opposite directions (an increase in X will lead to a decrease in Y, and a decrease in X will lead to an increase in Y). Solution measures embody complex efforts to change the behavioural structure of the system, influencing feedback loops, where balancing feedback works as control mechanisms and reinforcing feedback amplifies system change. For example, an intervention that increases Skills and competences in the labour market entails a control mechanism on the Wages, triggered by the offer increase of the workforce pool with the skills and competences required for the CE transition. Therefore, Skills and competences have an amplifying effect over Wages in the CMS when allocating the limited resources among the most competitive and frontrunner firms in the VC.

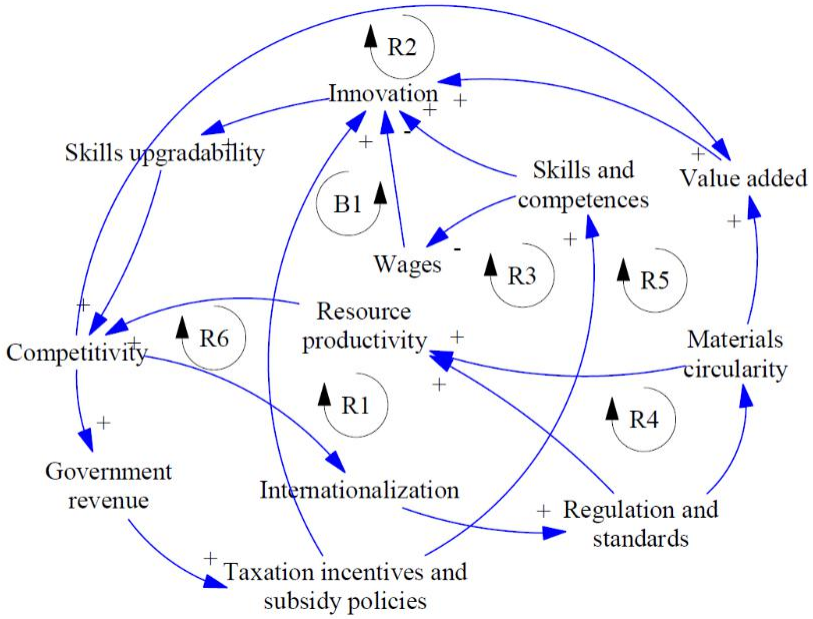

Figure 3. Causal Loop Diagram of the CE key-drivers engaging CMS transition

Herein, we identify six reinforcing loops (R1, R2, R3, R4, R5 and R6) and one balancing loop (B1) were identified in the Causal loop diagram. The identified loops need to engage more than two variables (bilateral relationship) to be considered in the CLD. There are feedback effects created by reinforcing and balancing relationships in the current structure of the CMS, which have an impact on the likelihood of CE transition in the CMS.

The circularity implementation in VCs is an essential component for the CMS to improve global sustainability. However, if adopted wrongly, the organizations will face a high loss of investment costs individually and collectively. According to the findings of this paper, we can show evidence claiming that the key-drivers of CMS transitions depend on the VC context based on the socio-technical transition framework. Hence, it becomes essential to identify the complexity of the causal relationships, the main challenges and the solution measures required for a successful adoption of CMS. Based on the CLD integrating SD within the multi-level perspective theory we counter the bottom-up hierarchical framework proposed by Kumar et al., (2019). This study claims that systems approach offers to decision-makers and stakeholders the possibility to deal with CAS and improve our understanding regarding causal relationships among key drivers in the CMS transition in a geographic specific context like Lithuania. The empirical evidence found in this study helps to answer two research questions stated in the CMS case study where a multi-level perspective framework is applied to analyse the CE transition. The systemic construction of causal loops, drivers and interrelations in the CLD aims to improve our CMS understanding using CAS and SD to identify the solution measures that could counterbalance or amplify the circular patterns that address the greatest challenges for the CE transition.

From the empirical observations in the Causal Loop Diagrams in Figure 3, we identified some discrepancies between the expected causal relationship direction according to the literature and the observed behaviour of the quantitative key-drivers collected for Lithuania in the databases during the 2010-2019 period. The conflict could be categorized in major discrepancies and minor discrepancies. The minor discrepancies identified in the Lithuanian CMS are those that are not opposite, meaning that the deviation from the expected behaviour is less than the difference of the Lithuanian inflation rate. For example, the Innovation variable observed in R2, R3, R5, R6, B1 and B2 shows a steady trend, whereas Skills upgradability experiences an increase higher than the inflation rate during that period. The previous relationship could be explained by exogenous variables impacting Skills upgradability variable or because the Innovation mechanisms in Lithuania are not triggering the prescriptive causal effect, and therefore needs to be resettled. Other minor discrepancies are observed in the following variables: Regulations & standards, Resource productivity and Taxation incentives and subsidy policies. The major discrepancies in the causal effects consist of relationships triggering the opposite effect to the one expected in the literature. In the Lithuanian CMS the two variables present major discrepancies with the CMS theoretical framework, the key-driver of Government revenue observed in the R3 and B2; and Skills upgradability observed in R3. The *Skills upgradability* and *Government revenue* were identified as the two major discrepancies of the causal effects with the theoretical framework utilized for the CMS transition in Lithuania, indeed they embody one of the most relevant outcomes of this study.

The authors claim that most of the interactions encountered in the literature analysis (Razzaq et al., 2021; Tseng & Bui, 2017) were found to be supported by the empirical observations in the CLD, with the exception of the two major discrepancies observed in the CMS in Lithuania: the Government revenue, and Skills upgradability.

Table 1. Causal table of proposed solutions in the CMS Lithuanian context to address the major discrepancies identified

MAJOR DISCREPANCIES	COMPOSING ELEMENTS	PROPOSED SOLUTION MEASURES
Government revenue	High-cost of sustainability adoption	the collaboration and coordination among value chain members
		the Adoption of Smart factory components
	Lack of availability of resources for CE transition strategies	the adoption of industrial ecology initiatives
		the understanding of economic and social benefits
Skills upgradability	Ineffective employees training for sustainability	the Adoption of advanced quality improvement techniques
		the Adoption of advanced predictive maintenance systems
	Lack of effective employees engagement and empowerment	the Digitalisation of supply chain activities
		the Adoption of advanced machine learning algorithms
	Non consideration of human-factors for CE	the Integration of digital and physical systems
		the Adoption of advanced machine learning algorithms

Government revenue discrepancies are explained by Yadav et al., (2020) as the inability to overcome some challenges related to the High-cost of sustainability adoption and the Lack of availability of resources for CE transition strategies. The measures proposed in the literature to solve the High cost of sustainability adoption are the collaboration and coordination among value chain members and the Adoption of Smart factory components. The solution measures to address the Lack of availability of resources are the adoption of industrial ecology initiatives and the understanding of economic and social benefits.

Skills upgradability is here understood, as the highly skilled STEM workers required engaging the transitions in the Manufacturing sectors able to power the national economy and build economic opportunities in the high technology manufacturing and Knowledge intensive services. The increase on Skills and competence was identified in this study as one of the main challenges in Lithuania to propel CMS transition through the training of highly educated professionals and public policies regulating the reduction of Wages below a certain

threshold that avoid the brain drain of the creative demographic sector to other regions that propose better salaries.

Moreover, Skills upgradability discrepancies with the theoretical framework are explained by Yadav et al., (2020) as the inability to overcome some challenges related to the Ineffective employees training for sustainability, lack of effective employees engagement and empowerment and the Non consideration of human-factors for CE transition strategies. The measures proposed in the literature (Yadav et al., 2020) to solve the Ineffective employees training for sustainability are the Adoption of advanced quality improvement techniques and the Adoption of advanced predictive maintenance systems. The increase on Skills and competence training was identified in this study as one of the main challenges in Lithuania to propel CMS transition through highly educated professionals and public policies regulating the reduction of Wages below a certain threshold that avoid the brain drain of the creative demographic sector to other regions that propose better salaries. The solution measures addressing the lack of effective employee engagement and empowerment are: the Digitalisation of supply chain activities, and the Adoption of advanced machine learning algorithms. The solution measures to address the Non consideration of human-factors for CE transition strategies are the Integration of digital and physical systems and the Adoption of advanced machine learning algorithms, again. Policy makers are though advised to conduct campaigns that could assist in enhancing the nation's economy.

In practice, it is extremely difficult for practitioners to simultaneously execute all the solution measures required for manufacturing ecosystems, measures that cover different scales of analysis. A huge challenge in the implementation of CE transition emerge in the form of the bottom-up hierarchical framework (Kumar et al., 2019), suggesting that the transition process should start from micro level with enterprises and move towards the macro level, where the transformation process should be accomplished, but just after being consolidated in the firms. The bottom-up hierarchical framework claims that each level forms a basis for the following level, neglecting the systemic and simultaneous features of the multi-perspective theory applied to CE transition, its challenges and solution measures. The bottom-up hierarchical framework engages a logical fallacy stating that if CE is applied successfully at firms level, then macro-level landscape will ensure political, institutional and socioeconomic conditions for the CE transition. If the macro-level landscape ensures political, institutional and socioeconomic conditions for the CE transition, then CE will be applied successfully at the firm's level. While this may appear to be perfectly fine logical reasoning, it is not a valid argument because the first statement does not logically guarantee the second. If we are not certain about the causal effect and the direction and magnitude of this influence, any intervention would be true but the conclusion would be incorrect. Therefore, in our study we propose a systemic approach to both scale levels: 1) meso-level value chains where the functional viability is established and; 2)

macro-level landscape ensuring the political, institutional, economic and social conditions required to engage the CE transition.

The more variables we have in a system, the more complex the CMS becomes, facing challenges like the transmission of huge quantities of knowledge across large networks of people, the cooperation with multiple suppliers/receivers, transaction costs, and transportation costs, among others. Multi-product and multi-firm interactions in the VC have proven the potential of being systemically approached, integrating context-specific allocation decisions of the CMS through feedback loops, engaging specific outcomes like reverse supply chain, downcycling or cascading of materials, energy or by-products on it. The key-drivers identified in the CLD and the causal relationships portrayed will assist policymakers and stakeholders to build a systemic and complex adaptive understanding of the CMS orienting efforts towards high tech and knowledge intensive solutions in Lithuania. It is therefore expected that Lithuanian public actors develop policies to improve Skills upgrading and Governmental revenue collection strategies. Herein, the findings suggest that both levels (meso and macro) together with the bottom third level (the micro-level) represented by the individual firms entail a complex dynamic CMS. In the CMS we found evidence about the two-ways feedback loops between the macro-level landscape and the meso-level dominant regime. Low complexity productive structures like the observed in less industrialized countries like Lithuanian where high skills labour force is limited, stresses the structural investment needs for Skills upgrading, research & development to reach the breakthrough technology point and increase investment in targeted Science, Technology, Engineering, and Mathematics (STEM) training and education that allows Innovation and Competitivity increases (Hallward-Driemeier & Nayyar, 2017).

4. Conclusions

The present study supplies breakthrough insights to identify the key-drivers and the causal relationships enabling the CE transitions on the macro-scale level and the solution measures that have the potential to amplify or counterbalance the behavioural patterns in the CMS. Indeed, the study offers a tool able to improve the current understanding of the CMS using CAS and SD to shape the CE transition. To do so, this study identifies the key variables influencing CE transition in the CMS, and uses the causal relationship direction and progression order as the empirical ground under which CE interventions could be proposed to shape the transition. All at all, the present study contributes to look at the bigger picture in the current state of the art which focuses in the symptomatic effects observed in the barriers and business models as approached by Tura et al., (2019) rather than disentangling the behavioural key-drivers of the VC system approached through the dominant regime in the meso-level, a theoretical construction influenced by the multi-level perspective of transition studies (Morone, 2016).

Furthermore the authors suggest approaching the CMS as a dynamic system where the three levels (micro, meso and macro) wave causal relationships and feedback loops between the Macro-level landscape, the meso-level dominant regime and the Micro-level innovation niche. Finally, the study suggests that CE transitions in the manufacturing industries respond to contextual (geographical, political, social and economic) differences inherent to the VCs aggregated in the CMS of each particular sector.

We found empirical evidence about the advantages of representing a problem or issue from a causal perspective, because decision-makers become more aware of the structural forces triggering puzzling behaviour when they are able to identify the causal loops driving the transition process in the CMS. Herein, we claim that CMS represents an ideal arena to integrate the CAS and SD into a macroscale territorial system able to engage CE transition in the VC. The present study supports this comprehensive view and offers additional empirical evidence to conclude that CAS and SD methods fill existing gaps regarding the systemic and complexity analysis of the CMS models. Moreover, this study provides some solution measures and recommendations on how to tackle the biggest CE challenges per territory, without simply replicating already existing waste management formulas of developed countries. Thus, to escape from the trap of including recycling into the linear economy paradigm, the transitions in developing countries like Lithuania are composed by solution measures like the adoption of industrial ecology initiatives and the understanding of economic and social benefits; and the Adoption of advanced quality improvement techniques and advanced predictive maintenance systems. The adoption of advanced quality improvement techniques and predictive maintenance systems target specially Science, Technology, Engineering, and Mathematics (STEM) training and education programs implementation, because they increase the available pool in high-technology manufacturing and knowledge intensive services.

This study have identified either the implications of a CAS and systems approach in the CMS using a comprehensive perspective integrating multi-level transition theory, which changes fundamentally the needs of simultaneous interventions in all three levels (micro, meso and macro) to propel the CE transition within a specific socioeconomic context looking to place people and societal needs in their very centre of the structure. The methods and diagrams presented here are subject to certain degree of estimation errors and caution is advised while interpreting and generalizing the conclusions drawn in this study to different countries and different sectors. Future studies should collect data from other countries in Europe to validate or adjust our findings. This study focuses on methods able to handle SD and CAS at CMS, because you can only improve what you can measure, and CMS represents an ideal arena to put on trails the implementation of smart coding systems, data analytics in multi-dimensional strategic evaluation and blockchain technologies among others. The EU Green Deal is a major driver for CE in the coming decade but its success depends on complex adaptive and systemic action for socio-ecological wellbeing. The political agenda addressed in the European Commission's Green Deal is setting CE as the required

transition model to trigger the path for the Industry 5.0 transition driving a fundamental transformation of Europe's economies and societies. Further research avenues for CMS and CAS are identified in the circularity assessment indicators, starting by measuring the overall performance of the VC in terms of their impacts. The originality of this study stands on taking a step back and trying to understand the value chain's complexity and systemic condition is the interwoven relationship of behavioural key-drivers able that shape the causal relationships in the CE transition according to the geographic context of the CMS, instead of looking independently at firms to disentangle the symptoms, barriers and business models in the micro-level.

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Which Visions of Bioeconomy are most Common in the New Research Field of Circular Bioeconomy?

Evidences from a bibliometric analysis

Maria Antonietta Passari[1], Roberta Salomone[2], Walter J.V. Vermeulen [3], Teresa Maria Gulotta[4]

[1]*Department of Economics, University of Messina, Piazza Pugliatti 1, 98122, Messina, Italy, mariaantonietta.passari@unime.it*

[2]*Department of Economics, University of Messina, Piazza Pugliatti 1, 98122, Messina, Italy, roberta.salomone@unime.it*

[3]*Copernicus Institute of Sustainable Development, Faculty of Geosciences, Utrecht University, w.j.v.vermeulen@uu.nl*

[4]*Department of Economics, University of Messina, Piazza Pugliatti 1, 98122, Messina, Italy, teresamaria.gulotta@unime.it*

Abstract

Since its first appearance in literature around 2015, the innovative concept of Circular Bioeconomy (CBE) has raised in popularity being identified as a strategic solution for facing the present and upcoming environmental challenges and for bringing about a sustainable decisive shift in current linear economic systems. In this regard, an eloquent example of the centrality acquired by the notion of CBE can be observed in the renewed ecological narrative promoted by the European Commission and sculpted in two pivotal documents, the Updated Bioeconomy Strategy (2018) and the European Green Deal (2019), in which CBE is interpreted as a central framework to meet the Sustainable Development Goals. Nonetheless, despite its growing echo in both academic and political debate, we cannot deny that we are dealing with an extremely controversial and nebulous phenomenon that poses enormous challenges, especially from a theoretical point of view. In particular, the unsolved ambiguity that surrounds the relationship between its two building blocks, bioeconomy and circular economy, results in an obvious difficulty of drawing clear and understandable boundaries and increases the risk of spreading another chameleonic notion. Therefore, the need for systematic categorization is more than evident to unlock the full potential of the paradigm and ensure its scientific stature trying to avoid the shallowness of the "buzzword effect" by investigating the dynamics intrinsic to recent history of this emerging concept.

In this context, our research goal is to contribute to a better and deeper understanding of the emerging paradigm of CBE and its role in the global challenges by exploring the debated relationship between its building blocks. We also aim to contribute to clarifying the interaction of CBE with other popular and partially overlapping conceptualizations, first and foremost green economy. Pursuing this goal, we first

perform a bibliometric network analysis for assessing trend and patterns within a sample of papers selected according to specific and predefined inclusion criteria to better reflect the fragmented composition of the research field. Secondly, through screening and coding the selected papers, we conduct a content analysis in order to understand the distribution in the sample of the different visions of the bioeconomy. Finally, in the light of the results of the content analysis, we carry out a systematic literature review to verify which bioeconomy narratives has the most connections with circular economy vision and how these connections are declined especially in terms of weak or strong sustainability. The present paper reports the results of the first step of this methodological structure that is related to the bibliometric analysis.

Keywords: Circular Bioeconomy, Bioeconomy, Circular Economy, Literature Review, Bibliometric Analysis

1. Introduction

In the list of concepts proposed as a panacea to the major environmental challenges of our time (Giampietro, 2019), a new term has recently emerged: Circular Bioeconomy (CBE). Since its first appearance, around 2015, what, generally speaking, is considered as the combination of Bioeconomy (BE) and Circular Economy (CE) has known a considerable success gaining increasing recognition as strategic solution to impart a sustainable transformation to the current economic system. Undoubtedly, by offering the possibility of synthesising how resources should be used, CE, and what resources should be used, BE (D'Amato et al., 2017), the concept has broken as a game changer into the sustainability debate raising expectation and optimism among practitioners. In this regard, the transition towards CBE is pointed as pivotal in the recent revision of the European Union's Bioeconomy Strategy which affirms the need for the bioeconomy to be inspired by the principles of circularity (European Commission, 2018a). However, the rising popularity, both academic and political, of the notion does not seem to be supported by adequate theoretical elaboration posing the risk of a chameleon concept exposed to the spectrum of the "buzzword effect". The present study constitutes the first step of a complex research path directed to trace the theoretical web that inspires the concept of "Circular Bioeconomy" (CBE) and to lay the foundations for a more conscious and effective implementation of it, especially at the level of national and international environmental policies. In particular, with this preliminary work, we aim to explore the evolution of academic literature on CBE in the attempt to answer the following research question: which visions of Bioeconomy (BE) are most common in the new research field of CBE? Indeed, in a literature review that has become pivotal among practitioners, Bugge, Hansen, and Klitkou (2016) identified three ideal visions of BE: Bio-technology vision, Bio-resource vision, and Bio-ecology vision. We decided to apply this proposed distinction as theoretical guide in the effort to respond to the need for more systematic categorisation of the notion of CBE and provide a first conceptualisation of its main thematic streams. In this way, we expect to improve the comprehension of the dynamics that involve the two

building blocks of CBE, BE and Circular Economy (CE), moving from the assumption that, for drawing clear and understandable boundaries of the paradigm, is essential to clarify the relationship of its components.

2. Methods and Materials

The categorisation of the notion of CBE is delineated using as theoretical guide the three ideal visions of BE proposed by Bugge, Hansen, and Klitkou (2016) summarised in Table 1: Bio-technology vision, Bio-resource vision, and Bio-ecology vision. The first two narratives of BE are evidently characterised by a strong technical and economic perspective. While the Bio-technology vision urges for investing in the development and application of bio-technology research in different economic sectors, the Bio-resource vision emphasises the role of bio-resources capitalization as main drivers for economic growth through the creation of new value chains. Adopting a diametrically opposed approach, closer to the social and environmental dimension of sustainability, the Bio-resource vision focuses on the promotion of biodiversity and conservation of ecosystems through designing circular and integrated process especially at regional level. This means that if the first and second visions have a more manifest business as usual connotation assuming a positive relationship between technological development and environmental sustainability, the third one calls for more circular and self-sustained production systems in a contest of strong sustainability able to avoid soil degradation and maintain the capacity of ecosystem services.

Table 1. *Key characteristics of the three Bioeconomy Visions from Bugge et al. 2016*

	The Bio-Technology Vision	The Bio-Resource Vision	The Bio-Ecology Vision
Aims & objectives	Economic growth & job creation	Economic growth & sustainability	Sustainability, biodiversity, conservation of ecosystems, avoiding soil degradation
Value creation	Application of biotechnology, commercialisation of research & technology	Conversion and upgrading of bio-resources (process oriented)	Development of integrated production systems and high-quality products with territorial identity
Drivers & mediators of innovation	R & D, patents, TTOs, Research councils and funders (Science push, linear model)	Interdisciplinary, optimisation of land use, include degraded land in the production of biofuels, use and availability of bio-resources, waste management, engineering, science & market (Interactive & networked production mode)	Identification of favourable organic agro-ecological practices, ethics, risk, transdisciplinary sustainability, ecological interactions, re-use & recycling of waste, land use, (Circular and self-sustained production mode)
Spatial focus	Global clusters/ Central regions	Rural/Peripheral regions	Rural/Peripheral regions

In order to portrait the BE discourses that operate inside the new paradigm of CBE, we carried out a comprehensive bibliometric analysis though the combination of the main bibliometric procedures, i.e. performance analysis and science mapping (Cobo et al., 2011). While performance analysis tries to measure the performance of different research constituents, such as authors and institution, in a specific research field by examining their contributions

to it, science mapping investigates the relationships between research constituents to uncover the cognitive structure and dynamics of a scientific fields (Donthu et al., 2021; Župič & Čater, 2015). Conscious of this, the research has been designed not only to account the contributions of research constituents, but also to construct a powerful "visual" holistic representation of the inner intellectual interactions and structural connections among bibliographic data (Donthu et al., 2021). As previous works have done in the field of CE and BE, we intend to reinterpret the traditional quantitative methods of bibliometric analysis to extract qualitative information from statistical observations (Konstantinis et al., 2018). Indeed, with their quantitative rigor, bibliometric methods can bring a degree of objectivity into the subjective evaluation of literature providing a valid instrument for discover thematic patterns especially in a wide breadth of studies (Garfield, 1979; Župič
Čater, 2015). However, the aim of this contribution is not to report a mere bibliometric exercise, but to interpret the results of both performance analysis and science mapping through the lens of BE visions in the effort to provide an exhaustive response to the research question. For this reason, we propose a methodological progression that allows the topic to be explored with an increasing level of detail.

Firstly, the literature sample was built. Data mining was conducted on January 6, 2022 through Scopus database using the following Boolean string "circular bioeconomy" OR "circular bio-based economy" OR "circular bio-economy" within titles, abstracts and keywords. The search was further refined by limiting the document typology to articles and reviews and selecting English as language. Instead, concerning the time range no initial deadline was applied, while it was considered appropriate to exclude 2022.

Consequently, once checked for duplicates, publications were collected and uploaded in SciVal, a web-based analytics solution developed by Elsevier that, using Scopus data, enables researchers to evaluate research activities from a variety of perspectives (Elsevier, 2022). Exploiting the functionalities offered by the two bibliometric platforms, Scopus and SciVal, we tried to get an overall picture of the field and its constituents by applying some of the main performance analysis metrics: number of publications per year; total and average citations; number of contributing authors; identification of central journals, countries, founding sponsors and subject areas.

Therefore, to give a more in-depth answer to the investigated research question and verify the validity of the hints obtained from the performance analysis, we reviewed the identified literature through some classical science mapping techniques, i.e.: Citation Analysis, Bibliographic Coupling and Co-word Analysis. Citation Analysis is known as a basic instrument to implement science mapping and aims to ascertain the most influential publications in a research field by the number of citations that it receives. In other terms, this type of analysis determines the impact of a publication moving from the assumption that citations can reflect its intellectual quality and stature in an objective and straightforward way (Donthu et al. 2021; Pieters & Baumgartner, 2002; Stremersch, Verniers, & Verhoef, 2007). After using this measure of influence (Župič & Čater, 2015) for getting a preliminary idea about

the thematic orientation of the examined area, we assessed bibliographic overlap of the sample through Bibliographic Coupling. This notorious science mapping technique allows to link source documents together (Baker, 1990), assuming that their sharing of common references may be symptomatic of potential content similarity (Donthu et al. 2021; Kessler, 1963; Weinberg, 1974). Although bibliographic coupling offers, in line with the purpose of the study, an effective tool to understand how knowledge is combined among sets of publication (Donthu et al. 2021; Biscaro & Giupponi, 2014), the similarity association established tends to be considered static, because makes it difficult to determine for each document the reason behind the same reference. To compensate these limitations, typical of citation-based methods, we decided to combinate it with a more dynamic and powerful tool for discovering knowledge infrastructure of a research domain, i.e. Co-word analysis (Baker, 1990; Ferreira, 2018; Župič & Čater, 2015). Unlike previous applied science mapping technique, this method doesn't employ cited or citing publications as focal point or proxy, but elects words as the unit of its analysis (Donthu et al. 2021). By extracting words from "author keywords", "article titles", "abstracts" or "full texts" co-word analysis focuses on the actual content of the publication itself aiming to discover thematic linkages in the co-occurrence of pairs of words (He, 1999; Donthu et al. 2021). This because the fundamental assumption underlying this procedure is that the frequency with which words appear together should be indicative of their conceptual connection. Since the quality of results of a co-word analysis may be affected by the type of words chosen or the statistical method adopted (He, 1999; Župič Čater, 2015), this study proposes a co-word analysis structured on a double level using text data extrapolated from both titles and abstracts. To perform in an intuitive graphical way both Bibliographic Coupling and Co-word analysis (Donthu et al. 2021), all the data were also exported in CSV format and uploaded in VOSviewer. This is a software developed by van Eck and Ludo Waltman for creating and visualising bibliometric networks, that is particularly suitable when working with larger amount of bibliometric data.

3. Results and Discussion

This section illustrates and discusses the results achieved with the illustrated research method by organising them in two paragraphs dedicated, respectively, to performance analysis and science mapping.

3.1 Performance Analysis

The Scopus database search delivered 458 publications, 293 articles and 165 reviews dating from 2016 to 2021, that include the words "circular bioeconomy" OR "circular bio-based economy" OR "circular bio-economy" in title, abstract, and keywords.

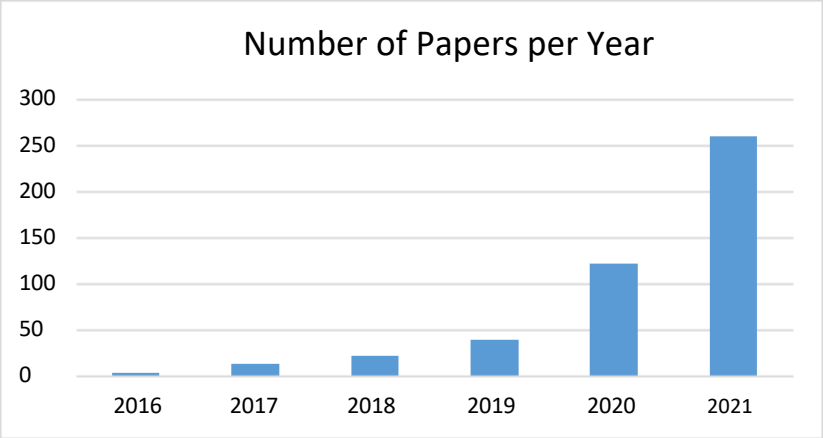

Figure 1. *Number of papers per year (source: Scopus)*

The three oldest publications date to 2016 and it is interesting to note how two of them cite CBE in the title. To better understand the yearly trends of published papers on CBE, we can ideally divide the information into two periods of three-year extension, 2016-2018 and 2019-2021. Between 2016 and 2018, a total of 38 peer-reviewed paper has been published, just one unit less than in 2019 alone. Instead, between 2019 and 2021, the total number of publications amounts to 420. This means that the last period represents 91.72 % of the considered production compared with 8.28 % of the first period. Although excluded from the survey, quick research shows that 2022 follows the growth trend and is expected to be the most productive year for the sector so far. However, the short period of time covered by the Elviser scientific search engine confirms that we are confronting just the early stages of an extremely recent scientific field whose full potential requires to be adequately explored.

The increasing attention paid to the topic in the academic literature is also demonstrated by the considerable number of citations reached by the sample at the time of the research: 6833 total citations with an average of 14,9 citations per publication. A number that knows a high rate of increase, as attested by the statistics provided by SciVal.

The analysis of the sources reveals that the 458 collected papers have been published in a total of 159 journals, but only nine of them have 7 or more publications collecting nearly 37% of the results. In addition, as it can be observed by reading the following table, top journals seem to have a strong focus on subjects that can be considered closer to the Bio-technology and Bio-resources discourses of BE, i.e.: technologies applied to bioresource, production of energy, sustainable chemistry and engineering.

Table 2. *Journals with seven or more publications (source: SciVal)*

Journal	Number of Papers
Bioresource Technology	47
Journal of Cleaner Production	30
Sustainability	29
Journal of Environmental Management	14
Renewable and Sustainable Energy Reviews	14
Energies	12
ACS Sustainable Chemistry and Engineering	8
Science of the Total Environment	8
Forest Policy and Economics	7

The number of authors is significant with 2075 researchers that can count one (87.90% or 1824 of them) or more than one contribution (12.09 %) among the 458 articles and review. By looking at their country of affiliation it is possible to trace the geographical origin of the scientific production. The investigation shows that 81 countries are involved with India, Italy and China as the three leading ones. In this regard, figure 2 allows to notice a consistent presence of European countries, that might be explained as response to the release of two fundamental documents by the European Commission, i.e. the Updated Bioeconomy Strategy (2018) and the European Green Deal (2019) where the centrality of CBE in the sustainable transition is affirmed. Nevertheless, almost all the European Countries mentioned among the 10 most productive ones have developed a national BE strategy or a CE action plan, or both (Biancolillo et al., 2020; Duque-Acevedo CLICProject.eu). The Asian region is also well represented with three of its most advanced economies in the top 10. From this point of view, CBE seems to transcend the different geographical distribution of its two components as described in 2017 by D'Amato et al. who identified a Chinese dominance in the CE sector compared to a strong European focus on BE (D'Amato et al., 2017).

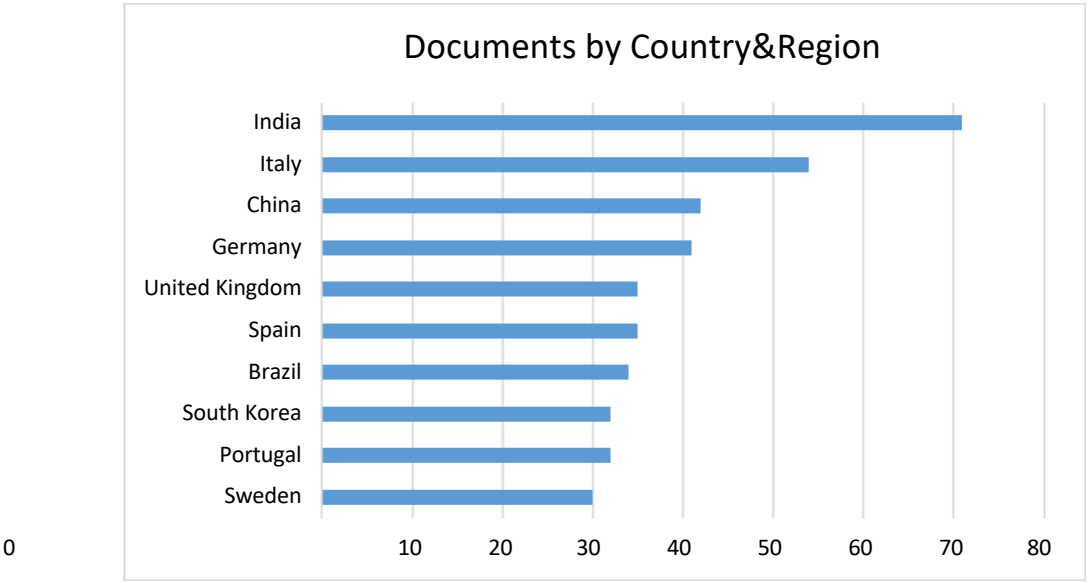

Figure 2. *Geographical origin of the scientific production (source: SciVal)*

If we add up the documents assigned to each of the 81 countries identified, we obtain a much higher number than the above-mentioned 458. This is explained by the fact that both Scopus and SciVal are influenced by the collaboration factor which implies counting the country of affiliation of each author who contributed to the publication. Indeed, in terms of collaborations, according to SciVal metrics, 201 peer reviewed papers (43.9% of the total number) are the result of international collaborations, 114 publications (24.9%) are labelled as only national collaborations, 123 works (26.9%) are classified as only institutional collaborations and just 20 outputs (4.4%) are attributed to a single author.

The strategic role of the European Union that emerges from the geographic distribution of the sample is, to some extent, confirmed by the Scopus list of the 15 main founding sponsors interesting in support the development of the topic. As can be easily deduced from Figure 3, the European Commission and research programs promoted by the European executive body itself appear as the major sponsors.

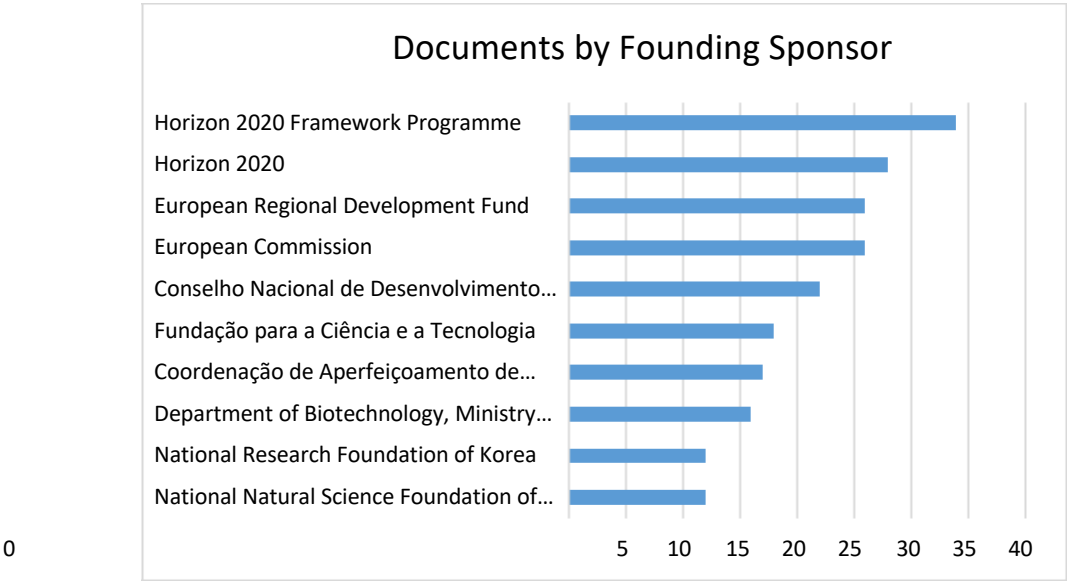

***Figure 3**. Documents by founding sponsor (source: Scopus)*

For concluding the performance analysis, could be useful to have a glance at the main subject area where CBE is discussed. According to figure 4, the 458 results fall in 25 disciplines and most of them, especially if we look at the 14 prominent ones, have a clear technical and energetic orientation. An aspect that, knowing the characteristics of the three BE Visions identified by Bugge et al. (2016), may suggests an orientation of the sample towards the Bio-Technology and the Bio-resource visions in which the technological, engineering and chemical dimensions play a decisive role in the production of bioenergy and bioproducts through the valorisation of bioresources.

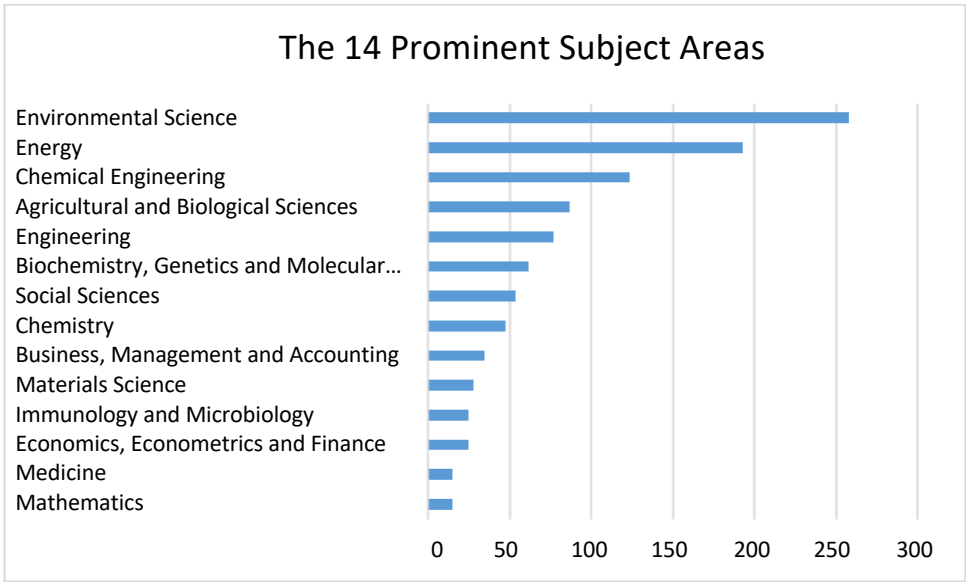

Figure 4. *Documents by Subject Area (source: SciVal)*

A deduction that appears to be supported by the analysis of the most relevant Topics addressed within each subject area, as reported in the following figure 5, results of a specific SciVal features. In particular, the Topics are represented as bubbles whose size depends on the output of the selected entity, the number of papers attributed to the topic in this case. Regarding the position of the bubbles, it is based upon the subject areas of the journals in which the document is published. This means that a topic will be brought towards the section of the Wheel of Science where the subject areas with the greatest influence on it are located. Consequently, the closer topics are to the centre of the Wheel, the more likely they are to be multidisciplinary, compared to the Topics towards the edge of the Wheel (Elsevier, 2022). And this because a paper could be related to multiple subject area, but not to more than one of the 96,000 Topics formed by SciVal.

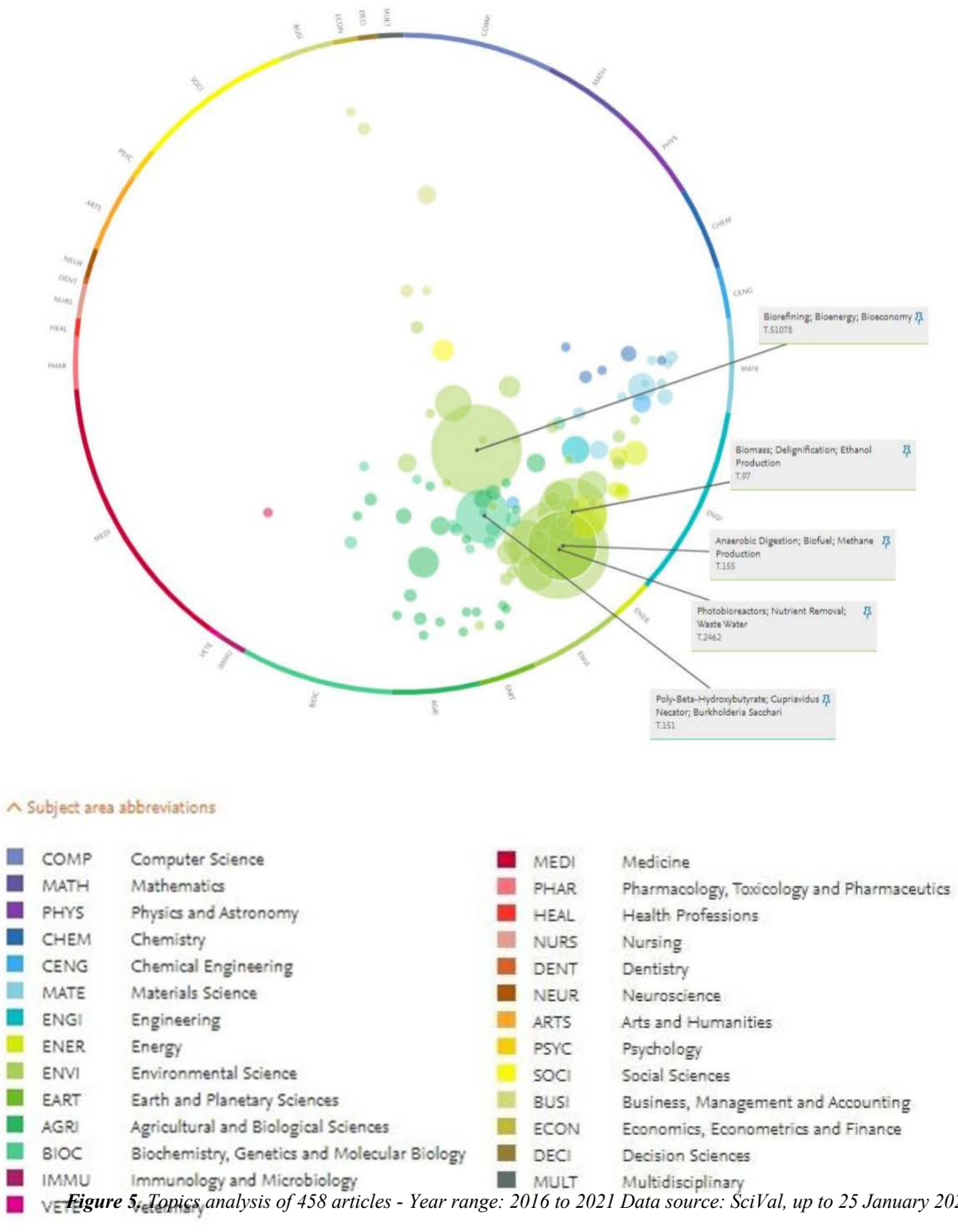

Figure 5. *Topics analysis of 458 articles - Year range: 2016 to 2021 Data source: SciVal, up to 25 January 2022*

Indeed, according to the explained figure 5, the 5 most prominent Topic for scholarity output in our sample are: 1) Photobioreactors; Nutrient Removal; Waste Water (31 documents); 2) Biorefining; Bioenergy;

Bioeconomy (28 documents); 3) Biomass; Delignification; Ethanol Production (21 documents); 4) Anaerobic Digestion; Biofuel; Methane Production (21 documents); 5) Poly-Beta-Hydroxybutyrate; Cupriavidus Necator; Burkholderia Sacchari (16 documents). They collect about a quarter of the analysed 458 papers and present an evident focus on bioresources, bioproducts, energy and biotechnologies as most of the other 171 following Topics giving significative evidence of the supposed orientation of the sample toward the Bio-technology and the Bio-resource narratives.

3.2 Science Mapping

To perform Citation Analysis and ascertain the most influential publications in a research field, we relied on the citation overview function provided by Scopus, the search engine chosen for building the sample. We decided to direct our attention to the 10 most cited peer-reviewed papers in the effort to get a first insight into the intellectual trends towards which the sector appears to be headed. The findings are summarized in the following table.

In purely quantitative terms, it is easy to observe how there is a skew in the distribution of citations with the 3 most cited papers receiving about 14% of the total amount of citations, 6883 as reported before. Obviously, this asymmetry is a direct consequence of the year of publication. In fact, citation count is known to be a measure of influence more biased toward older publication, as recent ones have less time to be cited (Župič & Čater, 2015). In line with this assertion, more than half of the papers in Table 2 date from the first three years of scientific production, 2016-2018, while the 75 units of the sample without citations have a publication range between 2020 and 2021. However, four publications, including one from 2019 and three from 2020, saw a rapid increase in citations, revealing an immediate and decisive impact on the academic community, despite their relative newness.

Table 3. *The 10 most cited papers*

Reference	Year of Publication	Number of Citations	Share of Citations
Waste biorefinery models towards sustainable circular bioeconomy: Critical review and future perspectives	2016	374	5.47
Green, circular, bio economy: A comparative analysis of sustainability avenues	2017	316	4.62
Food waste biorefinery: Sustainable strategy for circular bioeconomy	2018	239	3.50
Biorefineries in circular bioeconomy: A comprehensive review	2020	184	2.69
A Circular Bioeconomy with Biobased Products from CO2 Sequestration	2016	147	2.15
Green Bioplastics as Part of a Circular Bioeconomy	2019	111	1.62
Engineering aspects of hydrothermal pretreatment: From batch to continuous operation, scale-up and pilot reactor under biorefinery concept	2020	103	1.51
Multi-product biorefineries from lignocelluloses: A pathway to revitalisation of the sugar industry?	2017	102	1.49
The circular bioeconomy: Its elements and role in European bioeconomy clusters	2020	92	1.35
The Next Generation of Sustainable Food Packaging to Preserve Our Environment in a Circular Economy Context	2018	92	1.35

Once the counting operation has been completed, it is important to take a qualitative perspective and try to understand what information this group of influential works is able to provide concerning the thematic dynamics of the whole documents set. Already from their titles, it is possible to deduce how most of them consider the biorefinery means, the wide range of bioresources processed in them and the development of biotechnologies applied in these processes as essential elements in the implementation of CBE. A more theoretical approach to the sustainable paradigm can be read in the second and ninth paper in order of achieved references. In particular, “The circular bioeconomy: Its elements and role in European bioeconomy clusters”, authored by Stegmann et al. (2020), is the only work that attempts to elaborate a definition of the investigated narrative emphasizing the “sustainable, resource-efficient valorization of biomass”. Therefore, adopting the lens of the three visions of BE proposed by Bugge et al. (2016), we may conclude that the citation analysis seems to add another clue in support of the prevalence Bio-technology and Bio-resource topics in the collected literature.

The thematic convergence that characterizes the 10 most prominent works appears to be further confirmed by the bibliographic coupling displayed in figure 6. In this methodology, coupling strength measures the number of coupling units that two publications share, where the unit of coupling represents the shared reference (Baker, 1990). Thus, it is possible talking of bibliographic coupling network when documents in a group interrelate having at least one coupling unit in common with other members of the set (Baker, 1990). When bibliographic coupling is performed using VOSviewer, objects of interest are citing publications which are connected by lines whose thickness is determined by the number of common references. The map delivered by the bibliometric software demonstrates the existence of an interesting bibliographic coupling network among the 30 highest cited documents

which, except for two with no links, share from a minimum of 1 to a maximum of 36 units of coupling. The latter is the case of "Biorefineries in circular bioeconomy: A comprehensive review", a review published by Ubando et al. (2020) that not only boasts the third highest number of citations in the sample but also shares references with 19 of the works represented, thus forming the central light blue node of figure 6. Undoubtedly, the fact that it is a review partly explains its centrality and the inevitable link with older works from 2016-2018. However, it is also true that the work of Ubando et al. (2020) has numerous and strong relationships with contextual or subsequent publications on biorefinery concept, transition to renewable biobased energy sources and sustainable waste management. Thematic streams that can also be deduced from the network of links that unfolds from the second most interconnected publication, "Sustainable food waste management towards circular bioeconomy: Policy review, limitations and opportunities", the purple item located right above the central light blue one of Ubando et al (2020).

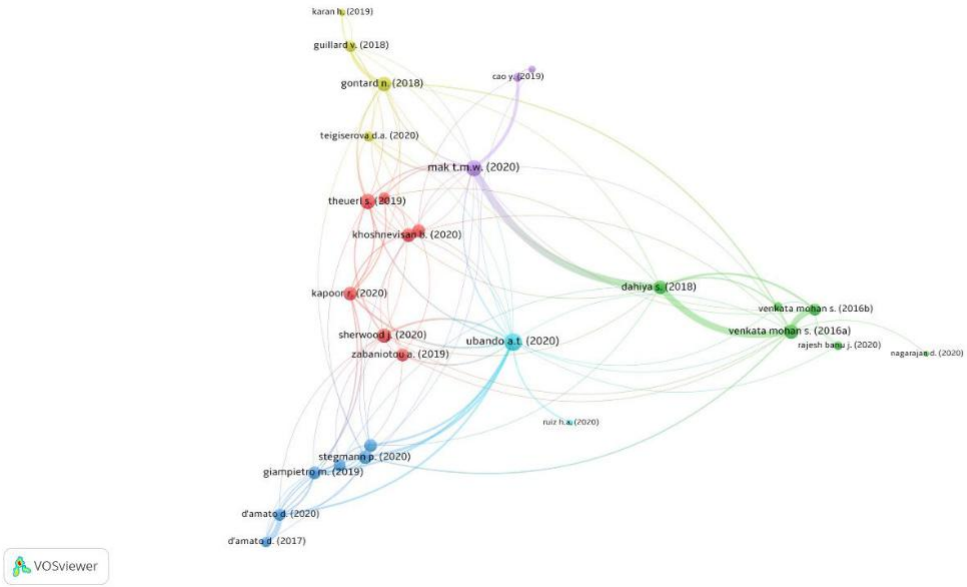

Figure 6. *Bibliographic Coupling Network Visualization of the 30 most cited papers*

However, the perception of an intense bibliographical correspondence and, therefore, of a probable thematic assonance finds a significant confirmation when the methodology in question is extended to the whole set of 458 publications projecting beyond the boundary of the 30 most cited papers. Indeed, the density diagram presented in Figure 7 reveals that the vast majority of the sample is crossed by a consistent coupling strength, especially within the broader cloud of 380 items that runs longitudinally through the centre of the map including the studies with highest bibliographic coupling scores. In this case, the density visualization function made available by VOSviewer

was chosen in order to facilitate the understanding of the geography of a map with so many elements. Through a wise use of the weight options, it has been possible to highlight the elements with the largest number of shared references and their areas of influence. Overall, 436 publications are related, albeit with different levels of intensity. The peak of 304 of shared references is reached by the work of Duque-Acevedo et al., published in 2020 and titled "Analysis of the circular economic production models and their approach in agriculture and agricultural waste biomass management". As can been seen, this second visualization is pivotal for a deeper comprehension of the theoretical foundation of the 458 contributions collected for this research. The topography of Figure 7 gives visibility to newer or niche works indicating that the presence of certain level of thematic coherence is not a prerogative of only the most cited works. Going in detail, almost 20 prominent studies respect to this type of indicator date from 2020-2021 and, except for the aforementioned review of Ubando et al. (2020), do not exceed the threshold of 70 citations.

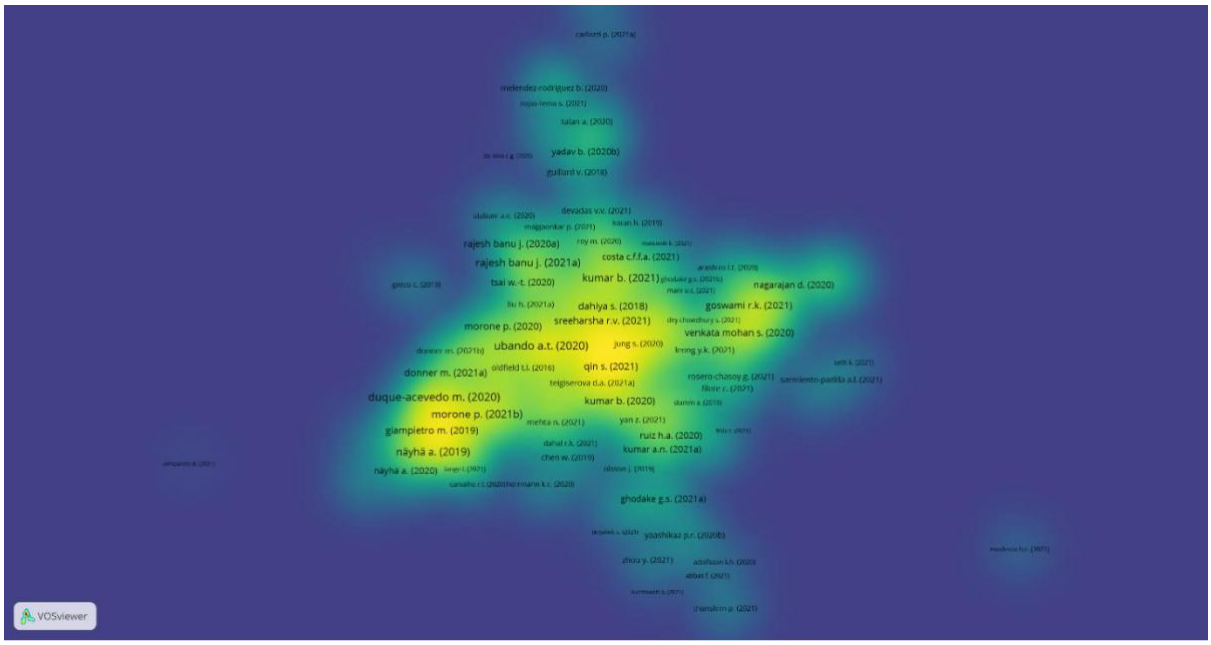

Figure 7. *Density diagram of the bibliographic coupling of 436 interconnected papers*

Finally, to retrieve a more dynamic comprehension of the distribution and relationships of BE visions in the sample a Co-word analysis has been carried out by screening the content of both titles and abstracts. A technical choice designed to compensate the problem that could derived from relaying on just one category of text data. In particular, when dealing with titles or keywords, the so-called "indexer effect" should be taken into account, because not always these indexers are able to reflect all relevant aspects of an entire document. On the contrary, the use of abstracts as well as full texts can bring disturbance complicating the identification of important words (Župič &

Čater, 2015). Consequently, exploiting the versatility of VOSviewer, a network map of co-occurrence links between terms has been built using text data extrapolated from both titles and abstracts (VOSviewer Manual).

The titles words network map generated by VOSviewer is represented in Figure 8 and includes, out of a total of 1577 analysed words, only terms with a minimum number of 5 occurrences. Since the size of the circles is proportional to their weight, words with a higher occurrence are shown more prominently than word with a lower occurrence. If two words appear together, they are connected by links whose thicknesses explains the extent of their occurrence relationship (Kim et al., 2016), i.e. the number of titles in which the two keywords were used together. The 45 words that meets the occurrence threshold are grouped in 6 clusters of differ colours. The clusters, whose number is determined by the resolution parameter, are highly interconnected. This aspect makes hard to isolate a main topic inside each cluster, but, at the same time, may be regarded as an indirect confirmation of the multifaceted and complex nature of the subject matter. However, since VOSviewer takes a distance-based approach to visualizing bibliometric networks, the distance between two items is also determinant for the correct interpretation of the map, because it is symptomatic of their degree of relatedness: in general, the closer the nodes are, the stronger their relationship is (Van Eck & Waltman, 2014). In this regard, the proximity, or rather the overlap, between the CBE and biorefinery items, both belonging to Cluster 5 (in purple), is quite evident indicating the key role assigned in the examined literature to this typology of multi-output production chain in the implementation of CBE (Stegmann et al., 2020). From a holistic point of view, this first stage of the co-word analysis, synthesised in the structure of Figure 8, supports a preponderance of terminology associated with the Bio-resource and Bio-technology visions. The articulation of the titles seems to describe CBE as production-oriented concept, a future perspective of development that see an opportunity of transition in the valorisation of bio-waste and in its conversion into a wide range of products mainly through the application of new advanced biorefinery technologies. The robust connections between CBE and items such as production, waste, valorisation and, once again, biorefinery clearly move in this direction. On the other hand, the lack of terms related to the Bio-ecology discourse is eloquent. Indeed, the sustainability node has a marginal relevance as witnessed by its relatively low number of occurrences compared to words typical of the other two visions of BE. The ties with strategy and life cycle assessment show that the sustainable dimension is included and addressed in the sample even if probably not in the strong sense promoted by the third vision of BE. In addition, it is interesting to notice how in Figure 8 the string “sustainable circular bioeconomy” is a stand-alone element with an occurrence of 10. A detail that could be subject to a double reading: on the one hand it could compensate for the lack of a direct link between CBE and sustainability, on the other hand it could reveal a tendency to interpret CBE concept as sustainable per se.

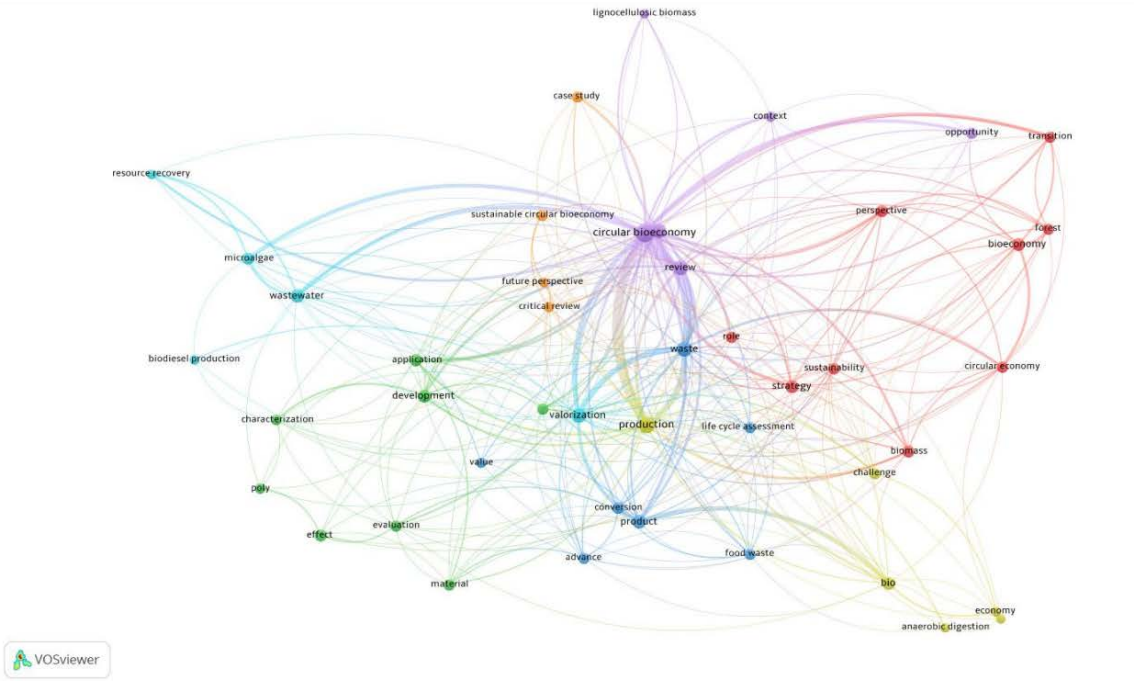

Figure 8. *Titles words network map*

Figure 9 documents the second stage of co-word analysis by extracting from the abstracts the terms with a minimum occurrence of 20. In this case, VOSviewer produces a network map of 125 objects divided into 4 clusters with a considerable level of interactions. Despite the inevitable noise introduced using large corpuses of text, extending the co-word approach to the abstracts proves to be an effective way of pursuing quality through quantitative (Callon et al., 1986d). Without affecting heterogeneity of the investigated scientific field, it has been possible to recognize and graphically aggregate some conceptual features that can corroborate previous results and, at the same time, highlight details that deserve to be further investigated. As in Figure 8, while CBE maintains a relatively central position in the map, we can also appreciate an increased plethora of technical expressions mainly linked to the production item located in the red cluster. In continuity with the previous phase of the analysis, the lack of terms related to the social and environmental dimension is still manifest. Although, this time, there is a direct connection between CBE and sustainability, the distance between these two nodes suggests a limited impact of latter one on the former one. A similar observation can be directed towards other objects such as environmental impact, climate change and sustainable development whose peripherical position, as well as their network of links, has significant implications in describing the cognitive structure of the sample. As epitome of the research path proposed in this study, the co-word analysis of abstracts depicts a notion of CBE characterized by a macro focus on bio-resources and their capitalisation into a wide spectrum of new marketable products, in particular energy, through the application and commercialisation of advanced technologies. Zooming on the map, the principal evidence in favour of this conclusion can be found in the area, to the left of the CBE node, occupied by the self-explanatory subnetwork

composed of production, waste, process, biomass and technology. As the swich to density visualisation shown in Figure 10 can easily demonstrate, this is the area that reaches the highest level of both occurrences and total link strength, where the total link strength measures the total strength of the co-occurrence link between terms (VOSviewer Manual). A quantitative and graphic aspect that, according to the assumptions of co-word analysis, allows to perceive this combination of words as an influential pole in the thematic architecture of the sample. Undoubtedly, both the technological and ecological-environmental components are taken into account, but in a sense that might be considered distant from that promoted by the respective visions of reference, i.e. Bio-technology and Bio-ecology visions. The network geography seems to indicate a prevalent preordination of technological research and development to the improvement of processing and conversion of biological raw materials, in coherence with the idea of technology innovation highlighted in the Bio-resource vision. Indeed, as well as Bio-technology vision, the Bio-resource vision emphasises the importance of research and innovation as driver of value creation, but in a less linear way that transcends the narrow science application of technologies calling for stronger cross-sectoral collaborations in multiple fields related to biological materials (Bugge et al., 2016). Similarly, the sample appears inspired by a meaning of sustainability as a consequence of bio-innovation and bioresource capitalization, and thus far from the strong connotation adopted by the Bio-resource vision.

Always in the light of Bio-resource principles, should be read the conspicuous presence of terms borrowed from the waste sector. In this regard, the high co-occurrence strength between waste and biorefinery items, in both titles and abstracts analysis, requires attention because it might be implied that the energy production from bio-waste plays a key role in CBE literature and is not intended as the extrema ratio recommended by the Bio-ecology narrative.

In conclusion, trying to interpret the results of the different science mapping techniques in a unified way, the following answer to the research question emerges: the new research field of CBE present a common thematic foundation that seems to be mainly inspired by a bio-resource vision of BE and grounded in a weak sustainability narrative. An answer that leads the consideration that CBE, as its building blocks, is a resource focused paradigm (D'Amato et al. 2017) that is still missing a preponderant social and environmental dimension and is unable to offer a solution to the sustainability challenges posed by BE and CE.

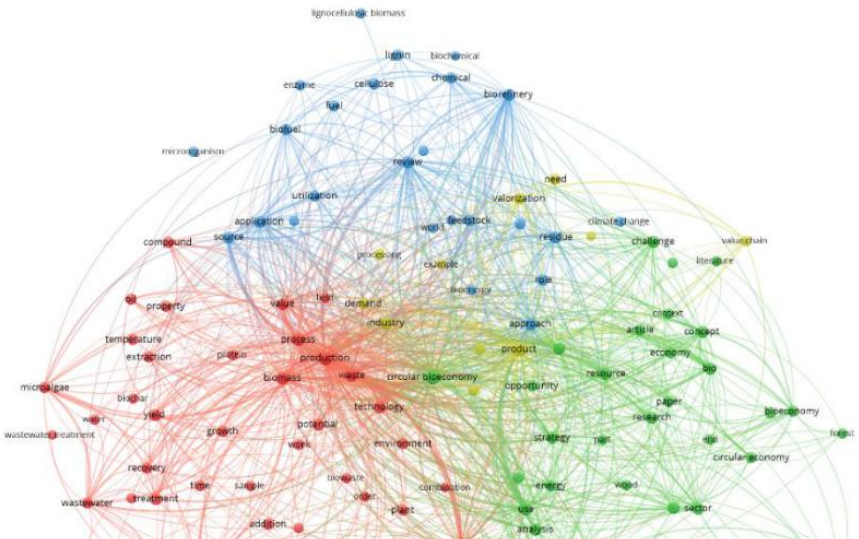

Figure 9. *Abstracts words network map*

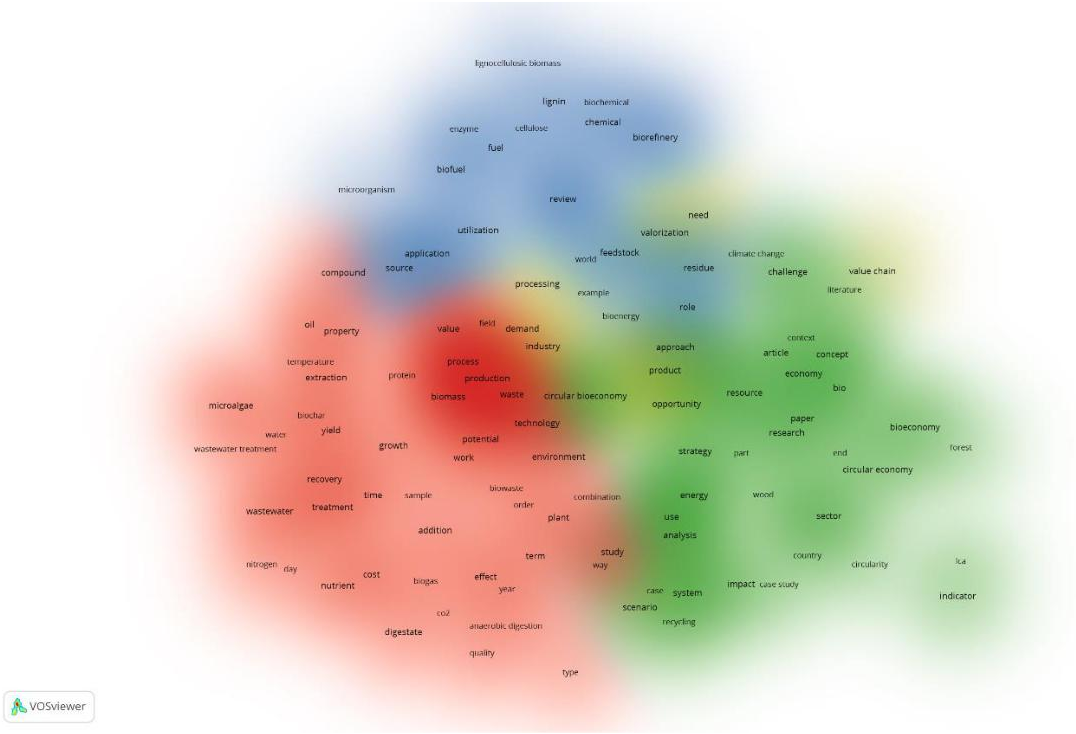

Figure 10. *Density visualisation of abstracts co-word analysis*

4. Conclusions

Through an articulated methodological structure, the present study has aimed to deepen the recent concept of CBE trying to provide a first response to the theoretical challenges posed by its extremely controversial and nebulous nature. To contribute to define more accurately the epistemological boundaries of the phenomenon, we proposed a hermeneutic pathway that focuses on the analysis of one of its constitutive components, the BE. A detailed bibliometric analysis was conducted, employing several advanced bibliometric tools, and the results were interpreted according to the taxonomy developed by Bugge et al. (2016) in order to understand which view of BE could be considered prevalent in the CBE landscape.

The performance analysis confirms, firstly, that CBE is gaining increasing attention in the literature, being recognised as innovative sustainable solution in a yearly growing number of papers mostly authored by researchers affiliated to European and Asian institutions. A possible intuition of the BE visions towards which the sample may be oriented begins to emerge when dwelling on the top journals active in the sector as well as the subject areas and topics to which the collected publications are attributed.

However, thanks to science mapping techniques it is possible to outline, at least from the macro perspective typical of this methodology, a more elaborate answer to the research question. If the bibliographic coupling

suggests a certain degree of thematic similarity within the considered sample, the co-word analysis, as content approach, allows to identify and visualise the direction of the intuited conceptual convergences. In fact, even if the difference should not be considered in a strict way and the three BE discourses necessarily interrelate on different levels (Bugge et al., 2016), there are consistent evidence of an alignment of CBE with the terminology associated with the Bio-resource vision. The technological aspect of the first vision is also covered, but always in a way that is instrumental to understand how and which resources to employ efficiently. Overall, it is possible to perceive an under-representation of the themes specific to the Bio-ecology visions.

Although this is a preliminary and exploratory study, it provides results that will be pivotal in orienting the future phase of the research on CBE. Indeed, even with its inevitable methodological limitations, the proposed contribution allows to highlight how CBE is still an evolving notion whose understanding requires further investigations if we intend exploit its full potential as solution for the present and future environmental, social and economic challenges.

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Posters

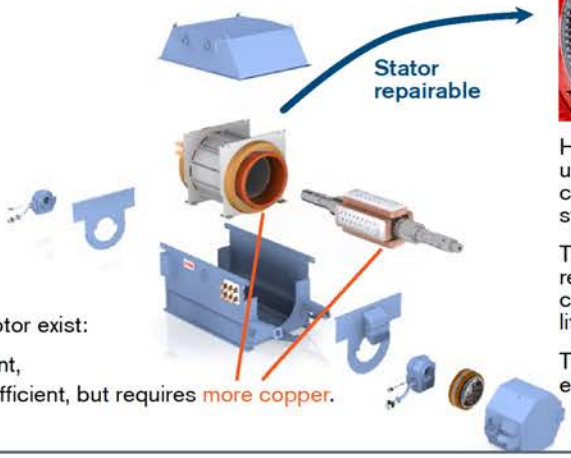
For durable and energy intensive products, maintaining high energy efficiency is key for repair to be beneficial

Adeline Jerome, Maria Ljunggren and Matty Janssen

For **durable and energy intensive products**, maintaining **high energy efficiency is key for repair** to be beneficial.

Context

High voltage electric motors are big and long-lived (designed for min 20 years) stationary motors used in the industry. Examples of application are in the chemical and metal industries, to drive pumps or compressors.



Two main designs of high voltage motor exist:

- Induction motor: less energy efficient,
- Synchronous motor: more energy efficient, but requires more copper.

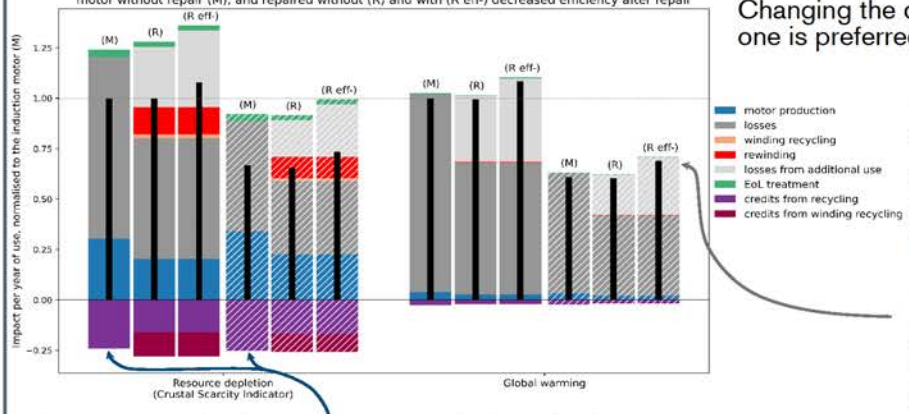
High voltage motors are often used until failure, with one of the most common faults occurring in the stator copper windings.

The stator could be repaired by rewinding, i.e. replacing the copper windings, for an additional lifetime (here assumed 10 years).

The repair may lead to a reduced energy efficiency.

Results

Comparison of the environmental impact for the induction (non-hatched) and synchronous (hatched) motor without repair (M), and repaired without (R) and with (R eff-) decreased efficiency after repair



Higher production impact on resource depletion for the synchronous motor. But lower energy losses compensate for the difference.

Changing the design to a more energy efficient one is preferred over use extension with repair.

The contribution of rewinding is lower than motor production.

But the net benefit of repair is very small for both global warming and resource depletion (comparison of (R) and (M) for both designs).

With an efficiency reduction after repair, the additional energy losses offset the gain from avoiding the production of a new motor (impact for (R eff-) higher than for (M)).

The repair is not beneficial if high efficiency is not maintained.

Environmental sustainability of high voltage motors: do better efficiency and repair lead to improved environmental impact?

Adeline Jerome[1], Maria Ljunggren[1] and Matty Janssen[1]

[1] Environmental Systems Analysis
Chalmers University of Technology
Gothenburg, Sweden
Contact: adeline.jerome@chalmers.se

CHALMERS UNIVERSITY OF TECHNOLOGY

REES MISTRA Resource-Efficient and Effective Solutions

5. Production, consumption and innovation

5d. Value chains and trade

Abstracts

The Food Retail Sector towards a Circular Economy

Dr Carmen Jaca, Dr Marta Ormazabal, Dr Maria Jesús Alvarez-Arjona, Florencia Kalemkerian

Tecnun- Universidad de Navarra, San Sebastian, Spain

Abstract

Retailing is a key activity for cities as it helps to meet citizens' needs and generate economic activity. This activity refers to the sale of goods or services from manufacturers and producers to individual end-consumers and consequently, retailing consists of the last step in a supply chain including the sale of a product or the provision of a service to the final consumer.

In the current context, where cities need to accelerate their transition to a circular and sustainable economy, retailers are an important agent of change. They can adopt sustainable practices in their own internal processes and also facilitate the adoption of sustainable behavior among their customers (Paiho et al., 2020). Although retailers can contribute significantly to the implementation of a circular economy, little attention has been paid to this field of research in the literature (Wautelet, 2018). It is therefore crucial to better understand their role and how they can potentially accelerate the transition to a circular economy.

The objective of this research is to work with a group of people representative of different profiles of this sector to have a diagnosis and in turn, constitute a first group of traders involved in direct actions in their business. This research project consisted of four workshops aimed at traditional businesses in the food retail sector located in San Sebastian, in northern Spain. Specifically, the food sector has been selected, as it is one of the key sectors in the European Green Deal and as it accounts for 30.7% of the city's businesses. The workshops were as follows:

- What is my value proposition? Customer of the 21st century
- How can I be more sustainable? Business sustainability
- How can I get more out of my waste? Waste: waste or business?
- How can you help me in this improvement of the circular economy? Conclusions

In each session, an introduction to the concepts related to the topic and good practices was given. Then, through participatory dynamics, exercises were carried out to reflect on their businesses in order to analyze their processes and think about improvements and opportunities.

An interesting atmosphere was created in which new ideas emerged, relevant problems were pointed out and experiences were exchanged. Those attending the workshops were people who were environmentally aware and motivated to improve in this regard. One opportunity that arose from these workshops is the need to collaborate among them and with other agents to address actions that would not be possible on their own.

PAIHO, Satu, et al. Towards circular cities—Conceptualizing core aspects. Sustainable Cities and Society, 2020, vol. 59, p. 102143.

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SDG 11 (sustainable cities and communities) and SDG 12 (Responsible consumption and production)

This paper contributes to the topic SUSTAINABLE DEVELOPMENT AND COURAGE: CULTURE, ART AND HUMAN RIGHTS, from the perspective of cities and their trading, exploring pathways to increase its sustainability.

Track

Track 5d Value chains and trade

Full papers

Applying Oiconomy Pricing

First experiences of producers applying real cost sustainability assessment of products

Vermeulen, W.J.V.[1], Croes, P.R. [2], van der Feen, L.[3]

[1]*Copernicus Institute of Sustainable Development, Utrecht University, Netherlands, w.j.v.vermeulen@uu.nl*
[2]*Copernicus Institute of Sustainable Development, Utrecht University, Netherlands, p.r.croes@uu.nl*
[3]*Copernicus Institute of Sustainable Development, Utrecht University, Netherlands, l.vanderfeen@uu.nl*

Abstract

The Oiconomy approach provides a normalized way of measuring and communication of (un)sustainability. In this standard (un)sustainability is expressed in a virtual monetary unit, the "ESCU" (Eco Social Cost Unit). As closely as possible, the ESCU score of a product equals the hidden preventative costs, or externalities, related to a product, the costs that should have been spent to avoid any of the damage that the product causes during its entire lifecycle. This assessment addresses preventative costs for all UN-SDG sustainability aspects including Planet-aspects (climate impacts, biodiversity, land use, resource depletion, circularity), People-aspects (working conditions, fair wages, health), and Prosperity-aspects (corruption, fair inequality, fair trading). Added to the standard economic price of the product the ESCU score represents the total costs of a fully sustainable alternative for the product. The ESCU also provides a normalized means of transfer of (un)sustainability through the supply chain enabling all players in the supply chain to build on each other's data.

This paper presents the result of a pilot project with three companies, operating in global value chain, applying the Oiconomy Sustainability Assessment Tool.

Goals of the Oiconomy Project are to develop a uniform and aggregable measurement of the preventative cost distance to sustainability for products. With this it aims to make 'preventative costs' a permanent topic in the supplier – customer communications. The project encourages end-producer companies and their whole value chains to calculate and implement sustainable solutions. The tool provides an innovative comprehensive measurement of environmental sustainability and social responsibility.

In a pilot project three Dutch end-producer companies (one selling spices to consumers, one producing kitchen topping and one producing medical devices) applied the new methodology together with their suppliers, partly in low-income countries (Indonesia, Ukraine, Egypt). The goal of the pilot study was to test whether the tool was clear enough to be applied by company experts instead of external consultants, to identify points of improvement before further market introduction and share experiences which forms of presentation of the

outcomes in the supplier – customer communications and evoke collaboration about further performance improvement. The methodology has so far been described in various scientific articles in the International Journal of Life Cycle Assessment and the Journal of Cleaner Production, yet without real life testing.

In the paper we will show the results of these calculations for the three cases, the experiences of the companies and the implications for the market introduction of the tool.

Keywords: True Cost Accounting, Life Cycle Assessment, Sustainable Value Chain Management, Corporate Sustainability

1. Introduction

Corporate sustainability (CS), also described as corporate social responsibility (CSR, MVO), presents the role of the business world in contributing to the full complexity of the current massive sustainability challenges. This problematic complexity is illustrated by the 17 Sustainable Development Goals (and 169 sub-goals) agreed upon in the United Nations. It includes a twin agenda of integral environmental and societal fairness: the triple-P agenda (Planet, People, Prosperity) (Vermeulen, 2018). The World Business Council of Sustainable Development (WBCSD) argues that this critical agenda cannot be realized without effective engagement by the private sector. As a crucial element of their programs for business engagement they state that "better information equals better decision-making; disclosing sustainability risks and impacts, and pricing them appropriately, is increasingly where the market is heading for" (WBCSD, 2022).

However, the practice of corporate sustainability performance measurement rather still looks like the Babylonian confusion of speech. First problem is that many competing measurement tools exist, mostly addressing only a few or one of the 17 SDGs, not integrating the environmental and social dimension. Second, these tools focus on measuring the negative impacts produced, thus not showing companies what they could or should do, but rather blaming and shaming them. Third, many of these assessment tools are based on general available data on negative impacts for product categories, provided by tools and repositories, like Ecoinvent, Gabi and Simapro, using national averages. Thus, companies cannot fully show the own specific improved performance compared to competitors. The assessment of both the environment and social performance cannot yet be appropriately integrated in one consistent comprehensive system.

As a solution for these needs the Oiconomy Pricing methodology was developed. It presents a practical tool for companies which enables them to make a full triple-P spectrum assessment together with their main suppliers, in the standard monetary language in the market, which a focus on solutions (prevention options), rather than on negative impacts on nature and society. Some forms of monetary approaches in product assessment do exist at this moment (like TruePrice), however the transparent, non-profit, science-based

approach and the focus on prevention instead of damage costs are unique in the world, as well as the feature that companies apply the methodology themselves and can integrate that in their supplier base information systems.

2. Methods

The Oiconomy Pricing methodology has been developed in the PhD research of dr. Pim Croes, who defended his PhD thesis (Croes, 2021) on January 14th, 2021. The research focussed on positioning the core idea of the approach in the existing field of life cycle assessment and sustainability performance measurement (Croes and Vermeulen, 2015), justifying the methodological ground rules. The methodology for establishing default values, applied when companies do not have the company specific preventative cost information themselves, was elaborated with state-of -the art reviews and check on data quality of existing global databases for examples of social impact indicators, including fair wages, levels of inequality and corruption prevention (Croes and Vermeulen, 2016a, 2016b, 2019). The methodology includes a systematic analysis of methods used for including positive impacts in the methodology, preventing forms of greenwashing in this respect (Croes and Vermeulen, 2020). This scientific groundwork resulted in 5 articles published in the Journal of Cleaner Production and the International Journal of Life Cycle Assessment.

The negative hidden costs measured in Oiconomy Pricing are covering all 17 UN SDGs and all triple-P pillars (Planet, People, Prosperity). Table 1 displays the included aspects in measuring the preventative costs towards a fully sustainable product. In contrast to many environmental assessment methods, Oiconomy Pricing addresses all SGD related sustainability aspects in a consistent and comprehensive methodology. It enables fully integrated assessment and prevents (unintended) trade-offs between sustainability aspects. All prevention costs are expressed in a virtual monetary unit, the “ESCU” (Eco Social Cost Unit). This represents the costs that should have been spent to avoid any of the damage that the product causes during its entire lifecycle and can be transferred into any currency. Besides negative hidden costs, positive externalities, a positive externality occurs when a third-party benefits from activities or consumption of a product without contributing to the (full) costs of the transaction (Benoît Norris et al., 2009). Croes & Vermeulen (2020) formulated a list of criteria for the allocation of positive costs.

Table 1. Included aspects Oiconomy Pricing

Pillar	**Aspect**	**Measures prevention costs towards:**
Planet	Emission of toxic gasses	Zero emissions of harmful gasses/substances to air, soil and water (bulk gasses, toxic emissions and agri-chemicals)
	Use of scarce resources	Use of renewable resources instead of virgin (scarce) resources
	Biodiversity	Preservation of (original) biodiversity
	Land use	Optimizing yields for food production
	Waste & Disposal	Sustainable disposal of waste and optimized lifetime of product
People	Human health risk	Reduced human health risks
	Labour	Fair remuneration & safe labour conditions
		Fair inequality between lowest and highest salary within company
		Sufficient contribution to health insurance, personal development, and pension plans
		Ensuring occupational health & safety
		Mitigation of child labour.
Prosperity	Economic Responsibility	Fair payment to suppliers
		Responsible financial management
	Corruption & Conflict	Prevention of corruption & conflict

The system copies the normal economic price build-up in the supply chain for the hidden costs of preventing environmental, social and economic harm, inflicted as consequence of the production, use and disposal of the

product. The actors themselves make the assessments and calculations and transfer the results to the next in the supply chain. When self-provided ("foreground") data are not available,

the system provides default ("background") data. There are two types of data used in the system 1) performance data and 2) data on prevention costs. Performance data is data measuring the sustainability performance of companies (e.g. kWh used). Performance data should be foreground data as much as possible, as this reflects the reality of activities in the supply-chain. Data on prevention costs reflects data on the cost of sustainability mitigation measures (e.g. investing in solar panels). It is preferable to use company-specific prevention costs, however this takes time as companies need to assess the costs of specific mitigation measures. If such data is unavailable, generic data-base sourced data on sustainability mitigation measures are used.

Trustworthiness of the data is obtained by verification and certification according to international standards. A draft standard is available for certification purposes and an assessment tool for the actors in the supply chain.

The core design principles of the Oiconomy system of the approach are:

1. All triple-P pillars (Planet, People, Prosperity) are included, covering all 17 UN SDGs. The word "sustainability" therefore includes social and economic responsibility.
2. (Un)sustainability is determined by the additional costs for a sustainable product version, expressed in "Eco Social Cost Units" (ESCU's).
3. ESCU's are transferred as one total value, but also separately for the 10 aspect categories.
4. Verification of the reliability of the data takes place by means of certification on the Oiconomy standard (in the future).
5. Information about the sustainability performance in the form of ESCU's is transferred and documented in the value chain like normal prices (without the margins). The Oiconomy System is a bookkeeping system for the yet hidden preventative externalities.
6. By only transferring information in the form of aggregated ESCU's, intellectual property of production specifications of suppliers remains safe.
7. The Oiconomy system is a type of "Life Cycle Assessment", but measured by the value chain actors themselves, instead of afterwards by scientists, consultants or NGOs based on general databases.
8. Without demonstrable specific data, generic default values from a database are used, but the companies can continuously improve these with their specific data and investment calculations.

To apply Oiconomy pricing, the Oiconomy Sustainability Assessment Tool has been developed. It leads the practitioner through all stages of the product life cycle and along all aspects of sustainability. By means of a questionnaire, all aspects of sustainability are measured, and the hidden cost are automatically calculated. Figure 1 displays the process of calculation hidden costs through the Oiconomy Assessment Tool. The first step in applying the assessment is scoping of the supply chain. The practitioner needs to identify suppliers that are within 80% of the purchased value of a product. The suppliers that fall within the 80% scope needs to be

included in the Oiconomy Pricing Assessment. The tool then challenges selected companies to self-provide their specific ("foreground") costs to prevent causing harm, or in other words the extra costs (without margin) for the sustainable version of the product. However, in absence of foreground prevention costs, the tool provides default ("background") data, which are based on either internationally determined conventions, science, or benchmarks.

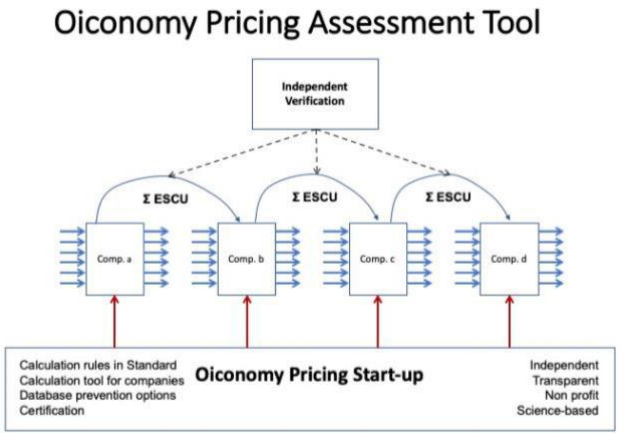


Figure 1. Oiconomy Pricing Assessment Tool

From November 2021 to March 2022, three pilot companies applied the Oiconomy Pricing, with one part-time researcher at UU available for explanations and support. The end-producers (one selling spices to consumers, one producing stone kitchen topping and one producing medical devices) involved their main suppliers to measure their hidden costs. The goal was to test whether the tool was clear enough to be applied by company experts instead of external consultants, to identify points of improvement before further market introduction and share experiences which forms of presentation of the outcomes in the supplier – customer communications and evoke collaboration about further performance improvement.

3. Results and Discussion

3.1 Case study 1: stone kitchen countertop

The first case under assessment was a company called Arte, that produces stone kitchen counter topping. The company is located in the Netherlands and produces various types of stone kitchen counter tops. The unit under review is 1 m^2 of stone kitchen countertop and the exact product properties are not disclosed due to confidentiality of supply-chain partners. The supply-chain of the stone countertop was traced back by including 80% of the purchased value. This identified the most relevant supply-chains for stone: Feldspar,

Clay and other chemicals (Figure 2). The stone surfaces manufacturer and Arte supplied foreground data and the clay, feldspar and chemical suppliers were assessed using background data from databases. The results reveal that the total hidden costs of 1 m^2 of stone countertop is € 32,44 (Figure 3). The sales price of 1 m2 stone countertop is € 912 meaning the hidden costs are adding 3,56% onto the sales price.

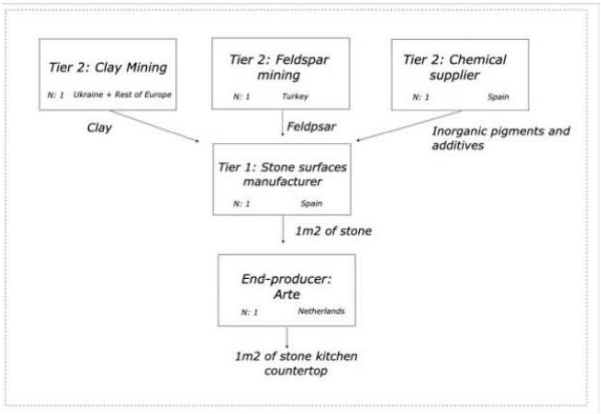


Figure 2. Scope of assessment

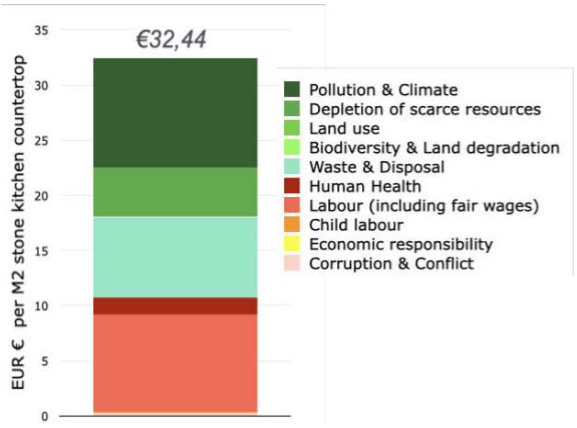


Figure 3. Breakdown negative hidden costs

The main negative hidden costs come from the category Pollution & Climate. Pollution & Climate measures the cost to prevent polluting emissions to soil, air and water. Most of the costs come from the manufacturing process and transport of the stone surfaces producer (€ 5,15), other costs include the energy usage of Arte (€ 1,54) and the mining operations of clay and feldspar (€ 2,41 and € 0,85). The second biggest category is Labour. Labour measures fair wages, fair inequality and other labour conditions. The bulk of the costs come form the stone surfaces manufacturer in Spain as they could not demonstrate the absence of various labour aspects.

There is a high risk of child labour in the feldspar and clay mines in Ukraine and Turkey. The lack of demonstrated evidence of the absence of child labour led to the allocation of €0,12. € 0,12 is the amount necessary to replace the children with adults earning the fair minimum wage. In the category Waste & Disposal, the cost- distance to sustainable disposal is measured for both processing-waste and end-of life waste. Negative costs emerge from the end-of- life disposal as the demolition of the countertop creates inert waste (€ 4,20). Furthermore, hidden costs found include cost to prevent the depletion of scarce resources. The stone surfaces manufacturer uses a lot of fossil resources, that lead to negative costs of € 1,33. Additionally, the water consumption for 1 m^2 of countertop is 0,17 m^3 and is extracted in a water-scarce area, which leads to negative hidden costs of € 3,09.

Besides negative hidden costs, positive costs were calculated (Figure 4). Positive costs of € 6,89 were found, which was spent by Arte and by the stone surfaces manufacturer. Among other things, Arte invested in extra preventative medical care for their employees (category: Social Responsibility), and set up the Responsible Stone Foundation that aims to eradicate child labour in the communities nearby stone quarries by supporting quality education (category: Economic Responsibility).

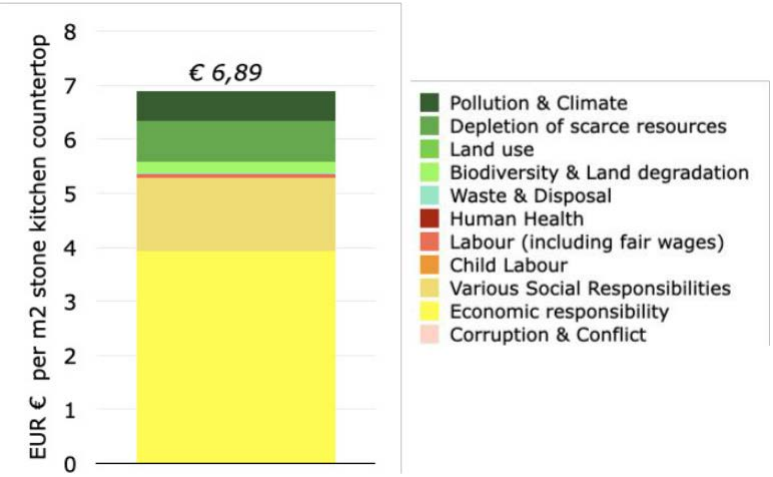


Figure 4. Breakdown of positive costs per m^2 stone countertop

3.1.1 Data specificity assessment of m^2 stone kitchen countertop

Performance data is data measuring the sustainability performance of companies (e.g. kWh used). The data specificity of performance data of this analysis is displayed in Figure 5. Arte was able to complete the assessment using mainly company-specific data. The stone surfaces manufacturer also actively took part in this pilot but was not able to demonstrate all the data, so partly, background data was used. Regarding the feldspar and clay supplier only background data was used.

Prevention costs are data on the costs of sustainability mitigation measures (e.g. investing in solar panels). The data specificity of prevention costs of this analysis are displayed in Figure 6. None of the value-chain partners were able to provide much foreground prevention costs, as it takes time to make investment proposals to mitigate impact. This should be a focus when the assessment is repeated.

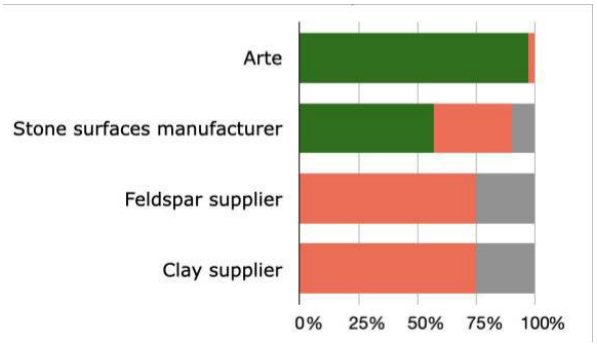


Figure 5. Data specificity of performance costs

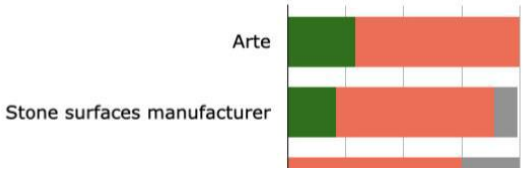


Figure 6. Data specificity of prevention costs

3.2 Case study 2: Medical Device

The second company under assessment was a company called ADMC Group, located in the Netherlands. ADMC produces medical equipment in the rehabilitation and physiotherapy field. The product under review is a pack heater. The pack heater is an electrical box that can heat packs used in heat therapy. The supply-chain of the pack heater was traced back by including 80% of the purchased value. This identified the most relevant supply-chain: the steel components (outer-body of the pack heater, inner body, the net, the cover and the handle) (Figure 7). ADMC and the steel workshops were able to provide data on their sustainability performance and data from the steel producer and steel trader was sourced using databases. The total hidden cost of a pack heater is € 130,12 (Figure 8). The sales price of a pack heater is € 1600, meaning the hidden costs are adding 8,13% onto the sales price.

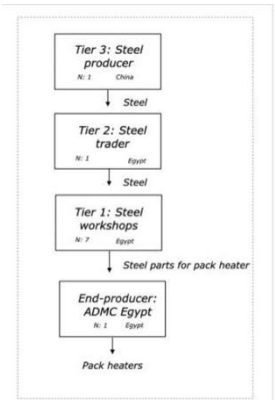


Figure 7. Scope of assessment

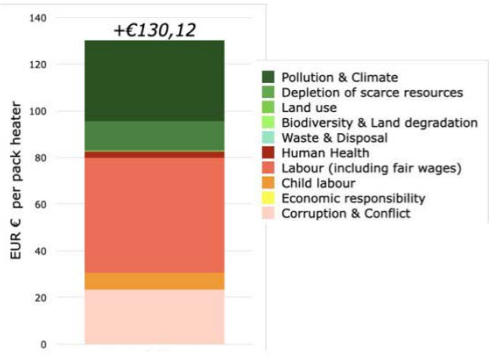


Figure 8. Breakdown negative hidden costs

The main negative hidden costs come from the category Labour. Labour measures fair wages, fair inequality and other labour conditions. The main costs come from the steel workshops as employees receive a

remuneration that is far below the fair minimum wage as determined by the Oiconomy Standard. Employees in the workshops earn € 55- 65 per month, while the fair minimum wage is € 129 per month. Increasing the price of the product so employees receive a fair minimum wage leads to negative costs of € 24,88. Besides fair remuneration, the employees do not receive sufficient contribution to health insurance nor is their occupational health & safety sufficiently managed (€ 3,69). Besides the steel workshops, steel traders were allocated default costs on Labour, as no company-specific data was gathered (€ 9,46). Gathering specific data on the steel trader or cutting out this middle-men could eliminate these costs. The second biggest impact category is Pollution & Climate. The electricity consumed by the steel workshops (€ 12,12), ADMC (€ 9,00), and CO2 emissions during steel production (€ 11,42), contribute mostly to this. The negative costs on Depletion of scarce resources are background costs for the primary production of steel in China (€ 11,42).

Besides negative hidden costs, positive costs were calculated (Figure 9). Bonus ESCU's are based on actual company spending, benefitting others than the ones involved in the transaction. Positive costs of € 17,56 were found, all of this was spent by ADMC. ADMC invested to train their employees, reimburse medical expenses and contribute to a project to prevent child labour, by among other things providing microcredits and by organizing capacity raising activities.

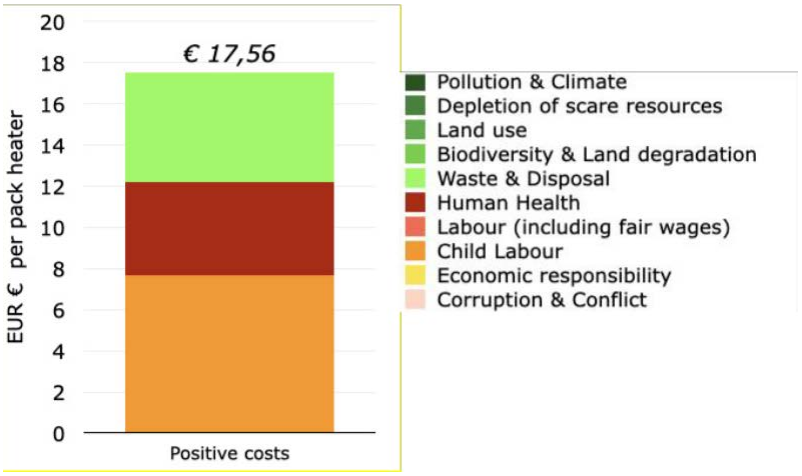


Figure 9 Positive costs per pack heater

3.2.1 Data specificity assessment of pack heater

The data specificity of performance data of this assessment is displayed in Figure 10. ADMC Group was able to complete the assessment using mainly company-specific data. Data on the steel workshops was retrieved through a questionnaire, conducted by a local NGO. Regarding the steel trader and steel producer data was mostly obtained using generic databases.

The data specificity of prevention costs of this analysis are displayed in Figure 11. None of the value-chain partners were able to provide much company- specific prevention costs, as it takes time to make investment proposals to mitigate impact. This should be a focus when the assessment is repeated.

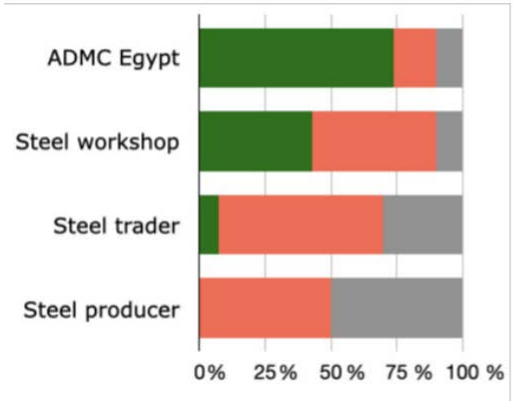


Figure 10 Data specificity of performance costs

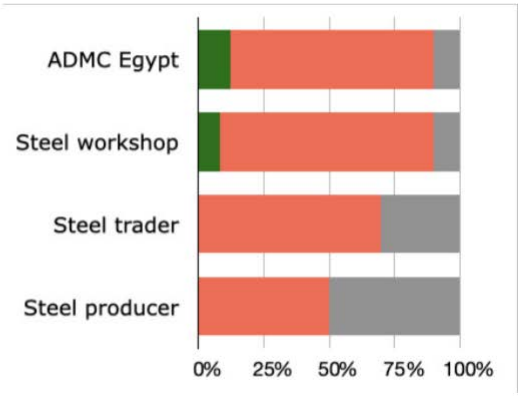
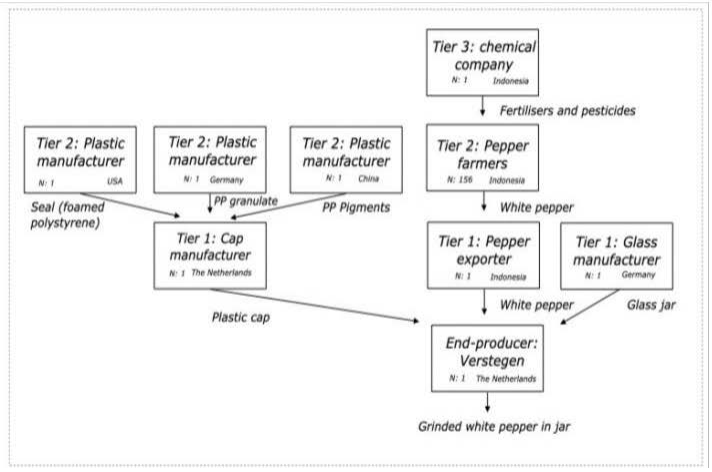


Figure 11 Data specificity of prevention costs

3.3 Case study 3: White pepper

The third company under assessment was Verstegen Spices & Spauces, located in the Netherlands. The product under review was 1 jar of ground white pepper. Verstegen sells white pepper sourced from Indonesia, where the pepper is cultivated by smallholders and sold to the pepper exporter. The supply-chain of white pepper in a jar was traced back by including 80% of the purchased value. This identified the most relevant supply-chains: the plastic cap, the white pepper and the glass jar (Figure 12). The total hidden costs of 1 jar of grinded white pepper are € 1,03 (Figure 13). The sales price of a jar is € 2,99 meaning the hidden costs are adding 34% onto the sales price.



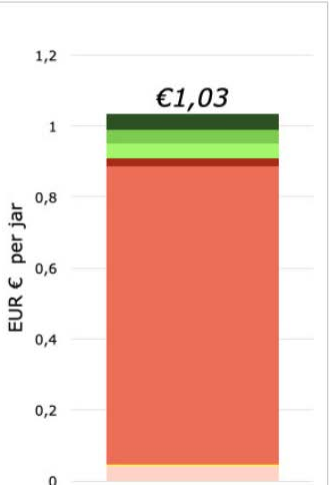


Figure 12 Scope of assessment

Figure 13 Breakdown negative hidden costs

The main negative hidden costs come from the category Labour. Labour measures fair wages, fair inequality and other labour conditions. The glass manufacturer has a salary inequality ratio of 98,7 between the lowest and highest paid salaries within the company. This is above the fair inequality ratio of 23,8. This leads to costs of € 0,76. Additionally, the pepper farmers do not offer their employees health insurance or ensure occupational health & safety (€ 0,04). The second and third biggest cost categories are Pollution & Climate and Corruption & Conflict. Most costs to mitigate pollution are caused by the pepper farmers using fertilizers (€ 0,01) and through the production of glass (€ 0,19). Pepper farmers and pepper exporters are most susceptible to Corruption and have no active governance to mitigate that (€0,04). Other hidden costs that were found, include costs to prevent biodiversity loss. Verstegen, together with the pepper exporter, invested in Agroforestry solutions to increase biodiversity. Through this project, supply- chain specific mitigation costs were used to calculate prevention costs.

Besides negative hidden costs, positive costs were calculated (Figure 14). Positive costs are based on actual company spending, benefitting others than the ones involved in the transaction. Positive costs of € 0,89 were found, 98% of this was spent by Verstegen. Verstegen invested to increase yields, contributing to food security (expressed in the category Land use). The project also led to increased livelihoods of pepper farmers (Economic Responsibility).

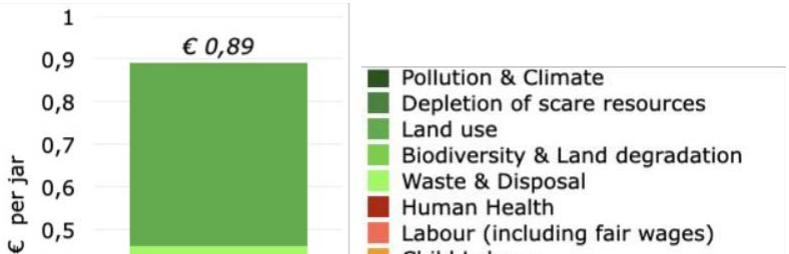


Figure 14 Positive costs per jar of white pepper

3.3.1 Data specificity assessment of white pepper

The data specificity of performance data of this analysis is displayed in Figure 15. Verstegen, the pepper exporter, the pepper farmers and the cap manufacturer were able to complete the assessment using mainly company-specific data. The data of the glass manufacturer was mainly obtained through generic databases.

The data specificity of prevention data are displayed in Figure 16. None of the value-chain partners were able to provide much company- specific prevention costs, as it takes time to make investment proposals to mitigate impact. This should be a focus when the assessment is repeated.

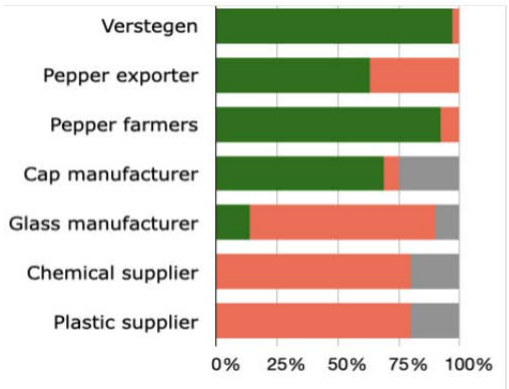


Figure 15. Data specificity of performance costs

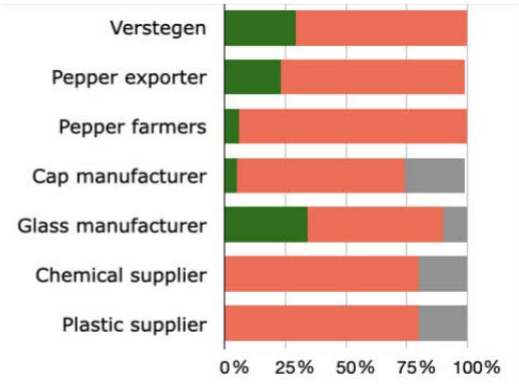


Figure 16. Data specificity of prevention costs

3.4 Main observations and learnings from case studies

The case studies have resulted in observations and learnings that have implications on the Oiconomy assessment tool, further support that is necessary and on further development of the Oiconomy pricing methodology. The following observations were made:

All pilot companies have independently started reaching out to their main suppliers after the initial scoping of the assessment. With the background support from the UU team all three companies were able to complete the full scope assessment.

The pilot companies were in good contact with their main suppliers and were able to convince and motivate the most relevant suppliers to join the pilot. Large suppliers of small elements of the product were hard to convince. In these cases, background-data-based assessments were made. *In the future users will need to be supported in filling such gaps.*

For various aspects, the method includes a self-assessment of the quality of corporate governance, based on the worldwide applied form of management systems, applying the plan-do-check-act approach. The tool includes questionnaires which have been experienced as too detailed especially in the case of small and medium size enterprises. The rationale for using this needs to be better communicated to users, while a simplified version is needed for SME's.

It may be tempting to calculate net positive value by distracting the negative costs from the positives but this is not the intention of the system. The negative hidden costs are derived from prevention of hidden impacts and the positive costs are extra benefits for people and planet. Negative costs cannot compensate the positive costs. In our discussions we see the temptation to do this. *We have to more explicitly communicate the difference.*

Full scope assessment is quite labour intensive the first time, mainly because the companies lack data or the knowledge who has the data even in their own company. Future assessments will therefore be much easier. *Based on the pilot experiences a guidance for starting to use of Oiconomy can be developed. Before starting an assessment, a* ***quick ex ante check*** *on applicability and product scoping can be done. Training opportunities and materials, online available explanations and justifications will be provided in the next stages.*

Where more remote tiers of suppliers (3rd, 4th tier etc.) are involved, it is harder to achieve direct participation and collaboration. This is especially relevant when small or medium size enterprises are involved in middle- or low-income countries. Maintaining the full PPP scope in these cases raises objections of two types: a- the total contribution to the total ESCU of the end-product will be marginal, and b- these remote suppliers may have many other clients, not being interested in such assessments. Despite this **dilution effect** in a specific value chain, the total of small contributions may still be relevant for

prevention. Yet, the fact that the 1st tier suppliers could be involved, also raises the expectation that in the longer term, when the requirement to engage in the system reaches the 3rd, 4th tier etc. suppliers from several customers, these 3rd, 4th tier suppliers can also be engaged. *However, we plan to develop standard ESCU values for a short list of (100-200) inputs in the remote supplier tiers to solve this dilution issue. Most of the environmental default data on remote tier suppliers are already in the system. Science will have to add the socio-economic default data.*

Partly overlapping with this issue is that in remote tiers of suppliers, tool users may need to collaborate with **small suppliers with low level capacities**, not used to business administrations or even illiterate. One can not expect such small suppliers to contribute to the assessment. *We will clarify the role of the supplier tier that is closest to such low developed suppliers, giving them the responsibility of applying the tool.*

The presentation of the overall results shows **very different distributions of hidden costs** between the sustainability aspects. This expressed the tailor-made approach showing the specifics of the supply chains analysed. Some relative high scores as well as very low scores surprised both the companies as well as the UU team. Correctness of the calculations were checked. *In some cases the underlying background data will be re-evaluated. We observe that an interpretation protocol for reading the end results is needed. Relative high prevention costs does by principle not equal relative high priority. Each sustainability aspect identified as have (some) hidden negative costs will need to be addressed. Low costs prevention options may still very well have high impact in reducing emission and unfair social conditions.*

Current positives were sometimes calculated as the positives of the entire organization divided by the % of revenue of the product under review, while they were location specific. However, we aim to only measure the positives linked to specific value chains. *We will adjust the standard by distinguishing rules for value-chain specific positives and organisation-wide positives to the related products.*

The participating end-producers in this pilot found Oiconomy pricing to be a useful tool in starting the dialogue with suppliers, increasing transparency, and jointly working on a more sustainable product. The participation companies also appreciated the insights that an overview of the hidden costs provided as it gives them with a tool to measure the progress towards their sustainability goals. Also, Oiconomy Pricing revealed hidden cost on sustainability aspects that companies were previously unaware of. Overall, the companies found Oiconomy Pricing to be a useful tool in navigating the complex field of sustainability.

4. Conclusion

The goal of the pilot study was to test whether the Oiconomy Pricing tool is clear enough to lead to calculations of hidden cost by company experts instead of external consultants, to identify points of improvement of the

methodology and to test whether the method evokes collaboration about further sustainability performance improvement along the supply-chain.

Applying Oiconomy Pricing, the negative and positive hidden cost of a stone kitchen countertop, a medical device and a jar of white pepper were successfully calculated. The analysis revealed preventative costs of € 32,44 per m^2 stone kitchen countertop, € 130,12 per pack heater and € 1,03 per jar of white pepper. Through the Oiconomy Tool company-experts were guided in making the assessment and sometimes needed additional support from the UU-team. Based on the issues encountered the UU-team was able to improve the Oiconomy Tool and will make training and instructions materials to raise capacity within organizations. Also, several points of methodological improvement were identified: questionnaires to check the quality of corporate governance needed to be simplified for SME's, the relationship between negative and positive costs needs to be clarified and standard ESCU's need to be calculated for raw material producers far upstream in the supply-chain. The pilot reached its objective of increasing supply-chain collaboration to improve sustainability, as the end-producers all started dialogues with suppliers on to lower their environmental and social burden. Additionally, Oiconomy Pricing was able to provide companies with a holistic sustainability assessment of their product, showing preventative costs for sustainability aspects that companies were previously not aware of.

Oiconomy Pricing is relevant as transparency and due diligence are increasingly incorporated into corporate responsibility legislation. Non-financial disclosure is required for large groups of companies, especially in the international market. Full sustainability costs accounting tools can serve the implementation of this new legislation. Also, Oiconomy Pricing can serve as a tool in sustainable public procurement policy, having suppliers substantiate their bids with the Oiconomy price.

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5. Production, consumption and innovation

5e. Sustainable consumption and consumers

Abstracts

Consumers' Attitude for Fish and Seafood in Portugal: Opportunities for footprint reduction and more sustainable consumption

Prof Sara Moreno Pires[1], Dr. Alessandro Galli[2], Adeline Murthy[2], Miss Catarina Madeira[1], Dr. Serena Mancini[2]

[1]University of Aveiro, Aveiro, Portugal. [2]Global Footprint Network, Oakland, USA

Abstract

The habits of seafood consumption have been described as varying substantially from country to country, mainly related to socio-demographic characteristics, regional and traditional factors. Nevertheless, overall, fish consumption and capture in Europe have been increasing over last decade as a result of European fish campaigns and the growth of fish distributors. Portugal has been taking part of this trend, being the third biggest consumer in the world, with 59 kg per capita year. Some explanations for these values include the cultural roots, governmental fish campaigns and the dynamics of the fish market system as well the Portuguese geography, which makes the fisheries and the consumption of fish products extremely value.

Furthermore, food consumption is the single largest driver of Portuguese's Footprint, representing around 30% of the Ecological Footprint of the country. Galli et al. (2020) when analyzing the significance of food in comparison to other daily anthropogenic demands, identified the current sourcing and resource intensities profiles of dietary patterns at Portuguese national and city level through Ecological Footprint Accounting (EFA). Their findings point out that consumption of "fish and seafood" contributes to approximately 26% of the total food Footprint at national level and it significantly depends on production activities outside the national boundaries. Dietary choices in Portugal cause noticeable land appropriation from the biocapacity of ecosystems outside the national borders and "fish and seafood" represents the single highest import of biocapacity from abroad, with about 1.6million gha of biocapacity being imported (about 60% of this food category).

Therefore, with the focus on "fish and seafood" consumption in the country, the aim of this paper is to understand Portuguese Consumers': i) habits of buying and consuming fish and seafood; ii) perception of different fishing methods; iii) attention to environmental issues and sustainability, and iv) barriers to opt for alternative fish and seafood choices. By recognizing what drives seafood consumption choices in Portugal as well as what prevents alternative choices to be made, it is possible to shed light on whether a willingness exist among Portuguese consumers to modify their choices and thus assess the likelihood of transition strategies towards sustainable seafood consumption in Portugal and propose some recommendations and policy orientations.

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Track

Track 5e Sustainable consumption and consumers

Consumers' Post-purchase Behaviour of Fashion Products

Arifa Parvin Kemi, Dr. Gyula Zilahy

Budapest University of Technology and Economics, Budapest, Hungary

Abstract

Sustainable consumption is gaining scholarly attention as it has become an essential aspect of designing and implementing national and international policy. The review of the literature regarding fashion consumption shows that most studies focus on consumers' initial purchase willingness and behaviour for fashion products. As a result, to complement previous research, this paper aims to identify and categorize the drivers of consumers' post-purchase willingness and behaviour toward new and second-hand fashion product

The literature on sustainable consumption has grown dramatically, but most have focused on initial purchase decisions. This study went beyond the purchase decision and aims at the post-purchase decision for different types of fashion products. It focuses on consumers' willingness and behaviour to reuse, repair, recycle and repurchase new and second-hand fashion (clothing) products. It compares consumers' post-purchase behaviour of new and second-hand fashion. To complement these research findings, our study attempted to reveal consumers' post-purchase behaviour, asking the following questions: what factors influence post-purchase behaviour towards reuse, repair, and recycling fashion products? What factors influence consumers' post-purchase behaviour towards the repurchase of fashion products? What are the barriers to consumers' post-purchase behaviour towards reuse, repair, recycling, and repurchasing fashion products? We developed our research model with the theory of planned behaviour as a background because consumers' attitudes, subjective norms, and perceived behavioural control considerably impact post-purchase willingness and behaviour of fashion products.

The study's primary purpose was to gain a deeper understanding of how buyers dispose of clothing items and how they respond after purchasing second-hand fashion products. However, it later focused on both new and used textiles to better understand initial purchase behaviour and second-hand product purchase behaviour. The research used both qualitative and quantitative research methods. We have already gone through the qualitative research where second-hand fashion store owners and consumers were interviewed regarding their purchase behaviour patterns.

Based on this, a large-scale questionnaire survey of new and second-hand fashion consumers has been carried out. We surveyed the post-purchase behaviour of 490 individuals through telephone calls. The questionnaire survey used a non-random sampling method to reach a representative group of consumers of Budapest, Hungary. Data will be analyzed using multi-dimensional statistical methods to uncover patterns of post-purchase behaviour. This study states the qualitative research now and later it will analyze the quantitative part in further research. The research results will enable us to understand better the sustainability implications of the new and second-hand fashion market and form suggestions for policymaking relating to this vital sector.

Keywords: Sustainable consumption, fast fashion, second-hand fashion products, post-purchase behaviour, textile fashion products.

Track
Track 5e Sustainable consumption and consumers

Dates from which Waste Derives: Multifaceted research to improve date mark labels for consumers to reduce food waste

Associate Professor Simon Lockrey[1], Dr Dianne McGrath[1], Dr Eloise Florence[1], Associate Professor Karli Verghese[1], Professor Linda Brennan[1], Associate Professor Lukas Parker[1], Dr Bhavna Middha[1], Associate Professor Cecily Maller[1], Dr Peter Stasinopoulos[1], Dr Nirajan Shiwakoti[1], Mr Allister Hill[1], Dr Caroline Francis[1], Ms Maddison Ryder[1], Ms Sophie Langley[1], Ms Nhat Tram Phan-Le[1], Dr Michaela Jackson[1], Ms Anouk Sherman[1], Dr Ella Chorazy[1], Dr Nooshin Torabi[1], Mr Seyed Mojib Zahraee[1], Dr Natalia Alessi[2], Dr Tej Pochun[3]

[1]RMIT University, Melbourne, Australia. [2]University of Melbourne, Melbourne, Australia. [3]Monash University, Melbourne, Australia

Abstract

The food system is a crucial vehicle in sustaining people and their health, supporting their human right to food. Food loss and waste risks this and other rights, in driving negative economic, social, and environmental impacts. Food waste is usually characterized as waste occurring post supply chain, such as at the household, rather than food loss which occurs within the supply chain. Consumers are responsible for the bulk of combined food loss and waste in many global contexts. As such consumer approaches to reducing food waste are imperative.

Date mark labels included on food assist consumers to safely eat it. 'Best before' dates suggest when it may be ideal to consume food prior to, but do not necessarily suggest dates food becomes unsafe. 'Use by' dates advise consumers not to consume labelled foods past a date marked, for safety reasons. Confusion about such date mark labelling is often highlighted as a key driver of food waste in households. Hence calls have been made for clearer date mark labels to reduce food waste.

This paper documents the progress of three related research projects. The projects focus on consumer issues relating to food waste, within the AU$121 million Fight Food Waste Cooperative Research Centre, a partnership linking government, industry, and the academy in Australia to halve food loss and waste by 2030 over a 10-year time frame. Our primary contribution is detailing the role date mark labels play in the industry and consumer contexts analysed by the projects and developing insights into how such labels may be designed more effectively in the future.

We conduct our review by analysing results from the projects thus far. Both small and large companies in industry participated, as did governments, not for profits, and consumers across the socio-economic spread of the Australian population. The research teams carried out surveys, interviews, observations, workshops, and prototype testing were carried out by the research teams. When collated these data paint a distinct picture of date mark labels in relation to consumers, food, refrigerators/ storage infrastructure, packaging, industry product development, and communication. We triangulated data to develop themes that appeared to be either consistent or contrasting across research contexts and stakeholders by taking this approach.

Results show continued confusion over date mark labelling by consumers, and a lack of effective new solutions thus far by industry or government. We identify a need for consistent and clear communications through date mark labelling, and associated education. We conclude by discussing areas for future research for the projects reviewed and new projects. Further work may include; larger research projects aimed at transforming how date mark labels are deployed in the Australian context, likely lead by the Fight Food Waste Cooperative Research Centre; a national consumer behaviour change campaign; and industry/ supply chain integration and assistance in date mark labelling approaches nationally. These options hold promise for better consumer outcomes in food sustainability which is central to United Nations Sustainable Development Goal 12, Target 12.3, to halve food loss and waste by 2030.

Track

Track 5e Sustainable consumption and consumers

Gamified Apps for Sustainable Consumption: A systematic review

Georgina Guillen-Hanson[1], Daniel Fernandez Galeote[1], Nevena Sicevic[1], Dr. Juho Hamari[1], Dr. Jaco Quist[2]

[1]Gamification Group. Tampere University, Tampere, Finland. [2]TU Delft, Delft, Netherlands

Abstract

A considerable amount of research has been conducted on understanding sustainable consumption and different approaches to it. One of them is resource efficiency, which is reflected in SDG 12 with target 8 directly looking into lifestyles. Mobile apps are ubiquitous, affecting our everyday activities and practices because "there is always an app for that." In this vein, there have been a significant number of apps devised to support peoples' lifestyles to make them more sustainable, and this study is set out to draw an overview of the market of gamified mobile apps for sustainable consumption. Following a systematic search, this study analyzes 67 gamified apps regarding their sustainability impact and gamification elements. The findings suggest a tendency to (1) present sustainable consumption as the efficient use of resources to impact the environment positively, rarely addressing societal impacts, potential rebounds, and even economic gains from shifting consumption practices. Other findings include (2) a lack of diversity in gamification strategies, given the prevalence of direct communication with the user, the absence of virtual identities, and most apps targeting behavior change without attitude change. Another potentially problematic design choice is (3) the presence, in some cases, of external rewards that are often contradictory to the message of sustainable consumption as they lead to more consumption. Nonetheless, it is possible to conclude that gamification, the intentional use of game elements in non-game contexts, brings an additional value to motivate shifts in the lifestyles of the apps' users.

Gamification and games play an important cultural and artistic role; they are expressions of specific cultural contexts, while at the same time, they help communicate and even create new forms of culture and art. Our present research aims to develop a blueprint for developers, researchers, and practitioners alike, to encourage them to explore gamification as elements that enable different approaches to consumption, addressing topics such as human rights and rebounds. Besides Target 12.8, our study also touches upon targets 12.2, 12.3, and 12.5, as most apps for SC support individuals and households to manage their domestic material consumption and reduce food waste and waste generation in general.

Track
Track 5e Sustainable consumption and consumers

Other Ways of Living – producing and consuming in pace with nature

Associate Professor Karin Winroth

Södertörn University, Stockholm, Sweden

Abstract

Consumer culture of today often focus on urban lifestyle where technique, success and social media play crucial roles. The medialized culture offers an arranged version of reality in which filtered photos and visible signs of success and happiness are in focus. Already have researchers and doctors underlined how this media version of lifestyles create anxiety and neuroses.

There are, however, other ways of living. By highlighting and illustrating lifestyles and consumption in line with sustainable ideas, other models for how to live and other ideals become more publicly available. This paper introduces two examples of producers, one offering services and one offering products, where the production as well as the consumption is in line with sustainable living. The aim of the paper is to answer the question: what makes these two cases illustration of sustainable production processes as well as sustainable consumer processes? In addition, what can other firms learn from this?

The methods used for the empirical data is a combination of text analyses, interviews, observation and actual consumption of the product and service. The findings illustrate how consumption of these product/service is both comfortable but also educational. They offer insights into lifestyles in harmony with nature as well as knowledge of how to preserve natural resources. The conclusion of the paper is how important it is for people to be introduced to sustainable lifestyles and to experience and learn about nature to develop a respect for its' resources.

This abstract especially relate to 'STG+target: 12, more specifically 12.2, 12.8, 12c'.

Proposed contribution relates to the topic of the Conference SUSTAINABLE DEVELOPMENT AND COURAGE: CULTURE, ART AND HUMAN RIGHTS by highlighting how lifestyles are embedded in culture. In addition, it can be cultural traditions and knowledge passed over generations that become crucial knots for producing according to sustainable ideals.

Track
Track 5e Sustainable consumption and consumers

Prosumption - state of the art and implications for sustainable development

Dr. Ádám Csuvár, Dr. Gyula Zilahy

Budapest University of Technology and Economics, Budapest, Hungary

Abstract

Exploring the perspectives for a sustainable society in the 21st century, Alvin Toffler argues in his book, 'The Third Wave' (Toffler, 1980) that the number of classic consumers of industrially provided goods will decline and will be replaced by 'prosumers': people producing and consuming goods and services for their own and other's consumption (Ritzer and Jurgenson, 2010).

Since then, a number of definitions of prosumption surfaced and the fast growing number of prosumers and the increasing importance of prosumption in the economy slowly started to spur scientific inquiry into the topic. In 2009 Ritzer discussed the 'age of prosumer' (Ritzer, 2009) just to be followed by others characterising prosumers and certain types of prosumption activities (see e.g. Blättel-Mink and Hellman, 2010; Collins, 2010; Comor, 2011; Humphreys & Grayson, 2008; Ritzer, 2010; Ritzer & Jurgenson, 2010).

Prosumption promises solutions to many of today's problems. Consumers may gain from producing goods and services in several ways including, but not limited to financial savings, self-employment, improved social relationships, the satisfaction arising from engagement in creative activities, etc. Similarly, corporations may gain direct and indirect financial benefits from utilizing resources provided by prosumers for free or for a fee.

For society, prosumption may bring the benefit of the empowerment of people (by education and learning) and democratization; a more efficient use of resources; the implementation of the ideas of the circular economy; economic benefits to marginalized regions; raised resilience, etc.

However, it is not self-evident that actors make use of these benefits and the sustainability potentials of the prosumption economy can be utilised. For instance, services provided through sharing economy platforms may not be based on the best available technologies (e.g. using outdated cars, apartments with inefficient heating, etc.) and prosumers installing solar panels may increase their electricity consumption as a result of lower energy costs (Ottelin et al., 2017).

To this end, an ongoing research project at the Budapest University of Technology and Economics aims at a better understanding of prosumption activities and their environmental and social implications.

During the first stage of the research, business models facilitating prosumption, as well the potential environmental and social impacts of increasing prosumer activities have been identified and characterized based on desk research. The results of these investigations will be demonstrated along with the results of an ongoing qualitative empirical research implemented in Hungary, which targets the identification and characterization of actual presumption activities including the types of activities, their frequency and distribution in space and time and the motivation factors of and barriers to different prosumption activities.

Track
Track 5e Sustainable consumption and consumers

Sustainability-Related Consumer Attitudes Towards Ecological Food Products: Does a consumer healthy lifestyle determine them?

Prof. dr. Jurate Banyte, Assoc. prof. dr. Agne Gadeikiene, Assoc. prof. dr. Aiste Dovaliene, Prof. dr. Zaneta Piligrimiene

Kaunas University of Technology, Kaunas, Lithuania

Abstract

The discourse on sustainability is widely evident in studies on food product consumer behavior, e.g., sustainable food choice motives (Verain et al., 2015) or sustainable consumption dimensions (Fischer et al., 2017) are being analyzed. Verain et al. (2021), in their developed Sustainable Food Choice Questionnaire (SUS-FCQ), looked to sustainability through the assurance of animal welfare, reduction of environmental harm, fair trade, local product choice. Such characteristics as food taste, price, or purchasing convenience are also considered relevant from the sustainable consumption perspective. In the Thøgersen (2017) study, food taste and price were analyzed as the factors influencing sustainable food consumption. We agree with this opinion and argue that the holistic evaluation of sustainability-related consumer attitudes requires to include attributes of so-called utilitarian consumer motives ("tasteful", "expensive", "cheap", and "easily accessible"). Other selected attributes correspond to the categories of SUS-FCQ (Verain et al., 2021): animal welfare ("vegan", "animal-friendly"), environment ("environment-friendly", "produced while responsibly using resources"), fair trade ("fair trade"), local product choice ("locally produced"). The attribute of ecological food product "healthy" is related to Sautron et al. (2015) suggested category "health and well-being", and attributes "high quality", "natural", and "organic" – to the category "miscellaneous".

This study considers consumer healthy lifestyle as determining sustainability-related attitudes towards ecological food products, food consumption habits, and general health-related beliefs. We adopt four consumer healthy lifestyles described by Gadeikiene et al. (2021).

According to the above-mentioned arguments, this study aims to investigate different healthy lifestyle consumer segments' sustainability-related attitudes towards ecological food product attributes. In this study, we employed indirect measures of implicit attitudes in addition to explicit attitude measurement. We asked respondents to express their attitudes to the attributes characterizing ecological food products (explicit test) and also measured the reaction time (implicit test). A total number of 302 respondents representing different healthy lifestyles participated in the study.

The research results demonstrate that the majority of the respondents consider ecological food products as "expensive", "natural", "healthy", "environment-friendly", "high quality". They disagree that ecological food products are "cheap", "vegan", "easily accessible", "locally produced", and "fair trade". Measurement of the implicit attitudes shows that the certainty of the respondents in their attitudes is medium. The results contradict our initial assumption that consumers' attitudes towards ecological products might be determined by a healthy lifestyle. Respondents representing segments "unhealthy lifestyle representatives" and "mental well-being oriented" agree with fewer attributes characterizing ecological food products than those of the other two segments. Evaluation of the implicit attitudes showed that respondents from the segment "healthy lifestyle guru" very quickly react to the attribute "cheap". However, this attribute is not selected among the majority of the respondents.

References available upon request.

SDG+target: 12.3, 12.5, and 12.8.

The proposed contribution relates to the topic of the Conference as it offers a holistic understanding of sustainability-related consumer attitudes towards ecological food products. It could be beneficial for public and private bodies that appeal to consumers of different healthy lifestyles and seek to encourage a more thorough general understanding of sustainability issues in the food sector.

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Track
Track 5e Sustainable consumption and consumers

Full papers

Analysis of Wastage Mechanisms in the Supply Chain of Fish Products in a Circular Economy Perspective: An empirical research

Survey to Italian families on the food waste of fish products.

Francesco Tola[1], Enrico Maria Mosconi[2], Stefano Poponi[3], Mattia Gianvincenzi[4]

[1]*Universitità degli Studi della Tuscia, francesco.tola1995@gmail.com*
[2]*Università degli Studi della Tuscia, enrico.mosconi@unitus.it*
[3]*Università degli Studi della Tuscia, poponi@unitus.it*
[4]*Università degli Studi della Tuscia, mattia.gianvincenzi@unitus.it*

Abstract

The fish waste problem at the consumption phase and the rational management of fish products is one of the central matters of the transition process undertaken by the European Union, especially within the new Action Plan for Circular Economy and it is widely debated in the literature. Due to the exploitation of the entire chain of fisheries and Fishery products, significant damage is caused to the marine ecosystem, which is already, heavily, damaged by anthropocentric actions. Report of the field is agreed that fish products are going to be insufficient to cover the trending demand for consumption. The number of species at risk of extinction is constantly increasing the need to protect marine ecosystems has become a global priority. The waste of these products occurs throughout the supply chain. Specifically, the consumption phase generates a strong economic, social and environmental impact. Literature and studies analyzing food waste on this subject, mainly focus on the first part of the fishing supply chain fisheries, This work aims to investigate the mechanisms and causes of wastage that occurs in the last part of the supply chain. Specifically, this link in the chain presupposes an interaction between the distributor and the consumer conditioned by factors such as quantity (availability of the product), quality, behavior and consumption habits of the final customer. This last aspect has been drastically modified in the light of the Covid-19. The work focuses on the analysis of food waste at the final stage of fish consumption, generated by Italian families and the change in consumption habits, as a result of the restrictions brought by the pandemic. To investigate what actions, habits and behaviors contribute to waste, a survey was conducted. The causes of waste have been identified by framing them in the two dimensions of final consumption, such as consumption in the home and consumption outside the home. The research has the ambition to enrich the existing literature to clarify the determinants of waste in the final consumption phase. A special feature of the research is the current pandemic situation. The scenario of the complete closure of the catering activities has been projected, examining whether the consumption change of households in taking advantage of the takeaway, modified the volume of waste produced in the home. Two

logit models have been used to identify whether factors identified as causes may increase or decrease the waste product. The construction of the survey system is consistent with the methodologies used in the literature for the study of food waste. The results of the models have found several factors influencing the generation of food waste of fish products six inside that out of the house, to each of these variables have been proposed different strategies. The proposed basic strategies focus on awareness-raising, and culinary education, through the implementation, planning and promotion of information channels. The research topic falls within the Sustainable Development Goal 12 for responsible consumption. Specifically, the 12.3 target and at 12.3.1b sub-indicator.

Keywords: Food waste fish, Consumer behaviour, Logistic regression, Prevention and culinary education

1. Introduction

Fishery products are an important food source providing approximately 17% of animal protein consumed globally. Their consumption has reached 20.5 kilograms per capita per year and will tend to increase in the coming decades [1]. Notwithstanding the current Covid-19 pandemic crisis, the European consumption of Fishery products has shown no signs of receding [2]. Fishery products are perishable foods that have a high potential for waste and loss. The waste of fishery products is a problem of particular concern due to growing global demand, unsustainable fishing and aquaculture practices and the high propensity to waste. The loss and waste of fishery products occurs throughout the supply chain [3], bringing further impacts to the resource already heavily damaged by marine degradation, all geographical areas are involved in generating waste both in the primary production phase and in the final consumption phase [4]. It has been observed that developing countries tend to generate food loss, i.e. aimed at the early stages of the supply chain, usually attributed to inadequate handling, processing, and commercialization practices [5]. In the high-income countries, in contrast, food waste is more consistent with the retail, restaurant and household level [6]. A recent evaluation [7]estimated that 35% of the global fish crop is wasted every year. Reducing losses and waste of fish products can lead to a reduction in pressure on fish stocks and help improve resource sustainability as well as food security. Food waste, identified as " *food appropriate for human consumption that is discarded or left to deteriorate at the consumer level regardless of the cause"* [8], has become an increasingly relevant topic in recent years due to the economic and environmental burden it entails. It is estimated that each year about 1/3 of the food produced becomes waste, which is equivalent to about 1.3 billion tons of wasted food [9]. The pressures of food waste have influenced the United Nations (ONU) in setting the goal of halving world food waste and substantially reducing global food loss by 2030 (SDGs 12, target 12.3) as part of its program of 2030 Agenda [10]. FAO and UNEP are the managers of indicator 12.3 and retain they can subdivide the indicator into two sub-indicators as there are different drivers along the food chain that generate different food waste or losses. Sub-indicator 12.3.1b monitors and measures waste in the last stages of the supply chain, the

measurement methods can be different, questionnaires, interviews, surveys, statistical coefficients and agendas are the most widespread in the scientific field [11]. According to the latest revision, the sub-indicator is classified at tier2 [12]. About 931 million tons of food waste were generated in 2019 [11], 61% of which came from households, 26% from catering and 13% from retail. Similarly, the EU produces 88 million tonnes of food waste and only households generate more than half, 47 million tonnes, followed by restaurant services and retail trade [13]. Through the communication on the circular economy, the EU[1] will set new objectives to reduce food waste as a key action within the "Farm to Fork" strategy (*Farm to Fork Strategy For a Fair, Healthy and environmentally-Friendly System*, n.d.). Quantifying food waste is essential for the development of effective prevention and reduction strategies and for verifying their effectiveness over time [15]. To reduce fish waste, it is necessary to understand how to quantify the waste and how it occurs. To date, few studies have been published relating to the quantification of fish food waste at European and international level. These studies focus on catches [16], production [5], industrial processing [17] and catering activities (on the restaurant side) [18] while the information on fish waste in distribution and households is currently poor, scarcely exportable and focused on food waste in general instead than on a single food [19]. This study focused on the generation of food waste of fish products by Italian families and on investigations of the reasons behind the waste both inside and outside the habitation. The survey is presented as first research aimed at quantifying fish waste in high-income families, differentiating the waste produced inside and outside the home. A relevant peculiarity of the research lies in the consideration of the current pandemic crisis. Analyzes were carried out on the general causes of waste outside the home, before the various closures of the catering activities for the containment of the virus. The scenario of the current pandemic crisis was observed, examining whether the change in consumption of families in taking advantage of home delivery of fish-based dishes, has changed the volume of waste at home. The research questions to be answered are the following: *i) What are the causes that determine the food waste of fish products in the home? ii) What are the causes that determine the waste of fish products outside the home? iii) Did home delivery during Covid-19 containment change the waste of fishery products produced indoors?*

2. Methods

A questionnaire was developed to answer the research questions. For the realization of the questionnaire, an analysis of the literature existing in the various bibliographic databases was carried out, in particular ScienceDirect. The various studies dealing with food waste and methods of quantifying domestic food waste were filtered out. The questionnaire method is widespread in the literature [20][21][22][23][24][25][26].

[1] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Circular Economy Action Plan For a cleaner and more competitive Europe COM / 2020/98 final

The study was conducted from May 2021 to July 2021. A questionnaire was created through the Google Form platform. The questionnaire was disseminated on various social platforms (e.g., Facebook and Instagram). Participation was voluntary and anonymous. The questionnaire consists of 24 open and multiple-choice questions, divided into four areas. The first section investigates domestic consumption, purchasing preferences, the place of purchase, trends and fish products purchasing habits. The second section focuses on the frequency of out-of-home meals based on fish products before the restrictions for contagion from Covid-19 and the frequency of take-away foods containing fish products, during the closing period of the catering activities. The third section concerns questions on the knowledge of food waste and the self-quantification of the waste of fish products both inside and outside the habitation, associating the causes for which the waste occurred. The fourth section is regarding socio-demographic questions. The definition taken into consideration for the research is the one proposed by [8]. To identify the factors and causes that generate fish waste, two logistic regression models were used through the Gretel software. The Logit model is mainly used in the social sciences [27], it serves to describe the probability of a relationship between a dichotomous variable and one or more quantitative or qualitative variables. The Logit model is a widely used methodology in the literature for estimating the probability of increasing or reducing food waste according to various factors [28][29][30][31][32]. For the quantification of fish waste produced inside and outside the home, it was asked to self-declare the waste threshold in a numerical range from 0 to 100. The technique used for the quantification has already been tested in other studies dealing with food waste in the last stages of the supply chain. For the self-reported quantification of waste both inside and outside the home, two logistic regression models were estimated. The dichotomous dependent variable of indoor fish waste is defined through the indications of [33], suggesting the value in which fish waste occurs is estimated through the arithmetic mean of the self-declared value of the sample, in the research the observed threshold value for waste is equal to $\chi = 14.5$. The dichotomous dependent variable of food waste was estimated according to the study [34], suggests considering identifying waste in restaurants with a self-reported value greater than or equal to five. The independent variables used for the logistic regression model for waste inside and outside the home and their modalities are shown in Table 1.

Table 1 *Description of the variables*

Dependent variable: waste of fish products Inside the home		**Dependent variable: waste of fish products Outside the home**	
Variable denomination	*Definition*	*Variable denomination*	*Definition*
Low frequency of consumption	Less than once a week	Low frequency to the restaurant	Less than once a month / once or twice a month
Medium frequency of consumption	Once a week	Medium frequency to the restaurant	Less than once a week / once a week
High frequency of consumption	Two or three times a week / Four or more times a week	High frequency to the restaurant	Two or three times a week / four or more times a week
Purchasing Responsibility (Me)	Me / Me, along with another member of my family	Food Waste Knowledge	Values range from 0 to 5
Medium frequency of takeaway	Less than once a week / once a week	Satiety	Values range from 0 to 5
High frequency of takeaway	Two or three times a week / four or more times a week	Different expectations	Values range from 0 to 5
Never use take away	Never used the take away	Wrong meal	Values range from 0 to 5
Food Waste Knowledge	Values range from 0 to 5	Fish cleaning	Values range from 0 to 5
Excessive purchases	Values range from 0 to 5	Doggy-bag	Values range from 0 to 5
Excessive culinary preparations	Values range from 0 to 5		
Malodor	Values range from 0 to 5		
Product expiration	Values range from 0 to 5		
Visceral parts	Values range from 0 to 5		
Different taste	Values range from 0 to 5		
Incorrect preservation	Values range from 0 to 5		
Reuse waste	Values range from 0 to 5		

The extrapolation of the independent variables to choose to build the probabilistic regression models focused on existing research in the quantification of food waste and consumer behavior both inside and outside the home, the most appropriate ways to investigate the research were chosen. It is suggested to search in the independent variables inside the home, the frequency of consumption [35], the person responsible for the purchases and the knowledge of the impacts on food waste [36]. For the causes that identify the waste produced indoor, the most frequent and consolidated causes taken from previous studies have been attributed [37], [38], while reuse has been identified as a method to reduce waste [39]. The take-away consumption frequency has been inserted to seek the change in consumer behavior due to the closure of the restaurant

activities, which has led to a change in generating waste. It is suggested to search in the dependent variables outside the home, the frequency of consumption at the restaurant [40], the knowledge of the impacts of waste. The possible causes to which waste can be generated outside the home [34], the doggy bag is identified as a tool to reduce waste [41].

3. Results and Discussion

An amount of 161 Italian families residing in Lazio (Viterbo and Civitavecchia) participated in the questionnaire. The socio-demographic characteristics of the sample are reported in table 2.

Table 2 *Characteristics of the sample*

FEATURES	DISTRIBUTION OF THE SAMPLE
Gender	102 - Women (63.35%) 59 - Men (36.65%)
Average age (range)	41.62 (from 18 to 85 years old)
Residence area	35 - Coastal area (21.74%) 126 - Inland area (78.26%)
Nuclear family	33 - Presence of children up to 12 years (20.50%) 128 - No children (70.50%)
Education level	6 - Primary education (3.73%) 72 - Secondary education (44.72%) 83 - Higher education (51.55%)
Monthly wage	53 - first income bracket 0 € - 1000 € (32.92%) 91 - second income bracket € 1001 - € 2500 (56.53%) 17 - Third income bracket > € 2501 (10.55%)

The descriptive statistic of the dependentvariable FWHOUSEHOLD is reported in Table 3

Table 3 *Descriptive statistics FWHOUSEHOLD*

"FW HOUSEHOLD"	
Average	14.460
Median	10,000
Mean square deviation	16.081
Min	0.00
Max	70.00
Coefficient of variation	1.1122

As the first aspect, the sample mean is equal to (14.46), the median value is equal to (10), the mean square deviation (16.081), the Min value assigned for waste is equal to zero and the Max assigned to waste is equal to (70). The technique used for the dichotomization of the FWHOUSEHOLD variable revealed that in the sample (59) respondents declared a value above the average, while the rest (102) assigned a value below the average.

The descriptive statistics of the dependent variable FWOUTHOUSE are shown in Table 4.

Table 4 *Descriptive statistic FWOUTHOUSE*

"FW OUTHOUSE"	
Average	16.950
Median	10,000
Mean square deviation	19.161
Min	0.00
Max	70.00
Coefficient of variation	1.1304

It is noted that the self-declared mean of waste of the sample is equal (16.95), the median value is equal to (10), the standard deviation is equal to (19.161), the Min value assigned for waste is equal to zero and the Max declared waste is equal to (70). The dichotomization technique of the variable revealed that (111) families declared a waste greater than 5% when eating fish outside the home, the remaining (50) declared a lower value.

The results of the logistic regression model of the factors affecting the significance of the dichotomous variable FWHOUSEHOLD are shown in Table 5.

Table 5 *Logit Model FWHOUSEHOLD*

FW HOUSEHOLD

	Coefficient	*Std error .*	*z*	*p-value*	
const	1.29661	1.47908	0.8766	0.3807	
Children	0.431740	0.585428	0.7375	0.4608	
Average wage	1.03305	0.521747	1,980	0.0477	**
High-education	−0.486061	0.513139	−0.9472	0.3435	
Residence	0.320491	0.642138	0.4991	0.6177	
Age	−0.0701882	0.0200108	−3.508	0.0005	***
Gender	0.417618	0.522192	0.7997	0.4239	
Low frequency of consumption	−0.751746	0.742783	−1.012	0.3115	
Medium frequency of consumption	1.83718	0.534871	3.435	0.0006	***
Purchasing Responsibility	−0.889995	0.551833	−1.613	0.1068	
Low frequency of takeaway	0.586563	0.612318	0.9579	0.3381	
Medium frequency of takeaway	1.49369	0.656277	2.276	0.0228	**
High frequency of takeaway	−1.55592	1.20612	−1.290	0.1970	
Food Waste Knowledge	−1.95638	0.804838	−2.431	0.0151	**
Excessive purchases	0.635325	0.305759	2.078	0.0377	**
Excessive culinary preparations	−0.280190	0.305424	−0.9174	0.3589	
Malodor	0.556362	0.279995	1.987	0.0469	**
Product expiration	−0.213339	0.263461	−0.8098	0.4181	
Visceral parts	−0.141371	0.235481	−0.6003	0.5483	
Different taste	0.603534	0.264178	2.285	0.0223	**
Incorrect preservation	−0.500266	0.231820	−2.158	0.0309	**
Reuse waste	−0.220398	0.173604	−1.270	0.2042	*
McFadden 's R-framework				0.358169	
Number of cases 'predicted correctly'				132 (82.0%)	

As the first aspect of the model we note its goodness of fit, the value of Mcfadden 's R-square is equal to 0.358169. The value is in line with scientific studies on food waste through a self-declaration methodology of waste with qualitative variables [34][20]. The results are described below:

Wage: the *average wage* variable was considered as the base variable in the model. The model returns the coefficient of the *average wage* variable with a positive value, at a significance level of $\alpha = 0.05$. The result is interpreted as an increase in income, probably corresponding to a greater food waste of fish products inside the house. This result confirms studies by [42][43], agree that people with higher wages waste more than people with lower wages.

Age: The model returns the coefficient of the variable *age* with a negative value, at a significance level of $\alpha = 0.01$, the result from the model is interpreted, as young people probably waste more fish products indoors than adults. That finding is in line with the studies of [44], [45], [46], which agree that young people waste more than adults.

Consumption: In the model, the *high frequency of consumption* category was considered as the basis. The model returns the coefficient of the *average frequency of consumption* variable with a positive value, at a significance level of $\alpha = 0.01$, this response is interpreted as the probability of an increase in consumption can generate an increase in waste. The hypothesis of generating more waste as the frequency of consumption increases may depend on several factors, such as behavioral norms, social norms and procurement practices. The higher availability of consumption leads to an increase in waste compared to those who consume a minimum quantity, the result of the model on the trend of the frequency of consumption reflects the studies of [47][48] agree that an increase in the frequency of consumption can increase the threshold for food waste in the home.

Purchasing responsibility: The value of the coefficient of the *Purch.Respons.ME* variable is positive at a significance level of α: 0.05. This response is undertaken as communication and the involvement of the purchase within the family unit can decrease the food waste of fish products inside the home. This result is confirmed by the studies [49] stating that the involvement and participation in the purchase phase helps to decrease the food waste produced at home.

Home deliveries: During the current pandemic crisis, the service of home deliveries by catering businesses has been encouraged. We want to investigate whether the frequencies of home deliveries have contributed to increasing the food waste of fish products inside the home. The variables inserted in the model are *low frequency of takeaway*; *medium frequency of takeaway*; *high frequency of takeaway*; *never takeaway*. The *never takeaway* variable was omitted from the model in the response phase of the results. The model returns the coefficient of the *medium frequency of takeaway* variable with a positive value, at a significance level of α: 0.05. The results show that increasing the frequency of home delivery can probably generate an increase in food waste produced.

Knowledge and awareness: The response of the model on knowledge and awareness of food waste, it is possible to assume that food waste is probably higher in people who believe that food waste is not

interconnected with human health and the environment. The model returns the coefficient of the *Food Waste knowledge* variable with a negative value, at a significance level of α = 0.05. The knowledge of food waste and the involvement of food waste understood as the level of awareness and concern of the problems related to the phenomenon, have a proven effect on waste behaviors, in [50] it's believed that people who are aware of the problem of food waste are more likely to avoid of wasting food.

Excessive purchases: the excessive purchase is one of the main causes of food waste in the home [51]. The model returns the coefficient of the variable *excessive purchases* with a positive value, at a significance level of α = 0.05, this result is interpreted as the increase in the purchase quantities of fish products corresponds to an increase in the probability of increasing the waste. The model's response agrees with studies by [52][53]. buying more food than necessary increases the likelihood of spoilage.

Malodor: The coefficient of the *malodor* variable is positive with a significance level of α: 0.10. This result is undertaken as with the increase of the bad smell of a fish product, its possibility of becoming waste increases. The product must have good sensory capabilities because they help us determine the freshness of food in order to minimize or prevent waste [54].

Different taste: The coefficient of the *different taste* variable has a positive value with a significant level of α: 0.05, this result shows that variations in taste compared to expectations increase the probability of generating waste.

Incorrect preservation: Incorrect preservation has been included as a cause variable for the food waste of fish products. The model showed that the likelihood of improper conservation for fish products does not affect waste. The interpretation of the result shows that the sample has a good knowledge of the method of conservation of the various fish products.

Reuse: The coefficient of the *reuse* variable takes on a negative value at a significance level α = 0.10. The model shows that people who do not reuse fish product waste are more likely to waste. [33] showed that individuals who do not recycle or compost any of their kitchen waste tend to throw away more food than those who reuse kitchen waste.

The results of the probabilistic regression model of the factors that influence the significance of the dichotomous variable food waste of Fishery products outside the home are shown in Table 6.

Table 6 *Logit model FWOUTHOUSE*

FW OUTHOUSE

	Coefficient	*Std error .*	*z*	*p-value*	
const	−0.365402	1.52817	−0.2391	0.8110	
Children	0.0938731	0.575660	0.1631	0.8705	
Average wage	0.0885697	0.461335	0.1920	0.8478	
High education	0.115966	0.440648	0.2632	0.7924	
Residence	−0.788242	0.516659	−1.526	0.1271	
Age	−0.00972016	0.0148706	−0.6536	0.5133	
Gender	0.0894448	0.437055	0.2047	0.8378	
Low frequency to the restaurant	−0.138960	0.936832	−0.1483	0.8821	
Middle frequency to the restaurant	0.0541500	0.932143	0.05809	0.9537	
Food Waste Knowledge	1.22905	0.732953	1.677	0.0936	*
Satiety	0.429844	0.192167	2.237	0.0253	**
Different Expectations	0.0881395	0.198227	0.4446	0.6566	
Wrong meal	−0.521014	0.238497	−2.185	0.0289	**
Fish cleaning	0.490758	0.213059	2.303	0.0213	**
Covered	0.332175	0.242696	1,369	0.1711	
Doggybag	−0.291299	0.149629	−1.947	0.0516	*
McFadden 's R-framework				0.200312	
Number of cases 'predicted correctly'				132 (82.0%)	

As the first aspect of the model we note its goodness of fit, the value of McFadden 's R-square is 0.200312, The value of the goodness of fit is comparable to studies of [33], [55]. The results are described below:

Satiety: In [56] it's believed that satiety due to portion sizes is a major cause of food waste in the catering industry. In line with this study, the model demonstrates that the coefficient of the satiety variable is positive with a significance level of α: 0.01, proving that the higher an individual's level of satiety increases, the greater his relative waste.

Wrong meal: The model returns the variable with a negative coefficient value at a significance level of α: 0.05. Therefore, this result is interpreted that despite errors in the communication or assembly phase of the order, the probability of food waste from fish products outside the home does not increase.

Fish cleaning: Respondents were asked to self declare whether cleaning the fish product (for example breaking the shell, removing the bones, etc.) could contribute to increasing the level of food waste from fish products outside the home. The model demonstrates that the coefficient of the *fish cleaning* variable is positive at a significance level of α: 0.05. We can therefore hypothesize the probability of increased food waste of fish products when the courses are served with the presence of shells, bones or carapaces.

Doggy-bag: Using the doggy bag is a good way to reduce food waste in the catering sector.
The coefficient of the doggy-bag variable is negative at a significant level of α: 0.1. In line with the study by [28] shows that not requiring the doggy bag for the leftovers has a greater chance of generating waste.

The research has some limitations. Since there is no univocal definition of food waste, many hypotheses are created to define the food waste of fish products, both for the variety of products, for the organoleptic differences, and for the various variables of deterioration of the fish product. The elaboration of the questionnaire was carried out through the analysis of single scientific studies dealing with food waste for a wide range of products. Furthermore, the [11] in the guidelines for the quantification of food waste, does not recommend using the questionnaire as a quantification methodology. It proposes to use the questionnaire as a method to deepen and enrich the research with additional information. The methodology proposed for the research is also limited in the European field, the decision of the European Commission[2] proposes to combine the questionnaire with a methodology aimed at increasing reliability and relevance. In contrast to the limits of the research, the study [57] believes that questionnaires are structured and formal ways to collect quantitative and qualitative data among all the actors of the agri-food chain, from producers to consumers, they are convenient, usually standardized, accessible and easy to read.

4. Conclusions

The investigation is a first step in the search for fish waste in the final consumption phase, the research lays the foundations in deeper exploration in the phenomenon in question. An interesting data emerged during the analysis of the results of the food waste of fish products inside the house turns out to be the takeaway frequencies during the periods of closure of catering activities. From the analysis of the significance of the frequencies of the takeaway it turns out that to an increase of the fish waste produced inside house can make

[2]Commission Delegated Decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98 / EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste (Text with EEA relevance.)

to verify an increase of the produced waste inside house. This result is destabilizing, as the change in consumption due to the incidence of the takeaway phenomenon can lead to an increase in fish waste produced indoors. Various solutions are expressed to mitigate this expectation: the restaurateur offers the consumer the possibility to choose the quantity of fish-based dishes in the home delivery phase. This solution has two enormous advantages, the economic and environmental savings for the consumer. Ordering less quantity of food leads to a reduction in expenditure and therefore generates economic savings for families, while reducing the quantity of portions ordered contributes to the reduction of waste. Another possible alternative is the commitment by the restaurant activities to encourage the use of leftovers, recommending possible solutions for subsequent preparation. This type of information would be fundamental for the reduction of fish food waste due to home deliveries and at the same time increase the knowledge of the techniques for reusing fish leftovers, another factor that greatly affects fish food waste. The model of food waste of fish products in the home returns two significant variables, which deserve particular attention, the different taste compared to expectations and the practice of reusing food waste from fish products. The interpretation of the different taste variable of the food waste model of fish products at home, believes that there is the probability of an increase in waste of the fish product, when the product has a different taste than imagined expectations. This divergence can be addressed by increasing information on the organoleptic properties of the various fish products and promoting culinary education campaigns for the various fish products. Contributing to the dissemination of prevention and culinary education is already a recognized solution to reduce the production of food [58] waste. A fundamental aspect for possible future developments is to direct these policies towards young people, given their greater incidence in generating fish waste inside home. Another aspect that emerged that contributes significantly to generating food waste from fish products at home is the technique of reusing leftovers / waste from fish products for subsequent preparations. From the replies to the questionnaire it emerges that the reuse technique is not much appreciated by the sample and this situation is projected into an increase in fish waste produced at home.

The solution devised to increase the technique of reuse of leftovers / scraps of fish products, focused on the will and intent of the consumer to reduce their waste, the reuse technique could be increased, using communication channels to show with evidence practices, new culinary recipes that include the reuse of fish product waste, praising its advantages, including economic savings. Satiety of the courses and the use of the doggy-bag are the significant variables worthy of a discussion of the food waste of fish products outside the home. During the administration of the questionnaire, it was asked whether the dishes ordered lead to a sense of satiety on the part of the interviewees before they are able to finish the dishes. The response of the model to this variable was to believe that the sense of satiety affects the variable waste outside the home, determining

the probability of generating waste as the sense of satiety increases due to the portions of fish-based dishes. A plausible solution, to be implemented in food waste prevention strategies within the restaurant business, is the one proposed by [59] suggesting a model that can be adopted by both the restaurateur and the customer, i.e., inserting the quantity of portions in the menu suggesting whole portions or half portions, in order to limit the amount of waste, of course the cost of half portions will be cheaper than whole portions. This hypothesis leads to two very important advantages, limiting waste and saving money. To stimulate the use of the diversification of the portion quantities in the menus by restaurateurs, it is believed that the public body must encourage and support the activities that adopt prevention strategies against food waste, through the disbursement of subsidies or incentives, so that the use of half portions becomes a common norm. A relevant factor that contributes significantly to the food waste of fish products outside the home is the doggy-bag. The result of the logistic model demonstrates that not using the doggy-bag can probably lead to an increase in fish waste produced outside the home. Encouraging the use of the doggy-bag can therefore lead to the generation of less waste. Studies [60] show that encouraging consumers to adopt doggy-bags requires increasing the perceived benefits of using them and reducing negative emotions such as shame. To implement the doggy-bag strategy, it is necessary that the public body be the guarantor of the education and prevention campaigns of food waste, encouraging its use and increasing its practicality, reversing negative thoughts into proactive ones and encouraging catering activities. who practice the spread of use. The results show that it is essential to create information channels to enrich skills in preventing waste, it is important to involve young people in these initiatives, as they are the most responsible. From the analysis it emerged that some factors influence the probability of food waste of fish products inside the home, including buying in excessive quantities, which can be attributed to incorrect planning in the purchase phase or to incorrect communication within of the family unit. Paying more attention in the purchase planning phase or checking inventory can reduce the excess of fish products purchased and consequently reduce their waste. The bad smell increases the probability of waste, this situation can arise from various aspects, incorrect preservation, expiration date exceeded, or the purchase of the product already damaged. To reduce the bad odor factor, it is advisable to check the product label, make sure it came from and when it was caught. Incorrect preservation of the fish product does not appear to be influential in the model and a good education in the methods of conservation of fish products by the sample is assumed. From a circular economy perspective, the reuse of fish products is the most useful practice in limiting the food waste of fish products, contributing to enormous benefits ranging from economic savings, mitigating the enormous pressures on fish resources, reducing the environmental impact and the possibility of creating a second raw materials market based on the waste of fish resources, which today, thanks to new technologies and various experiments, it is possible to reuse the waste of fish products in a second life. A discordant factor of the waste of fish products both inside and outside the home is the presence of visceral

parts, they do not appear to be significant in the waste inside the home, but they appear to be a cause of waste outside the home, indicating that the cleanliness of the product is perceived in a way different from the sample according to the place where it is consuming fish products. Encouraging the request for the doggy-bag is a possible solution to limit the waste generated outside the home. The sample does not show a positive attitude to the use of the doggy-bag, in fact, more than half of the sample has never taken this action. It is therefore important to make people aware of this topic. The results of the study may support future research aimed at developing strategies to mitigate fish waste generated during the consumption phase. Although the focus of this research is focused on a specific point in the fisheries supply chain, the findings may have broader implications for reducing waste at a wider level. The research provides a better understanding of what drives the generation of fish waste by Italian families both inside and outside the home, the research paves the way for new studies that focus on the waste of a certain food. The search may also be applicable to other regions.

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Emerging Prosumers and Company Management – A stakeholder approach

Adam Csuvar[1], Gyula Zilahy[2]

[1]*Assistant Professor, Budapest University of Technology and Economics, csuvar.adam@gtk.bme.hu*
[2]*Professor, Budapest University of Technology and Economics, zilahy.gyula@gtk.bme.hu*

Abstract

Prosumption promises solutions to many of today's problems. Consumers may gain from producing goods and services in several ways including, but not limited to financial savings, self-employment, improved social relationships, the satisfaction arising from engagement in creative activities, etc. Similarly, corporations may gain direct and indirect financial benefits from utilising resources provided by prosumers for free or for a fee. For society, prosumption may bring the benefit of the empowerment of people (by education and learning) and democratization; a more efficient use of resources; the implementation of the ideas of the circular economy; economic benefits to marginalized regions; raised resilience, etc. However, it is not self-evident that actors make use of these benefits and the sustainability potentials of the prosumption economy can be utilised. For instance, services provided through sharing economy platforms may not be based on the best available technologies (e.g., using outdated cars, apartments with inefficient heating, etc.) and prosumers installing solar panels may increase their electricity consumption because of lower energy costs). To this end, an ongoing research project at the Budapest University of Technology and Economics aims at a better understanding of prosumption activities and their environmental and social implications focusing both on prosumers themselves and business models facilitating prosumption. In this article, we take a business perspective on prosumption and use the stakeholder view of the firm to demonstrate how different prosumption activities influence the business models of incumbent organisations in two industrial sectors, namely energy production and personal mobility.

Keywords: prosumption, sustainable consumption and production, stakeholder approach, business model

1. Introduction

Exploring the perspectives for a sustainable society in the 21st century, Alvin Toffler argues in his book, 'The Third Wave' (Toffler, 1980) that the number of classic consumers of industrially provided goods will decline

and will be replaced by 'prosumers': people producing and consuming goods and services for their own and other's consumption (Ritzer and Jurgenson, 2010).

Since then, several definitions of prosumption surfaced and the fast-growing number of prosumers and the increasing importance of prosumption in the economy slowly started to spur scientific inquiry into the topic. In 2009 Ritzer discussed the 'age of prosumer' (Ritzer, 2009) just to be followed by others characterising prosumers and certain types of prosumption activities (see e.g., Blättel-Mink and Hellman, 2010; Collins, 2010; Comor, 2011; Humphreys and Grayson, 2008; Ritzer, 2010; Ritzer and Jurgenson, 2010).

In practice, production and consumption has been traditionally intertwined – local agricultural production providing a perfect example – until the first industrial revolution, which resulted in the widespread use of mechanized factory systems and novel organizing solutions. Successive industrial revolutions brought about the emergence of mass production, which still characterises most of the products we consume today and reduced the significance of small-scale production.

However, consumers' contribution to the economy never ceased. Ritzer (2013) in fact identifies a continuum from prosumption-as-production to prosumption-as-consumption, along which most activities can be placed stating that production and consumption have never been fully separated. "Production and consumption, at least in their pure forms devoid of prosumption, do not exist on this continuum. There is no such thing as either pure production (without at least some consumption) or pure consumption (without at least some production); the two processes always interpenetrate. In the ''middle'' of the prosumption continuum production (-as-consumption) and consumption (-as-production) are more or less evenly balanced; it is there where something approaching ''balanced'' prosumption exists" (Ritzer, 2013, p. 8).

Prosumption does not assume that production and consumption happen at the same time or same location. Over the years, a number of prosumer activities have been identified from do-it-yourself home repair (Watson and Shove, 2008), through the creation and consumption of craft products (Campbell, 2005), co-creation (Prahalad and Ramaswamy, 2004a; Prahalad and Ramaswamy, 2004b), collaborative capitalism (Cova et al., 2011), productive consumption (Laughey, 2010), etc. The concept of prosumption – coined before the age of the internet – has proved to be surprisingly useful in understanding various consumer behaviours as we experience them today, but broadening its coverage to many, hugely different activities may also lead to a loss of its explanatory power.

In the next section we introduce some of the most important types of prosumer activities, some of which have been around for longer periods, while others emerging only recently, typically with the spread of the internet.

2. Typical areas of prosumption

Producers more and more often delegate tasks to consumers, which have been traditionally part of their job, in order to reduce costs. Such prosumers are engaged in collecting their items in storehouses, checking them out on their own and shipping and setting up the products themselves. The resulting cost reduction can be shared between the producer and the consumer (Lengyel and Rechnitzer, 2004), although some see such activities as new forms of exploiting consumers (see McDonaldisation by Ritzer, 1993)

While such tasks can be a burden to some, the benefits of traditional do-it-yourself (DIY) activities usually go beyond saving financial resources. Home improvement and other similar pursuits can become a serious hobby and provide some additional income as well apart from saving on the bills.

Food production has several forms, in which production and consumption is connected (Moreira, 2020). Traditional small scale, household farming is a typical example, but newer forms such as growing spices in windows and cultivating mushrooms in garages are also spreading. Veen et al. (2021) add community gardens, the gathering of fruits in wilderness areas, beekeeping and hunting and fishing.

Another example of spreading prosumer activities is the installation of household scale power plants utilising renewable energy resources such as solar, wind and biomass energy (Kotilainen, 2020). The resulting distributed energy systems promise environmental and social benefits and may dramatically change business models prevalent in the sector already in the near future. They also turn passive consumers into active prosumers, which has important implications for the energy markets (Ellsworth-Krebs and Reid, 2016).

A new area of prosumption has been created by the fast spread of the internet and social media. As of April 2022, there were 5 billion internet users globally most of whom (4.65 billion) were also active social media users (Johnson, 2022). Internet communities do not only serve as a source of information, but ‘digital prosumers’ use the available platforms to create content – often free of charge.

Real time, uninterrupted access to the internet also created innovative business models, such as those of the sharing economy. Car and apartment sharing platforms promise a better utilisation of resources and related environmental and social benefits, and other sectors are also exploring the possibility of the sharing business model (e.g., in the job and financial markets) (Lengyel, 2017).

Customization (Salvador et al., 2020) and co-creation (Prahalad and Ramaswamy, 2004; Ranjan et al., 2021; Cui et al., 2021; Re et al., 2022) are also often seen as novel forms of prosumption, when the consumer is involved in the development stage of the product life cycle (Zhang et al., 2022). Both producers and consumers may benefit from this involvement, companies being able to collect precious information about their customers.

3. Theoretical background and method

In order to better understand the business aspects of prosumption, we take a stakeholder approach since it has a potential benefit of highlighting the changes in the roles of consumers and producers within the context of prosumption. As a practical tool, we will use the concept of business modelling, which in turn is beneficial in understanding the interrelated activities of different stakeholders and can provide insights regarding how new, innovative business models embrace the phenomenon of prosumption.

Post et al. (2002) characterizes the extended enterprise as "the nodal element within a network of interrelated stakeholders that create, sustain, and enhance its value-creating capacity". They define stakeholders as "individuals and constituencies that contribute, either voluntarily or involuntarily, to its wealth-creating capacity and activities, and who are therefore its potential beneficiaries and/or risk bearers" (Post et al., 2002, p. 8). This wealth creation is put into the centre of business modelling as value creation (see e.g., Osterwalder et al., 2005).

The stakeholder approach of the firm emphasizes the importance of the needs of various stakeholders of the firm in company decision making processes beyond its actual owners in order to achieve long term market success. The stakeholder approach implies that companies should seek ways in which to satisfy these often-diverging needs – especially of critical stakeholders – and that failing to do so may result in company failure.

Customers and users are some of the most critical stakeholders for any business organisation, thus require special attention. With the emergence of prosumption, companies selling to final customers, find that their customers take up new roles and have new ways of influencing their operations, they cease to act solely as customers. With self-service options, for example, customers deliver the job of those, formerly employed by the organisation while renewable energy producing households may completely turn away from their service providers. These – when becoming large scale – can provide serious problems to energy companies and the whole sector. Moreover, the spread of prosumption may also give birth to new sectors of industry and changes the role of other stakeholders.

In the next section we analyse two typical areas of prosumption, namely the utilisation of renewable energy sources to produce electricity for one's own consumption and the different models of the sharing economy. We will use the framework developed by Post et al. (2002) depicted in the following figure to describe the operation of the extended enterprise illustrating the position of various stakeholders in relation to the 'resource base' of the firm, its interaction with the 'industry-market' and the 'social-political arena' it operates in.

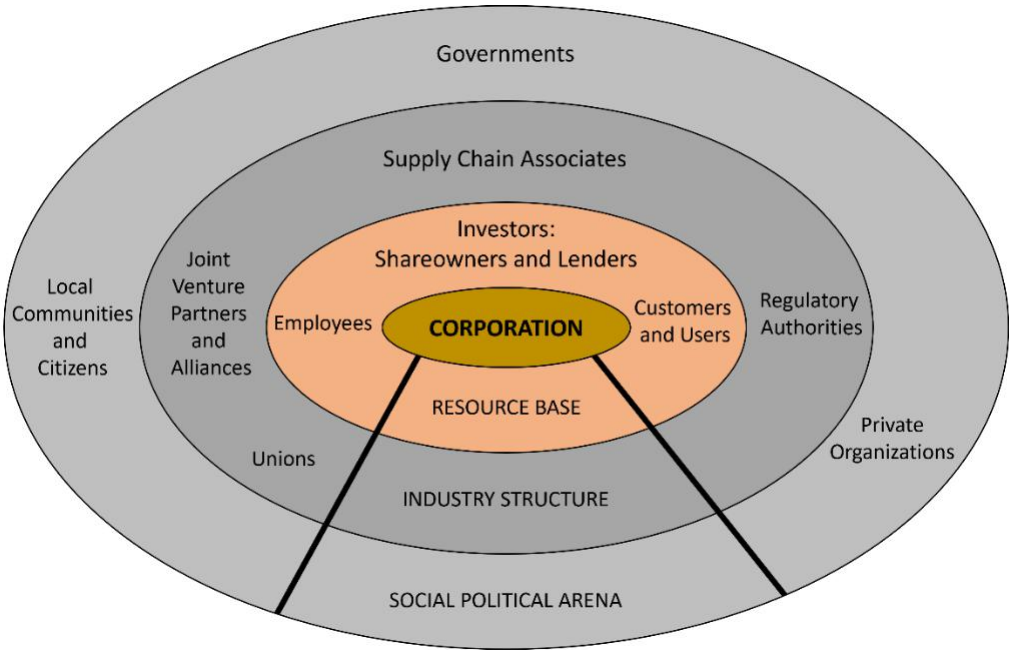

Figure 1. *The stakeholders of the firm in three dimensions (Post et al., 2002).*

According to this model, the customers of the firm constitute the resource base of the firm, along with the employees and investors, while communities form part of the social-political arena, such as other private organisation.

We will also utilise the concept of business models, defined by Magrette as stories that describe how companies operate (Magrette, 2002). According to the popular definition of Osterwalder and Pigneur, business models demonstrate how organisations create, deliver and capture value (Osterwalder and Pigneur, 2010), while from a stakeholder perspective the definition of Zott and Amit (2010) is especially useful defining business models as systems of different activities undertaken by the business organisation to meet market demand. Business models define which players (the company and its partners) undertake what activities and how these activities fit together.

The literature often identifies business models by their components. According to Barakonyi (2008) we can distinguish between the following components:

- infrastructure
- fundamental capabilities (as most significant resources)
- network of partners (with which missing capabilities can be compensated)
- consumer (at the centre of the business model)
- distribution channels and the
- financial system including the cost and income structure.

Studying the phenomena of prosumption can benefit from the concept of business models not only because it concentrates on the roles of different stakeholders and thus can describe prosumption activities, but also because the design of appropriate business models may promote sustainable ways of prosumption. We illustrate the usefulness of these concepts in the next sections by introducing how the role of stakeholders change in the case of two specific types of prosumer activities, namely household energy production and the sharing economy.

4. Household energy production as prosumption

Hall et al. (2020) describe a number of business models built around the household production of energy based on renewable resources, such as solar and wind. Many of these models build upon the support of individual households in order to promote a more sustainable, distributed energy system, which is also believed to contribute to our fight against climate change. One such system operated in the United Kingdom till 2019, within which prosumers producing electricity with the help of solar panels attached to their roofs received two types of payments: one for the net amount of energy (after subtracting their own consumption) exported to the grid (feed-in-tariff) and another payment (subsidy) to support energy production based on the total energy produced. Moreover, prosumers participating in the scheme were also charged favourable energy system usage fees.

Another typical business model utilizing renewable energy sources is the setting up and operation of energy communities, which can bring savings and extra income to a number of households spreading the costs of investment and enjoying its benefits together (e.g., owners of apartments in buildings, neighbourhoods, etc.). Such tenant electricity models operate in Germany with the name of ‘Mietstrom’, under which businesses owning such solar roof systems can sell the produced energy to the tenants without charging network fees and other taxes in the case of solar systems smaller than 100 kW.

Another model (the so-called the local energy company model) operates in Portugal, in which local communities team up to produce renewable energy, which they trade between each other through a local energy company to optimize at the local level, before they sell to external customers. Local energy charges are established by the community so that they maximise local use (Hall et al., 2020).

Apart from technological innovations in the renewables sector, such innovative business models and related financial schemes are needed to increase the share of renewable energy sources in today’s societies (Horváth and Szabó, 2018). This is not only beneficial from an environmental perspective, but also brings about more resilient energy systems.

However, all of these solutions have dramatic effects on the relationship between traditional energy producers and their stakeholders, especially those who they traditionally deemed as their customers. While it is unrealistic to assume that incumbent companies will lose their customers in the short term, local power generation already influences the stability of the electricity grid. In Hungary, for example, where the government supports household solar investments by operating a net payment system (meters are read once a year and payments are made based on the net amount of energy used), voltage anomalies and power surges already happen in neighbourhoods with high built in solar capacity. Yet, prosumers benefiting from this system do not contribute to the maintenance of the national electricity grid and the mismatch between supply and demand will require investments into storage facilities by the traditional players of the sector.

With the spread of household energy consumption, the traditional consumer and his/her behaviour will change considerably. While electricity markets are characterised by daily and seasonal fluctuations, the overall household demand of electricity can be forecasted and planned rather precisely for even longer periods, much better than in other market segments. The number of households and their energy consumption patterns change only over longer periods of time, which stabilises the markets. On the other hand, shifts in the energy infrastructure also take long time to manifest, thus the development of markets can maintain a long-term balance.

With the fast spread of household energy production, some of this stability is lost. Producers should catch up with the fast growth of home electricity production by preparing and restructuring national energy systems, which will be needed even if all households could fully provide for their own electricity consumption. Thus, the value created, the main activities and the income structure – and ultimately the entire business model – of traditional energy companies should be reconsidered with a higher emphasis on the provision of infrastructure and storage services.

Household producers of electricity do often also replace their demand for natural gas and/or oil by electricity, for example by turning to electric heating and electric personal vehicles. This will have a significant impact on the companies of the oil and gas sector and their business models.

Prosumers also often become more aware of the products they produce and consume, which may especially happen in the electricity sector, where many of the traditional consumers do not have a good understanding of either how the electricity system operates or how much they pay for the received services. This is in fact one of the main barriers of reducing energy consumption at the household level. Consumers turning into prosumers and furnished with the appropriate tools (e.g., mobile applications), however, become more aware of their energy use patterns and their implications compared to their traditional consumer counterparts.

While local communities have always been one of the stakeholder groups influencing company operations, customers forming energy communities and using local energy service providers make them even more

important. Local communities have always played the role of customers through buying energy to provide local services, but now private customers also turn into communities, which are more aware of energy matters and conscious about their choices.

It is not only customers/communities and their behaviour that changes with the emergence of prosumption in the energy sector, but other private organisations also appear on the market, which provide permitting, consulting and installation services. Financial institutions such as banks and insurance companies also offer new, targeted products to homeowners and communities. While some traditional energy providers also started to offer similar services, in many markets the demand for solar installations resulted in a boom of these new service providers, creating new stakeholders for traditional electricity producers.

5. Prosumption in the sharing economy

The development of the information technology and the fast spread of the internet provides opportunities for a number of innovative business models. One prominent example is provided by the companies of the sharing economy, which promise parallel economic, environmental and social benefits, although assessing their overall impact is often difficult and raises methodological issues. With the fast spreading of sharing economy businesses, several distinct types of business models based on resource sharing emerged, which differ considerably from each other (Soltész and Zilahy, 2020). Many of the sharing economy businesses, however, provide a platform for different types of prosumers: prosumers can use home sharing applications to rent their apartments on a short-term basis and can lend their cars and other valuable appliances to others for a fee or free of charge.

The various sharing economy business models may be implemented by the incumbent businesses of the tourism, mobility and other relevant sectors or by newcomers to the industry (start-ups). In both cases, the traditional relationships of businesses and their stakeholders change radically compared to traditional business models.

A change in the role of customers is indicated by the use of the more appropriate term ‘users’ who themselves can take a number of different roles. Users of drive sharing platforms (e.g., BlaBlaCar) can act either as passengers or drivers (or both). The means of mobility (e.g., a car), which formed the value proposition of traditional businesses is replaced by the opportunity to connect offered by platform operators.

In the peer-to-peer sharing economy business models (P2P) users often interact more closely with other users than the actual platform provider, which coordinates activities from the background. In business-to-peer (B2P)

models the service provider still plays a central role, but instead of providing users with physical assets (i.e., cars), they become service providers.

Service oriented business models in general promise a number of economic and sustainability advantages, which is warranted by a shift in the underlying interests of the most important players. While the income of traditional producers is attached to the number of products and related services sold (and are thus interested in frequent repeated purchases and the provision of expensive services), in service-based business models service providers are interested in utilising durable products, which they can use to provide high quality services for a long period.

However, users of the sharing economy do not embody only the traditional customers, but also employees as it is apparent in the case of the access economy (e.g., Uber). While providing additional income to such 'employees', a number of social issues are raised by the operation of these businesses, which may take advantage of their users (e.g., by not providing social security, etc.).

6. Conclusions

Post et al. (2002) identifies an organisations' role towards their customers/users to include: building good reputation and brand loyalty; urging repeated purchase; collaborating in problem-solving and developing new products and services. While some of these roles will be still relevant with the emergence of prosumers, we demonstrated that changes in the business models employed are inevitable. Prosumers do not only act as consumer, but also as suppliers (e.g., renewable energy) and/or employees (e.g., in the access economy). The tools developed by traditional companies to deal with these stakeholders may or may not apply in the case of prosumers. In order to achieve market success, companies actively manage their supply chains: cooperate for better products and lower costs. In the case of larger organisations this is supported by their market power. However, if traditional suppliers are replaced by thousands of prosumers, such an optimisation may not be possible or should take a different form.

Similarly, replacing employees by prosumers may offer a number of benefits (mainly by reducing costs), but may also reduce the control of companies over their workforce. Prosumption also contributes to the formation of new stakeholders (e.g., private organisations), which should be dealt with through conscious stakeholder management and the change in the role of other traditional stakeholders, e.g., communities and regulatory authorities.

These changes resulted by the emergence of the prosumer economy challenge mainly incumbent companies, which utilise traditional business models. In contrast to technological innovation where large, established organisations may have an advantage because of their significant R&D infrastructure and resources available,

they may be at a disadvantage when business model innovation becomes necessary. Beliefs of how companies in a certain industry should operate and inflexible organisational structures may mean that newcomers can take over the lead.

Our analysis showed that taking a stakeholder approach to understand how the emerging phenomena of prosumption affects business operations is a valuable contribution to this relatively new area of management science. However, our current analysis is only a first step, which should be complemented by empirical research of both prosumer behaviour and changing company practices.

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Consumers' Post-purchase Behaviour of Sashion Products

Kemi Arifa Parvin[1], Dr. Gyula Zilahy[2]

[1]*PhD Student, Department of Environmental Economics, Budapest University of Technology and Economics, kemi.arifaparvin@edu.bme.hu*

[2]*Professor, Department of Environmental Economics, Budapest University of Technology and Economics, zilahy.gyula@gtk.bme.hu*

Abstract

Sustainable consumption is gaining scholarly attention as it has become an essential aspect of designing and implementing national and international policy. But the emergence of environmental concerns has not been attributed to an increase in the consumption of sustainable fashion (textile) products. The review of the literature regarding fashion consumption shows that most studies focus on consumers' initial purchase willingness and behaviour for fashion products. As a result, to complement previous research, this paper aims to identify and categorize the drivers of consumers' post-purchase willingness and behaviour toward new and second-hand fashion products.

The literature on sustainable consumption has grown dramatically, but most have focused on initial purchase decisions. This study went beyond the purchase decision and aims at the post-purchase decision for different types of fashion products. It focuses on consumers' willingness and behaviour to reuse, repair, recycle and repurchase new and second-hand fashion (clothing) products. It compares consumers' post- purchase behaviour of new and second-hand fashion. To complement these research findings, our study attempted to reveal consumers' post-purchase behaviour, asking the following questions: what factors influence post-purchase behaviour towards reuse, repair, and recycling of fashion products? What factors influence consumers' post-purchase behaviour towards the repurchase of fashion products? We developed our research model with the theory of planned behaviour as a background because consumers' attitudes, subjective norms, and perceived behavioural control considerably impact post-purchase willingness and behaviour of fashion products.

The study's primary purpose was to gain a deeper understanding of how buyers dispose of clothing items and how they respond after purchasing second-hand fashion products. However, it later focused on both new and used textiles to better understand initial purchase behaviour and second-hand product purchase behaviour. The research used both qualitative and quantitative research methods. We have already gone through the qualitative research where second-hand fashion store owners and consumers were interviewed regarding their purchase behaviour patterns.

Based on this, a large-scale questionnaire survey of new and second-hand fashion consumers has been carried out. We surveyed the post-purchase behaviour of 490 individuals through telephone calls. The questionnaire survey used a non-random sampling method to reach a representative group of consumers of Budapest, Hungary. Data has been analysed using multi-dimensional statistical methods to uncover patterns of post-purchase behaviour. The research results will enable us to understand better the sustainability implications of the new and second-hand fashion market and form suggestions for policymaking relating to this vital sector.

Keywords: Sustainable consumption, fast fashion, second-hand fashion products, post-purchase behaviour, textile fashion products.

1. Introduction

In recent years, the literature on sustainable consumption has exploded. Consequently, sustainable consumption has become an essential component of national policy development and implementation. The subjects of this study were consumer attitudes and behaviour toward post-purchase reuse, repair, recycling, and repurchase of new and used fashion (clothing) products. As a result, the research study focused on post-purchase decisions for numerous forms of fashion products rather than purchase decisions. It analysed customers' post-purchase behaviour for new and used fashion and influenced their post-purchase behaviour for reuse, repair, recycling, and repurchase of fashion items.

In the last three decades, experts have paid close attention to the concept of sustainable development. Sustainable consumption and production are vital elements of sustainable development, as they require firms and consumers to adopt sustainable behavioural patterns. The World Commission on Environment and Development (1987) defined sustainable development as meeting the current requirements without damaging future generations' capacity to achieve their own needs. It forms a basis for executing social and environmental policies and activities. Researchers are constantly considering sustainability on a conceptual level, whereas corporations and policymakers deal with sustainability issues on a pragmatic level. Environmentally friendly consumption is a significant component of long-term sustainability. As a result, both consumers and businesses need to pay greater attention to environmental protection to ensure long-term sustainability.

Clothing is one of the essential components of a human's life. As a result, one of the most important sustainable and green consumer product types is sustainable fashion. However, due to the apparent growing usage of textiles and the consequent environmental, moral, and societal issues, sustainable apparel consumption is becoming contentious. During 1975, for example, 34 million metric tons of apparel fibres were produced

globally. This number will have more than tripled before 2020, exceeding 109 million metric tons, reaching 146 million metric tons expected before 2030 (Esbeih et al. 2021). According to a study by Gilg, Barr and Ford (2005), consumers expect moral, environmentally friendly, and socially conscious items. Green apparel is durable, according to Chan and Wong (2012), since it incorporates organic elements and fibres and promotes ethical practices that conserve the environment for future generations. Niinimäki (2010) revealed that ethical beliefs and attitudes to shopping behaviour are vital motives for purchasing green apparel. Such a moral attitude increases the product's worth, resulting in prolonged product longevity, more remarkable results, and a shorter fashion loop. Another way of approaching understanding the meaning of modern consumerism, apparel consumption, and consumers purchasing preferences is to examine the moral consumer's attitude in the apparel sector. They evaluated green consumption from the perspective of distinctiveness and cognitive qualities such as ethical commitment. The environmental factor of sustainable consumption and production is related to sustainable fashion (Lundblad and Davies 2016). Furthermore, sustainable fashion encompasses a wide spectrum of socially accountable considerations in the production and use of clothing (Lee et al. 2012).

In recent times, scientific work in the apparel industry has emphasized sustainability. However, consumption and production in the fashion business are unsustainable (Connell 2010). As a result, fashion and clothing item disposal has dramatic negative impacts (Kant 2011), and waste minimization can be obtained through reuse (Geissdoerfer et al. 2017). Furthermore, "fast fashion changes" are a societal issue that has led to the trash and environmental disasters (Birtwistle and Moore 2007). Even the apparel business has contributed to the spread of home garbage. For example, according to "China Water Risk," Industries produce over 65 per cent of the world's enormous apparel. As a result, identifying a solution is necessary, as decreasing fabric and apparel usage cannot be the primary solution to pollution challenges. Recycling, redesigning and renovating new apparel to extend the product's useful life span appear to indicate environmentally sustainable apparel products and discarded modes of behaviour that promote sustainability. The use of second-hand apparel products is becoming more popular every year, and the largest market for second-hand apparel is expected to nearly or more in the future years (Herjanto, Scheller- Sampson, and Erickson 2016). As per Farrant, Olsen and Wangel (2010), reused clothing is also correlated with lowering the amount of thrown-away garments into the garbage and lowering environmental pollution. Aside from that, clothing renting and exchanging are becoming more popular in offering customers second- hand consumers' buying options (Albinsson and Perera 2009). So this research focuses on the post-purchase behaviour of consumers of new and second-hand fashion products that may lead consumers to repurchase fashion products that can be reused, repaired, and recycled, minimising waste of clothing products.

Much research has already concentrated primarily on consumer behaviour to improve long-term behavioural patterns (Kronrod, Grinstein, and Wathieu 2012; Lilley 2009; Young et al. 2010). But the researchers also

argue that several studies on second-hand clothing are limited and not more like other sectors (Na'amneh and Al Husban 2012). So by examining consumers' post-purchase behaviour of second- hand fashion products, it can be possible to know how consumers can be motivated, encouraged, and facilitate sustainable lifestyles in the textile (clothing) sector. Moreover, a phenomenon of new and second- hand fashion products was explored that provides a review of consumers' post-purchase behavioural intentions towards repair, reuse, recycling and repurchase of fashion products which will lead the researchers in their future research directions. Because reusing apparel is linked to a decrease in the cost of discarded clothing in landfills and a pollution reduction (Farrant et al. 2010). Besides that, clothes rental and swapping have become increasingly common ways for buyers to buy used apparel (Albinsson and Perera 2009). Therefore, this study focuses on consumers' post-purchase behaviour of new and used fashion items, which may also result in customers repurchasing clothing items that can be recycled, repaired, and reused, reducing textile trash.

To better understand consumer behaviour patterns, this study focused on the post-purchase behaviour of new and used fashion products. The method through which purchasers use goods and services and assess their efficiency is called post-purchase behaviour (Assael 2005). At the post-purchase stage, customers consider whether they are happy with the product, which impacts their future choices. Consumer happiness is linked to repeat purchases. Customers' shopping for fashion (clothing) products is based on three factors: individual, situational, and product qualities (Bianchi and Birtwistle 2012; Ha-Brookshire and Hodges 2009). (Gunnells, Hale and Hale, 2009)Individual characteristics include behavioural, emotional, and demographic characteristics (Gunnells, Hale, and Hale 2009). Furthermore, human traits such as motivation, mood, self-concept, and confidence are examined. Finally, demographic factors such as age and gender are cognitive elements that influence customers' decisions to buy fashion apparel (Bianchi and Birtwistle 2012; Felix, Asuamah, and Darkwa 2013).

According to Machado *et al. (*2019), various variables influence buyers' post-purchase behaviour for new and used apparel products. Customers who buy apparel are influenced by uniqueness and style accessibility because they are impressionable. Another aspect, on the other hand, determines the post-purchase behaviour of clothing products for consumers. Social behaviour contributes to the long-term use of apparel products (Kong et al. 2016). When picking which stores to go to and what to acquire, buyers are significantly impacted by social considerations when deciding which stores to go. The theory of planned behaviour was applied to various product areas, including organic food studies (Arvola et al. 2008). The idea of planned behaviour by Ajzen (1991) is frequently employed to anticipate consumer behaviour, implying that subjective norms account for consumer behaviour. Schaller and Malhotra (2015) wrote a book that used planned behaviour theory to conduct a survey in which attitudes, personal criteria, and perceived behavioural control were all significant factors. The study's outcomes are relevant to the design of a decision-making

process and behavioural modifications.

2. Method

2.1 Research design

The modern clothing industry has progressed well beyond simply meeting basic physiological and psychological needs. The emergence of fast fashion has drastically altered the social and cultural meaning of clothing. As a result, the focus of this research was on sustainable new and second-hand fashion in the clothing industry. Following a literature review, this study discovered that social and personal norms are connected and impact behavioural intentions for buying new and second-hand fashion products that can be reused, repaired, recycled, and repurchased. Furthermore, environmentally conscious consumers who are more knowledgeable and aware of environmental benefits react favourably at the post-purchase stage and consider the issues of new and second-hand clothing repair, reuse, repurchase, and recycling issues. According to Yan, Bae and Xu (2015), second-hand garment buyers are environmentally aware and buy recycled clothing to support sustainable consumption. Second-hand clothing is becoming highly widespread and the fastest growing fashion industry, also regarded as an environmentally friendly consumption choice. So it is necessary to investigate more the researchers to establish business policy. After reviewing the relevant literature and identifying research gaps, we developed a research model based on this study.

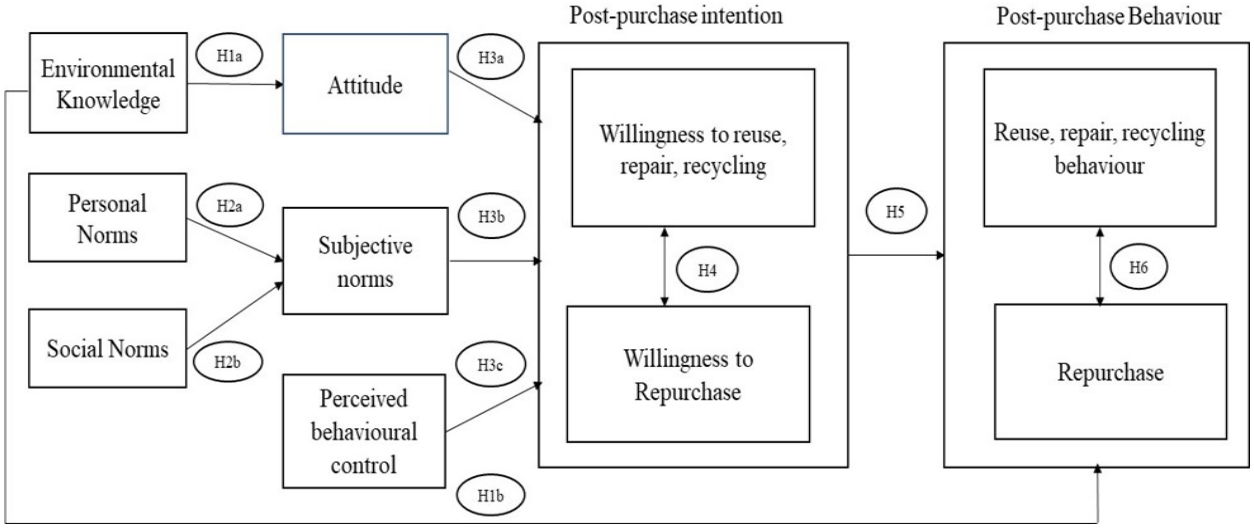

Figure 1. Research model, Source: Own edition.

After a review of literature, it was found that it is essential to investigate the factors that influence the consumers' post-purchase behaviour and intentions to repair, reuse, repurchase, and recycle new and second-hand fashion products. Thus some of the research questions were found to get answers from this research

work. The research questions are: what factors influence consumers post-purchase behaviour towards reuse, repair, recycling of fashion products? What factors influence consumers post-purchase behaviour towards the repurchase of fashion products? Based on these research questions, theory of planned behaviour and related literature and research model, we have developed some hypotheses, which are:

- H1a: Environmental knowledge positively affects consumers' attitudes.
- H1b: Environmental knowledge positively impacts consumers post-purchase behaviour towards reuse, recycling, repair and repurchase of fashion products.
- H2a: Personal norms have positive impacts on subjective norms. H2b: Social norms have positive impacts on subjective norms.
- H3a: Attitude positively impacts consumers' post-purchase intentions for reuse, recycling, repair and repurchase of fashion products.
- H3b: Subjective norms positively affect consumers' post-purchase intentions for reuse, recycling, repair, and repurchase fashion products.
- H3c: Perceived behavioural control positively affects consumers' post-purchase intentions for reuse, recycling, repair, and repurchase fashion products.
- H4: Consumers' willingness to reuse, repair, recycling, and willingness to repurchase are interconnected.
- H5: Consumers' willingness to reuse, repair, recycling, and willingness to repurchase have positive impacts on consumers' post-purchase behaviour towards reuse, recycle, repair and repurchase of fashion products.
- H6: Consumers post-purchase behaviour to reuse, repair, recycling and repurchase are interconnected. But we have worked on H1a, H1b, H3a, H3b, H3c and H5.

2.2. Data collection

We followed multiple methodologies (qualitative-quantitative approach) known as triangulation for conducting this study. Triangulation is described as incorporating two or even more philosophies, data collection methods, processes, or investigations into a single analysis of a specific concept. A researcher can interview people of differing perspectives and vastly different levels of authority, like high-level management staff and position executives in the same company (Denzin 2007). Triangulation is significant in research, including interviews to get a complete view of the current situation and problems (Davies 2001). At first, we conducted interviews of the major stakeholders and consumers of second-hand fashion products and to determine the research questions concerning post-purchase behaviour and disposition of fashion products. Then we our department hired a professional survey company to conduct telephone interview of 490 consumers who buy new and second-hand fashion clothing. The data collection methods were as follows-

Qualitative Research

In social science, qualitative research considers various problems with the interview. According to

researchers, qualitative is the reality generated interactively and then becomes meaningful subjectively (Hopf 2004). Initially, we conducted consumer focus groups and interviews to understand the critical themes relating to fashion consumption patterns and the disposition of second-hand fashion products. We validated the qualitative research results and evaluated the intensity of repair, reuse, or recycling of second- hand fashion products. Furthermore, we intended to set our research goal and conduct a survey questionnaire to do quantitative analysis based on understanding the problems and limitations from the focus group interviews with the major stakeholders and consumers of second-hand fashion products. We did this so that the quantitative survey questionnaire variables would be valid, reliable, and valuable for our research. This preliminary focus group interview revealed consumers' lack of understanding of how their behaviour affects the environment and how cloth trash and clothing consumption can be made entirely sustainable.

As a representative city of Europe, we chose Budapest as the sample area for our research. Budapest has 23 districts, 16 of which are on the Pest side.

As a result, we focused on the Pest side and preferred various second-hand fashion stores in some of the largest districts: V, VII, and VIII. First, we interviewed the significant stakeholders directly related to second-hand fashion stores such as Hada, Cream, and Vintage shops. We interviewed the shop's managers and a few of its employees. We visited ten stores, but stakeholders from eight were able to provide information because the managers of the other two stores were busy with a new collection of stocks and were unwilling to participate in the interview. As a result, we conducted interviews with eight managers and four staff of second-hand fashion stores. Then we narrowed our focus to consultations with customers of second-hand fashion products. We interviewed ten consumers who had bought clothes at second-hand fashion stores. On the other hand, the professional survey company conducted the telephone interview by following the non-random sampling method.

Quantitative Research

To validate the research hypotheses, research was conducted via questionnaires distributed to a survey of responsible consumers in Budapest. After receiving the responses, we analysed the data to see if the reliability of the answers was significant. The population of Budapest in 2021 is now estimated to be 1,771,865. Budapest has a total land area of 525.2 square kilometres. With roughly 1.77 million citizens, the population density is approximately 3,351 persons per square kilometre (Source: World Urbanization Prospects - United Nations population estimates and projections of major Urban Agglomerations). So it was challenging to collect data from all types of consumers of Budapest.

After reviewing the literature, some variables from the research model were utilised in developing the questionnaire to collect data through telephone interview. The variables are social norms, personal norms,

repair, reuse and recycling, environmental knowledge and awareness and product attributes. In addition, age, gender, level of education, employment status, monthly income, and shopping frequency have all been considered demographic variables. A 5-point and 7-point Likert scale was also used in the survey questions to anticipate potential consumers' behavioural intentions.

2.3 Data Analysis

The frequency, EFA (exploratory factor analysis), and reliability have been examined using SPSS 26.0.

3. Result

3.1 Results from the survey

We followed snowball sampling in the interview method to collect data from the major stakeholders of the second-hand fashion stores. Snowball sampling is a technique of randomising a sample of participants from a known population. Participants who are not in the randomly selected model but are instead identified by someone from the first phase. In the very first phase, participants are then asked to give the name of the various individuals (Goodman 1961). The profile of the respondents from major stakeholders is as follows-

Table 1: Profile of the respondents of significant stakeholders from the interview

Participant (P) numbers	Gender	Age range
Managers		
P1, P4, P5	Female	25-40
P2, P3, P7, P8	Female	30-45
P6	Male	25-40
Staffs		
P9, P12	Female	25-40
P10, P11	Male	30-45

Table 2: Profile of the respondent (consumers) from the interview

Participants of Consumers (C)	Gender	Age	Income range	Marital status	Occupation
C1	Female	20-30	$600-$800	Unmarried	Student
C2	Female	31-45	$0-$500	Married	Housewife
C3	Female	45-above	$0-$500	Divorced	Housewife
C4	Male	31-45	$600-$800	Married	Job
C5	Male	20-30	$0-$500	Unmarried	Student
C6	Female	20-30	$600-$800	Unmarried	Student
C7	Female	31-45	$600-$800	Married	Job
C8	Male	31-45	$1300-$Above	Married	Business
C9	Female	20-30	$600-$800	Unmarried	Job
C10	Male	20-30	$600-$800	Unmarried	Student

Table 3: Coding of the answers of the major stakeholders and consumers from the interview

Questions	Answers
From major stakeholders:	
What factors influence consumers repurchase of second-hand fashion products?	Cheap, reasonable, diversity of products, branded products at a low price,
What types of consumers buy it more? (By Gender and age)	All types but mostly the females, teenagers. In age mostly from 20-80.
What types of strategies do second-hand fashion stores follow to repair, reuse, and recycle second- hand fashion products?	Discount, everyday services, environmental protection, diversification, associations of products, understanding customers' demands, repairing products to make usable, and recycling products to minimize waste.
From consumers	
What do you act normally when the clothing products are damaged?	Throw, repair and reuse, the gift to family members and relatives, sell to second-hand fashion stores, donate to the voluntary organization and low-income people,
Why do you buy second-hand fashion (clothing) products?	Cheap, helpful to maintain social status, branded products availability, environmentally beneficial,
What factors influence your post-purchase intentions when you buy second-hand fashion products?	Opportunity to get high quality and branded products at a low budget can be maintained different styles, social and financial balance, saving money and controlling consumption more.
What are the reasons for your negative post- purchase behaviour of second-hand fashion products?	Non-returnable option, no warranty, quality and durability issues,

Almost all the eight managers and four staff of the second-hand fashion stores stated that consumers purchase second fashion products because they are affordable. The managers of the second-hand fashion stores told that all ages of consumers demand buying products from there. Nowadays, there is much demand for children's dress as they grow up very quickly and their dresses are more expensive. But mainly by the age range 20-80 years of consumers are comparatively other ages. They believe they contribute to sustainable consumption

as they provide everyday services to consumers who are providing consumers to fulfil their needs of clothing at a reasonable price. Moreover, they said they keep the clothes' categories in different sections to make the shopping easy. They have many stories in other places to make it available to all consumers. For example, the manager of Hada in Corvin plaza said that they had had 88 stores in the whole of Hungary for 25 years that are operating services of second-hand fashion clothing for consumers as part of sustainable production and consumption. Even their logo of the name indicates that it is secure and states that they are providing environmental protections. The other stakeholders said they focus on repair, reuse, and recycling strategies to provide consumers with better services. Even though they have separate marketing departments that handle the consumers' issues, they considerably consider consumers' reviews and try to correct services as per that. But they believed that still there is a lack of consumers' awareness about the environmental benefits of using second-hand fashion products; instead, they are more concerned about price and brand. However, they think yet they must lack ecological knowledge. Still, consumers' buying habits as positive post-purchase behaviour may have a long-term positive impact on sustainable consumption that will help to reduce waste in the textile industry.

From the side of consumers, the respondents were interviewed with some questions regarding their purchase and post-purchase intentions towards second-hand fashion products and whether they were concerned about recycling and minimisation of waste. We took interviews first with a general question like, what do they do with consequences if they are damaged or long? Why do they buy second-hand fashion products? Moreover, we tried to determine the influencing factors on their positive and negative post- purchase behaviour. In the above figure, we have coded the answers in table-VI. They have said that second- hand fashion stores can get high-quality products with a low budget, which is the main influential factor for positive post-purchase behaviour. Consumers recognise that they can purchase higher-quality, longer- lasting goods at lower prices than the local market. Even by this, they can contribute to resource utilisation as there is resource scarcity and local stores sell low-quality products at a higher price (Roux 2006). Moreover, they think that purchasing second-hand fashion products is helpful to minimise waste of the environment. According to research, the acquisition of second-hand clothing is connected to belonging because social relationships support the growing intentions with the thinking about environmental benefits (Guiot and Roux 2010).

3.2 Results of the telephone interviews

Table 4: Descriptive statistics

Attributes	Category	Frequency	Percentage (%)
Gender	Male	219	44.7
	Female	271	55.3
Monthly Income	Under 50 000 forints	8	1.6
	50 001-100 000 forints	35	7.1
	100 001-150 000 forints	88	18.0
	150 001-200 000 forints	97	19.8
	200 001-250 000 forints	62	12.7
	250 001-300 000 forints	47	9.6
	300 001-350 000 forints	28	5.7
	350 001-400 000 forints	14	2.9
	400 000 forint- above Do not	61	12.4
	know / do not answer	50	10.2
Age	Under 16	0	O
	16-29 Years	107	21.8
	30-44 Years	140	28.6
	45-59 Years	103	21.0
	60 Years- Over	140	28.6

The table 2 and figure 2 show that majority of the participants were female (55.3%) representing 271 participants while the remaining was male (44.7%) representing 219 participants. Here we can see that female participants are a bit more than male participants. Moreover, table 3 also shows the descriptive statistics of income statements of the participants. The table 3 and figure 3 demonstrate that the more percentage was in the income ratio between the 150001 to 200000 forints which is 97 participants' income. The other majority of percentage was 88 with representing the 18.0%, 62 participants with representing 12.7% and so on. But the lowest percentage of income was 1.6 of 8 participants.

The table 2 also show the descriptive statistics of age range. The same number of participants was in the age range of 30-40 and 60-over. In both range the number of participants were total of 140, respectively. Among the total 490 participants 107 participants were from the age range of 16-29 years old whereas 103 participants

were in the range of 45-59 years age.

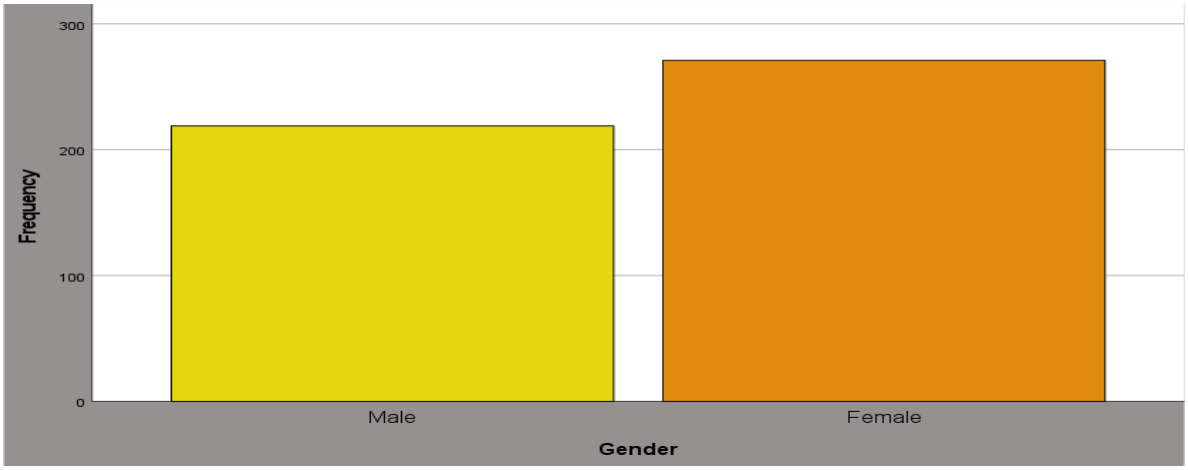

Figure 2: Frequency distribution of gender

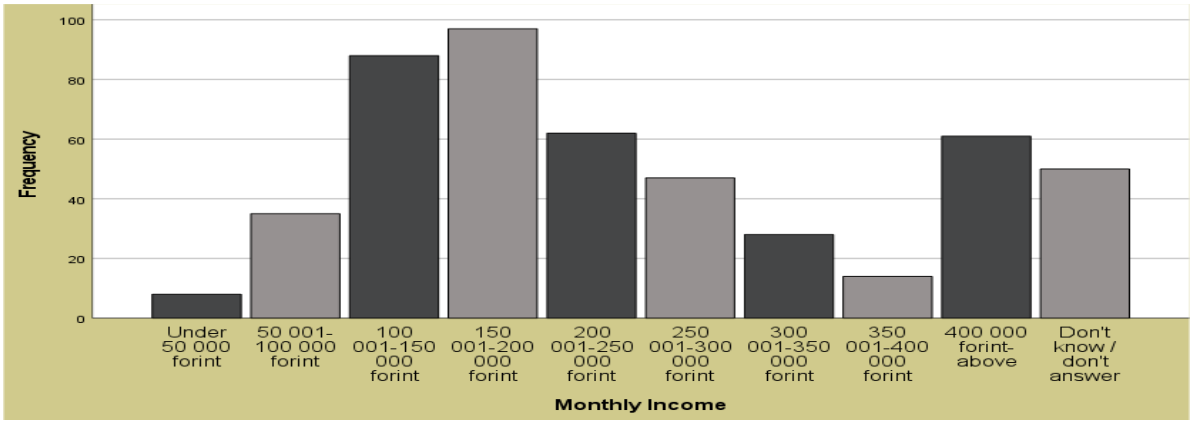

Figure 3: Frequency distribution of monthly income

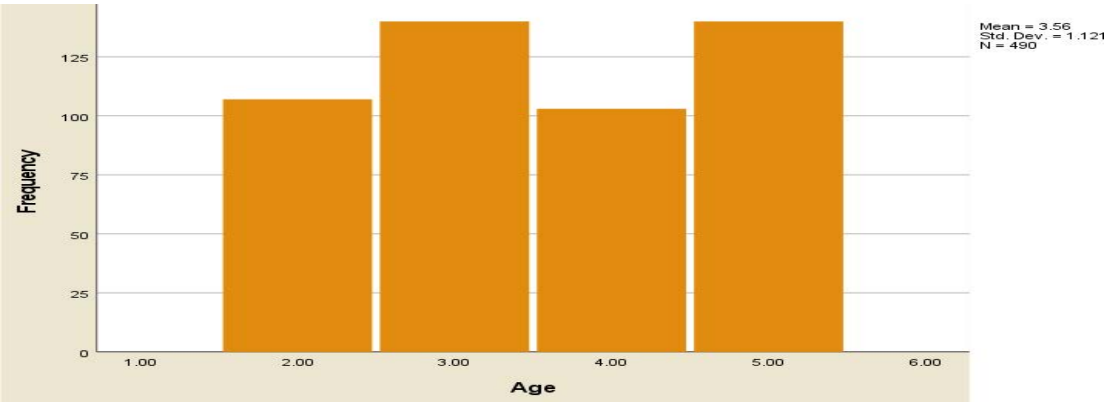

Figure 4: Frequency distribution of the age

The figure 4 states that the age distribution is significant enough to present. The mean and standard deviation are satisfactory. Most of the respondents were neutral because the mean score is 3.56 with standard deviation 1.121.

Table 5: Reliability analysis of each variable

Construct	Items	Cronbach's Alpha
Environmental Knowledge (EK)	EK1- Environmental problems are among the most important problems of our age.	.668
	EK2- The fashion industry is one of the most polluting industries regarding water pollution.	
	EK3- The production of fashion products creates social problems.	
	EK4- Fashion product producers cannot solve the environmental and social problems of the industry alone.	
	EK5- Changing consumer behaviour is an important element of solving environmental problems.	
Attitude (ATT)	ATT1- Buying too many fashion (clothing) products harms the environment.	.717
	ATT2- Companies should produce longer-lasting fashion products	
	ATT3- Fashion companies should offer repair services.	
	ATT4- By repairing and reusing fashion products the burden on the environment can be reduced.	

	ATT5- I believe that purchasing second-hand fashion products is good for the environment.	
	ATT6- Giving away fashion products, which I do not need anymore, gives me a good feeling.	
	ATT7- By selling/swapping my old fashion products I can help somebody else.	
	ATT8- Purchasing fashion products that can be used for a long period, can be repaired or recycled is satisfactory.	
Subjective norms (SN)	SN1- My friends consider environmental issues when purchasing fashion products.	.766
	SN2- Many of my friends buy fashion products in second-hand fashion stores.	
	SN3- It is trendy to shop in second-hand fashion stores.	
	SN4- My friends use their fashion products for a long time and repair them when possible.	
	SN5- If I repair and use my fashion products for a long time, most people who are important to me agree with my decision.	
	SN6- It is trendy to repair and use clothes for a long time.	
	SN7- It is common practice in my family that we pass clothing items to each other if we do not need them anymore.	
	SN8- I know many people, who give away their fashion products to others when they do not need them anymore.	
	SN9- I know many people, who sell their fashion products to others when they do not need them anymore.	
Perceived behavioral control (PBC)	PBC1- I always try to purchase fashion products that I can use for a long time and can be repaired if needed.	.662
	PBC2- If it were entirely up to me, I am confident that I will repurchase fashion products that can be used for a long time and can be repaired and recycled	
	PBC3- I feel that purchasing fashion products that can be used for a long time, can repair, and are recycled is totally within my control.	

	PBC4- In the future, it is entirely up to me whether or not I repurchase fashion products that can be used for a long time, repaired, and recycled.	
Purchase behaviour (PB)	PB1- I often purchase fashion products that are made of environmentally friendly materials.	.861
	PB2- I often purchase fashion products that are made of recycled materials	
	PB3- I often purchase fashion products that were manufactured responsibly	
	PB4- I often purchase fashion products that can be used for a long time	
	PB5- I often purchase fashion products that can be repaired	
	PB6- I often purchase fashion products that can be recycled	
Post-purchase intention (PPI)	PPI1- In the future, I intend to buy fashion products that can be used for a long period of time.	.739
	PPI2- In the future, I plan to buy fashion products that can be repaired.	
	PPI3- In the future, I will buy fashion products that can be recycled.	
	PPI4- I intend to buy clothing products less frequently in the future.	
	PPI5- I plan to use fashion products for a long period of time after purchase.	
	PPI6- I intend to give away the fashion products that I do not need to others, who can still use them.	
	PPI7- I plan to sell fashion products, which I do not need anymore.	

	PPI8- I intend to repair fashion products after purchasing.	
	PPI9- I intend to select fashion products and take them to recycle facilities/collection points.	
Post-purchase behaviour (PPB)	PPB1- I keep using fashion products as long as I can	.517
	PPB2- I reuse my outdated/used/unwanted clothing products for other purposes	
	PPB3- I give away my outdated/used/unwanted clothing products to my family members and friends	
	PPB4- I use my old garments for crafts or sewing purposes	
	PPB5- I donate my clothes to charity	
	PPB6- I often repair clothes if they are damaged and use them again	
	PPB7- When I repair my clothes, I do it because: o I like them and I get attached to them o I want to save money o I want to reduce waste o For other reasons:……	
	PPB8- I often keep my clothes for several years even though I do not use them anymore	
	PPB9- If a clothing product cannot be used anymore, I put it in the bin	
	PPB10- If a clothing product is not suitable for further use, I take it to a recycling facility	
	PPB11- If I am satisfied with a particular product, I will search for the same brand/producer again	
	PPB12- If I am satisfied with a particular product, I will continue shopping in the same store	

The table 5 shows the reliability test of each variables. There are 7 variables in the analysis with different number of items. There are 5 items in the first variable which is environmental knowledge whose Cronbach's Alpha is .668. Normally, if the Cronbach's Alpha value is .70 or greater than that then there is no problem with the items. But if there are less than 10 items then it should be more than .5. We can see that there are 8 items in the variable Environmental knowledge and Cronbach's Alpha is .630. So, we do not have any problem with the instrument to continue with our research. We can say the same with perceived behavioural control but in the other three variables which are attitude, subjective norms and post-purchase intention the Cronbach's Alpha is .717, .766 and .739 respectively which is quite significant.

So, we can go further with this research. But in the last variable (post-purchase behaviour) there are more than 10 items and the Cronbach's Alpha is .517 which is not significant. So we need to focus on each item and make the variable consistent to go for the further research.

Table 6- Reliability test of each items of PPI and PPB

Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PPI1- In the future, I intend to buy fashion products that can be used for a long period of time.	.57 . 62	.70
PPI2- In the future, I plan to buy fashion products that can be repaired.	.56	.78
PPI3- In the future, I will buy fashion products that can be recycled.	.23	.70
PPI4- I intend to buy clothing products less frequently in the future.	.42	.75
PPI5- I plan to use fashion products for a long period of time after purchasing.	.40	.72
PPI6- I intend to give away the fashion products that I do not need to others, who can still use them.	.20	.72
PPI7- I plan to sell fashion products, which I do not need any more.	.56	.77
PPI8- I intend to repair fashion products after purchasing.	.38	.70
PPI9- I intend to select fashion products and take them to recycling facilities/collection points.		.72

PPB1- I keep using fashion products as long as I can	.18	.50
PPB2- I reuse my outdated/used/unwanted clothing products for other purposes	.27	.48
PPB3- I give away my outdated/used/unwanted clothing products to my family members and friends	.30	.47
PPB4- I use my old garments for crafts or sewing purposes PPB5-	.28	.47
I donate my clothes to charity	.28	.47
PPB6- I often repair clothes if they are damaged and use them again	.30	.47
PPB7- I often repair my clothes if they get damaged and keep using them	.24	.48
PPB8- I often keep my clothes for several years even though I do not use them any more	.10	.52
PPB9- If a clothing product cannot be used any more, I put it in the bin	-.17	.59
PPB10- If a clothing product is not suitable for further use, I take it to a recycling facility	.26	.48
PPB11- If I am satisfied with a particular product, I will search for the same brand/producer again	.21	.49
PPB12- If I am satisfied with a particular product, I will continue shopping in the same store	.27	.49

The table 6 shows the reliability test of each item of the PPI and PPB from we can see the Cronbach's Alpha is significant in all the items of PPI because all are .70 and greater than that. On the other hand the Cronbach Alpha in the items of PPB is not so much significance.

We analysed correlation matrix also with some variables. Like between EK and ATT the Pearson Correlation of EK is 1 and ATT is .50. So we can say that these two variables are positively correlated. Moreover correlation is significant at the 0.01 level.

4. Conclusions

This study initially examined on the second-hand textile post-purchase behaviour. Later it focused on the aspects that influence consumers' post-purchase intentions and behavior when it comes to fashion textile products. Initially the study focused on the reliability, correlation, and frequency analysis to understand the significance of each variable. The study found out that the factors: environmental knowledge, attitude, subjective norms, perceived behavioural control all positively influence on the consumer's post-purchase

intentions. But consumers post-purchase behaviour depends on many other factors. For examples consumers are knowledgeable about environmental knowledge but when it come to the after-purchase stage they do not focus more on the aspects of post-purchase behaviour. The result of this study found out that the post-purchase behaviour is not significant like post-purchase intention. Consumers have positive attitude towards purchase behaviour and post-purchase intentions but have less positive attitude towards post-purchase behaviour. According to the findings, marketers should be aware that consumers have various post-purchase behaviours while purchasing fashion textile products in the future. As a result, they should concentrate on the other aspects of it.

The study is still ongoing because of time limitations. So we aim to continue this research to know the post-purchase behaviour of the consumers and test the developed hypotheses that will enable the future scholars to better understand of the aspects like repair, reuse, recycling, and repurchasing of fashion textile consumers that may influence on their positive post-purchase behaviour.

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Going Back to the Roots: Finding the positives in the old practices

Pooja Kapoor

National Institute of Fashion Technology (NIFT), New Delhi,
poojakapoor05@gmail.com

Abstract

Over the last few generations, our society as a whole, has been gradually led into adopting the instant gratification lifestyle. The global apparel market is projected to grow in value to about 2.25 trillion dollars by 2025, this shows that the demand for apparel is on a steep rise across the world. Throw away fashion has been the key to promote and feed into the fast fashion cycle, wherein, consumers are splurging more than ever on apparel, wearing them less and simply discarding perfectly usable products within a season or two. This entire process in turn, is leading to uncontrollable apparel waste and ever increasing, unmanageable landfills across the world. On an average, consumers throw away almost 60 per cent on their apparel purchase within the first year, if this trend continues at the same pace, over 150 million tonnes of clothing waste will end up clogging landfills by 2050. Thanks to the media spotlight and increasing awareness people are waking up to the unsustainable aspect of fast fashion and sustainability is fast becoming a focus point. This movement counters the use and discard lifestyle by fostering a change in fashion products and the fashion system as a whole towards not just greater ecological integrity but also social consciousness. Sustainable fashion addresses the entire manner in which clothing is produced, who produces it, and how long the life span of a product is before it reaches the landfill. Thus, countering the large carbon footprint that the fashion industry in its mad dash towards higher and higher sales is creating.

This paper briefly focuses on the current sustainability practices followed by some of the fast-fashion apparel brands, if they are just seen as a rich man's game/ green-washing. The paper then investigates and analyzes if these practices are as sustainable as the traditional practices followed across the traditional Indian societies and what actually make them more applicable at grass- root levels. For this paper, various people within the traditional Indian society over the age of 40 years were questioned in order to document some of the integrated sustainable practices from their own early childhood. Wherein, the adults in the Indian traditional family/ society as a whole used to incorporate the concept of reduction, recycling and reuse into every aspect of daily life and to see if these lifestyle choices still hold true today and to what extent. We explore the current impact of these practices by using 18-30 year olds as the second focus group and analyzing their reaction to/ use of some of these practises. The results thus collected, conclusively demonstrate that the use of these traditional practices are still prevalent in our societies and they do reduce impulsive, unsustainable buying behaviour and prove the hypothesis, with some small refinements the

possibility of reintegrating these the traditional practices into daily life will continue to make an impact on a larger scale by reducing the demand for these products.

Keywords: Traditional Sustainable Fashion Practices, prevention, reduction, recycling, reuse, Fast Fashion, Impulse Buying, #ReFashionNow

1. Introduction

The production and consumption of textile products continue to grow exponentially and so does their impact not just on the climate, but on water and energy consumption as well as our environment. As per Ellen MacArthur Foundation (EMF) report, cited in the communication from the Commission to the European Parliament (2022), the global textiles production almost doubled between 2000 and 2015, and the consumption of clothing and footwear is expected to increase by 63% by 2030, from 62 million tonnes now to 102 million tonnes in 2030, as per the European Environment Agency (EEA) (2019), cited in the same communication.

At its core, the entire premise of the fashion industry is based on demand and supply just like any other business. This was in healthy balance in the past, wherein, consumers used to have to wait to get their needs catered to before moving on to their wants. With the increase in disposable incomes, (Disposable Personal Income in India increased to 238573760 INR Million in 2021 from 199689740 INR Million in 2020. Source: Ministry of Statistics and Programme Implementation (MOSPI)) and the disruptive innovations in the apparel sector; this careful balance has been upturned drastically by the fast fashion brands looking for higher and higher sales by encouraging impulse purchasing with the emphasis purely on instant gratification. Instant gratification is the desire to experience pleasure or fulfilment without delay or deferment. Basically, it's when you want it; and you want it now, Neil Patel (2014). The fast-fashion business strategy is focused on minimizing the buying cycle and lead times processes for the latest fashion trends by frequently updating their products. This system combines short manufacturing cycles, rapid distribution, and offers highly current fashion trends. Due to this production model, fashion products can reach the market almost instantaneously, this allows the fast-fashion retailers the chance to meet the consumers' wants and expectations more effectively. Some global fast-fashion companies such as Zara and H&M started using this strategy and launch new products into their stores every three to five weeks, leading to an even shorter product life cycle and thus making the fast-fashion industry one of the main drivers in environmental impact, Lidia Alexa, et al (2022).

This consumer inclination of using garments for ever shorter periods before throwing them away contribute the most to unsustainable patterns of overproduction and overconsumption. Such trends entice consumers to keep on buying clothing of inferior quality and lower price, produced rapidly in response to

keep up with the latest fashion trends. This growing demand for cheap textiles is fuelling the inefficient use of non-renewable resources, including the production of synthetic fibres from fossil-fuels. These negative impacts have their roots in a linear model that is characterised by low rates of use, reuse, repair and fibre-to-fibre recycling of textiles, and that often does not put quality, durability and recyclability as priorities for the design and manufacturing of apparel. KÖHLER Andreas et al (2021).

In the last few years, the emphasis on sustainability is being embedded across all industries and sectors due to the increasing awareness levels across the world. Studies show that consumers are more inclined to "choose a brand over another if they believe the brand will help the environment". They are also more inclined to act positively towards companies that are perceived to be sensitive to environmental concerns. In this context, starting with the late 1980s and early 1990s, Green marketing, which refers to the inclusion of environmental awareness in marketing management, has begun to be used more and more often, Lidia Alexa et al (2022). The American Marketing Association (AMA) defined green marketing as "the study of marketing activities' positive and negative aspects on pollution, energy depletion and non-energy resource depletion".

The change in consumer behaviour because of their increased awareness regarding the social and environmental impact of their fashion consumption has ensued an intensified need for more ethical alternatives, thus, generating a market demand for more sustainable products. As a result, sustainable fashion has turned into the primary focus for long-term growth and the fast fashion companies want to be associated with that image to improve their brand perception among their consumers.

Considering that the company's reputation has a significant impact on consumers' perception and likelihood to buy, in parallel with Green marketing, another concept arose, namely Greenwashing, which was first used in 1986 by Jay Westerveld. According to de Freitas Netto et al. as cited by Alexa et al. (2022), greenwashing represents "a phenomenon that includes poor environmental performance and positive communication about it. Greenwashing is perceived as a deliberate corporate action that misleads consumers. Siano et al. (2017) describe greenwashing from a wider viewpoint: "a gap between symbolic and substantive actions" (initiatives in line with the sustainability approach) as cited by Alexa et al. (2022). This can also be characterized as selective disclosure by the companies: reducing the disclosure of negative information regarding the company's environmental performance and exposing or highlighting positive information regarding its environmental performance.

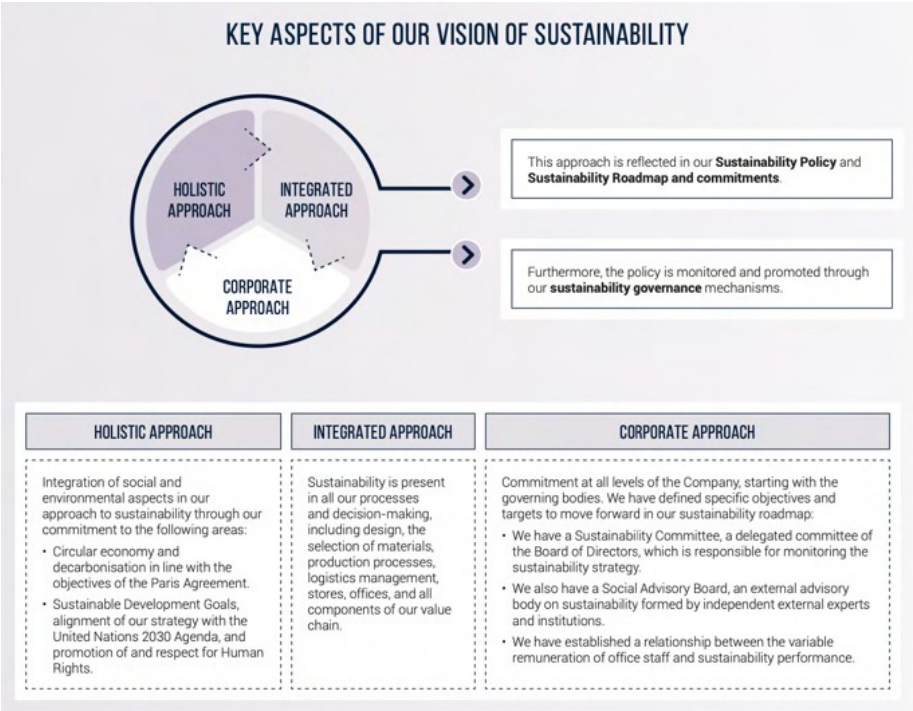

Fig: 1. Inditex | 2020 Annual Report

Inditex group in their annual report (2020), created a Sustainability Roadmap, Fig:1.1, 1.2, based on a circular economy model, in order to mitigate the effects of climate change and other potential environmental and social impacts. They are still vague with their numbers, Fig:2, depending on vague percentages instead of hard facts. The environmental marketing company called TerraChoice designed a classification named “the seven sins of greenwashing”, covering the primary ways companies mislead consumers using environmental claims as explained by Alexa et al (2022), “The sin of vagueness” refers to a poorly defined claim that the consumer likely misunderstands its real meaning. “The sin of lesser of two evils” represents a claim that may be true within the product category, but that risks distracting the consumer from the more significant environmental impacts of the category as a whole.

Fig:2. Inditex | 2020 Annual Report

H&M Group ranked second in Fashion Revolution’s 2021 Fashion Transparency Index, scoring 68% (73%

in 2020) as per their Sustainability Disclosure report (2021). Their ambition is, “to achieve net-zero CO2e emissions by 2040, taking a climate positive approach and having a net positive impact on biodiversity. Becoming circular throughout our business is key to achieving these aims.” Ref, fig:3. But, they don’t have any numbers mentioning their current negative impact on their environment either.

Fig: 3. H&M circular ecosystem

Just to give an idea of the sheer numbers involved, “In a recent 12-month period, the Gap listed roughly 12,000 different items on its website, H&M had about 25,000, and Zara had some 35,000, Shein, in that period, had 1.3 million”, Professor Lu, as quoted by Vauhini Vara (2022).

Shein, fast becoming the most valued fast fashion company, after its recent $100 billion valuation, doesn’t release any sustainability related information at all apart from generic statements on its website.

According to Kozlowski et al. (2016), one of the main issues for fast-fashion companies is sustainability, as the industry poses complex environmental and social consequences, both in terms of production and consumption. Fast fashion encourages quick buy and quicker disposal, promoting unsustainable consumerism because of the sheer volumes involved. The disposal mindset of consumers and shortened lifecycle of garments simply does not equate to the pursuit of sustainability, making the afterlife of a product more significant, particularly with reducing and recycling waste within the supply chain. Choi, T.M. et all (2012), as cited by Esther Oluwadamilola Olufemi Rotimi, et all (2021).

2. Methods

The study was characterized as a quantitative and qualitative research in three stages. In an attempt to

understand the current scenario, a thorough literature review was conducted, briefly reiterated in the introduction as well. This lead to the discovery of certain gaps in the existing research that needed to be brought to attention. As per observation, when researchers start talking about sustainability they focus on either the current fast-fashion consumers or focus on the traditional tribes/ indigenous people who live as one with the nature and are often viewed as as primitive. That being said, these indigenous people have a tremendous understanding of their ecosystem and the factors that sustain them, by the virtue of living in symbiotic relationship with nature throughout their lives.

Researchers haven't focused on the sizeable Indian middle class, who have evolved from these tribes/ traditional societies and are currently populating all the major metropolitan cities across India and some parts across the world. They already have that balance between the two extremes and hold the key towards making a wider impact with the current sustainability efforts. The focus on sustainability has always been a core component of traditional Indian societies. Their philosophy and intrinsic values have always encouraged a sustainable way of life, wherein, humans and nature share a harmonious symbiotic relationship. This goes as far as inherent reverence for various flora and fauna which is programmed into their systems since childhood.

Today, when people across the world are concerned by the degradation of the environment and the disastrous consequences facing us, this could be looked upon as a source of inspiration and guidance for sustainable ventures in the future. Perhaps, no other society can provide such a profound variety of cultural practices and ecologically sound relationship with nature as an average Indian. This being said, India is no exception to the unfortunate global phenomenon of environmental degradation brought about by rapid developmental activities. Rapid industrialization, growing urbanization, intensive cultivation, and other developmental activities, coupled with increasing biotic pressure caused by a huge population has had a very adverse impact on India's environment.

The younger generations buy into the aspirational lifestyle and consider material success as a reflection of social prestige. They are one of the largest consumers of fast fashion in India. According to a survey conducted by Business Today (2021), customers in the age group of 18-30 drove the demand for online fashion, with 71 per cent of them spending on the category. This is one of the age groups under focus for this research. The second category is the middle age group (40-60 year), who have been around long enough to see these changes come across our societies. They are well established in their family lives, with kids (if any) belonging to the category mentioned above and have parents belonging to the post independence era, wherein being thrifty was a matter of survival not just a choice. Both the sample groups were picked out of the faculty and students of NIFT.

After the initial literature review, separate questionnaires were circulated within the institute, focusing on the faculty members for the 40-60 age group and the students for the 18-30 age group. This was done in order to collect the quantitative data. Both of these questionnaires started with a few common questions and branched out into age group specific queries. These questionnaires also contained a few open-ended questions that allowed the target groups to answer in their own words, this in turn, helped generate the qualitative data for this research. The process followed has been simplified and shown in Fig.: 4.

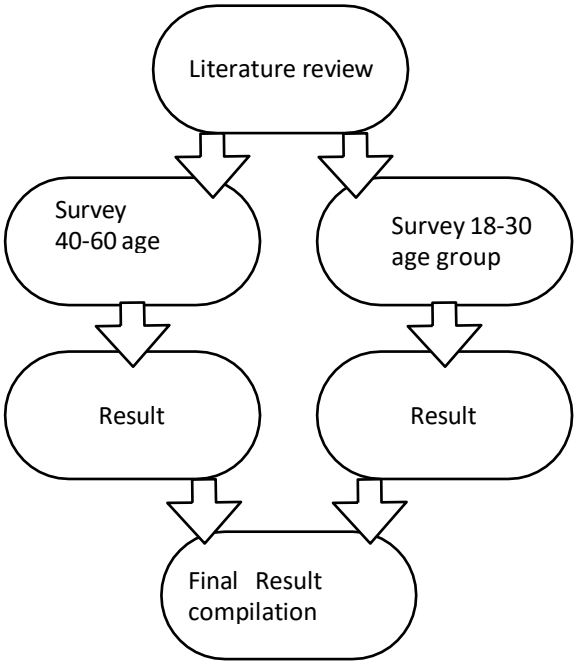

Fig:4. Research methodology

3. Results & Discussions

The questionnaire started with a few basic questions to establish the already prevalent trends between the two age groups as per the information drawn from the literature review. Based on the responses compiled from the questionnaires, some early conclusions were raised which are being briefly compiled below:

- The publicizing of sustainability practices by the companies has not been enough for the clients to recognize them in India to a larger extent. 35% of the respondents between the ages 18-30yrs didn't have any awareness when asked about the sustainability practices followed by the larger fast-fashion

brands like H&M and Zara, Fig: 5.

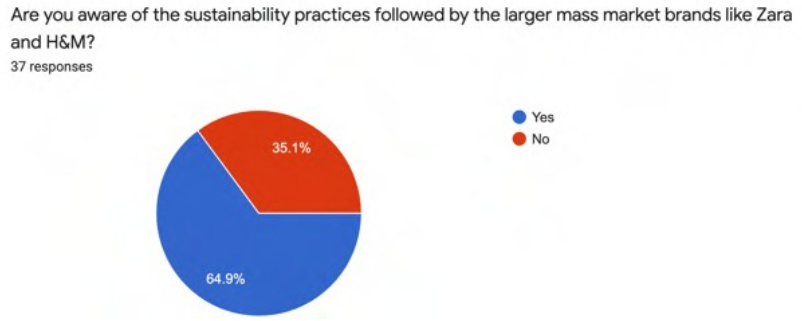

Fig: 5

- Knowing about the sustainability practices is not enough to change the decision of the consumer between the 18-30 age group, when they were asked if these practices made any impact on their shopping habits, 45.2% of the respondents claimed that it didn't make an impact, Fig:6.

Fig:6

- People consider that environmental sustainability is important, but this is still not enough to change their purchase decision. Only 33.3% of the respondents between 18-30 years has proactively shopped with sustainable brands, Fig:7.

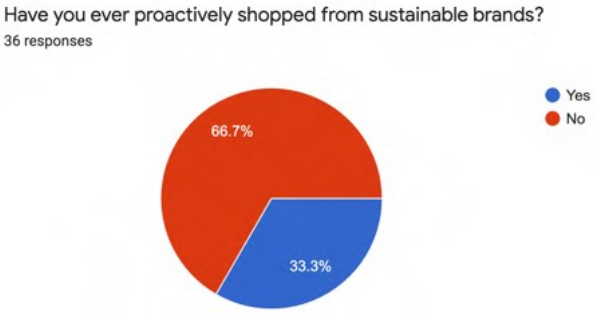

Fig:7

- Both the target groups believe in wearing out a garment completely before they cast it aside. What was interesting was the fact that the older generation (40-60yrs) just donated it (80%) when they were done with it. The younger generation (18-30) were more creative with their handling of the worn out apparel products, wherein, 62% of the respondents donated them, while 27% of the respondents tried figuring out ways to reuse these products, Fig:8/9.

Fig:8/9

- Both the target groups had a good understanding of what sustainability actually means. What was interesting again, was the overwhelming response that showcases the impact of the previous generations on the sustainability practices followed by the current generation. Within the 40-60 year age group 96.7% of the respondents acknowledge their elder's role in their sustainability habits, Fig:10. The younger generation (18-30) doesn't have the same overwhelming numbers at 57.1%, but another 42.9% had parents with some elements of sustainability that they used to practice, Fig:11.

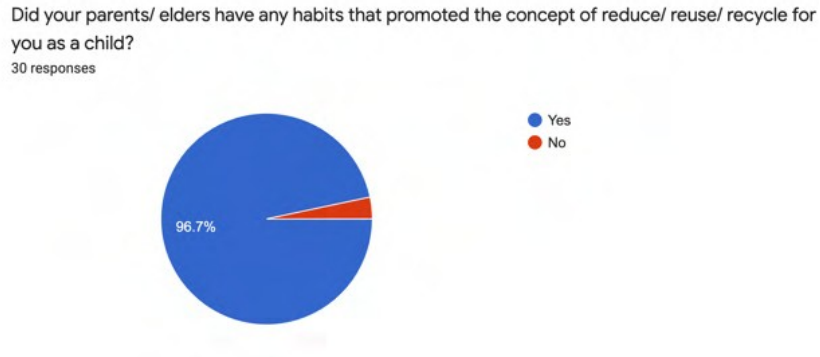

Fig:10

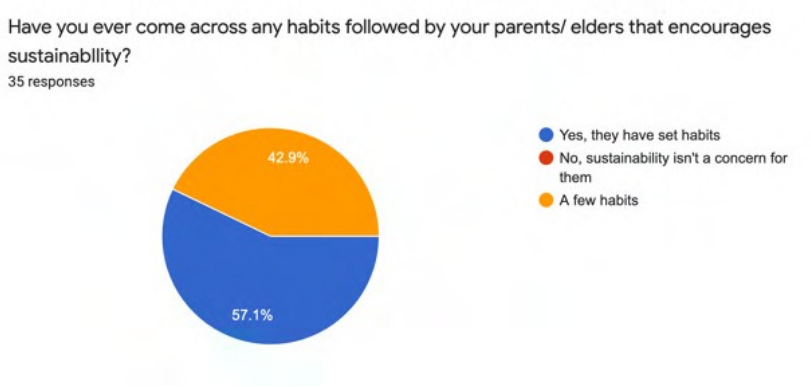

Fig: 11

- In order to get a better understanding of the matter, the next question was kept open-ended and asked the 40-60yr group for their suggestions in order to get the younger generations more invested in sustainability. Creating awareness took the top priority among most of the responses received. A majority of the respondents are convinced that leading by example, as a role model, is the best option, wherein the adults in the family can guide the younger generations into following a more sustainable lifestyle by integrating the practices they see the adults follow into their own lifestyle.

“Awareness, demonstration, and practice in daily life. It's a slow process as now we are trapped with the problem of plenty.. many things are available a click away and people have disposable income. But one should understand that one should buy if they actually need it... full utilization of available things are must and reuse as much as possible. Also for sustainability better waste management techniques need to be talked about and practiced. Consumerism is a white elephant ...we can't curb that, however, better end-of- life management of used things will definitely bring changes.”

This focus group also believes that starting them on the path towards sustainability as young as possible is the best option, along with the habits integrated at home under parental supervision, schools and colleges can be involved in the process of initiating a conversation regarding sustainable practices. This can be done by creating awareness of the issues we are collectively facing by hosting workshops and other programs.

- 93% of the older group had tried passing on these habits to their younger generation Fig:12, with 71.4% mentioning that they had succeeded in integrating some of these principles partially, Fig:13.

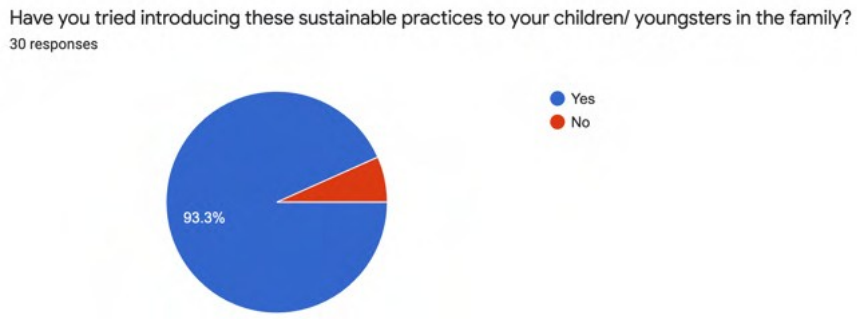

Fig:12

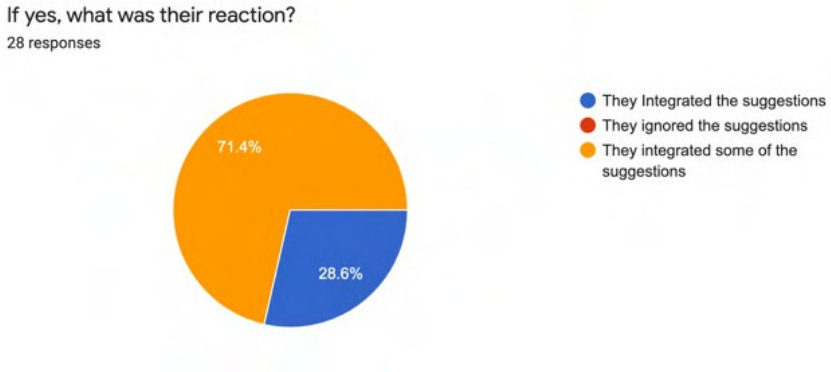

Fig: 13

- This data collected from the above questionnaire can be proven as effective as the younger generation is observant, and the older generation is proving to be good role models. 100% of the respondents within the younger focus group claim to have seen the older generation practicing some elements of sustainability in their daily lives. This can be seen in the fig. 14, 57.1% have very set sustainable habits but the balance 42.9% still follow through with these practices to a smaller degree.

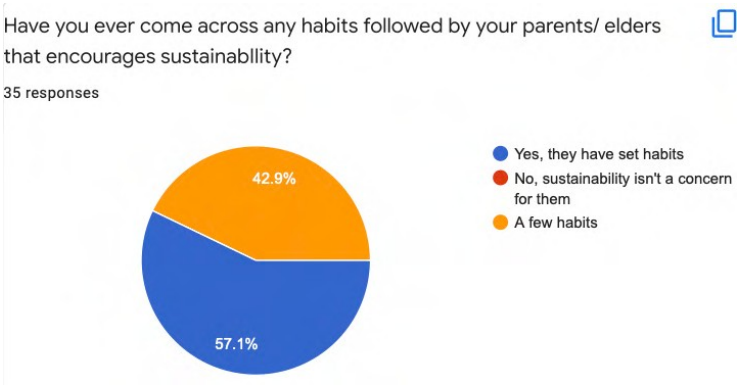

Fig. 14

- Not only is the younger generation observant, they are also following through and integrating these habits into their lifestyle. 97.3% of the respondents in the 18-30 age group reuse/ recycle and upcycle their clothing items, ref Fig. 15, thus making a huge impact on the product lifecycle and keeping these apparel products from reaching the landfills before their time.

Fig. 15

The open ended question asking about their choice of sustainable practices, match the older generation wherein the clothing items are traded across their siblings/ friends while still in good shape. Small issues with wear and tear are handled by actively up-cycling the products. Once the apparel item is too worn to be used, it is usually put into use as a dusting cloth etc.

4. Conclusions

The growing demand across the globe for textiles products is fuelling the inefficient use of non- renewable resources, including the production of synthetic fibres from fossil-fuels and creating massive landfills. These negative impacts have their roots in a linear business model that is characterised by low/ negligible rates of use, reuse, repair and fibre-to-fibre recycling of textiles. This model does not put quality, durability and recyclability as a priority for the design and manufacturing of apparel. This fast-fashion business model encourages the consumers into using garments for shorter periods before discarding the products, and contributes the most to unsustainable patterns of overproduction and overconsumption across the world. Environmentalists, businesses, consumers and public authorities across the world, specially in the EU are already focussing on increasing the sustainability and circularity of this sector, but the transition is slow and the environmental footprints of the sector remains impossibly high.

EU Strategy for Sustainable and Circular Textiles, Brussels (2022), aims to create a coherent framework and a vision for the transition of the textiles sector whereby: "By 2030 textile products placed on the EU market are long-lived and recyclable, to a great extent made of recycled fibres, free of hazardous substances and produced in respect of social rights and the environment. Consumers benefit longer from high quality affordable textiles, fast fashion is out of fashion, and economically profitable re-use and repair services are widely available. In a competitive, resilient and innovative textiles sector, producers take responsibility for their products along the value chain, including when they become waste. The circular textiles ecosystem is thriving, driven by sufficient capacities for innovative fibre-to-fibre recycling, while the incineration and landfilling of textiles is reduced to the minimum."

Increased durability will enable consumers to use clothing for longer and at the same time support circular business models such as reuse, renting and repair, take-back services and second-hand retail, in a way that creates cost-saving opportunities to citizens, ECOS (2021). Although these, so called, new models still represent a niche market in the international forum, they have been shown to extend the lifetime of textile products, and are a cost effective and affordable alternative to handling the mess created by fast fashion.

The point highlighted here, as shown by the study conducted above, these practices have been in use across the Indian societies across generations. Sustainable and environmentally friendly practices are an integral part of our lifestyle and culture. The traditional Indian society has both, a concept of hoarding (in case something might come in useful), and thriftiness (re-use and hand-me- downs). Its very normal to see things which have absolutely no monetary value, such as old apparel items, newspapers and books, or utensils, being easily sold off to a scrap dealers to be re-used or re- cycled by creating new base fabrics,

Fig.: 16, 17 or up-cycled products, ref Fig.18. Culturally, there is also an aversion to wasting anything that might be reused and this is prevalent across the grassroots levels.

Fig.16: Decorative Rug created by using recycled fabric patchwork.

Fig. 17: Patchwork fabric created by using recycled fabric with hand-embroidery.

Fig. 18: Decorative rug created from recycled fabric strips braided together

All of these measures tie in with what the EU strategy is focusing on. In order to accelerate the change in consumption and production patterns, the Commission has decided to promote this transformation under the motto #ReFashionNow and will be putting quality, durability, longer use, repair and reuse at the core, with a passport issued for each garment detailing its sustainability scores. The suggestions put forth by the commission are well-meaning, but they still don't focus on controlling the sheer volume of products hitting the market. There's already a huge inventory in circulation and the numbers that are being projected can't be handled in a sustainable manner. The biggest impact will be to address the sheer volume of the products that are being manufactured, this will only happen by reducing the demand for fresh product. This

can be done by encouraging the consumers to use the apparel product available currently to their full potential. We can use the practices followed by our traditional Indian society as a template and integrate this into use at the grassroots level for maximum impact in favour of sustainability.

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Role of Behavioural Cost, Habits, and Lifestyle in Green Food

Understanding green food purchase behaviour

Waqas Mazhar[1], Dr. Gyula Zilahy[2]

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

Faculty of Management Sciences, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology (SZABIST) Karachi, H-99, Block 5, Clifton Karachi, Pakistan, waqsoom@gmail.com

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

zilahy.gyula@gtk.bme.hu

Abstract

Our food consumption threatens the environment and society, including climate change, overexploitation of natural resources, and social tension among nations and different social groups. The literature regarding food consumption acknowledges that the problem cannot solely be addressed by looking at food production, but an interdisciplinary approach is needed. Consumers' unsustainable consumption is counterbalancing the efforts for cleaner production. In this regard, green behaviour is considered an approach to curbing food-related environmental challenges. Since food choices are integral to our lifestyles and habits, it is challenging to persuade consumers to alter their food choices and shift to a more sustainable way of life. Several studies have empirically applied the theory of planned behaviour to understand green purchase behaviours. However, their results are prone to the attitude-behaviour gap in food consumption. The current study aims to understand the relationship by integrating behavioural cost, habits, and food-related lifestyles to explain green food purchase behaviours. The survey covered 487 responses from households residing in Budapest, Hungary through telephone interviews. The reliability of constructs is evaluated using Cronbach's alpha. Moreover, the preliminary analysis involved linearity and normality analysis of the data. Afterwards, the study implied Pearson product-moment correlation to evaluate the relationship between variables using IBM SPSS 26.0 computer application. The results show all proposed hypotheses are accepted. It is further concluded that attitude and green habits are strongly correlated with green food purchase intention. Green food purchase behaviour is related to green habits, intentions, and lifestyles. These results can help managers and policymakers to identify significant behavioural costs and habits associated with each segment. Moreover, the study will theoretically contribute to extending the theory of planned behaviour with the integration of habits and behavioural cost factors.

Keywords: Green food purchase, Green habits, TPB, Lifestyle, Behavioural costs.

1. Introduction

The study is aimed to understand consumers' intention to purchase green food and measure attitudes, habits, and certain lifestyles that increase the likelihood of green food purchase behaviour. From production to preparation, the food system is recognized as a significant contributor to the loss of biodiversity, pollution, and water extraction. Moreover, the issue can be viewed as production, consumption, or socio-economic challenge (Garnett, 2013b). Specifically, looking at consumption, our food consumption threatens the environment and society, including climate change, overexploitation of natural resources (M. Clark et al., 2020), and accelerates social tensions among nations (Reisch et al., 2013). Such consumption drives abundant water usage and emits greenhouse gases (Reisch et al., 2013). It has been acknowledged that sustainable development is based not only on sustainable production but also on sustainable consumption (G. Clark, 2007). As a result, green behaviour is considered an approach to curb environmental challenges (Liu et al., 2012), and it has been discussed within international public administrative agendas (Valor, 2008).

Ideally, green or environmentally friendly food consumption refers to minimizing dairy and meat consumption, reducing the consumption of cars for shopping, adopting energy-efficient technologies to store food, and preventing food waste (Garnett & Garnett, 2009). There has been growing consumer concern about the environment, leading to green purchase behaviour (Honkanen et al., 2006). These consumers are conscious of ecological aspects and are likely to adopt pro-environmental behaviours Woo & Kim, 2019). It is essential to transform behaviour into green consumption, and at the same time, it is a challenging task to motivate people. Mainly, preferences for food and eating patterns are integral to the socio-cultural environment, habits, and lifestyles (Vermeir et al., 2020). The study by ElHaffar et al. (2020) found that the Theory of Planned Behavior (TPB), Attitude-Behavior-Context (ABC), Self-termination, and social dilemma theories are prominent and frequently applied theoretical frameworks in investigating green behaviours.

According to the cognitive view of the consumer buying process, the theory of reasoned action (TRA, Fishbein, 1980) and the theory of planned behaviour (TPB, Ajzen, 1991) are notably recognized and often applied frameworks (ElHaffar et al., 2020) in green consumption studies. The theory has effectively helped understand consumer behaviour in numerous consumption domains, including food (Vermeir & Verbeke, 2005). As food choices are rather complex, TPB or TRA models considerably have limitations in describing food purchases (Armitage & Conner, 2001). These frameworks likely determine the variance in food choices when the behaviour is new (Ouellette & Wood, 1998). Therefore, several suggestions have been put forward

by scholars that TPB may be extended by considering some important factors like the effects of constraints in behaviour, habits, lifestyle, previous brand loyalty, ethical factors, and uncertainties (Peattie, 2001).

Several studies in the food context suggest assessing habits in attitudinal studies (Honkanen et al., 2005). Since food choices are made daily and repeated over time (Gardner, 2015), these decisions are less often planned, and little conscious effort is applied (Lavelle et al., 2015). Therefore, scholars argue that habits should be studied to predict pro-environmental behaviour (Aydin & Yildirim, 2021; Ghazali et al., 2018). Previously, the studies examined the role of habits in understanding food waste behaviour (Aydin & Yildirim, 2021), food consumption of rural residents (J. Huang et al., 2020), halal food purchase among Indonesian millennials (Amalia et al., 2020), and green purchase (Ghazali et al., 2018). The findings of these studies indicate a significant influence of habits on actual behaviour or intention. However, the literature is limited to understanding overall green food purchase behaviour. Thus, based on suggestions from previous studies and limitations in the literature, the current study aimed to investigate habits to determine green food purchase behaviour.

Furthermore, the difference between people who mentioned positive attitude and actual behaviour exists due to disregard for the behavioural cost involved. Environmental behaviours are subject to attitude and the cost involved in performing the behaviour (Kaiser et al., 2010). Previously, the studies have analysed behavioural cost in examining general pro-environmental behaviour Best & Kneip, 2011; L. Huang et al., 2020a), there is a need for similar studies in green food purchase behaviour studies. Hence, the current study is aimed to evaluate the effect of behavioural costs on green food purchase behaviour.

Moreover, there is a probability that lifestyles and purchase behaviour are related (Tang et al., 2020). Several studies have investigated lifestyle in explaining the purchase of environmentally friendly products (Mataracı & Kurtuluş, 2020), green consumer behaviour (Tang et al., 2020), and organic food purchase (Azzurra et al., 2019; Liang, 2014). The finding of these studies had a consensus on the vital role of lifestyle in determining behaviours. These studies cover several consumption domains; however, limited studies have incorporated the Food-related-lifestyle (FRL) framework in examining a more general view of sustainable consumption or green food purchase. Therefore, the current research is aimed to explore the FRL of green food consumers.

The current study aims to explore green food purchase behaviour by studying the intention-behaviour relationship. First, the study extended the TPB by exploring the role of green habits in exploring purchase behaviour. Second, we attempt to identify underlying behaviour costs hindering consumers from buying green food. Third, we analysed the relationship between food-related lifestyles and purchase behaviour.

The paper will first put light on the theoretical foundation of TPB and describe its limitation. Respectively, the literature will present the importance of other variables that may enhance the predictability of TPB. Following the literature review, the paper will demonstrate the proposed study hypothesis and its development based on previous research. The report will discuss the rationale of the research methodology adopted. After data collection, the study will present the data analysis procedure and discuss finding and compare them with previous findings. Finally, the discussion elaborates on key contributions in theory and managerial implications.

2. Literature Review and Hypothesis Development

2.1. Theory of planned behaviour

There is tremendous growth in research on the theory of planned behaviour (Yuriev et al., 2020). It is widely accepted (Moták et al., 2017) and reliable theories in consumer studies worldwide (Verma & Chandra, 2018). The theory of planned behaviour (TPB) is an extension of the Theory of Reasoned Action (TRA). Both theories are similar on a central point that attitude has a causal relationship with the intention to behave, and in turn, intention spurs the particular behaviour (Ajzen, 1991). The theory is efficient in several studies investigating environmental behaviours. Recent research by Yuriev et al. (2020) has established that recycling, energy-saving, and travelling are the most frequently studied behaviour through the TPB lens. Moreover, green purchase studies are also part of an ongoing research stream (Paul et al., 2016; Yadav & Pathak, 2016, 2017).

Despite the prevalence of significant effects of Attitude and Intention on behaviour in the literature, multiple consumer surveys reflect that positive attitude is not reflected in actual sustainable behaviour (Hanss et al., 2016). Such inconsistency between attitude and actual green behaviour is stressed as "green purchasing inconsistency" or "green attitude-behaviour gap" (Joshi & Rahman, 2015). It becomes essential to investigate the reasons for the difference in attitude and green purchase behaviour (Joshi & Rahman, 2015), and exploring other relevant factors may help to fulfil the discrepancy. According to Ajzen (2011), reasoned actions are taken place in parallel to automatic behaviours or habits. Therefore, the studies should measure habits side-by-side with other constructs of the TPB.

2.2. Attitude (ATT), Subjective Norm, and Perceived Behavioural Control:

According to Ajzen (1991), the attitude is "the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question". The more favourable the attitude towards behaviour, the more will be the intention to perform that behaviour. Among three independent antecedents of behavioural intention, some studies count attitude as a significant contributor to Intention (T. N. Nguyen et al., 2018; Scalco

et al., 2017). It is also evident in environmental and behavioural studies. Some scholars (Hines et al., 1987; Kotchen & Reiling, 2000) have postulated that attitude is salient in manifesting environmental behaviours and intentions. Several studies indicated a positive association between attitude toward green purchase and green purchase intention (Dhir et al., 2021; Zaremohzzabieh et al., 2020). However, these studies covered organic food, agricultural products, or green purchase in general. There is limited understanding of the effect of attitude on green food or environmentally friendly food purchase behaviour. The current study proposes that attitude towards green purchase behaviour positively and significantly affects green food purchase intention based on existing literature.

H1: Positive attitude toward green food purchase related to positive green food purchase intention.

Another independent predictor of intention to behave is the subjective norm (SN). It is referred to as the perceptions of others' opinions and influence on the behaviour (Ajzen, 1991). In other terms, it implies the influence of social pressure on consumer choice of performing a behaviour. In green marketing literature, the subjective norm has a significant association with the intention to behave pro-environmentally. The study by Yadav & Pathak (2016) indicated the positive relationship between SN and the intention to purchase green products. However, some studies indicate the relationship between subjective norm and intention is not significant. For example, the results of the study by H. V Nguyen et al. (2021) indicate that SN is not significantly related to the intention to purchase sustainable food. From the literature review, it is concluded that SN is not consistent in predicting intention. It is possible that it may vary when studied in different contexts. Therefore, further investigation is required to confirm its role in explaining green purchase behaviour. The current study included the construct in the conceptual model to verify its role in defining the intention to purchase green food.

H2: Subjective norm toward the purchase of green food is related to green food purchase intention.

Lastly, the third antecedent of intention to behave is perceived behaviour control (PBC). According to Ajzen (1991), perceived behaviour control is "the perceived ease or difficulty of performing the behaviour." A higher degree of perception of ease of performing a behaviour will increase the probability of the intention to behave. Several studies on green food purchases have shown a significant effect of PBC on the intention to act. Qi & Ploeger (2019) highlighted the significant role of PBC in determining the intention to purchase green food. Therefore, the current study aimed to analyse the PBC to explain the intention to purchase green food.

H3: Perceived behavioural control toward the purchase of green food is related to green food purchase intention.

2.3. Intention (BI) and green purchase behaviour (BP):

The central factor in both TRA and TPB is the motivation to behave in a certain way that exerts willingness and effort to perform or behave (Ajzen, 1991). The term intention can be defined as motivation or planned action to an individual's motivation to act in a certain way (Fishbein, 1980; Woo
Kim, 2019). According to TPB, behavioural intention results in purchase behaviour (Ajzen, 1991). Research on environmental behaviour studies implied a positive relationship between intention and behaviour. The study of (Zhu et al., 2013) explains the impact of green purchase intention on purchase behaviour. Related results are found in food purchase behavioural investigations, such as the study of Scalco et al. (2017) confirmed the intention behaviour relationship in the organic food context is significant. However, these behavioural studies remain in the domain of agricultural food products, organic food, and overall green purchase. The current study aims to contribute to and analyze the relationship between intention and behaviour in green food.

H4: Green food purchase intention is related to green food purchase behaviour.

2.4. Habits (HB):

Habit is a process that enables a person to automatically respond to a situation based on prior experience or learned stimulus-response association. Due to the repetition of a behaviour, an individual becomes accustomed to behaviour or sequence of acts without conscious thought, and that behaviour comes to be part of the routine (Ajzen, 2002; Verplanken, 2006). Thus, a high frequency of behaviour may lead to becoming a habit (Verplanken & Orbell, 2003). The study of Verplanken & Orbell (2003) proposes methods of measuring habits known as the self-Reported Behavioral Automaticity Index (SRBAI). The index is used in measuring habits in the present study.

The integration of habits in TPB improves the explanation of e-waste recycling intention among young consumers (Aboelmaged, 2021). Likewise, Aydin & Yildirim (2021) infer the significant part of shopping habits in mediating moral attitude and food waste behaviour. In food consumption, habits also significantly explain food consumption intention better than other TPB factors (J. Huang et al., 2020). Hence, the current study aimed to measure the impact of habit in predicting green food consumption behaviour. Researchers assessed habits from different angles. For example, Carrus et al. (2008) and Charng et al. (1988) proposed a habit and intention relationship, and (Verplanken et al., 1998) emphasized the relationship with behaviour directly. The existing literature on habits often covers various food domains and green purchases; besides, these studies are limited and require further investigations. Thus, the following hypothesis is developed.

H5: Green habits are related to green food purchase intention.

H6: Green habits are related to green food purchase behaviour.

2.5. Behavioral Costs:

When the behaviour is performed it requires an individual to sacrifice or utilize behavioural resources. The decision to act depends on the benefits and costs associated with the act. The attitude-behaviour discrepancy that occurs may be due to the ignorance of behavioural cost elements (Kaiser et al., 2010). For example, performing a behaviour may demand physical effort, time, money, and opportunity cost. Here, the cost concept is extended beyond the financial constraints to behavioural and social budgets. Some behaviours demand physical, time, and psychic costs more than others. The variation in the behaviours may be characterized by the importance of the individual's goal (Verhallen & Pieters, 1984). When the goal is important, the individual may put more behavioural costs in order to perform the behaviour. Moreover, the discrepancy between attitude and behaviour is due to the lack of behavioural cost consideration. Behaviour is the function of attitude and cost simultaneously associated with the performance of the behaviour (Kaiser et al., 2010).

H7: behavioural cost is negatively related to green food purchase behaviour

2.6. Food-related Lifestyle (FRL):

As it is described that the discrepancy between attitude and action is evident in the literature, green consumption is not devoid of the gap (ElHaffar et al., 2020; H. V. Nguyen et al., 2019). Another approach is to count contextual factors underplay. It is to say there could a strong relationship between lifestyle and consumption. It is suggested to integrate lifestyle with TPB in explaining sustainable behaviour. The results of a study indicate lifestyle as an extension of TPB in examining behaviour (Matharu et al., 2020).

Giddens (1991) defines lifestyle as practices performed by an individual to express self-identity. For instance, the involvement in pro-environmental energy conservation activities, recycling, and green food consumption compositely make a pro-environmental lifestyle (Axsen et al., 2018). Within a broad range of lifestyle definitions, day-to-day activities such as consumption are also relevant (Veal, 1993). The literature presents various approaches to lifestyle assessments. One approach specifically covers food behaviours is Food-related Lifestyle (FRL). It is comprised of five lifestyle dimensions of food consumption such as; ways of shopping, cooking, the situation of consumption, quality consideration, and motives of purchase (Grunert, 1993). FRL is considered more relevant to the context of the current study compared to other approaches. FRL measurement is based on activities, interests, and opinions that help to classify consumers into various segments.

A recent study by Brunsø et al. (2021) developed a new abbreviated version of the instrument based on the original framework. The new study concluded three core dimensions (food involvement, innovativeness, and responsibility) of the FRL instrument. The further development in the adoption of FRL seemed

prominent. Research on sustainable consumption empirically proves the relationship between lifestyle and consumption (Axsen et al., 2012; Tang et al., 2020). Moreover, a healthy and sustainable lifestyle contributes to sustainable consumption behaviour (Matharu et al., 2020). Hence, the study follows the given hypothesis.

H8: green lifestyle is related to green food purchase behaviour.

3. Methods

The study is based on a cross-sectional survey-based method using a structured questionnaire adapted from literature. The questions are designed in English language and later translated into Hungarian. The data is collected randomly from 500 respondents currently living in Budapest, Hungary through telephonic interviews. After excluding respondents with missing values, a total of 487 valid responses are retained for the data analysis purpose.

Pearson product-moment correlation method is used to assess the relationship and strength of the relationship between constructs proposed in the current study. These constructs are measured using a multi-item on the Likert scale; therefore, the constructs are considered as an interval scale. The data is analyzed using IBM SPSS 26.0 computer application.

4. Results and Discussion

4.1. Sample description:

The demographic characteristics distribution of the sample is presented in Table 1. The female respondents are in majority (55%) compared to males (45%). Most of them are college graduates (46.2%) and received master's degrees (20.7%). Whereas the ratio of respondents of different ages is distributed from age of 16 to over the age of 60. The Majority of them belong to 16-29 years (29.8%) and over 60 years (28.5%) respectively. The respondents belong to different occupations such as pensioners (27%), government employees (13%), working in multinational companies (9%), entrepreneurs (9%), working in small and medium enterprises (11%), and others.

Table 1. *Sample demographics.*

Characteristics	Frequency	%	Characteristics	Frequency	%
Gender			Age		
Male	219	45	16-29	99	20.3
Female	268	55	30-44	145	29.8
Total	487	100	45-59	104	21.4
Occupation			Over 60 years	139	28.5
Student	19	4%	Total	487	100
Pensioner	130	27%	*Education Level*		
Government employee	64	13%	Elementary school 8th grade	16	3.3
Entrepreneur	44	9%	Secondary School	55	11.3
Skilled labour	22	5%	Graduation	225	46.2
Trained worker	16	3%	College or bachelor's degree	82	16.8
Intellectual employee in a multinational company	44	9%	University or Master's degree	101	20.7
Intellectual employee in Hungarian small and medium-sized enterprises	52	11%	Postgraduate training (doctorate)	8	1.6
Intellectual employee at a large Hungarian company	27	6%	Total	487	100
Housewife	20	4%			
Unemployed	6	1%			
Other:	43	9%			
Total	487	100			

4.2. Reliability Analysis:

The items used to measure the variables in the present study are assessed for internal consistency reliability using Cronbach's alpha (Cronbach, 1951). Table 2 provides the alpha values and number of items in the questionnaire for each variable. According to Bonett & Wright (2015), the acceptable value of alpha is 0.7 and whereas, a value of 0.8 is desired. In the current study, all variables have above threshold values except 'PB'. However, the alpha value is not universal but rather generally accepted. Other researchers have suggested that a cut-off value of 0.6 can be considered (Hair et al., 2010). In this case, PB has a 0.67 alpha value that is not undesirable or poor (Mallery, 2003). Hence, all the variables are considered for further analysis.

Table 2. *Reliability Analysis.*

Variables	Code	Cronbach's Alpha	N. of items
Theory of Planned Behavior			
Attitude	Attitude	0.82	5
Perceived Behavioral Control	PBC	0.75	4
Subjective Norm	SN	0.73	3
Green Food Purchase Intention	PI	0.86	3
Green Food Purchase Behavior	PB	0.67	3
Extension			
Green Habits	HB	0.79	3
Behavioral Cost	BHC	0.73	9
Food-related Lifestyle			
Food Involvement	FIV	0.79	5
Food Innovation	FIN	0.89	5
Food Responsibility	FR	0.84	5

4.3. Linearity analysis:

The graphical method is used to test the linearity of relationships. The study utilized a scatterplot matrix and divided the analysis into two phases. In the first phase, the relationships among variables related to the theory of planned behaviours are analyzed. The scatter plot matrix in figure 1 shows the relationship between attitude and intention is positive and linear. Where the data points are forming a direction towards right upwards. Similarly, the relationship between SN and PBC is positive and linear, however, in this case, the strength of the relationship is weak. In the second phase, the relationships among purchase intention, green habits, purchase behaviour, lifestyle, and behavioural cost are assessed. The relationships in figure 2 indicate the positive and linear relationship between PI - PB, PI – HB, FRL-PB, and PB – HB. Whereas PB- BHC relationship is linear and negative.

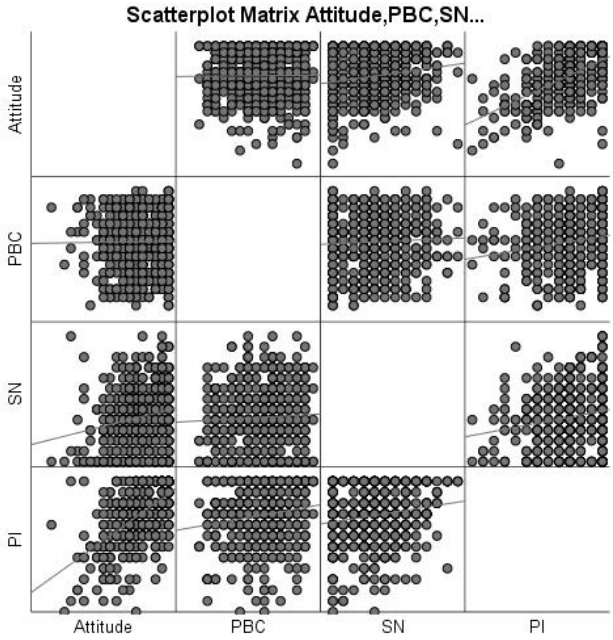

Figure 1*. Scatterplot matrix for Linearity assessment- variables of the theory of planned behaviour.*

4.4. Normality assessment:

The normality is examined using values of skewness and kurtosis. When the sample size is greater than 300 then the absolute values of skewness less than 2 and an absolute value of kurtosis less than 7 are considered normal (Kim, 2013). The values of skewness and kurtosis are given in table 3. Based on the results, all variables' skewness and kurtosis values are within the range of normality.

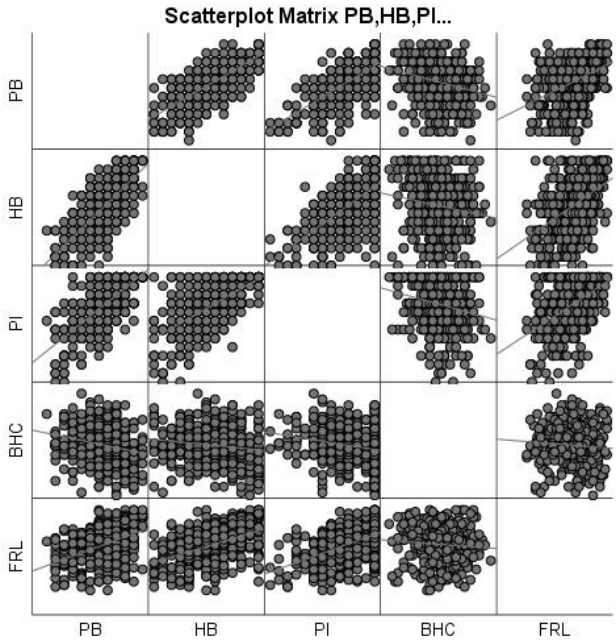

Figure 2*. scatter plot matrix for linearity assessment- additional variables.*

Table 3. *Skewness and Kurtosis values.*

Variable	Variable Code	Skewness	Kurtosis
Attitude	Attitude	-0.665	0.135
Perceived Behavioral Control	PBC	0.269	-0.714
Subjective Norm	SN	-0.335	-0.626
Green Food Purchase Intention	PI	-0.286	0.489
Green Food Purchase Behavior	PB	-0.802	-0.016
Green Habits	HB	-0.575	-0.524
Behavioral Cost	BHC	-0.088	0.239
Lifestyle	FRL	-0.357	-0.255

4.5. Testing Hypothesis:

Pearson product-moment correlation is employed to test the given hypothesis in the study. The assumption of normality and linearity are met. The Pearson correlation coefficient is applied at a significance of 0.05 to

assess the direction and strength of association between two variables (Chen & Popovich, 2002). The results of correlations for the proposed hypothesis are presented in Table 4.

The association between attitude and purchase intention (PI) is positive and significant (sig.<0.05) hence the H1 is supported. Moreover, the strength of the relationship (0..058) is greater than 0.5, hence, the attitude and intention to purchase green food are strongly associated. The relationship is also proven by other researchers in the literature. The study by Yadav and Pathak (2017) has shown a positive relationship between attitude and intention to purchase organic food. A similar relationship is evident in other green purchases (Nguyen, Lobo and Nguyen, 2018).

Table 5. *Pearson correlation coefficients.*

Hypothesis	Variables	Pearson correlation	Sig. (2-tailed)	Decision
H1	Attitude, PI	0.581**	0.00	Supported
H2	SN, PI	.17**	0.000	Supported
H3	PBC, PI	.17**	0.000	Supported
H4	PI, PB	.69**	0.000	Supported
H5	HB, PB	.74**	0.000	Supported
H6	HB, PI	.64**	0.000	Supported
H7	BHC, PB	-.24**	0.000	Supported
H8	FRL, PB	.43**	0.000	Supported
** Correlation is significant at the 0.01 level (2-tailed).				

Moreover, the relationship between SN and PI is significant (sig. <0.05), hence, H2 is supported (Table 5). However, the magnitude of the relationship (0.17) is less than 0.3, therefore, it is concluded that the subjective norms are weakly correlated with the intention to purchase green food. The weak relationship is also evident in the scatter diagram (Figure 1), where the data points are largely scattered around the fitted line. Subjective norm is significantly related to purchasing intention in other studies. For example, H. V Nguyen et al. (2021) show a significant relationship in the study of sustainable food purchases. Likewise, the relationship also prevailed in the study of the intention to purchase vegetable burgers (Hansmann et al., 2020). The results also indicate the relationship between PBC and PI is significant (sign. <0.05) and positive (Table 5), therefore, the association between perceived behavioural control and intention to purchase green food (H3) is supported. However, the strength is the relationship (r=0.17) is weak. Significant results are also found in the literature, where perceived behavioural control is positively related to green food purchase intention (Qi & Ploeger, 2019), environmentally friendly agricultural food (Li et al., 2020), and organic food (Latip et al., 2021). The result of the correlations

shows a significant (sign. < 0.05) and positive relationship between PI and PB (Table 5). Therefore, the purchase intention that is significantly associated with green food purchase behaviour (H4) is supported. Compared to other relationships in the theory of planned behaviour, purchase intention is strongly associated (r = 0.69) with green food purchase behaviour. similar results are found in the study of Scalco et al. (2017) in understanding organic food purchases and eco-friendly agricultural food (Li et al., 2020).

HB is significantly (sign. <0.05) and positively related to PB (Table 5). Hence, it is concluded that green habits are positively related to green food purchase intention (H5). Compared to the theory of planned behaviour variable, green habits show a strong relationship (r = 0.74) with purchase behaviour in the context of green food. Comparing these results in the literature, we found that green habits are strongly associated with green foods (Ghazali et al., 2018). The literature also supports that the relationship is comparatively stronger than other the theory of planned behaviour variables (J. Huang et al., 2020). Moreover, the results also indicate a positive and significant (sig. < 0.05) with PI. Thus, green habits related to green food purchase intention (H6) are also supported. In both cases, green habits are strongly associated with purchase intention and purchase behaviour in the context of green food. Furthermore, the relationship between BHC and PB is significant (sig. < 0.05) and negative, therefore, H7 is supported. On contrary, the strength is less than 0.3 hence, the behavioural cost is weakly related (-0.24) to green food purchase behaviour. The study by Kaiser et al. (2010) shows similarly the negative relationship and explained that the behaviour is the function of attitude and behavioural cost. Whereas FRL is moderately (r = 0.43) associated with green food purchase behaviour (H8). According to Matharu et al. (2020), lifestyle is an extension of the theory of planned behaviour, whereas, lifestyle is positively related to behaviour.

5. Conclusion

The key objective of the study is to measure purchase green food purchase behaviour based on the theory of planned behaviour. Moreover, the study examines green habits, behavioural cost, and food-related lifestyle (FRL) in explaining green behaviour. The study shows attitude, subjective norm, perceived behavioural control, and green habits are significantly associated with the intention to purchase green food. Comparatively, green habits and attitude are strongly related to purchasing intention respectively, whereas subjective norms and perceived behavioural control have weak relationships. The intention to purchase green food may be closely associated with a positive attitude towards buying green food and another important related aspect is the habits of buying green food.

Moreover, the purchase of green food is related to purchase intention, green habits, food-related lifestyle, and behavioural cost. When consumers have already developed green food purchase habits and have a high intention to purchase then there are more chances of purchase behaviour. Moreover, the relation is opposite when

consumers perceive higher behavioural costs such as time, effort, lack of facilities, lack of skills and knowledge, and lack of infrastructure. When these hurdles are more prevalent during the purchase decision process, the chances are that food purchases may not take place. However, the relationship between behavioural costs and purchase behaviour is not strong, therefore, the probability of the relationship occurrences is low. Whereas food-related lifestyle is moderately related to the behaviour. It explains that food innovation, food involvement, and food responsibilities (food-related lifestyle) are relevant to green food purchase behaviour. Relatively, green food purchase behaviour is strongly associated with consumers' habits of green food purchase. These green habits are more automatic, and consumers perform the behaviour because these behaviours are performed in the past.

In summary, green food purchase is related to high intention, adopted green habits, and a food-related lifestyle. Whereas behavioural costs are not largely intervening in the purchase decision process. As intentions are closely associated with consumers' positive beliefs about green food, the first step to promoting green food is developing positive beliefs and emotions of consumers towards green food. Furthermore, the behaviour is possible to occur when these intentions are accompanied by habits of buying green food and a lifestyle that considers environmental responsibilities and consumer high involvement in food-related decisions.

The research has some important limitations. The present study analysed the data on the Pearson correlation coefficient; however, it is important to measure the causal relationship and explore the cause and effect. Therefore, it is suggested that future research should apply the multiple regression method. Furthermore, the study represents the population of Budapest city. It is possible to include other populations for broader representation in the research. One way to achieve that objective is the inclusion of other cities in Hungary in future research. Moreover, the results indicate a weak relationship between subjective norm and perceived behavioural control with purchase intention. However, the literature indicates the use of a second order construct or further classification of these constructs and inclusion in further studies. In this way, these variables' measurements may provide better results.

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Posters

The importance of consumer communication for sustainable consumption in the outdoor apparel sector

Elina Fraenkel and Thomas Zobel

The Importance of Customer Communication for Sustainable Consumption in the Outdoor Apparel Sector

Background and aim

The apparel industry is pointed out as an industry highly contributing with negative environmental impacts in all different stages of the production to consumption chain (White et al., 2017). Some apparel companies within the outdoor sector have been trying to combat this issue by producing apparel that are less harmful for the environment and by encouraging consumers to care for and keep their clothing items for a long time instead of buying new ones. Some outdoor brands have come a long way in terms of environmentally educative communication (Norum, 2018). However, retailers in the outdoor apparel sector must consider the environmental characteristics of many different brands and the educational communication with customers is thus much more complex. The aim of the study is to evaluate how retailers in the outdoor apparel sector use educational communication regarding environmentally preferable apparel (EPA) and to identify areas in which retailers can improve this communication.

Method

This study uses a qualitative case study approach in a large Swedish outdoor apparel retailer (hereafter referred to as the Retailer) with 34 stores (and one online store) spread across the country. Data were collected through interviews and qualitative content analysis of texts on web pages, customer magazines and social media postings. The case study investigated the Retailer's communication with its customers from the following themes (In parentheses, literature on which each theme is based):

1. How communication contributes to consumers' knowledge level regarding the outdoor apparel sector's environmental impact (Copeland & Bhaduri, 2019).
2. How the communication adds to perceived consumer effectiveness (how confident the customer is that the choice makes a difference) and perceived personal relevance (Kang et al., 2013).
3. How the communication is promoting personal benefits with EPA (Copeland & Bhaduris, 2019).
4. To what extent the communication could be perceived as transparent (Cowan & Kinley, 2014).
5. If the communication seems to be adding to consumer-product attachment (Michael et al., 2019).
6. In what way the communication is educating customers about the environmental benefits of care and repair (Hill & Lee, 2012).

Results

The main findings from the different empirical sources are below presented categorized by theme.

1. The Retailer frequently use educative communication and occasionally educate consumers about what environmental efforts they contribute to. The focus of the communication is what the Retailer are doing to reduce its negative impact. Efforts made to improve environmental standards was found as a reoccurring theme but what remains to be done is rarely communicated. Regarding specific apparel, the main approach is to increase transparency and to encourage consumption of EPA.
2. Communication on this theme is difficult. The problem is that the Retailer wants to promote EPA but not at the expense of other products it also sells. Certain environmentally preferable materials can be promoted but this is mostly done when the general performance of materials is also highlighted. Personal relevance for the customer is generally not in focus.
3. Personal benefits are seldom communicated in any of the communication channels. When it is done it is most often through general product texts. However, the Respondents recognizes that they focus more on promoting the functionality than the environmental features although they try with both features at the same time.
4. The respondents recognizes that transparency concerning the environmental impact of the products must be improved both regarding internal and external communication. A problem is that the company lacks knowledge regarding the products' environmental impact
5. Consumer-product attachment is the core in all the Retailer's marketing according to the marketing manager. Product attachment is frequently promoted in the magazine through personal stories about people's relationships to their products. Product attachment is also promoted by campaigns and instructional videos about care and repair of the products. The website and Instagram are also used to inform potential customers about the Retailer's values.
6. The Retailer frequently educate their customers about how to care and repair the products. The instructions are often detailed, but the environmental benefits are not specifically communicated. The respondents claim that the reason for this is that it is too complex to know the details of a certain products environmental impact.

Conclusions

The outdoor apparel retailer in this case study does, to some extent, use external communication in line with the identified themes to encourage consumers to purchase EPA. The retailer is using similar themes for promotion of EPA as specific brands within the sector. However, the retailer that sells many different brands face the challenge of complexity regarding their own knowledge of which products that are environmentally preferable. The complexity seems to hinder the promotion of EPA regarding some of the themes researched in this study.

Acknowledgement

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Elina Fraenkel[1] & Thomas Zobel[2]; [1]Tyrens AB, [2]Luleå University of Technology;
Track 5e Sustainable consumption and consumers

5/30/2022

5. Production, consumption and innovation

5f. Food security and agriculture

Abstracts

Revealing the Temporal and Spatial Patterns of Nrop-specific nutrient Utilization in China

Dr. Xin Liu[1,2], Mr. Dingming Zhang[1], Prof. Zengwei Yuan[1,2]

[1]School of the Environment, Nanjing University, Nanjing, Jiangsu Province, China. [2]Lishui Institute of Ecology and Environment, Nanjing University, Nanjing, Jiangsu Province, China

Abstract

Nitrogen (N) and phosphorus (P) are two critical nutrients for agroecosystems. To meet food demands, anthropogenic use of both nutrients has crossed the planetary boundaries. Furthermore, there has been a dramatic shift in the ratio of nutrients, which has led to stronger N:P imbalances. Despite enormous efforts spent on agronomic N and P budgets, the spatio-temporal characteristics of different crop types in using nutrients are unknown, as are the patterns in the stoichiometric coupling of these nutrients. Therefore, this study analyzed the crop-specific N and P budgets as well as their coupled stoichiometric characteristics for the production of ten major crops at provincial level of China during 2004-2018. Results show that, China has generally witnessed excessive input of nutrients over the past 15 years, and the net input of phosphorus has almost doubled. Among the ten crops, cereals constituted three quarters of all nutrient inputs applied to the farmland. Corn has had the biggest increase in both nutrient input and output, while nutrient use of soybean and cotton have both decreased. The large difference in the growth of net input of nitrogen and phosphorus resulted in a decline in the N:P ratios from 11 in 2004 to less than 4 in 2018, which indicated that the stoichiometric characteristics of nutrients had greatly changed. In addition, crop-aggregated apparent recovery efficiency (ARE) of N has increased in these years, attributable to the improvement of N use by most crops, while in contrast, most crops, especially corn and rapeseed, have shown a decreasing trend of this indicator for P during this period. On the whole, nutrient surplus has become a universal problem for China. Although N management has achieved some progress, P management should be more targeted. More importantly, N and P management strategies for sustainable agriculture in China should take full account of nutrient use characteristics of different crops in different locations in the future.

SDG+Target: 2.4 & 12.2

Excessive use of nutrients in China's agricultural systems has increased pressure on mineral resource depletion and altered soil nutrient stoichiometry, which may threaten food security. For instance, extravagant nitrogen and phosphorus would inhibit the absorption of zinc, silicon and other elements by crops, and enhance crops' respiration, resulting in yield reduction. In addition, the extensive use of phosphate fertilizers would not only lead to the accumulation of harmful elements such as lead and cadmium in the soil, but also may multiply the risk of eutrophication in aquatic ecosystem, damaging human health. Therefore, we must profoundly uncover the spatio-temporal characteristics and stoichiometric coupling patterns of crop-specific nutrient budgets in China.

Track
Track 5f Food security and agriculture

Sustainability of the Zero Hunger Support Systems of Faith-Based Organisations in Nigeria

Pst. Ayotunde William Okelana

Redeemed College of Missions, Ede, Nigeria. Lead City University, Ibadan, Nigeria

Abstract

Gradually, religious organisations in Nigeria especially the church are beginning to align with the concept of the United Nations Sustainable Development Goals (SDGs); even though development has been one of the major cruxes of Christianity. Verifiable historical accounts has it, that what Nigerians call staple foods today – cassava, maize, sweet potato, and certain fruits (pineapple, oranges) were by-products of the effort of missionaries in the West Africa region of the 19th Century. This classic grandeur notwithstanding has been met with critical perspectives challenging the impact of the Nigeria Church on ending hunger and food insecurity (SDG-2). By this, diverse questions have been incurred, and inquiring: what aspects of the SDG-2 is the Church addressing? Which of the five (5) targets, and three Means of Implementation (MoI) are they focusing on? Who are they feeding? How sustainable? These are questions already fixed by this qualitative study. Being descriptive in nature, this study employs a structured questionnaire which was distributed through the Google form and Key Informant Interviews (KII) for data collection. Maslow's hierarchy of needs was considered an appropriate framework because it presents food as basic for human sustainability. The digital link for the e-questionnaire was shared among the church communities (n=120), while the Church leadership (n=10) were engaged with the KII individually. Findings indicated that the existent system will not be sustainable, although many communities are presently being supported; considering the short-term provisions of regimented food items sustained by the collection of special offerings, contributions from the leadership as well as the tithes and offerings. Based on these findings, building a resilient zero hunger support system shall necessitate: encouraging family farming; providing start-up seeds and animal breeding stocks; giving equal access to land, and enabling technology as well as profitable market environs.

Track
Track 5f Food security and agriculture

Technical Efficiency-Food Security Nexus : A case study of Poultry farming households in Oyo state, Nigeria

Mr James Fasakin[1], Mr Sikiru Olowoyo[2], Mr Oyebisi Olajide[1], Mrs Ayoola Adewale[1], Mrs Nneji Umeokeke[1]

[1]Department of Agriculture Economics, University of Ibadan, Ibadan, Nigeria. [2]Federal University, Oye Ekiti, Nigeria

Abstract

The analysis of technical efficiency is generally associated with the likelihood of farms producing a certain optimal level of output from a given level of resources, or certain level of output at least cost. In Nigeria, the technical efficiency of poultry farmers varies due to the presence of inefficiency in poultry production in Nigeria. Efficiency has been identified as an important factor of productivity growth, especially in developing agriculture where resources are insufficient and opportunities for developing and adopting better technologies are declining (Ali and Chaudhry, 1990). In such economy, the farmers can benefit greatly by determining the extent to which it is possible to raise productivity or increase their efficiency, at the existing resource base or technology. Food insecurity exist when people lack physical, social or economic access to safe and healthy food, and it has been a major challenge in Nigeria despite large amounts of food imports into the country every year.

The study therefore, assessed nexus between the technical efficiency and food security among poultry farmers in Oyo State, Nigeria. The study used a cross sectional household data collected through a well-structured questionnaire within some selected local government areas LGAs in Ibadan metropolis. A three-stage sampling approach was used to select 180poultry farmers in the state. Descriptive statistics, stochastic frontier analysis, Foster Greern and Thorbeck (FGT) poverty measures and ordered probit regression were used to analyze data.

Results shows that majority of the farmers 72.45% were male while 27.55% were female, the mean age of the farmers was 47.8 years, mean households size was 7 and mean farming experience was 10.5years. Also, 70% of the farmers used deep litter poultry system, 30% were using cage system, only 28.5% have access to agricultural training and 15 % had access to credit. The Stochastic frontier analysis results shows that feed quantity, poultry system and poultry distance to residence were the variable influences the poultry farmers output. The source of technical inefficiencies among the poultry farmers are farming experience, access to credit and awareness in agricultural insurance. The FGT poverty analysis shows that 64.50% of the farmers are core-food poor, 30.0% were moderately food poor and 5.5% were not food poor. Also, food security incidence among the farmers was 24.4%, food security gap was 5.5% and severity of food insecurity was 2.02%. The ordered probit regression model results shows that variables that drives food insecurity among the poultry farmers are age, gender, farming experience and family type. The study therefore recommends provision of basic infrastructure for the farmers, training across all ages and policies that will enhance adoption of family planning by the famers should be considered.

The study set to achieve the sustainable development goals of no poverty i.e. end poverty in all its forms everywhere, and zero hunger- end hunger, achieve food security and improved nutrition and promote sustainable agriculture. (Goals 1 and 2)

Track

Track 5f Food security and agriculture

Full papers

Vegetable Buying Options in Bangalore – A consumer and Retail Perspective

Consumers' and retailers' perspectives

Padmaja Pancharatnam[1]

[1]padmaja.pancharatnam@sjc.ac.in

Abstract

The Indian fresh vegetable supply chain is being transformed. Over the past 15 years corporations such as Reliance Fresh, Godrej, and online platforms such as Big Basket and Amazon have become a part of vegetable retail in India. The proposed research aims to examine consumers' and retailers' perspectives on vegetable buying options in the City of Bangalore. The proposed research is important since it will help understand the interplay of a number of factors that influence the sustainability of alternate or non corporate fresh vegetable supply chains. Many of the previous studies, in Bangalore and India, appear to have focused on corporate fresh vegetable supply chains or on farmers or producers. However, to understand the sustainability of any supply chain perspectives of all stakeholders need to be accounted for. Two stakeholders who play an important role in the supply chain are consumers and retailers. In the backdrop of the transformation of the agricultural supply chains in India and Bangalore an understanding of both retailer and consumer perspectives is necessary in order to develop sustainable agricultural supply chains.

Keywords 1.Vegetable retail, 2.Consumer preference, 3.supply chain, 4.sustainability,
5. Bangaluru (Bangalore)

1. Introduction

Across the world, there has been an increasing super marketization of Vegetable markets. In India domestic supermarketssuch as the Nilgiris have operated since the 1980s. However,supermarket chains have expanded in the past 20 years. In September 2012 the Indian cabinet reversed its longstanding exclusion of foreign direct investment in food retail. It has almost been 10 years since this event took place(Cohen et al. 2013).

Another model of delivery the online platform has also become popular, a number of online platforms such as Big Basket and Amazon India are present. However, other forms of vegetable retail such as the neighbourhood vegetable shop, vegetable markets, pushcarts, and trucks continue to play a role

in vegetable retail. Many of these options are often called the informal retail or traditional sector (toI, 2010 in (Cohen et al,, 2013)

Bangalore an Information Technology (IT) boom city, located in the Deccan Plateau, attracts a large number of immigrants from all over the country and has a diverse population. It is also the city that is home to both farmers and cooperative movements. One such initiative has been the Horticultural Producers' Cooperative Marketing and Processing Society, popularly known by its acronym (HOPCOMS) a society for marketing vegetables and fruits started in 1965, HOPCOMS follows a direct marketing model. The main function of HOPCOMS was to eliminate middlemen, link producers, and consumers directly. There are a number of HOPCOMS shops in the different localities of Bangalore.

Many of the studies on vegetable retail optionsfocus on farmers' experiences. Studies were undertaken in the early 2000s when the retail market of vegetables was transformed and private and foreign retail options were allowed to operate in the vegetable retail market. These studies provide important insights into how the agricultural supply chains for supermarket chains operate. More recent studies undertaken by Naik and Suresh 2018 and Nandi et al. 2017 provide insights from producers or farmers. Both these studies are located in Bangalore There do not appear to be too many studies that focus on non
corporate retailers and consumers' preferences for different retailers.

Studies on consumers' preference for organic foods are critical in guiding the questions to be employed in the consumer survey. The qualities of the vegetables considered in these surveys will also be employed in this survey. Nandi et al. 2017 and Osmani et al 2013 have examined consumers' preferences for organic foods. In both papers, a logit model is employed. Willingness to pay for vegetables is considered as a binary choice variable, various other socioeconomic variables are controlled for in the model, Both these studies provide insights into which variables need to be controlled for in the model. The study by Nandi et al. 2017 which is located in Bangalore controls for variables such as family size, gender, income, and taste. Osmani et al. 2013 also control for similar variables, In addition to these variables, consumers' preferences and attributes of vegetables controlled are also controlled for such as whether a vegetable considered has the necessary organic attributes. The attributes of vegetables can be divided into various categories such as credence and other categories.

Food losses occur at all stages of the supply chain. Reasons for losses are diverse mechanical damage, sorting, degradation, processing, and transportation all lead to food loss (Mayer et al.2017). Post harvest losses can be broken into losses due to preparing and washing, storing, transporting, and packaging.

Patil et al. 2017 provide a detailed explanation of the sources of vegetables in Bangalore city. These sources are the Regulated Marketing Committee (RMC) and Agricultural Produce Marketing Committee (APMC). In addition. KR market is an example of a source of vegetables. Often informal or unorganized retail shops buy their produce from these markets.

A study of the agricultural Supply chain in Bangalore by Naik and Suresh 2018 advocates the role of such corporations in creating sustainable food chains. Also, Punjabi and Sardana 2007 have examined various corporate vegetable supply chains. inhabitants.

. The goal of this research will therefore be to examine non-corporate small fresh vegetable supply chains within the city of Bangalore, focusing on retailers and consumers. Both groups will be interviewed to understand the preferences of consumers for different types of retailers and the retailers experience. This research will help in understanding the sustainability of these food chains in terms of various measures. For example, the efficiency of these chains in terms of food loss and energy use will be examined.

As mentioned earlier there are varied retailers who are described in detail in the consumer survey. Many of these retail options would be considered informal. The goal of this study is to examine consumers' preferences for these retailers and the factors that affect retailer choice. Retailers in the informal sector will also be interviewed to understand sources from where retailers buy their vegetables and the storage facilities available.

2. Methods

Data

Information is obtained from both consumers as well as retailers and the approach employed is mixed methods. Both surveys and in-depth interviews will be employed to gather data. Data was collected from consumers using a google forms survey and semi-structured interviews were employed to get information from vegetable retailers.

Consumer Survey

The consumer survey employed is based on a survey of Republic Food Enterprise Centre a food hub that serves four states: Pennsylvania, Maryland, Ohio, and West Virginia in the United States. In this survey, there were multiple questions about the quality of vegetables included in the survey. In addition, to these variables, certain socio-economic data is also obtained from the consumers. Consumers were also asked questions about their preference for vegetable retail options. The options can be classified into the

following broad three categories supermarket, online platform, and the traditional/unorganized food supply chains which include the following market, neighbourhood shop, pushcart, truck vendors, etc.

The method used to sample the individuals is the convenience sampling method. Around 107 respondents have responded to the survey, and out of these the first four responses were treated as pilot responses. It is expected that the number of respondents will increase over time and allow for the development of more robust analysis. Basic statistics pertaining to the sample considered are presented
in table 1 given below.

Figure 1 Response to where consumers most frequently buy their vegetables (percentage)

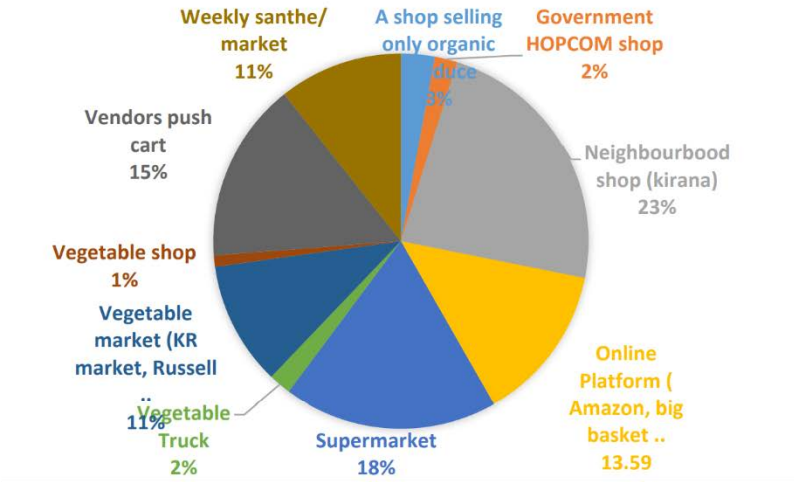
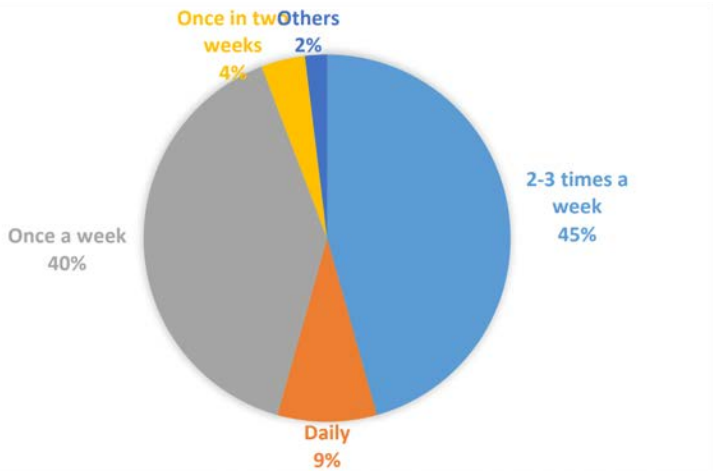


Figure 1 above represents where people buy their vegetables from. Most people buy their vegetables from their neighbourhood shop. This is followed by the supermarket and then the vendor's pushcart.

And then the online platform. Informal/ traditional forms of vegetable retail options appear to still be popular among consumers. In addition, the respondents were asked whether they obtained, vegetables or fruits from another source around 20-30% of the respondents obtained vegetables from their farms, gardens, parents' farms, or relative farms.

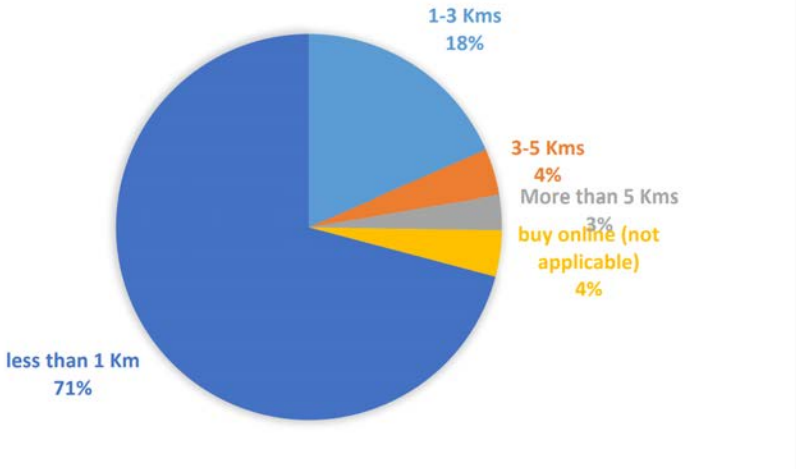
In addition, consumers were asked how far they travelled to buy their vegetables.

Figure 2 Response to how frequently Consumers buy Vegetables



Around 85% of the consumers to buy vegetables either 2-3 times a week or once a week. Around 45% of the consumers buy vegetables 2-3 times a week,

Figure 3. Distance travelled to buy Vegetables



From figure 3 it is seen that around 70% of the consumers travel less than 1 km to buy their vegetables, In addition, almost 90% of the consumers travel less than 3 kilometers to buy their vegetables.

Moser et al. 2011 have divided the attributes of food into private and credence base attributes. Where credence attributes are those that are concerned with the greater good, for example, support to farmers and Support to vendors. In addition, private good attributes are also explored in this study, they include quality attributes such as Freshness, affordability, ease of preparation convenience, etc. A complete list of

the attributes that were explored in this study is given below in Table 1 below. Consumers were asked to rank these attributes on a five-point score. The distribution of scores across the five points is given below.

Table 1: Vegetable Attributes Explored in this Study

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Credence based attributes (percentage of people who scored)					
Score	1	2	3	4	5
Support to farmers	8.74	11.65	33.01	28.15	18.45
Support to vendors	3.88	6.8	26.21	29.13	33.98
Private Good Attributes					
Freshness	2.91	1,94	12.62	30.10	52.43
Affordability	4.85	10.68	32.04	29.13	23.30
Taste	2.91	5.83	15.53	34.94	40.78
Variety	2.91	5.83	11.65	45.63	33.98
Ease of Preparation	5.83	4.85	25.24	33.01	31.07
Food safety	4.85	4.85	13.59	26.21	50.49
Visual Appeal	5.83	7.77	18.45	33.98	33.98
Convenience	4.85	4.86	21.36	32.04	36.89
Other Attributes					
Seasonality	3.88	4.86	13.59	31.07	46.6
Organic(uses no fertilizer or pesticide)	8.74	11.65	33.01	28.15	18.45

From table 1 above it is apparent that freshness, safety seasonality, and taste are the top 4 factors that consumers rank very important. Other attributes such as support to farmers, and vendors and the organic nature of the vegetables bought do not appear to get as much importance,

Principal component analysis was employed to create a credence index and a concern index variables which seemed to fall in overlapping categories such as seasonality and concern for farmers were treated separately. Using the Kaiser criterion the components with eigenvalues greater than 1 were used in the analysis. Variables with overlapping credence and private attribute criteria such as seasonality and organic nature of the vegetables were kept separate.

In addition to private and credence attributes, Consumers were also asked for information on certain Socio-demographic variables such as age, employment, etc A copy of the questionnaire as well as a link to the google forms links to the questionnaire is provided at the end of the paper. Convenience sampling was used to obtain information from the consumers.

Summary and Descriptive Statistics

Summary and other descriptive statistics are used to describe the data from the consumer survey. Summary Statistics of socio-demographic variables are presented in table 2 below. The average age is 33.80 years, the maximum age is 74 and the minimum age is 18 years. The percentage of male and female respondents is roughly equal. More than 50% of the population earns less than 50,000 rs per month. Equal percentages of the consumers appear to be employed and unemployed, Most consumers have enrolled or completed their graduation degree.

Table 2 : Socio-Demographic variables

Variables					
Age (in years)	Mean	stdev	Min	max	
	33.80	14.71	18	74	
Gender (percentage)	Male		Female		
	50.49		49.51		
Income levels (monthly income in INR)	Less than twenty thousand	20, 0000-500000	50,000-100,000	100,000-200000	More than 200000

	27.18	25.24	19.42	14.56	13.59
Education levels (percentage)	Secondary and less	Graduate		Post graduate	
	16.50	53.40		30.10	
	Employed		Unemployed		
Currently employed or not (percentage)	49.92		50.98		

Regression to understand the factors that influence A consumer's choice of vegetable retail.

The multinomial logit model is employed for a categorical variable with an outcome that does not have a natural ordering (Stata , 2022). In the analysis considered, the choice of retail is a response variable with multiple categories that have no natural ordering.. The multinomial logit model is an extension of the logit model. Similar to the logistic model the multinomial logit uses maximum likelihood estimation to evaluate the probability of a relationship. The various categories of vegetable retail options were encoded into three categories, traditional/informal, supermarket, and online. The coefficients β (1) , β (2) and β (3) are estimated corresponding to each outcome presented in the following equations (1)(stata, 2022).

$$\Pr(y=1) = \frac{e^{X\beta^{(1)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y=2) = \frac{e^{X\beta^{(2)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y=3) = \frac{e^{X\beta^{(3)}}}{e^{X\beta^{(1)}} + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

However, the above model has more than one solution. However, if the coefficient β (1) is set to be equal to zero, the remaining coefficients β (2) and β (3) will measure change relative to the reference category. The coefficients are then estimated based on the following equations (2)

$$\Pr(y = 1) = \frac{1}{1 + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y = 2) = \frac{e^{X\beta^{(2)}}}{1 + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

$$\Pr(y = 3) = \frac{e^{X\beta^{(3)}}}{1 + e^{X\beta^{(2)}} + e^{X\beta^{(3)}}}$$

In the model estimated above the reference category is traditional/ unorganized sector and the remaining categories are supermarket and online categories (Stata 2022).

Table 3 Results from the Multinomial Logistic Regression

Dependent variable	Supermarket	Online platform
Vegetable attributes		
Private attributes	.4071 * (.2149)	.7090 ** (.3108)
Credence attributes	-.6154 ** (.2763)	-.7694 ** (.3559)
Produced organically	.0013 (.2958)	-.2529 (.3276)
Buying vegetables in season	-.3153 (.3465)	-.1397 (.4793)
Socio demographic variables		
Age	.0252 (.0236)	-.03078 (.03690)
Family size	.1924 (.1893)	-.07991 (.2403)

Gender	.9972 (.7087)	-.2288 (.7699)
Employ	-2.171** (.7803)	.07810 (.8085)
Income	-.0980 (1.4429) -.3826074 (1.2870) .5595 (1.2848) .4069 (1.2041)	-.2889 (1.1273) .05996 (1.3808) -.2840 (1.1232) -.1863508 (1.2957)
Education	1.032 (.8888) -.1046 (1.2035)	16.3834 (1376.868) 17.12149 (1376.868)

*Variable significant at the 5% level ** variable significant at the 10 percent level

3.Results from the multinomial model.

The reference category for the multinomial logit model is also included in the table above. The variables that have turned out to be significant are the private and credence attributes. Consumers who decide to buy vegetables in a supermarket are more significantly concerned about the private aspects of vegetables compared to those who are likely to buy in the more traditional or unorganized sector.

In addition, perhaps surprisingly those who buy vegetables in the supermarket are more likely to be unemployed when compared to those who buy in traditional markets. This result needs to analysed further.

Similarly, when comparing respondents who most prefer to shop on online platforms it is again clear that the variables that turn out to be significant are private and credence indices. The private vegetable attribute

index has a positive and significant effect on choosing to buy on an online platform, Whereas, similar to the supermarket scenario, the respondents who buy on online platforms are significantly less likely to say that they are concerned about farmers and street vendors while buying vegetables. Very few of the other socio-demographic variables appear to be significant.

Semi-structured Interviews

Semi-structured interviews were employed to understand various vendors' experiences, Vendors Interviewed include Vegetable shop (kirana), Vegetable market shop, Vegetable cart and Vegetable vendor, The Semi-structured interview focused on areas such as Sources of vegetables, Frequency of purchase, Issues faced, Inventory and Storage and Spoilage issues. The information search is very preliminary.

From table 4 below it is indicated that only 4 types of vegetable retail options were interviewed. The source for 2 out of the 4 options was the Krishna Rajapuram market or the local central market as suggested by (Patil, 14 November 2014). The vegetable cart and truck sourced their vegetables from the farmers market or the mini market located on the outskirts of the town, Storage facilities do not appear to be present for many of the retail options and vegetables need to be bought frequently.

Table 4: Responses to Semi structured Interview

	Source of vegetable	Frequency of vegetable	Inventory, storage and spoilage issues
Vegetable shop	Whole sale central market	2-3 times a week based on demand	Did not comment on storage
Local Vegetable market	Whole sale central market	2-3 times a week, based on demand	No storage facilities are available. Considerable wastage

Vegetable truck	Farmers market	daily	No storage facilities are available. Considerable wastage
Vegetable push cart	Whole sale central market, mini market	daily	No storage facilities says that wastage is not considerable.

4. Conclusion

The results from the summary statistics that freshness, safety seasonality, and taste are the top 4 factors that consumers rank very important. Concern about farmers and vendors does not appear to be the most important concern. Most of the respondents from the survey seemed to prefer traditional / unorganised vegetable retail options. The multinomial logit suggests that respondents who prefer online platforms or supermarkets place greater importasnce or private credence attributes as opposed to consumers who prefer traditional/ unorganised sector. The brief and very few semi-structured interviews of vegetable retailers' suggest that vendors buy their produce from wholesale markets and they have very few storage facilities. They buy their vegetables from the markets based on their current sale of vegetables.

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Yield Effects of Climate Change Adaptation Strategies in Nigeria: Did anchor borrower's progamme play any role?

Nneji Ifeyinwa Umeokeke[1], Oluwafunmito Dorcas Babatunde[2], Osayi Precious Emokpae[3], Idowu James Fasakin[4]

[1]Department of Agricultural Economics, University of Ibadan, Nigeria, ifeyinwaumeokeke9@gmail.com

[2]Department of Agricultural Economics, University of Ibadan, Nigeria, sacordbabs@yahoo.com

[3]University of Benin, Benin, Nigeria, osayi.emokpae@uniben.edu

[4]University of Ibadan, Nigeria, idowufasakin2010@gmail.com

Abstract

Ensuring sustainable global food supply in the face of climate change requires efforts in incorporating climate change adaptation strategies in agricultural production. Rice is a major staple food with production in 2020 estimated to be 1.55 ton/ha in Nigeria (FAOSTAT, 2022). Smallholder farmers in Nigeria still face challenges such as limited financing, poor and untimely distribution of inputs, poor access to output market and adverse climate change. In 2016, the Nigerian government introduced the Anchor Borrower Programme (ABP) with the aim of increasing agricultural productivity which mandated farmers in forming cooperatives and compulsory training on climate change adaptation strategies as a prerequisite for participation. The study therefore, assessed the yield effect of climate change adaptation strategies among smallholder rice-based farmers in Ekiti state, Nigeria. The study used a cross sectional household data collected through a well-structured questionnaire within the selected agro-ecological zones in Ekiti state in 2021. A multistage sampling approach was used to select 288 smallholder rice-based farmers involved in ABP. Descriptive statistics and Conditional Mixed Process (CMP) with ordered probit was used to analyze data. Result shows that 147(51%) rice farmers employed more than three strategies. The average climate change adaptation strategy and rice paddy yield is four and 2.807 ton/ha which is higher than the 2020 rice paddy yield of 1.55 ton/ha according to FAOSTAT. The climate change adaptation strategies used by the rice-based farmers are stress resistant variety, reduced zero tillage, transplanting, organic manure, crop residue, irrigation and crop rotation. The result from CMP with ordered probit showed that increase in the number of climate adaptation strategy used significantly increased paddy rice yield by 5.6%. The marginal effect shows that farmer's age, experience, household with children less than 18 years, quantity of urea per hectare and quantity of NPK per hectare significantly reduced the number of climate change adaptation strategies used by 13.1%, 4.8%, 17.3%, 0.44%, and 0.03% respectively. Variables such as access to phone and use of hired labour significantly increased the number of strategies used by 41.8% and 54.5%

respectively. Therefore, it becomes necessary for stakeholders (government, private sector, non-governmental organization) promoting climate change adaptation strategies to put these measures into consideration in order to improve rice yield. Also, agricultural policies fostering climate change adaptation should incorporate the use of ICT and make labour available in order to speed up the use of climate change adaptation strategies.

Keywords: Climate, Adaptation strategies, Rice Yield.

1. Introduction

Balancing global food demand with supply in the face of climate change will require major effort to advance the triple goals of agricultural adaptation to extreme weather shocks, carbon sequestration, and increased agricultural yields (Fischer, 2018). Climate change adaptation strategies (CCAS) are adaptable approach that aims to enable agricultural systems to support rural development and ensure food security in a changing climate (Food and Agriculture Organization FAO, 2018). Despite this promise, however, these strategies often requires significant investment in land, labor, and financial capital, which limits adoption in low and middle income countries (Lipper et al., 2014). For instance, climate change adaptation measures like conservation agriculture require high labor and financial resources rendering them unaffordable for most smallholder farmers (Amadu et al., 2020, Brown et al., 2018).

In Nigeria, agricultural production is mainly dependent on rainfall. Variation in climate condition such as increase in temperature, low humidity, prolong dry season and drought have affected food production in the country. According to World Bank (2019), the country is among the top ten nations experiencing climate change with 6% of its land area exposed to adverse weather condition. These have adversely affected land use and livelihood of its citizens (Olaniyi et al., 2019). The wetland and water bodies have reduced tremendously in length with high evapotranspiration which have affected agricultural yield. Ekiti state known for its rice production have experienced climate change. Amount and frequency of rainfall have shown to be very critical before and during planting, with temperature exhibiting a positive relationship during rice harvest (Olanrewaju et al., 2017).

Funding from national and international investment in agricultural production is crucial in ensuring better livelihood in developing countries like Nigeria. Some of the investment in agriculture includes Growth Enhancement Scheme (GSE), Commercial Agricultural Development Programme (CADP), and Agricultural Value chain Development Programme (AVDP). With increasing climate change which has affected agricultural production, it becomes important in investing in Climate change adaptation strategies in order to achieve the desired outcome. In 2015, the Federal government implemented the anchor

borrower's scheme with the aim of investing in food (cereal, tubers, vegetable, and livestock) and achieving food security, and well as combating climate change effect through mandatory training programmes on combinations of improved practices. This research address the gap in knowledge by assessing the impact of Climate smart agricultural practices from Anchor Borrowers scheme on important crop consumed nationwide.

Rigorous impact assessment on climate have been carried out recently. While some focused on specific climate change adoption in Malawi, (Katengeza et al., 2019), others used combinations of strategies to combat climate change effect in Nigeria and Malawi (Aderinoye-Abdulwahab and Abdulbaki, 2021; Ogunpaimo et al., 2021; Amadu et al., 2020). This research will assess the yield effect of climate change adaptation strategies from Anchor Borrowers programme participation among rice farmers in Ekiti state, Nigeria. It is a novel research that reveals the importance of integrating climate change adaptation strategies in national policies and planning (Anchor Borrowers programme). Also, this study used the conditional mixed process (CMP) with ordered probit to address the problem of sample section bias with specific advantage over the two-stage least square, Heckman model, propensity matching and endogenous switching regression in that the response variables can take different forms (Roodman, 2011).

1.1 Rice production in Nigeria and Structure ABP

Rice is a cereal that contains, starch, protein, fiber, protein, vitamins, and minerals and is consumed by more than half of the world's population (Rathna et al., 2019) and is increasingly an important crop in Nigeria, with some improved varieties growing within 3 months. Africa cultivates about half of the 14 million metric tonnes of the annual global rice production (FAO, 2019), while Nigeria is the largest producer and the leader in terms of consumption as well as importation in Africa. Nigeria's production has steadily advanced from two million metric tonnes to 8.0 million metric tonnes between 2008 through 2018 with the aim of reaching 18 million tonnes by 2023 (FAO, 2019). This is due to rice policy reforms by the Federal Government of Nigeria who in its bid to eliminate rice importation enacted the anchor borrower's scheme that have paved way for proliferation of rice farming in the country (FAO, 2019). South west and north-central Nigeria records the highest rice production in the country (United State Department of Agriculture USDA and International Production Assessment Division IPAD, 2021).

The Central Bank of Nigeria (CBN) in line with its developmental function established the Anchor Borrowers' Programme (ABP) which intended to create a linkage between anchor companies involved in the processing and small holder farmers by providing farm inputs in kind and cash (for farm labour) to small holder farmers to boost production. For ease of administration, the farmers are expected to be in groups or cooperatives. The Programme evolved from the consultations with stakeholders comprising Federal

Ministry of Agriculture & Rural Development, State Governors, millers of agricultural produce, and smallholder farmers. In terms of capacity building, a compulsory training programme was organized for the farmers which includes Farming as a business, improved agricultural practices including climate agricultural practices, and group management dynamics of which the Anchor (processors) borne the cost of the training (Development Finance Department Central Bank of Nigeria, 2016).

In Ekiti state, the ABP is coordinated by the ADP Office, with the Block Extension Supervisor serving as the Desk Officer in each of the Local Government Areas (LGAs). The selection of Administrative office is based on prevalence of rice production under different production systems/ecologies. The farmers are selected based on major criteria which includes access to or possession of land, group participation with such group having constitution with which they operate. Selection of farmers is also enhanced by participation in any of the farmers group and membership of the apex rice farmers association (Rice Farmers Association of Nigeria-RIFAN). Each of the LGA in the State has one participating farmer's group. Activities of the groups include identification of qualified farmers, formation of cluster groups, identification of off-takers, and registration of farmers. Rice is rated as commodity of prime priority by the government because the state is the highest producer of rice in the southwest zone of the country. Major rice production systems includes Upland and lowland.

2. Literature

2.1 Theoretical expectation and empirical reviews

Random utility theory is based on the hypothesis that every individual is a rational decision-maker, maximizing utility relative to his/her choices which is best explained with a discrete choice model (Greene and Hensher, 2010). These choice according to McFadden (1981) must be mutually exclusive alternatives, exhaustive, and finite number of alternatives. The alternative choices can be rank-ordered according to a decreasing order of magnitude of their associated utilities. The top rank alternative has the highest utility while the bottom rank alternative has the lowest utility (Palma and Kilani, 2015). Therefore, in practice, households that adopt higher number of adaptation practice will have higher outcome more than others (Mabe and Asase, 2020, Amadu *et al.,* 2020). This then makes it possible to handle the number of adaptation strategies as the dependent variable in Ordered Probit model, noting the ordinal nature of the response variable. This then makes it possible to handle the number of adaptation strategies as the dependent variable in Ordered Probit model, noting the ordinal nature of the response variable. The households choose to adopt the number of strategies so as to maximize the resulting fundamental utility function:

$$U_i^* = U_i(\beta x_i) + \mu_i \quad where\ i = 1, \ldots\ldots, n (1)$$

Where, U_i is the observed part of the utility function, x_i is the vector of exogenous farmer's characteristics, β is the vector of parameters to be estimated, and μ_i is assumed to be equivalent to the unobserved part of utility function with zero mean (random variable). Therefore, a farmer will adopt an additional adaptation strategy if the utility/satisfaction (yield) he obtains from it is greater that the yield he obtain if he do not adopt the additional adaptation strategy.

In order to control for sample selection bias, the conditional mixed-process (CMP) framework which was developed by Roodman (2011) to jointly estimate two or more independent equations with correlated errors will be used. Just like two stage least squares model, Heckman model, Propensity Score matching with instrumental variable, and Endogenous Switching regression control for sample selection bias, the CMP has a higher advantage in simultaneously modeling equations with different response type.

From extant literatures variables that positively influences agricultural climate smart adaptation includes marital status; type of labour, government extension visit, number of extension visit, perception of soil fertility (Ogunpaimo et al., 2021; Amadu et al., 2020) while probability of adopting CSA decreased with age of household head; number of plot cultivated, prior crop failure, incidence of drought/flood (Ogunpaimo et al., 2021; Amadu et al., 2020). Age of the respondent, household size, membership in farm based organization, access to climate information and credit, and distance to output market positively influenced climate smart adaptation strategies (Adeabgo et al., 2021).

3. Methodology

3.1 Study area

The study was carried out in Ekiti State. It is located between latitudes 7.025º and 8.005º N and between longitude 4.045º and 5.46º East. The State is bounded to the North by Kwara and Kogi states, Osun state to the West and to the East and South by Edo and Ondo states respectively. Ekiti state is a landlocked state with no coastal boundary and a total land area of 6,353 square kilometer. The state is characterized by equatorial climate with bimodal rainfall pattern with distinct dry and wet seasons. Rainy season spans between April and October and the dry season between November and April with air temperature ranges between 21ºC and 28ºC. Ekiti has tropical rain forest vegetation in the South and savannah vegetation in the Northern fringes. The inhabitants are predominantly farmers producing crops such as such as yam, maize, cassava, rice, palm

oil, cowpea and some vegetables. The State is one of the 13 major rice producing states in the country and notably known for its production of a local rice variety “IGBEMO”. Figure 1 represents the map of Ekiti state showing the agricultural zones (Aramoko, Ikere and Isan).

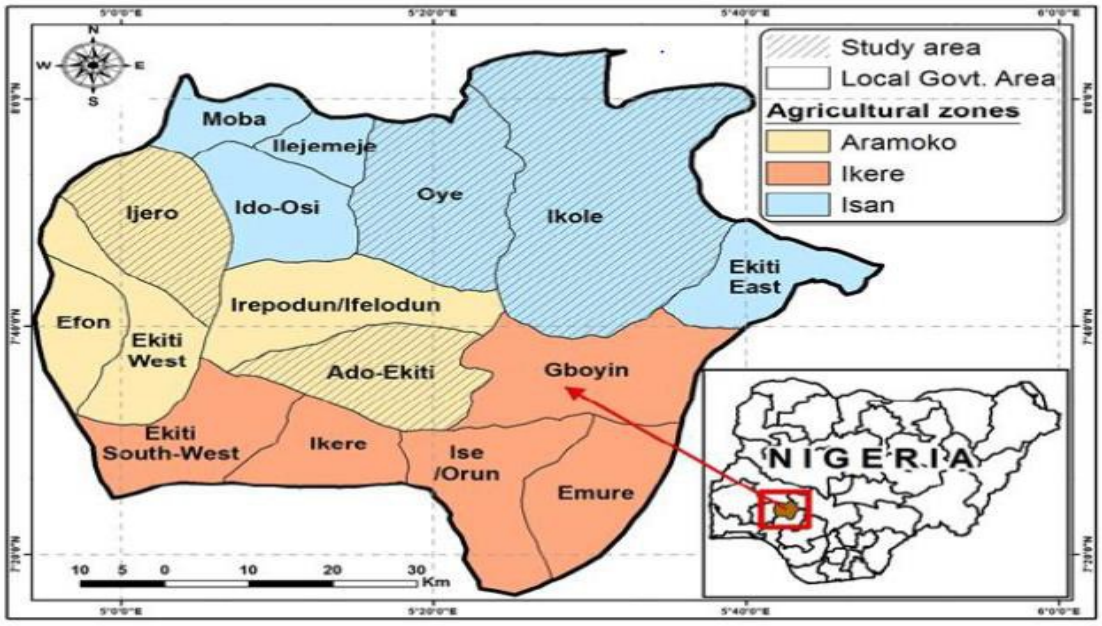

Figure 1: Map of Ekiti state showing the study area.

3.2 Data

The study employed a multi-stage sampling procedure to select respondents for the research. The first stage was a purposive selection of Ekiti state from southwest state due to the successful implementation of Anchor Borrower’s programme. Ekiti state is also noted as the highest rice producers in southwest Nigeria. The second stage involved the purposive selection of Aramoko (rainforest) and Isan (derived savannah) zones Agricultural Development Programme (ADP) zones from the three ADP zones in the state. In the third stage, four LGAs were randomly selected from the two selected zones. The fourth stage involved random selection of 2 villages from each of the LGA selected, making a total of 8 villages selected. Finally, 50 rice farmers were selected randomly from each of the selected village, making a total of 400 rice farmers which includes farmers that participated in ABP and those that did not participate. At the end, 288 were found to participate in the programme and was used for the analysis.

3.3 Model specification

To assess the effect of climate change adaptation strategies on rice yield, the conditional mixed process (CMP) framework was used. According to Roodman (2011), conditional mixed process is a framework that jointly estimates two or more equations where individual equation need not to be continuous variables. The CMP controls for endogeneity as climate change adaptation strategies is both exogenous and endogenous variables. We therefore hypothesize that the higher the number of strategies used by a farmers the higher the yield obtained. The first stage of the CMP is an ordered probit that examines the determinants of the number of strategies used by the farmer. It is given as:

$$No.\ CCAS_i = \alpha_0 + \sum_{k=1}^{k=k} \alpha_k X_{ki} + \delta_i \qquad (2)$$

Where, $No.\ CCAS$ is the number of climate change adaptation strategies used by the i_{th} rice farmer (1, 2, 3…, 7) that is Crop rotation, application of organic manure, application of crop residue, use of stress resistant variety, transplanting, zero tillage and irrigation is that order. X_k are the explanatory variables that determines the number of strategies used, α represents the coefficients to be determined, and δ is the error term.

In the second equation, the outcome from the first stage (number of CCAS) is used as an exogenous variables to determine its effect on rice yield. It is expressed as:

$$Rice.Yield_i = \beta_0 + \beta_j No.\ CCAS_i + \sum_{j=1}^{j=j} \alpha_j Z_{ji} + \delta_i \qquad (3)$$

Where, Z_j represents the independent variables that influences rice yield.

4. Result and discussion

4.1 Socioeconomic characteristics of rice farming households

Table1 shows the summary statistics and farming operation variables in the study area. The findings shows that the average number of climate change adaptation strategies and rice yield are 4 and 2807.8 kg/ha respectively. This shows that the zone obtained a higher yield as against the average rice paddy yield of 1.55 tons per hectare (FAOSTAT, 2020). The average age of rice farmers in the study area is 49 years while the age group for African youth falls within 15-35. This implies that the farmers are old there is low participation of youth in rice production. The mean year of education of rice farmers is 12 years (i.e. minimum of secondary school education). This shows that there is low synthesis of information on climate change and technology adoption. Szczepankmiewicz et al. (2020) buttressed the importance of introducing

climate change at secondary school level to increase knowledge while Malhi et al. (2021) stressed the implication of climate change in hampering the growth and productivity of plants. The average number of persons in the house is 7 members. This is above the national average of 5 members per household in Nigeria (National Bureau of Statistics, 2020). Also the mean number of person below 18 years is 0.4 implying that the households have more adults. The average rice farming experience is 13 years. This suggests that the rice farmers in the study area are well experience in applying different climate change adaptation strategies to minimize its effect.

Statistics on production variables shows that 81% of the respondents use hired labour for rice production. Rice farming is labour intensive and requires timely use of labour from seed plating, transplanting, irrigation, fertilizer and pesticides application, weeding and harvesting (Yamane, 2021). The average use of Urea and NPK fertilizer on rice per hectare is 29.5kg and 781.2kg respectively. This is much higher than the national average fertilizer use of less than 13kg per hectare or about 6kg of nutrient per hectare (Federal Ministry of Agriculture and Rural Development FMARD, 2012; Liverpool-Tasie and Takeshima, 2013). The land size available is within the range of smallholder farmers in Nigeria. According to FAO (2012), small family farmers contributes in producing a third of the world's food. Low crop yield has been associated with low fertilizer use in sub-Saharan Africa due to spatial variation in prices (Bonilla-Cedrez et al., 2020).

For policy and information variables, result from table 1 shows that 95% of respondent had access to agricultural extension service operating under the Ministry of Agriculture. This complimented the compulsory advisory and training service provided by the Anchor Borrower's Programme (ABP) to ensure effective use of cultural practices and climate change strategies. Also, 69% of respondents have mobile phone which enables easy access to information on climate change adaptation strategies and other production activities.

Table1. Descriptive statistics of main variables

Variables	**Mean**	**Std. Dev**	**Max.**	**Min.**
Main outcome				
Number of climate change adaptation strategies (0–7)	4.0382	1.7890	1	7
Rice yield (kg/hectare)	2807.7880	1865.3010	200	10000
Log of rice yield	3.3466	0.3294	2.301	4
Household characteristics				
Sex (male=1, female=0)	0.8472	0.3604	0	1
Age of household head (years)	48.5972	7.2548	23	78

Agesquared	2414.1390	753.3785	529	6084
Years of education	12.2500	5.0963	0	30
Household size (number of persons)	6.9547	2.6441	1	25
Household structure (number of persons less than 18years)	0.4201	1.5395	0	9
Experience (years in rice cultivation)	13.4861	6.9317	0	40
Production inputs				
Hired labour (1=yes, 0=no)	0.8090	0.3938	0	1
Urea kg/hectare	29.5051	48.9522	0	300
NPK kg/hectare	781.2145	695.9018	0	3000
Area cultivated (ha)	2.7003	2.1739	0.5	20
Ownership of mobile phone (1=yes, 0=no)	0.6944	0.4614	0	1
Institutional factors				
Access to agricultural extension service (1=yes, 0=no)	0.9479	0.2226	0	1
Location (Local Government Area)				
Resides in Oye (1=yes, 0=no)	0.3368	0.4734	0	1
Resides in Ijero (1=yes, 0=no)	0.2222	0.4165	0	1
Resides in Ado (1=yes, 0=no)	0.2813	0.4504	0	1
Resides in Ikole (1=yes, 0=no)	0.1597	0.3670	0	1

4.2 Climate change adaptation strategies

Figure 2 shows the CCAS used by the rice farmers. The chart shows that 210 out of 288 farmers applied reduce/zero tillage. Application of reduced/zero tillage reduces the cost of cultivation, soil erosion, crop duration and the amount of irrigation required (Ernstein, 2009). This strategy was found to increase yield in rice-wheat system in India (Jat et al., 2019). The second most used strategy among rice farmers is crop rotation. Crop rotation is an important pillar of conservation agriculture which allows replenishment of nutrients, reduces production cost and has proved to improve yield of cereals in Brazil (Canalli et al., 2020). Stress resistant variety was applied by 60% of the rice farmers. Climate change effect such as drought affect plant especially at the reproductive stage. Therefore, stress tolerant variety cushions drought and ensures high yield (Nirmala et al., 2019).

From the chart, 172 rice farmers applied organic manure. Application of organic manure is considered as a sustainable measure to preserve soil nutrient (Martinez, *et al.,* 2022). Transplanting is more prominent in vegetable and cereal cultivation. It helps to avoid stress, shortens harvest time, and ensures more uniform

and stable yield (Gavrić and Omerbegović, 2021). Good soil management practices such as the use of crop residue have a positive impact on soil quality and crop yield (Lu, 2020). It also reduces greenhouse gas emission and soil bulk density, and at the long run ensures environmental sustainability. Out of 288 farmers, 121 farmers used irrigation system. This low usage could be attributed to the high cost of equipment, maintenance and labour which is beyond the reach of smallholder farmers in Nigeria (Adekunle et al., 2015). Irrigation promotes water management, ensures sustainable farm production under prevailing climate change variability, and increases yield (Olayide et al., 2016).

Table2 shows the distribution of number of CCAS used by the rice farmers. It was observed that about 35.4% of the farmers used three CCAS on their farms and obtained a mean yield of 2108.3kg/ha. As the number of CCAS increases, the yield increase although there was a drop for farmers that used six CCAS. From figure 3, we observed that farmers who applied the seven CCAS had the highest mean of 6244.3kg/ha. This shows the importance of CCAS in achieving higher yield, sustainable food security in the face of climate change.

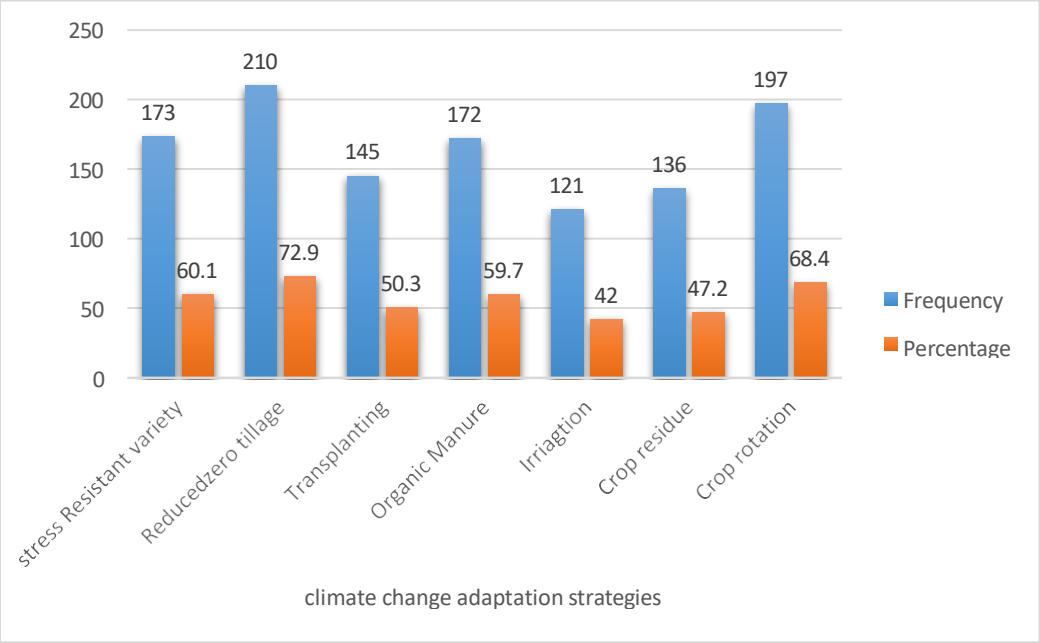

Figure 2. Climate change adaptation strategies. *Note: The responses were multiple.*

Table2. Distribution of Climate Change Adaptation Strategies.

Number of CCAS	Mean	Std.	Frequency	Percentage	Min.	Max.

1	2022.222	513.909	27	9.40	500	3000
2	2145.833	405.338	12	4.20	1750	3000
3	2108.309	767.325	102	35.4	500	4000
4	2429.225	745.552	43	14.9	1375	4500
5	2598.436	1282.134	30	10.4	200	5500
6	2384.244	2180.010	34	11.8	250	8000
7	6244.286	1926.870	40	13.9	600	10000
Total	**2807.788**	**1865.301**	**288**	**100**	**200**	**10000**

mean yield

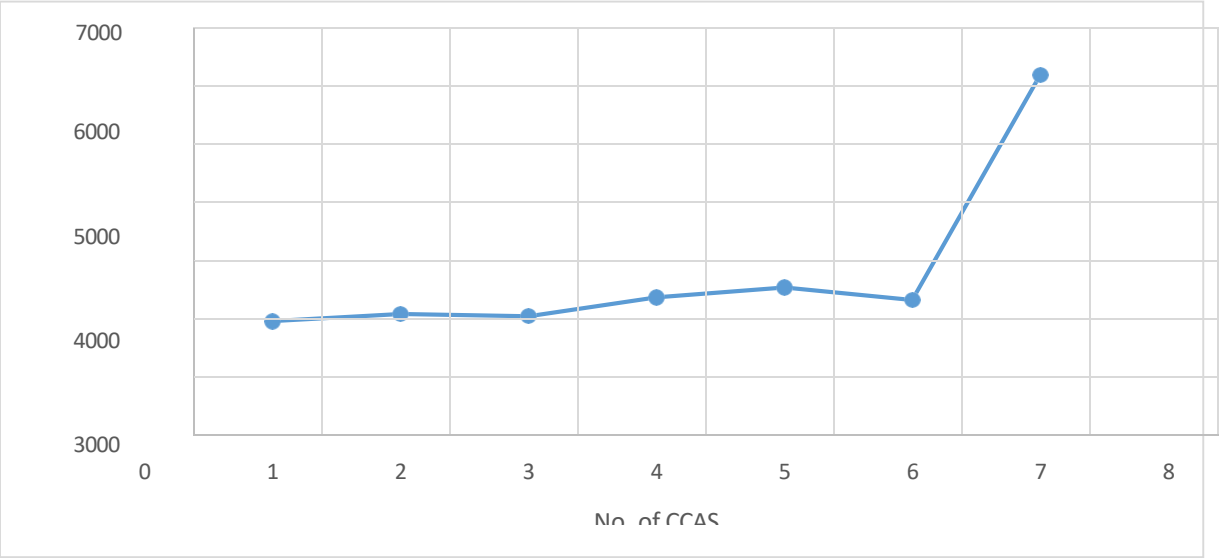

Figure 3. Rice yield and number of CCAS

4.3 Determinants and Effect of Climate Change Adaptation Strategies on rice yield

4.3.1 Determinants of Climate Change Adaptation Strategies

Table 3 shows the determinants of climate change adaptation strategies and its effect on rice yield. From the diagnostic results, the Fisher's z transformed correlation (atanhrho_12) negative sign and its statistical significance implies that there are some unobserved factors which influences the number of climate change adaptation strategies that rice farmers use and yield. Therefore, the use of ordinary least square would have produced bias result if used rather than the conditional mixed process. The significance of the likelihood ratio test indicates a strong correlation between the error terms of the number of adaptation strategies and yield model, hence, estimating the two models will bias.

Result shows that age of rice farmers significantly influenced the likelihood of adopting climate change adaptation strategies. The application of higher number of climate change adaptation strategies is more pronounced among young farmers (Damnyag et al., 2021; Esfandiari et al., 2020; Khanal *et al.,* 2019). Policies/strategies that will ensure involvement of youth in agriculture can have a positive effect on climate change. Agesquared was found to have a positive effect on climate change adaptation strategies in the long run. For instance, older farmers manage their land more effectively in combating to floods and adapting to drought seasons (Sam et al., 2020; Naz et al., 2018). Result also shows that households with children less than 18 years are less likely to increase the number of climate change adaptation strategies. Having younger children could implies having more responsibility in child care and less attention to climate change adaptation strategies. Years of farmers experience in rice cultivation negatively and significantly influenced

the number of climate change adaptation strategies. It is expected that years of farming experience will have a positive effect on adaptation strategies as farmers with higher experience are more prepared to manage their field and adapt (Esfandiari et al., 2020; Oo et al., 2017). On the contrary, result shows that farmers with lower years of experience have higher chances of increasing the number of climate change adaptation strategies. This could be attributed to the mandatory training executed by ABP as a requirement for participation irrespective of farmer's years of experience. The use of hired labour positively increased the likelihood of applying higher number adaptation strategies. The quantity of fertilizer (urea and NPK) used per hectare influenced the adoption of various adaptation strategies. Reduction in quantity of fertilizer influenced the use of multiple strategies by farmers. This shows the importance of adopting can produce effective result. Ownership of household asset like mobile phone increased the likelihood of employing various adaptation strategies. Using information and communication technologies assist farmers in obtaining information on climate change. Farmers who receive information on weather forecast, agricultural technology and practices (khanal et al., 2019; Aryal et al., 2018; Khanal et al., 2018).

4.3.2 Effect of Climate Change Adaptation Strategies on rice yield

Table 3 also shows the effect of climate change on rice yield. Climate change adaptation strategies positively and significantly influenced rice productivity at 1% level of significance. Therefore, a unit increase in the number of climate change adaptation strategy is positively and significantly associated with increase in rice yield. This finding is in line with the work of Ali et al. (2021) and Amadu et al. (2020) who found that adopting higher number of climate change adaptation strategies reduced the production risk related to unforeseen climate shocks and increased agricultural yield. Khanal et al. (2021) opined that Smallholder farmers' adaptation to climate change can contribute in achieving the United Nation's sustainable development goals of zero hunger and no poverty. Other factors that positively and significantly increased rice yield are age of household head, education, household size and Fertilizer while agesquared and ownership of mobile phone are less likely to influence rice yield.

Table 3. Determinants and Effect of Climate Change Adaptation Strategies on Fish Catchability.

Variables	Determinants of CCAS		Effect of CCAS on rice yield	
Main outcome	Coef.	Std. Err	Coef.	Std. Err
Number of climate change adaptation strategies (0–7)			0.0559***	0.0153
Household characteristics				
Sex (male=1, female=0)	0.1729	0.2147	-0.0182	0.0492
Age of household head (years)	-0.1313*	0.0697	0.0473***	0.0165
Agesquared	0.0015**	0.0007	-0.0005***	0.0002
Married	0.3311	0.2848	-0.0009	0.0673
Years of education	0.0051	0.0145	0.0109***	0.0036
Household size (number of persons)	0.0183	0.0304	0.0226***	0.0071
Children household size (nr persons less than18years)	-0.1727***	0.0525		
Experience (years in rice cultivation)	-0.0485***	0.0120	0.0030	0.0028
Production inputs				
Hired labour (1=yes, 0=no)	0.5454***	0.1998	-0.0200	0.0465
Amount of Urea used (kg per ha)	-0.0044**	0.0019	0.0005	0.0004
Amount of NPK used (kg per ha)	-0.0003**	0.0001	0.00007**	0.00003
Area cultivated (ha)	0.0164	0.0384	0.0003	0.0096
Ownership of mobile phone (1=yes, 0=no)	0.4182**	0.1919	-0.1613***	0.0395
Institutional factors				
Access to agricultural extension service (1=yes, 0=no)	0.4189	0.3132	0.1024	0.0743
Location (Local Government Area) Oye as base				
Resides in Ijero (1=yes, 0=no)	1.8341***	0.2979		
Resides in Ado (1=yes, 0=no)	4.2529***	0.3648		
Resides in Ikole (1=yes, 0=no)	-0.9415***	0.2441		
_cons			1.6892***	0.4369
/lnsig_2	-1.3013***	0.0421		
/atanhrho_12	-0.1477*	0.0849		
rho_12	-0.1467	0.0831		
Number of observation 288				
Log likelihood -347.76351; LR chi2(31) 479.79; Prob > chi2 = 0.0000				

***, ** and * at 1 %, 5% and 10 % significance level respectively. Source:
Analysis from field data (2021)

5. Policy implication

Our result divulges broad policies in tackling climate change and improving food security in Nigeria and sub-Saharan Africa. It showed the importance of integrating climate change considerations in national policies, strategies and planning. It revealed the significance of government funding through the Anchor Borrower's Programme (ABP) in achieving the country's goal of reducing poverty in rural sector. Result showed that increase in climate change adaptation strategies (CCAS) significantly increased yield by 5.59%

among rice farmers. This shows that CCAS can be used to achieve sustainable food supply (Khana et al., 2021; Ali et al., 2021). Important measure that can ensure the increase use of CCAS is availability of labour. High cost of labour tends to increase cost of production which if not addressed will lead to lower adoption of CCAS. The use of Information and Communication Technology ICT (mobile phone) has proved to be important in increasing agricultural productivity in the face of climate change (Khana et al., 2019). The study also highlight the importance of young farmers in adopting climate change adaptation strategies. Therefore, youth inclusiveness should be considered when formulating climate change policies (International Fund for Agricultural Development IFAD, 2018).

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6. Cities and regions

6a. Urban and regional transformations

Abstracts

Delivering Carbon-neutral Goals through End-user Driven Energy Rransitions: A cross-cultural perspectives on smart social learning in three Asian cities (Kyoto, Seoul and Hong Kong)

Dr Daphne Mah

Hong Kong Baptist University, Hong Kong, Hong Kong

Abstract

Carbon neutrality and deep decarbonisation are required to avoid catastrophic climate impacts. Government intervention and market approaches are insufficient to deliver ambitious carbon-neutral targets. Citizen engagement has become an increasingly important approach to achieving carbon-neural goals. With the rapid development of smart grids, smart homes and household solar, massive amount of data have become available, households can change from passive end-users to proactive engagers in smart grid-enabled energy transitions by playing active roles in energy saving and producing renewable electricity both at home and in communities. However, these smart human-technology interactions differ in impacts and forms in various national, city, and local community contexts. How and under what condition that households develop positive, new relationships with their communities, utilities, and governments so that the full potential of end-user driven smart energy transitions can be realised? This is an important question that has yet to be answered.

By conducting a comparative case study of three smart energy communities in Kyoto, Seoul, and Hong Kong, this study aims to explore how smart social learning processes may scale up and create long-lasting household energy behavioural changes in relation to energy saving and solar adoption in a community scale. We particularly aim to develop an integrated conceptual model to conceptualise the mechanisms of smart social learning for scaling up and deepening household energy behavioural changes from a cross-cultural perspective. Social learning is learning through social interaction that emphasises envision, experimentation and deliberative participation. Our analysis will focus on three critical processes of social learning in the context of smart grid-enabled energy transitions: (i) data-enabled envisioning (what an end-user can aspire what he or she can do); (ii) experimentation (so that local innovative initiatives can be tried out and tested in community settings); and (iii) community deliberation (on e.g. energy trade-off decisions). The cross-cultural perspective will compare the values, norms, and social practices across the three cities to explore the importance of energy culture in shaping and limiting smart social learning of end-users. This presentation will present preliminary findings based on literature review and a pilot project in Hong Kong.

Track
Track 6a Urban and regional transformations

Diagnostic Social-Ecological-Technological Lens and Co-design Toolkit for Complex Wrban water Systems Transformation

M.Sc., M.A. Tieza Mica Santos

Dresden Leibniz Graduate School, Dresden, Germany. TU Dresden, Dresden, Germany

Abstract

Rapidly developing urban regions and cities are confronted with unprecedented water challenges with significant pressure from human activities such as land use, economic growth, and climate change. There is a growing understanding among urban water scholars that the techno-centric perspective of disciplinary silos influences the appreciation of conventional knowledge and governance paradigms towards complex systems. The discipline-bound predict-and-control measures offering blueprint solutions to address urban water challenges are simplistic to manage such a complex dynamic system.

This research, therefore, argues for a re-orientation of fundamental urban water systems transformation ontological and epistemological assumptions. It proposes the Transformative Mosaic Framework (TMF), a diagnostic lens and co-design toolkit employing a patchwork of complementary Social-Ecological Systems and Sociotechnical Systems ontologies and epistemologies. Framed within the transformation and systems complexity narratives, the TMF draws from relevant theories, conceptual frameworks, and approaches, which include transition studies, resilience, sustainability, panarchy, multilevel governance, and multi-pattern approach, among others. It also underscores the coupled social, ecological, and technological dimensions of urban water.

Changes affecting the coupled dimensions of water inextricably mesh with urban systems. These are characterized by strong technological and institutional path dependencies. The oversight on the ecological, social, and cultural features rationalizes the need to reframe the urban water transformation narrative to support the normative goals of sustainability, resilience, and just transitions. These are decisive features that guide scholars and practitioners in assessing synergies and trade-offs that emerge during the evolution and implementation process, often defined by their spatial, temporal, as well as socio-economic context.

This research further provides a sectoral context representing a knowledge domain that contributes to further exploration of the dynamics of urban transformations. It relates to the Sustainable Development Goals (SDG) on (SDG6) Clean Water and Sanitation and (SDG11) Sustainable Cities and Communities, more specifically to targets 6.4, 65, 6.b, and 11a. The proposed scientific re-orientation of the Transformative Mosaic Framework considers the targets of SDG6 and 11 on balanced territorial development, positive economic, social, and environmental connections, and strong cross-sectoral cooperation to address water challenges in urban, including peri-urban regions. This could lead to spaces for sustainability innovations and opportunities that direct future pathways.

Track
Track 6a Urban and regional transformations

Experiments for Urban Sustainability Transformations and Causal Inference

Prof. Dr. Artem Korzhenevych

Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany

Abstract

In the recent years, urban experimentation in its diverse forms has become popular among both researchers and policymakers in search of new insights for sustainable urban development. Real-world labs, community-based initiatives, innovation experiments, and pilot projects have attracted a lot of public attention and produced active local and international discourses. However, simultaneously, a number of methodological issues arose that sparked a debate on experiment design in sustainability science. In this paper, we aim at addressing one particular aspect of that debate, which in our view currently remains understudied, namely the issue of (possibility of) causal inference through urban sustainability experiments as well as challenges and risks related to the quest for distinguishing cause and effect in this context.

The current literature describes a number of various forms of interventions that were tried out in different urban contexts worldwide. These interventions were motivated by the search for solutions and informed decisions that could advance transitions towards sustainability. Lately, a particular focus has been on evidence-based actionable or transformational knowledge. It is therefore of utter importance for sustainability researchers that the produced evidence about the causes of sustainability problems as well as about the effectiveness of solutions fulfil the criteria of scientific soundness and validity.

We start by carefully examining the concept of causality, in particular from the points of view of the variance theory and the process theory. We then carry out a review of a selection of widely cited examples of urban experimentation, and try to categorize them with respect to their approach to causal inference. We also review examples of field experiments in the domain of urban economics and draw lessons in particular with respect to the treatment of various types of biases in this strand of literature. Based on the review, we gather the common features of experimental design that allow various studies to come up with statements related to effectiveness of urban experiments in terms of certain outcomes or outputs. Particular attention is drawn to the aspects of complexity and uncertainty. We conclude with recommendations regarding scientific experimental design and the role of causality in it.

Track
Track 6a Urban and regional transformations

Improving Urban Green Infrastructure for the Sustainable Development of Cities

Prof. Dr. Francisco A. Comin, M. Sc. Elie Hanna

Instituto Pirenaico de Ecología-CSIC, Zaragoza, Spain

Abstract

Urban Green Infrastructure (UGI) can help to alleviate many of the environmental, social and economic problems that the growing urban population is facing. However, improving the green infrastructure of urban zones (UGI) is a challenge because most parts of cities are already urbanized which restricts the development of new UGI and the new urban areas may or may not consider sustainable development principles to plan and implement UGI. This study performed a literature review about UGI and sustainable development (SD) using the Web of Science (WoS), then it performed a disentangling of articles between theoretical and practical ones, the methodologies of these papers were reviewed and, through performing a systematic bibliographic review with the software Vosviewer, their topics were analyzed to study their links to each other's and to SD. Of the 195 papers selected, 89 are qualitative focusing mostly on literature reviews and design; equally 89 are quantitative focusing on metrics and spatial analysis and 17 are mixed articles combining both approaches. The bibliometric results showed that there is a significant link between three topics "green infrastructure", "ecosystem services" and "sustainable development", however only 39 of the articles take a holistic approach embracing environmental, social and economic aspects. Hence the need for more research focused on a holistic approach that includes the three pillar of sustainability. Most of the topics of interest for the reviewed papers are related with sustainable development goals (SDGs) 15 and 11. It is also suggested to widen the approach of future studies encompassing topics related with the other SDGs. In order to cover the lack of relationships between frequent research topics of interest and most SDGs a number of recommendations are given to link UGI planning and implementation with alleviation of poverty, zero hunger, quality education, gender equality, affordable and clean energy, climate change action, promote sustainable use of terrestrial ecosystems, increase partnerships.

Track
Track 6a Urban and regional transformations

Institutional Logic for Centralizing Local Environmental Responsibilities in China

Jiali Wang[1], Zihan Zhuo[2], Yu Qi[3], Wanxin Li[4]

[1]Tsinghua University, Beijing, China. [2]Fudan University, Shanghai, Chile. [3]Zhongnan University of Economics and Law, Wuhan, China. [4]City University of Hong Kong, Hong Kong, China

Abstract

This study aims to uncover the embeddedness of the organization of environmental governance, using the structural administrative reform taken by prefectural level cities in China, from 2003-2015 for illustration. Using a tailor-made data set, we analyzed the impacts of environmental challenges, administrative rank, dispositions of local leaders, and peer pressure on a prefectural level city's decision on whether to centralize their environmental responsibilities. We found the job tenure and number of remaining years before retirement of the party secretaries and number of reform cases in a same province to significantly increase the likelihood of a prefectural level city's environmental centralization reform. Although public environmental activism has become an emerging force, the findings suggest the importance of the political nature and upward accountability in environmental governance and the long standing top-down approach in bureaucratic decision-making in China.

At a global level, although consensus has been reached on the urgency of taking climate action, the international regime, the United Nations Framework Convention on Climate Change (UNFCCC) has failed to announce any binding greenhouse gas (GHG) emissions reduction targets for individual signatory states. The nationally determined contributions (NDCs) combined with voluntarily regular reporting of GHG emissions by each state have become the core implementation mechanisms installed by the Paris Agreement for combating climate change globally. Similarly, the pursuit of Sustainable Development Goals also relies on voluntary commitment and actions by the individual nation states. What China does as a whole has implications for global sustainability.

Given the importance of the prefectural level government in policy implementation in China, decisions taken to (re)partition the responsibilities and/or authorities of prefectural level EPBs vertically has implications for the efficiency and effectiveness of environmental governance and government accountability of the country. By analyzing considerations taken by the prefectural level government across China in deciding whether to centralize the environmental responsibilities, this study can shed light on factors that drive or impede institutional change towards voluntary sustainability initiatives. The lessons learned can inform the organization of environmental protection, carbon reduction, and sustainable development at a subnational level in the future.

Track
Track 6a Urban and regional transformations

Local Sustainability Analysis Revealing the Perceived Relationship between Digitalization and Adaptation in Hungary

Mária Szalmáné Csete

Department of Environmental Economics and Sustainability, Budapest University of Technology and Economics, Budapest, Hungary

Abstract

The measurability and monitoring of sustainability are also linked to improving adaptation to the expected effects of climate change. Adaptive capacity to deal with climate risks is strictly related to sustainability transition on the local level. Enhancement of adaptive capacity implicates complementary requirements as the encouragement of sustainable development. Successful adaptation depends on actions taken at different spatial levels due to vulnerability that can occur at different scales. Improving local knowledge considering sustainability and adaptive capacity can play a significant role in the reduction of vulnerability, especially in the era of the digital transition.

Although Hungary has a national sustainability indicator system, that is revised every two years, containing a total of 103 indicators at the national level, which was developed by the Hungarian Statistical Office to present the status of the four national resources (human, environmental, social and economic), it can be characterized by a number of shortcomings that require further development.

There is insufficient knowledge considering sustainability transition and digitalization-related processes on NUTS 3, moreover on LAU 1 and 2 levels in Hungary. The aim of this research is to provide indicators to promote sustainability on the local level considering the perceived relationship between digitalization and adaptation. Furthermore, improve measures of local sustainability performance in such a way that they are also suitable for taking into account local spatial interdependencies. It can also highlight the dynamics of adaptation and the role of non-climatic factors. Local spatial interdependency is a new approach to evaluate local sustainability performance. Based on the results it can be stated the sustainability performance in a location can be affected by the sustainability condition in its surrounding areas.

These indicators can be used as a monitoring tool and guidance to municipalities' policy-making as well as development programs. Based on Improving local measures in relation to sustainability performance can be pivotal in decision-making processes on the municipality level and is able to foster local solutions from a multidimensional perspective, effectively enhancing adaptive capacity enhancing transformative capacity.

The analyses revealing the perceived relationship between digitalization and adaptation can enhance new insights regarding sustainability transition on the local level. Fostering the practical implementation there is a special need for courage from decision-makers and other stakeholders taking into account this interdisciplinary perspective. The abstract is related to SDG targets 11.3 and 11. A.

Track
Track 6a Urban and regional transformations

Reassessing Urban Containment and Nature Preservation in Spatial Planning: A spatial-institutional analysis of the Green Heart in the Netherlands

Dr Mendel Giezen, Dr. Jochem De Vries

University of Amsterdam, Amsterdam, Netherlands

Abstract

Over the last decades, spatial planning has undergone crucial shifts in both focus and process. Under pressure of neo-liberal forces, processes of decentralization and liberalization have shifted the capacities of national governments to steer spatial developments to local governments and actors. This means that policies such as urban containment and nature preservation are increasingly difficult to steer at higher levels and therefore a higher fragmentation and differentiation of urban development is expected. To analyze the consequences for urban containment and nature preservation, this research combines a Remote Sensing analysis of Landsat satellites with in-depth institutional analysis to see if a relationship can be identified. The results show that building has taken place at a quite constant pace across the decades. It seems that the planning concept has had limited effect in the protection of green space and urban containment in terms of quantity. In part, it seems to relate to the fact that land-use policy is primarily a task for local governments and that without strict regulation individual choices lead to negative cumulative outcomes. However, there are significant differences between municipalities that relate to significant local pressures for the creation of housing and industrial zones. There are several indications that the differentiation in urbanization is also correlated to the development of infrastructure. But it is also clear that different municipalities also chose different strategies in dealing with growth. Some used the green Heart as a mechanism to prevent urban development, while others focused more on growth and living within the Green Heart.

Track
Track 6a Urban and regional transformations

The Structural Violence of Private Electric Automobility

Dr Keyvan Hosseini[1], Dr Agnieszka Stefaniec[2,1]

[1]Södertörn University, Huddinge, Sweden. [2]Trinity College Dublin, Dublin, Ireland

Abstract

Technological transformations are critical components of the systemic change required to achieve climate neutrality. Electrification of the vehicles supported by governmental and intergovernmental panels is considered one of these transformations to reduce anthropogenic dependency on fossil fuels. Currently, many automobile manufacturers have already shifted or plan to shift shortly to producing electric vehicles (EV). Several previous studies show net emission reduction from replacing EVs with internal combustion engine vehicles (ICEV). However, given that in 2019, almost 63% of the electricity was generated in fossil fuels power plants worldwide (68% in the case of China as the biggest market for EVs), we argue that electrification of the private car fleet is a strategy to lose more slowly, not a strategy to fulfill the goal of zero-carbon society timely. Also, EVs cannot solve the problems like car dependence, traffic congestion, as well as traffic accidents, and, eventually, increase inequalities in society. On the other hand, IPCC AR6 reports asserted that the world is running out of time to avoid the worst climate impacts. Therefore, determining which decarbonization strategies are more effective and inclusive is vital for governments' decisions on investment. This research shows that electrification of private automobility is not one of these strategies. We argue that using EVs structurally violates the biosphere and human communities in three forms of 1) production of emissions and pollution, 2) injustice, and 3) spaces of exception. We define the spaces of exception as 'EV Bubble'. It is this bubble that prevents consumers from perceiving the negative socio-environmental impacts of EVs and also gives impunity to manufacturers of private EVs. Finally, we conclude that climate mitigation measures such as moving away from car-oriented culture through compact cities and transit-oriented development, investing in sustainable transport modes and using EV technology in public transportation and commercial services are more effective and should be given more attention and resources.

Targets 11.2, 11.b, 7.a and 3.6

The topic of current research is related to sustainable transport. Sustainable transport has many advantages: it can ensure food security; facilitate access to vital services, such as health, education, and finance; enable inclusive economic growth; empower women and vulnerable groups. Therefore, sustainable transport can support the realization of human rights.

Track
Track 6a Urban and regional transformations

The Sustainable Development Goals and Urban Transformation: City government engagement with the SDG agenda.

Mr Jarrod Grainger-Brown, Dr Shirin Malekpour, Dr Rob Raven, Dr Liz Taylor

Monash University, Melbourne, Australia

Abstract

The Sustainable Development Goals (SDGs) offer a transformative vision for a more sustainable and equitable society by 2030. The SDG agenda is relevant for a variety of actors – from nation states to small communities – but the populations, resources and capacities within cities are particularly important for the achievement of the goals. Since the agenda's ratification in 2015, city governments around the world have been progressively acting towards it, trialling a variety of approaches based on their individual contexts. However, only a small number of these engagements have been formally investigated, with little detail about how they are currently being undertaken, the variations in action between cities or the implications this has for urban transformation (UT). This study aims to empirically map the differing ways that city governments are currently engaging with the SDG agenda, and how these engagements relate to urban transformation.

Cities were selected for study on the basis of their publication of a Voluntary Local Review (VLR), a formal, self-reported tracking document which details a cities actions and progress towards the SDGs. A process of web scrapping was then undertaken to gather additional documents that give further detail about each of these cities SDG engagement (such as city budgets, long-term city strategies, newspaper articles and press releases). In total, 400 documents were gathered in relation to the SDG engagements of 28 cities.

An iterative coding process was undertaken in two parts. First, the VLR's were openly coded to identify the broad ways that the cities were engaging with the SDGs. Second, all of the documents were coded for these engagements, as well as for any practical details about how they were implemented/governed, and for the presence of 15 factors which have been found to be important for UT. This two-part coding process produced a number of results, including: a typology of the SDG engagements currently utilised by city governments, individual charting of the combination of engagements utilised by each city (and the process undertaken to achieve them), mapping of emergent patterns in the engagements based on a number of city characteristics (including geography, wealth, previous experience with sustainable development frameworks etc) and the presence/dynamics/interactions of the UT factors in relation to the different types of SDG engagement.

The combination of these results gives a novel insight into how/why/if city governments engaging with the SDG agenda has any implications for the likelihood of UT. It explores the new forms of collaboration and participation which are being formed across public/private/community groups, the leadership and co-learning occurring across international city SDG networks, and the way that city governments themselves frame the transformative potential of the SDG framework.

This paper relates most closely to SDG11 (Sustainable Cities and Communities) but it is focused on the entire SDG agenda, and how cities and city actors engage with, implement and work towards all of the goals collectively.

Track
Track 6a Urban and regional transformations

Urban Transformation through Decision-making and Governance: The role of actors and institutional settings to achieve urban systems sustainability

Ticiana Ponte, Alexandra Polido, Filipe Teles

University of Aveiro (UA), Aveiro, Portugal

Abstract

Global environmental and social issues (e.g., climate change, growth of new diseases, biodiversity loss, natural resources use and social equity) place new challenges and pressures on urban systems and in its governance. Under local and regional context, it is fundamental to develop holistic approaches that inform a variety of interconnected urban actors, cultures, practices, and places in order to achieve the desired local and global change toward sustainability. 'Urban transformation' is a multi-actor process of structural and radical societal change, with multiple causes, drivers and dynamics occurring simultaneously at different levels (Frantzeskaki et al., 2017), understood as capable of driving urban development towards sustainability goals. This paradigm change is closely linked to understanding the challenges, decision-making processes (e.g., policies, plans, programmes) and governance issues in urban systems. Urban systems governance requires dealing with different public and private actors with divergent interests, different levels of competencies and different political and geographical administrative jurisdictions. Considering this background, the present research was conducted through an integrative literature review in Scopus scientific database using a Boolean set of words related to the broad scientific field of 'systemic change towards sustainability' and urban systems. After a qualitative content analysis, a sample of most cited articles was scrutinized to retrieve information that shed light in answering the following interrelated research questions: a) What are the links between decision-makers, practitioners and stakeholders in policies, plans and programmes that aim urban transformation? And how do these links work? and; b) What are the existing partnerships between urban systems that enable the exchange of knowledge, information and resources)? How are these partnerships formed and how do they work? Results show the importance of the links between decision-makers, practitioners, and local stakeholders in policies, plans and programmes to enable urban transformation toward sustainability and how agency can be a driver of change. It was also possible to better understand the role of leadership in this process. The analyses of the partnerships between urban systems helps to understand how collaboration to exchange knowledge, information and resources can inform urban transformation.

This research has a direct positive impact on priority research areas defined by public policies and in urban transformation research and sustainable development. The main contribution to the topics of the Conference are the research findings related to the role of leadership and inclusive and participative decision-making in policies, plans and programmes that aim urban transformation. The qualitative analysis conducted was based in the knowledge about the determinant role of cultural-cognitive institutions in the study of actor's behavior and agency in urban systems. The study is also very much aligned with the SDG#11 and SDG#16, promoting a better understanding on how to enable inclusive and sustainable planning and management (SDG#11.3) and how to promote positive economic, social and environmental links in national and regional development policies, plans and programmes (SDG#11.a). Moreover, the achievement of the project goals will lead to inclusive and participative decision-making (SDG#16.7).

Track
Track 6a Urban and regional transformations

Full papers

Dynamic Framings of Critical Infrastructure are Needed for Increasingly Complex Environments

Ryan Hoff[1], Alysha Helmrich[2], Abbie Dirks[3], Yeowon Kim[4], Rui Li[5], Mikhail Chester[6]

[1]School of Sustainable Engineering and the Built Environment, Arizona State University, ryan.hoff@asu.edu

[2]School of Sustainable Engineering and the Built Environment, Arizona State University, ahelmric@asu.edu

[3]School of Sustainable Engineering and the Built Environment, Arizona State University, acdirks@asu.edu

[4]Department of Civil and Environmental Engineering, Carleton University, yeowon.kim@carleton.ca

[5]School of Sustainable Engineering and the Built Environment, Arizona State University, ruili11@asu.edu [6]School of Sustainable Engineering and the Built Environment, Arizona State University, mchester@asu.edu

Abstract

Infrastructure – engineered systems that provide basic and critical services – are often viewed as rigid technologies and services. Many infrastructure services are critical to the functioning of society, during periods of stability and instability. The defining of critical infrastructure services drives how emergency resources are allocated and which technologies and processes are prioritized when disruptions occur. As the environments in which infrastructure operate become increasingly complex, instability will grow. As disruptions occur and their nature changes, there must be flexibility in which infrastructure services are deemed critical. A static framing of critical infrastructure is problematic against a backdrop of growing complexity. We hypothesize that there are contextually appropriate management methods necessary to inform proper responses from infrastructure managers as the environment shifts between stability and instability. Yet there remains a dearth of work on how infrastructure management should pivot priorities. We review domains that have shown capabilities to deploy dynamic management approaches in the face of changing disturbances: disaster Response, leadership and organizational change, manufacturing, medical triage, and military and defense. From these domains, we use a qualitative inductive coding approach to identify key themes and categories and analyze capabilities that describe the flexibility to pivot focus and resources with environmental change. We then describe how infrastructure can adopt dynamic management approaches according to environmental context and how the requisite complexity can inspire a dynamic framing for infrastructure managers which may aid in the avoidance of continued lock-in and service failures.

Keywords: Dynamic, Infrastructure, Critical, Resilience, Complexity

1. Introduction

The Anthropocene is creating rapid and uncertain global change (Lewis & Maslin, 2015; Steffen et al., 2015). Infrastructure is a supporting feature for nearly every facet of modern society (Grubler, 1990), but there appears to be a decoupling between changing environments in the Anthropocene and engineered infrastructures, which have typically been designed as rigid under assumptions of relatively stable environmental conditions. Infrastructure, as currently constructed and managed, fail to demonstrate commensurate adaptability to their changing environments (Allenby & Chester, 2018). More often, shortcomings are observed during events such as increasingly intense weather events (A. M. Helmrich & Chester, 2020; Kim et al., 2022; Markolf et al., 2021), the COVID-19 pandemic (Carvalhaes et al., 2020), and cyberwarfare (Chester & Allenby, 2020). "Infrastructure" refers specifically to engineered systems as physical technologies and governance, unless otherwise stated. Furthermore, "environment" will refer to the many external forces that affect infrastructures, including the natural environment, politics, cyberwarfare, disruptive technologies, etc.

As environments become more complex, infrastructures must have a requisite variety (sufficient repertoire of responses) and efficiency must be balanced with resilience (Markolf et al., 2022) to meaningfully engage with this complexity (Chester & Allenby, 2022). As such, adaptability, agility, and flexibility must be key design tenets of infrastructure systems and rigid and optimized designs prove increasingly problematic (Carlson & Doyle, 2002; Chester & Allenby, 2019b; Gilrein et al., 2019). According to the Cynefin complexity framework proposed by Snowden and Boone (2007), today's infrastructures, while complicated, can be understood when considering individual assets. However, at the system scale, where socio-technical interdependencies grow exponentially (Arbesman, 2016), they quickly become complex and exceed human comprehension (Chester & Allenby, 2019a), thus making infrastructure failures ever more unpredictable in terms of scale and scope.

There is an urgent need to protect critical infrastructure with novel management approaches that embrace complexity (Franchina et al., 2021). Infrastructure resilience has evolved to encompass adaptability and graceful failure, besides simply rebound and robustness (Westrum, 2006). Safe-to-fail principles have been proposed as novel ways to design infrastructure for states of chaos when design parameters are overwhelmed (Kim et al., 2019). But how do infrastructure managers prioritize systems that are not safe-to-fail and require active management during states of chaos? In the moment of disaster, how should infrastructure managers decide what gets attention first? Towards this end, we seek to ask: How do organizations that operate in dynamic and complex environments prioritize and decide what is critical in

the face of chaos and disorder? What methods are used? What themes emerge? How can these methods and themes be contextualized for a dynamic framing of critical infrastructure systems?

2. Analysis Approach & Industry Sector Methods

As infrastructure managers do not appear to deploy the capabilities to dynamically define critical infrastructure, a review of cross-industry sectors that appear to have these capabilities was conducted. Five sectors that exhibited dynamic adjustments when faced with disturbances were identified and analyzed: 1) Leadership and organizational change; 2) Military and defense; 3) Medical emergency and triage; 4) Manufacturing; and 5) Disaster response. Focusing on identifying organizational competencies that enable rapid adaptability when faced with unanticipated disturbances, articles were found through academic literature searches for key terms (e.g., dynamic, criticality, edge of chaos, self-organization, decision-making) combined with sector-specific terms. Twenty-nine articles were identified including journal publications, book chapters, and government reports which formed the basis for the analysis.

A thematic analysis – via an inductive coding process – was performed on the literature to identify key concepts from these articles. As inspired by Thomas (2006), inductive coding is a systematic methodology to evaluate qualitative data and generally assumes that the research is inspired by thematic objectives and that these objectives will guide the identification of themes in the text. It is particularly useful when reviewing a large amount of text or literature to derive a model, framework, or theory. In the case of this paper, the goal was to evaluate how the other sectors decide to prioritize critical systems amidst dynamic environments. From this evaluation, a theoretical framework for infrastructure criticality determination can be extrapolated.

Inductive coding follows three general steps: reviewing, coding, and validation (Thomas, 2006). First, the primary researcher read the literature until they were very familiar with it and then performed a formal review of the documents in random order. During the formal review, codes (referred to interchangeably as "themes") were assigned to sections of text that pertained to the research objectives and assigns them as the review progresses (instead of starting with a predetermined list). This was appropriate for this study because dynamism, criticality, and prioritization appear differently across the sectors, which required flexibility for theme identification. When relevant portions of text were encountered, the researcher matched the text with appropriate pre-existing themes or else defined new themes. By the end of the review, the list of generated themes was very long, as is consistent for inductive coding approaches (Creswell, 2002).

The codes were created with four essential attributes: the name, description, associated text, links to other themes, and embedded model type (Thomas, 2006). The name gives a generalized definition of the theme,

while the description provides more detail about what the theme is and how it pertains to the objectives of the study. The theme was associated with a specific set of text, allowing the researcher to revisit the instances of the theme for analysis or associations. Additionally, as the themes were created and assigned, they might have been linked with others, indicating an association with one another. Also, the themes were analyzed for an embedded model type, which describes the nature of how the theme appears in the literature (i.e. hierarchical with another theme, caused by another theme, causal to another theme).

Validation of the results from inductive coding can be accomplished several ways. The first is independent parallel coding, where two researchers complete the same extensive review, and the results are compared. The second is by selecting portions of the literature and providing them to another researcher (or researchers) who understand the objectives of the study, allowing them to independently code the assigned portions, and then comparing the resulting themes to the complete review. The third method uses outside stakeholders and field practitioners to review the findings and give an evaluation of credibility. This study uses the second method with a group of five researchers who were familiar with the objectives of the paper. The five reviewers were assigned one article each and performed inductive coding on the article to identify themes. In all five reviewer instances, the validation coding of each article was very similar to the complete review of the primary researcher, which provided acceptable confidence in the validity of the complete thematic analysis.

Finally, the many themes were analyzed for similarities, subtopics, and associations. This allowed them to be grouped into a generalized list of superordinate themes. These generalized themes form the basis for the model, theory, or framework of the study, and are presented in the results and used in the discussion to inform the research objectives (Thomas, 2006). The analysis from this study yielded forty-six themes which were reviewed and cross-compared for similarities. They were hence grouped into four general themes. Methodical findings and lexicons differ between the sectors, but common themes emerged. The remainder of the methodology consists of a brief description of each sector, the specific methods used in each that pertain to critical prioritization amidst highly dynamic periods, and contextual justifications for why it was appropriate to include this sector in this study towards infrastructure criticality selection.

Leadership & Organizational Change: Leadership and organizational change literature transcends specific industries and describes the culture, priorities, and structures of organizations as they respond to changing environments. The theories and balances between robustness and adaptability for resilience indicate the potential for these principles to inform decisions for dynamic prioritization of critical infrastructure. Organizations have experienced a dramatic number operational transitions, such as the shift from production-orientation to knowledge-production and the associated technological revolutions (Davenport, 2001; Manville & Ober, 2003; Uhl-Bien et al., 2007). These transitions have been entangled with tensions

such as supply chain disruptions due to logistics or dwindling resources, ever-changing consumer demands (e.g., increased awareness of corporate social responsibility to the latest technology), restructuring of workplace dynamics (e.g., dispersion of power to remote work), and competition which pressures the speed of innovation within an organization. These tensions interface in unpredictable ways and can destabilize organizations (Sterman, 1989; Uhl-Bien & Arena, 2018). Organizations have responded to this complexity with adaptability, recognizing they will be operating with some degree of chaos and disruption, utilizing tools such as dynamic decision-making (DDM) (Brehmer, 1992; Edwards, 1962; Gonzalez et al., 2005), contextual ambidexterity (March, 1991; Papachroni et al., 2016; Uhl-Bien & Arena, 2018), and leadership priorities that emphasize innovation (Uhl-Bien et al., 2007). Overall, these theories converge on balancing stable bureaucratic leadership with more abstract entrepreneurial leadership that emphasizes innovation in the face of chaos and the ability of the organization to pivot between efficiency (stability) and resilience as innovation during instability.

Military and Defense: Defense organizations must effectively operate across stable and chaotic contexts and have embraced several techniques for dynamically assessing the criticality of resources and threats. This sector was chosen because the strategic and competitive nature of military planning and decision-making may inspire more proactive strategies or techniques within infrastructure. Military techniques include Dynamic Force Employment (DFE), creating scalable and context-specific capabilities to deploy resources in an increasingly chaotic and diverse landscape (DoD, 2018; Wetzel, 2018). Mission command has also adopted decision-making techniques which encourage collaboration and bottom-up formation of relationships, create continuous dialogue towards shared understanding between stakeholders, and provides clear guidance and empowerment for autonomous decision-making (Deployable Training Division, 2020). Center of Gravity (COG) analysis has emerged as a tool for the assessment of threats and responses, and how those change with context (Mcfadden, 2014; Schnaubelt et al., 2014). COG is the entity capable of achieving or enabling an objective or capability and can represent physical assets (weapons systems or financial institutions), people (individuals or groups), or ideologies (Kornatz, 2016; Perez, 2012). COG analysis first identifies crucial capabilities (crucial enablers for a COG to function). Next, it selects critical requirements, i.e., essential conditions, resources, or means for a critical capability to be fully operational. Lastly, critical vulnerabilities are described where neutralization, interdiction or attack will create decisive or significant effects on the COG. The COG analysis guides the operational response including lines of operation (actions or events that must unfold in a particular sequence) and lines of effort (the linking together of tasks to determine how they will lead to an objective) (Kornatz, 2016; Schnaubelt et al., 2014). The themes presented by COG analysis might provide practical guidance for how infrastructure managers can holistically assess their environment and make strategic selections that are relevant to the most crucial objectives.

Medical Emergency & Triage: Triage is a clinical risk management system employed in emergency departments worldwide based on hierarchical systems of criticality to provide the maximize quality of care for the highest number of patients. Rapid assessment triage methods might contain unique competencies which will help infrastructure move away from rigidity to adaptability. Triage is a process involving the application of clinical guidelines and coordination of educational and development initiatives to patients with varying clinical and social conditions. Multiple triage techniques exist. START (simple triage and rapid treatment) triage system and SALT (sort, assess, life-saving interventions, treatment, and/or transport) are widely used across the United States to incorporate aspects from all existing triage systems into a single overarching guide for unifying the mass casualty triage process (Aacharya et al., 2011). Some medical emergency departments follow common guidelines such as the Manchester Triage System, the Canadian Triage and Acuity Scale, and the Australasian Triage Scale to select patients to be treated based on various discriminators of severity. These different triage systems developed due to increasing resource-consciousness and streamlining of emergency centers across the world based on their existing setting (Dippenaar, 2019). Still others use informal triage systems based on experience, which may be equally as effective as formal structures (Storm-Versloot et al., 2011). Indeed, structured triage systems have been noted to have contextual limitations, such as when patients do not accurately represent symptoms and, in these scenarios, medical professionals use tacit knowledge for final assessment (van Pijkeren et al., 2021). This underscores the necessity for both formal rapid-assessment frameworks as well as high levels of contextual expertise, both of which are likely to be necessary to build a framework for infrastructure dynamic prioritization.

Manufacturing: Manufacturing companies have recently faced a dramatic shift from mass production to mass customization – resembling the shift that infrastructure must make from rigid to adaptable. This shift has forced companies to design unique products for individuals at smaller volumes to win market competition and remain profitable and has created an increasingly volatile manufacturing environment (Hu, 2013). Two competencies that manufactures have adapted in are operational capabilities and technological versatility. For operational capability, manufacturers have increased use of decision support models, incorporating factors such as product costs, unique features, and customer preferences to balance customization and mass production that maintains profits (Xu et al., 2017). These models are often used to inform investment decisions for customized products. A manufacturer inputs a product platform (the modules and parts all common to a set of unique products) as well as customer preferences, features, functionality, weights, and tradeoffs, and feasible product options are identified as an output (Zha et al., 2004). Reconfigurable manufacturing systems (RMSs) have been a revolutionary technological adaption that has increased the ability to manage the volatility of the manufacturing environment demands for increased customization. RMSs are made up of individually reconfigurable machines that can be easily

added, removed, or adjusted to customize products to the demands of customers. RMSs improve the response time to unpredicted events and allow for optimization at both the machine and system level (Yelles-Chaouche et al., 2021). These large-scale, organizational operational and technological shifts are like the necessary shifts identified for infrastructure, forgoing rigid framings and transitioning adaptability, both technologically, operationally, and organizationally (Chester & Allenby, 2021).

Disaster Response: The long-term complexity in disaster response arises from shifting climatic conditions in hazard prediction, coordination of limited resources for disaster response and post-disaster recovery activities, and varying adaptive capacity and vulnerability of affected populations (O'Sullivan et al., 2013). However, when disasters occur, the environment is far too chaotic to understand. The high-stress of these environments underscores the importance of heuristics in decision-making (Sterman, 1989) and thoughtfully crafted and practiced response plans (FEMA, 2021; O'Sullivan et al., 2013). Criticality assessment is often an important decision-making process in disaster response because it helps institutions to identify critical assets for protection in terms of importance, value, sensitivity, associated resource requirements, and interdependencies (FEMA, 2018; Hempel et al., 2018). Traditionally, deterministic methods have been dominant in disaster response decision making, which are based on historical data, experiences, and judgment without explicit consideration of future uncertainties. Some critical values (e.g., water level or flood return period) are often suggested as indices for decision-making. More recently, probabilistic methods have been used to include uncertainties in hazard prediction models as probability terms (e.g., the relationship of dam failure probability and fatality). This approach can be combined with a real-time hazard assessment to reduce the uncertainty in the decision during the occurrence of disaster but require more information and an iterative process to improve the probability models, which can potentially delay the decision (Peng & Zhang, 2013). The nature of disaster response in rapid-paced environments fits very well with objective to advance infrastructure theory of rapid response and prioritization of critical infrastructure – a sign of potential for poignant insight for the objective framework of this study.

3. Theme Analysis Results

The thematic analysis of the literature revealed forty-six codes that were grouped into four overarching themes: 1) Environmental Framing; 2) Actions and Performance Indicators; 3) Organizational Structures; 4) Explicit and Implicit Behaviors. Figure 1 shows the results in the form of a word cloud. The primary overall emphasis of the themes showed that, during chaos, organizations must actively seek to make sense of the environment, practice good communication and openness, pursue adaptive changes constantly, and practice and assess for adaptive capacity prior to chaos ensuing.

3. 1 Theme 1: Environmental Framing

Plans cannot be dynamic unless an organization invests significant effort to make sense of the environment. For example, in manufacturing, lean methods of planning are quite effective when the organizational process and operational environment are fully understood (Hu, 2013). But overreliance on the success of the initial plan can be costly when circumstances change, demonstrated by less flexible mass-production strategies (Yelles-Chaouche et al., 2021). Operating in ignorance of the environment can turn into an inequitable situation both for organizations and individuals. As managers make sense of their environment toward adaptation, they must learn the contextual nuances of how their "product" interacts with the rest of the world, much like knowledge work versus product work (Davenport, 2001). Towards sense-making for disaster response specialists, holistic and equitable plans are built to accurately capture the needs of the community via specific community engagement such as town halls, and workshops (FEMA, 2016, 2021; O'Sullivan et al., 2013). The military emphasizes bidirectional understanding between field and rear commanders and incorporates diverse stakeholder perspective within planning considerations (Deployable Training Division, 2020). Additionally, the tacit knowledge and experience from heuristic learning of lower-level workers or other extra-organizational stakeholders is often undervalued, but can greatly benefit organizational knowledge development and sensemaking when incorporated into strategy building (Uhl-Bien & Arena, 2018). Planning for flexibility and dynamic environments must also be continuous and address significant uncertainties by thinking deeply about unknown unknowns to tease out creativity within the planning process (Schnaubelt et al., 2014; Uhl-Bien & Arena, 2018). The military increased flexibility by planning frequent and unpredictable movements to confuse and disrupt adversaries (Wetzel, 2018). Military COG analysis considers the environment holistically to identify critical capabilities, requirements, and vulnerabilities for COG selection (Schnaubelt et al., 2014).

Environmental Framing **Organizational Structure**

Actions & Performance Indicators **Overt/Covert Behaviors**

Figure 1 - Thematic Inductive Analysis Results

To improve environmental understanding and to anticipate dynamic complexity, modeling was a common practice in multiple sectors. Manufacturers commonly used quantitative uncertainty analysis models (e.g. Markov chains) to simulate the market environment and forecast performance. Oftentimes, the models use multiple objectives to balance performance between competing factors, such as cost, quality, and reliability (Hasan et al., 2014). Emergency managers used utility modeling to inform decision matrices for dam-break evacuation procedures for communities within the potential flood area, demonstrating organizational intentionally of pre-planning and system understanding to assist relevant plan development (Peng & Zhang, 2013). Hempel et al. (2018) created a digital twin of system networks which modeled interdependencies and isolated critical nodes. Additionally, including heuristic learning programming (learning by experimentation) improved manufacturing model resilience, realizing that exact methods are often unrealistic (Yelles-Chaouche et al., 2021).

3. 2 Theme 2: Organizational Structures

There are three types of leadership which have been proposed to foster organizational adaptability: entrepreneurial leadership, enabling leadership, and operational leadership (Uhl-Bien & Arena, 2018). Enabling leadership for the knowledge era should work to break down bureaucratic structures (or at least cooperate with them) to allow innovation to shine through. Operational leadership (bureaucracy) must be balanced with innovation to maintain adaptability. Innovation also requires assistance in transitioning into

the formal organizational structures from enabling leaders. Entrepreneurial leaders need to be technical experts as well as creative, emphasizing importance in human and intellectual capital investment (Uhl-Bien et al., 2007).

The predominance of knowledge work also caused the value of organizations to shift from physical capital to human and intellectual capital. Leaders and managers must take proactive steps to develop employees individually and collectively; this increases organizational commitment, collaboration, and innovation – which build adaptive capacity (Davenport, 2001; Manville & Ober, 2003; Uhl-Bien & Arena, 2018). Historically, casual approaches for personnel assignment in key positions within U.S. embassies and staff headquarters have led to poor training, unfamiliarity with coordination processes, disorganization, and disparate and independent efforts within the military interagency coordination system (Mcfadden, 2014). This emphasizes the importance of human capital investment. Medical triage literature showed direct benefits to emergency department performance when supporting was given to the staff through education, psychological, and ethical avenues was critical to maintaining adaptability for emergency care (Aacharya et al., 2011; Dippenaar, 2019). Similarly, manufacturing linked flexibility in product or production changes to human and intellectual capital investments in learning and knowledge creation, innovation, and valuing personal experience (Hasan et al., 2014).

Adaptive organizations appear to tailor their goals and visions to orient towards relevant adaptability. Leaders and organizations are responsible for ensuring that the goals and mission of the organization are sufficiently flexible, so they remain relevant during chaos. Additionally, proposed adaptions and innovations must be consistent with organizational goals (Uhl-Bien et al., 2007). An example is the shift in American military vision via DFE. The concept informs organizational decisions by leaders from the pentagon all way down to individual unit commanders. Military leaders at all levels are responsible for scrutinizing strategies and adaptions to ensure they are consistent with DFE doctrine (Wetzel, 2018). In addition to goals, adaptive organizations alter internal processes, structures, priorities, methods, and standards and manage bureaucracy as complexity changes. Surprisingly, the formalization of triage did not occur until the 1970, which corresponds to large population increases, and the associated medical needs. Thus, the medical system required a simplified strategy to facilitate decision-making in chaos. This same type of organizational adaption was also observed in the manufacturing with the move from fixed manufacturing systems to reconfigurable manufacturing systems (Hu, 2013). In both manufacturing and triage, simplification and standardization were stated to increase adaptability. In manufacturing, machines and production lines with standardized components and processes allowed for faster reconfiguration when markets shifted (Zha et al., 2004). Similarly, standardization was necessary for both expediency of care and clarity of communication when experiencing influxes of patients (Aacharya et al., 2011). Ultimately, standardization or diversity determination should be made contextually. Standardization may not apply in

sectors where diversity is known to be more adaptable.

Innovation, balanced carefully with operational efficiency is crucial to staving off obduracy. The balance between innovation and efficiency is termed "ambidexterity," and is a fundamental tension between the "Need to innovate and the need to produce." (Uhl-Bien & Arena, 2018). Ambidexterity is enabled by the aforementioned, "enabling leadership" (Uhl-Bien et al., 2007). While essential for adaptibility, organizations often struggle to find personnel willing to step into such a role due to the difficulties of managing bureaucratic structures and facilitating participation and collaboration (Davenport, 2001; Uhl-Bien & Arena, 2018). Manufacturers creatively crowd-sourcing designs from customers to improve market relevance, environmental understanding, increasing knowledge-building, which was counter to previous design cultural norms (Hu, 2013).

3.3 Theme 3: Adaptive Behaviors (Overt and Covert)

Coordination in the form of information flow and interactions – formally and informally – act as counterbalances to organizational bureaucracy. Vertical and horizontal coordination is important for an organization to foster diverse adaptive capabilities (i.e., innovation, understanding, adoption of new methods). Coordination and informal networks were also important ways to funnel adaptations to enabling leaders who facilitate implementation (Uhl-Bien and Arena 2018). During planning periods, disaster management prioritizes knowledge building and sensemaking, enabled by coordination, informal structures, and networking. During the response stage, the prior coordination accomplished during planning reduced confusion amidst the highly chaotic environment (FEMA 2016, 2021; O'Sullivan et al. 2013). In triage, formal and informal communications between staff are critical when assessing patient condition and progress. Open coordination between the technical staff, nursing staff, and medical doctors increases knowledge and perspective for holistic care (van Pijkeren et al. 2021).

Engagement with stakeholders and open communication keeps organizations contextually relevant in dynamic situations. Engagement with stakeholders ensures that representation is fair and equitable and that knowledge and sensemaking are maximized for decision-making (Manville & Ober, 2003). In the military, cross-organizational mission partners, which are are interdependent with one another for objective accomplishment, use mutual stakeholder engagement for information sharing and intentional relationship building (Deployable Training Division, 2020; Wetzel, 2018). Open communication in an emergency department is essential to ensure that flow of patient care is maintained to manage patient stress and anxiety and maximizing patient autonomy when receiving care (Aacharya et al., 2011). In manufacturing, stakeholder engagement was an enabler for innovation, such as sourcing product designs from customers (Hu, 2013) which has how become an industry-wide paradigm shift as market competition increases (Xu et

al., 2017; Zha et al., 2004).

Underlying – and often overlooked – cultural attributes, such as common values, ethics, belonging, shared responsibility, trust and autonomy, help prevent misunderstanding during times of chaos. When bureaucracy or top-down decision-making becomes commonplace, it erodes commitment and willingness to contribute (Davenport, 2001). Conversely, organizations that have "flatter" governance structures experience more participation and shared responsibility because they place a greater amount of trust and autonomy in individuals (Manville & Ober, 2003). Hierarchical trust and autonomy are necessary for successful military operations. Small unit commanders are better positioned to make tactical decisions due to their contextual knowledge; and higher commanders have a greater understanding of the overall strategy (Deployable Training Division, 2020). When this trust is present, participation, shared responsibility and common values enable sensemaking, collaboration, informal structures, networking, open communication, and knowledge building (Uhl-Bien & Arena, 2018). This was poignantly displayed by O'Sullivan et al. (2013) as communities performed disaster planning. When collaboration and community priorities were included, citizens became co-owners of disasters plans and were much more eager to participate.

3. 4 Theme 4: Actions and Performance Indicators

Performance indicators, while not prescriptive, are often helpful in identifying successful behavior. Manufacturing literature was rife with descriptions of complex adaptable system outputs or end states. "A reconfigurable manufacturing system (RMS) is a response system whose production capacity is adjustable to market fluctuations and whose functionality is adaptable to a variety of new products. The design of RMS evolves over a period of time in the wake of customer needs and market demands." (Hasan et al., 2014). Because RMS systems cannot autonomously reconfigure, a successful and responsive RMS is the product of leadership, adaptations, innovations, and coordination. Similarly, excellent disaster response plans and their execution are successful products of stakeholder engagement, open communication, shared responsibility, and common values within the community (FEMA, 2021; O'Sullivan et al., 2013); the real work is done prior to the disturbance. These proactive actions move the organization towards resilience. Organizations that train and practice for uncertainty are more likely to be prepared to react to disturbances (Mcfadden, 2014; Perez, 2012; Wetzel, 2018). Regular training is required to maintain nurse skills, who are the primary users of triage methods (van Pijkeren et al., 2021). Another factor, competition (particularly economic), also drives innovation; and organizations that take offensive action in their competitive environment are more likely to handle chaos adaptively (Hasan et al., 2014; Hu, 2013; Manville & Ober, 2003; March, 1991; Uhl-Bien & Arena, 2018; Zha et al., 2004). Lastly, proactivity in an organization indicates circumvention of chaos altogether. Triage was designed as a proactive measure to save lives on the battlefield during wartime (Dippenaar, 2019). Passivity usually leads to harmful effects for patients –

intentional or not. Triage emphasizes "beneficence" which describes proactively giving positive care, rather than simply, "refraining from harmful acts." (Aacharya et al., 2011).

4. Concluding Framework for Dynamic Management of Infrastructure

The relationships between the four main themes can inform how infrastructure managers can introduce flexibility towards the dynamic framing of critical services. The disturbances experienced by infrastructure systems vary; some disturbances are gradual, while some are more acute. A tornado might rip through a mid-western town, or a pandemic might cause wide-spread and long-lasting supply-chain challenges; but both cause their own variety of chaos until systems begin to understand and adapt to them to manage comlexity. Therefore, the framework, shown in Figure 2, must be specific enough to be helpful, yet general enough to be applicable for a wide variety of disturbances.

4.1 Prior to chaos

Making sense of the environment was the most cited competency for engaging dynamic environments. Additionally, uncertainty modeling is key prior-chaos behavior and is largely focused on aiding sensemaking. Analysis and decision tools like those used by emergency planners for dam breaks (Suo et al., 2021) and for manufacturing system configuration (Hu, 2013) can be used to improve decision-making for infrastructure by providing warning points for when infrastructure systems are on the brink of shifting into a state of disorder (Liu et al., 2021; Pescaroli & Alexander, 2016; Suo et al., 2021). These types of models are common for infrastructure organizations to develop and rehearse with certain high-impact infrastructures, like dams (Peng & Zhang, 2013). But the static nature of infrastructure systems, along with bureaucratic governance structures often stifles innovative or revolutionary decision-making processes (Chester et al., 2020; A. Helmrich & Chester, 2022).

A large portion of the inductive analysis showed that organizations that invest significant and frequent effort in developing and exercising plans are more prepared for chaos. This is especially present in disaster response, where prior-chaos plans and rehearsals of those plans form the foundation for responses (FEMA, 2021; O'Sullivan et al., 2013). During disasters, it is assumed that the environment will be chaotic and that decisions will need to be made dynamically. But static framings for infrastructure, pursuing optimization and robustness as a resiliency strategy (Allenby & Chester, 2018), do not include dynamic-decision frameworks. The National Infrastructure Protection Plan (NIPP) provides a risk management framework, which may be directly compatible with dynamic framings of infrastructure. It prioritizes three domains: physical, cyber, and human systems. As it builds response plans, it follows a linear progression which sets goals and objectives, identifies relevant infrastructures, assesses and analyzes risks, implements risk

management, and measures their effectiveness (DHS, 2013). All these steps are interlinked and provide feedback to support concurrent development of the other steps. This framework also agrees with the proposed framing in Figure 2. Information sharing across all actions and dimensions is consistent with the other literature as the primary enabler for adaptation. We observed that other sectors do not necessarily follow actions in a particular order, but rather they are all operating concurrently and are interdependent with one another. The NIPP framework is focused on developing plans for protection and risk mitigation and could be a helpful tool for infrastructure managers to holistically build plans for chaos.

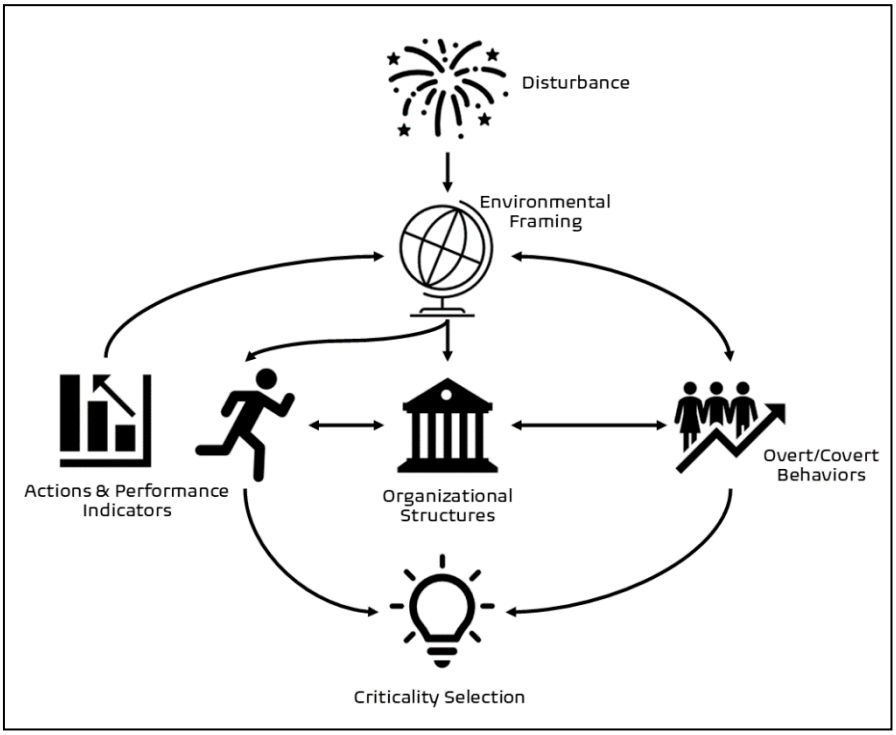

Figure 2 – Framework for Infrastructure Criticality Selection

Adaptation for infrastructure must be intentional. Organizations gravitate towards equilibrium, which breeds apathy. Therefore, adaptation, while necessary, is very uncomfortable and unnatural (Pascale, 1999). Stakeholder engagement, communication, and cross-organizational coordination are oftentimes repressed by naturally occurring bureaucratic control, micromanaging, and a lack of entrepreneurial support. But those organizations that intentionally maintained tension between these forces open up coordination, information pathways, and informal networks (Deployable Training Division, 2020; Manville & Ober, 2003; Uhl-Bien & Arena, 2018). Disaster response and triage literature showed that coordination and communication are essential aspects to proper response (FEMA, 2016, 2021; O'Sullivan et al., 2013; van Pijkeren et al., 2021). Infrastructure, characterized by efficiency and divisionalized structures, often restricts collaboration, and leaves no room for innovation. These challenges might be aided by decentralized

governance structures (A. Helmrich & Chester, 2022).

Lastly, prior to chaos, infrastructure organizations can assess themselves to evaluate their readiness to handle chaos or not and can take actions accordingly. Infrastructure managers can develop specific performance criteria that will show whether a system will be able to rapidly respond. Similarly, the military's dynamic force employment strategy came from assessing the ability to respond to rapidly developing scenarios. Old force employment strategies were not timely – so a new, more dynamic method was proactively implemented. Infrastructure managers can already anticipate that old methods for infrastructure are inadequate; thus they should develop and employ dynamic strategies like, "safe to fail" infrastructure to improve chaos management prior to disturbances (Kim et al., 2019).

4.2 During Chaos

After pre-chaos organizational actions have been completed, infrastructure, similar to medical triage, has historically prioritized "lifeline" infrastructures (Applied Technology Council, 2016a) based on human capabilities and essential needs (Clark et al., 2018). The disaster response sector responds and establishes priorities during chaos via five guiding principles: 1) engaged partnership; 2) tiered response; 3) scalable, flexible, and adaptable operational capabilities; 4) unity of effort through unified command; and 5) readiness to act (DHS, 2019) and also use these principles to guide the planning process prior to chaos (FEMA, 2021). Much like the NIPP framework, these principles are nearly directly applicable to infrastructure and do not require much contextualization.

During disaster response, coordinated, reliable, and actionable information-sharing aids decision-making for hazard mitigation or post-disaster recovery activities among regional, state, and tribal governments, private sector, NGOs, and federal agencies (FEMA, 2016). But infrastructure operation and management are often isolated in discrete sectors regardless of their geographical, physical, or logical interdependencies. Coordinated and real-time information-sharing across different infrastructure sectors accelerates the identification of priorities and interdependencies as well as the response to shifting risk profiles across various systems and institutions governing them. Like manufacturing, infrastructure managers can use crowd-sourced information to simultaneously make sense of the environment, innovate, collaborate, and engage with stakeholders. This knowledge brings awareness of possible cascades as well as who and what is affected (Applied Technology Council, 2016b) – assuming that sense-making efforts began prior to chaos, aided by modeling, scenarios, and stakeholder engagement to explain complexity (Macaulay, 2008). It is important to note that risk and uncertainty modeling in infrastructure is a long-established field of research, much like how manufactures attempt to make sense of the environment by modeling uncertainties which balance customization costs, quality, and reliability (Hasan et al., 2014). However, infrastructure

models have yet to transition to methods that truly reflect adaptability (Chester & Allenby, 2019b; Gilrein et al., 2019). Nuanced models need to be developed for infrastructure systems and combined with holistic stakeholder feedback to ensure that proper "trigger" points are developed, and significantly expand the competence of uncertainty calculations in an increasingly volatile environment.

Infrastructure should also mimic medical triage by prioritizing systems which are most critical to sustaining basic human life (Clark et al., 2018). Infrastructure managers can use this as guidance to make simplified decisions during chaos based on their own version of an infrastructure triage system. Medical triage, during periods of rapid decision making, often uses tacit knowledge and heuristic (intuitive) decision making that comes from experience (Storm-Versloot et al., 2011), which is also confirmed by dynamic decision-making research (Sterman, 1989). The three fundamental categories of medical triage are: 1) can recover without medical treatment; 2) can recover with medical treatment; and 3) will not recover regardless of treatment (Dippenaar, 2019). Mimicking this simple system, infrastructure managers can triage their systems so that the level of environmental complexity is equal to the system capability, much like the law of requisite variety (Chester & Allenby, 2022). This simplicity may allow infrastructure to be triaged much more realistically. Once recoverable infrastructure are identified, they may be prioritized, where the decisionmaker can use critical factors analysis, inspired by the military's center of gravity method to identify networked and interdependent priorities that are critical to the success of objectives (Schnaubelt et al., 2014). As Clark et al. (2018) demonstrated, critical infrastructure cannot be statically prioritized. Infrastructure must be actively prioritized based on the needs and requirements of the people and systems that are being effected during each unique disturbance.

5. Conclusion

In the current global environment, dynamic framings of infrastructure are necessary to move infrastructure towards resilience during chaos. In this study, the insights from other industrial sectors that must frequently shift assets and priorities amidst dynamism were studied. The insights inform how infrastructure might shift framing amidst chaos towards organizational competencies prior to chaos, and then implement more dynamic decisions amidst chaos. These shifted focuses may aid in ensuring that the most critical systems are protected and oversights are avoided during disorder.

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Learnings from Emerging Implementation of Strategic Sustainable Development in a Regional Context

– the case of Åland

Lisa Wälitalo[1], Erica Scott[2], Edith Callaghan[3], Karl-Henrik Robèrt[4], Göran Broman[5]

[1]Blekinge Institute of Technology, lisa.walitalo@bth.se [2]Åland University of Applied Sciences erica.scott@ha.ax
[3]Acadia University, edith.callaghan@acadiau.ca
[4]Blekinge Institute of Technology, karl-henrik.robert@bth.se
[5]Blekinge Institute of Technology, goran.broman@bth.se

Abstract

An implementation model for a systemic, systematic, and strategic approach to integrate sustainability across sectors has been tested and developed further within a four-years action research project. Valuable insights on how the approach can be best introduced to facilitate broad application can be gained already from test uses of the preliminary model and this study aims to evaluate and learn from one of the regions participating, Åland (an autonomous protectorate of the Republic of Finland). With a comprehensive sustainability initiative for the whole community, including funding and human resources in place, Åland had particularly favourable conditions and came out as best practice in the research project. We examined what had been done and how initiatives have been received through interviews with process leaders and stakeholders from different sectors of society and through desktop reviews. Key success factors and challenges for the work were put in relation to elements of the implementation model. Indeed, the work has come a long way in terms of collaboration platforms and structures, and much can be learnt from at the Åland case. However, parts of the strategic sustainable development (SSD) perspective are seemingly forgotten or in hibernation. Reintroducing and reinforcing concrete SSD informed processes and support could arguably address several of the expressed challenges while making use of key success factors, such as the capacity building centre.

Keywords: Urban transition, Strategic sustainable development, Municipalities and Regions

1. Introduction

Sustainability transitions in local and regional societies are complex. Indeed, due to the dynamic sustainability challenge itself (Steffen et al., 2015, 2018), but also due to specific attributes described by Kubisch et al. (1995) and summarized by Forrest & Wiek (2014, p. 69) as: ”Horizontal complexity (cross-

sector); vertical complexity (individuals, households, communities); exogenous influences (economic, political, etc.), dynamic processes (initiatives unfold and evolve); breadth and diversity of outcomes (temporal, spatial, physical, social); and community uniqueness (limiting comparative approaches to evaluation)" (Forrest & Wiek, 2014, p. 69).

In respect of such complexity, the framework for strategic sustainable development (FSSD) is an attempt at a unifying methodology in support of a systemic, systematic, and strategic approach to sustainability transitions (Broman & Robèrt, 2017). It is based on 30 years of research and development among academics and practitioners. It has been implemented widely among companies, municipalities and other organizations and lately there has been an attempt to more systematically capture learnings from such cases to create a complementary implementation model, especially to better support cross- sector, multi-actor collaboration (Robèrt et al., 2017; Wälitalo et al., 2020). Previous studies of sustainability initiatives within local and regional settings demonstrate the importance of several elements inherent to the FSSD and its implementation, such as a synergistic, cross-sectoral approach based on continuous learning (Bryant & Thomson, 2020; Collier et al., 2013; Galderisi et al., 2020; Wittmayer et al., 2016), the necessity of a common vision and meta-governance (Frantzeskaki et al., 2014; Meuleman & Niestroy, 2015) and the need for a systems perspective and diversity in actions based on context specific needs (Hatuka et al., 2018).

The implementation model of the FSSD at Åland is a particularly interesting case since this region has come far in its sustainability transition according to many, for example being winners of The European Sustainability Award 2019 (Bärkraft.ax, 2022e) and should lend itself well for scaling up to national levels as Åland includes several municipalities held together by a government and a parliament. Thus, the aim of this study was to both evaluate the work at Åland through the lens of previous experience captured in a preliminary implementation model (see section 1.1) and to learn from experiences at Åland to strengthen the basis for further refinement of the model. The following research questions guided the work: (i) what was done, or not done, in terms of specific strategic sustainability work? (ii) how was work interpreted and received? (iii) what helped facilitate the work (key success factors)? and (iv) what hindered the work (key challenges) in relation to what happened? Answers to these questions in the Åland case were believed to help us build on previous work and formulate further guidance for future implementation of the FSSD in municipal and regional contexts.

1.1 Preliminary implementation model

Two main features of the FSSD are a universal principled definition of sustainability meant to provide the boundary conditions for any sustainable vision (the sustainability principles) and an operational procedure for co-creation of strategic plans with actions towards such vision (the ABCD procedure). The definition consists of three principles for ecological sustainability and five principles for social sustainability (Broman & Robèrt, 2017).

The ABCD procedure prompts the users to (A) learn about the FSSD, build a shared understanding of the system in focus and its dependencies of surrounding systems, and based on this, agree on a preliminary vision of success within the constraints of the sustainability principles; (B) assess the current reality in relation to the principle-framed vision (backcasting), identifying the gap between the two states; (C) find innovative measures that can bridge this gap to the vision and (D) prioritize those measures within a strategic plan. The procedure needs to be repeated iteratively to adjust the plan as, e.g., contextual conditions change (Broman & Robèrt, 2017).

A preliminary model for implementation of the FSSD in cross-sector, multi-actor collaboration is schematically illustrated in figure 1. It is important that all actors in all sectors have a shared definition of sustainability serving as a boundary for their co-creation of visions and overarching goals and a structured procedure to support their co-creation of plans with actions. This allows for municipal and regional actors to actively take part in the work and coordinate the use of supplementary methods and tools for decision support, monitoring, and communication of progress (Robèrt et al., 2017).

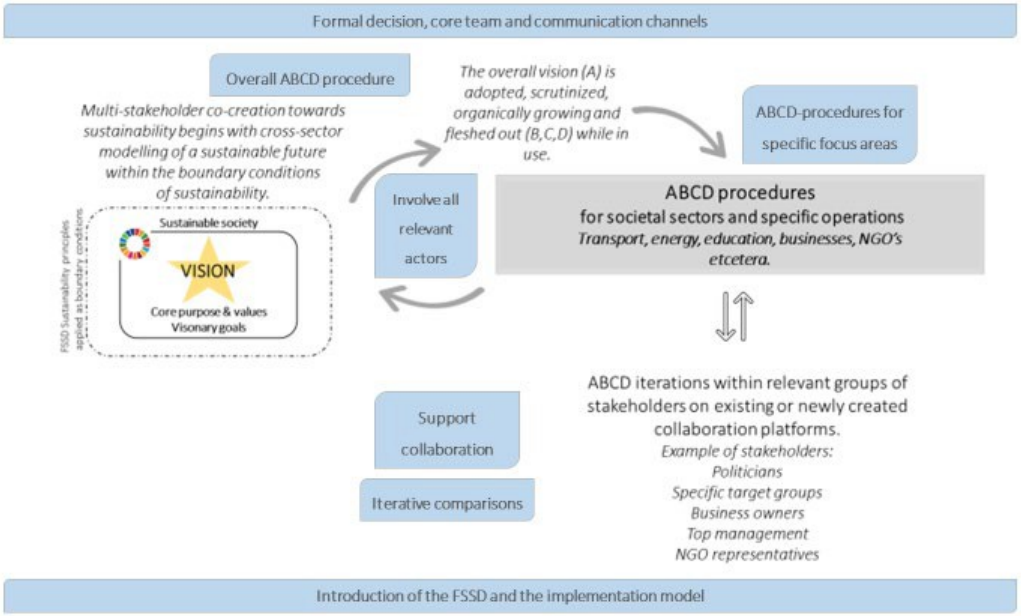

Figure 1. *Simplified sketch of a preliminary implementation model for the FSSD. Based on (Robèrt et al.,*

2017).

The implementation model explicitly stresses the importance of iterative cross-sector learning by doing, i.e. the contents under A, B, C and D, respectively are allowed to iteratively and dynamically be modified as strategic plans unfold in, and across various organizations, sectors, and the whole community. The ABCD procedure allows for separate planning of specific operations in organizations as well as for 'comparing notes' between organizations to guide cooperation and optimization over scales. This work is inherently strategic at ta macro level, so it is important that leaders are made active part of the cross-sector iterative learning and co-creation (Broman & Robèrt, 2017). This is also crucial for the systemic, systematic and strategic approach to last over time (Wälitalo et al., 2022).

The implementation model figure 1 attempts to summarize how the ABCD procedure can be used iteratively to inform stakeholder groups to, together, cover particularly essential elements of knowledge for modelling of sustainable futures and setting plans in motion to get there, individually and in dialogues between them. Elements considered essential for implementation of the FSSD (Wälitalo et al., 2020), as indicated in the figure, are further described below. An important note is that no specific order by which the elements should be is prescribed. The tactic of implementation is context dependent and should build on previous work. The work can start small with specific ABCDs for later merging into larger cross-sector approaches, or big with a formal decision and a large scale cross-sector kick- off, as in the case of Åland. Still, to successfully implement the FSSD for strategic action for sustainability in a municipality or region, the following essential elements should eventually be in place:

- A formal decision to apply the FSSD (along the implementation model) is made by the highest council, a core team tasked to lead and facilitate the implementation is appointed, and communication channels are established.
- The FSSD (and the implementation model) is introduced to all involved. This part is part of continuous capacity building as people are recruited into the work.
- Overall ABCD procedures are performed repeatedly which are deepened over time.
- ABCD-procedures for specific focus areas or organizations are performed repeatedly, which are deepened over time.
- All relevant actors in all relevant sectors are involved over time.
- Collaboration is supported through formal and informal structures and networks and decision makers' active participation is ensured.
- Iterative comparisons are performed between organizations, sectors, and specific plans, making use of the ABCD as a common structure to find ways forward together.

1.2 Åland

Åland Islands is an autonomous part of Finland celebrating 100 years in 2022. It consists of about 6500 islands and has about 30 000 inhabitants and has 16 municipalities. The Åland economy relies heavily on shipping, agriculture, banking, and IT. Åland has a government and a parliament. This means that Åland could be considered a (micro) state, including a responsibility to adhere to EU legislation. The exceptions are that foreign policy and national taxation are determined by the Finnish state.

From 2011, Åland has set out on a journey to implement the FSSD to guide its transitioning towards sustainability (Committee Transition Åland, 2013). Many municipalities and regions worldwide have worked with the FSSD in specific projects and to various degrees across sectors (e.g. P. H. Ouden & Gal, 2014; Resort Municipality of Whistler, 2007; SEKOM, n.d.), but Åland is the first attempt to implement the FSSD on a national level.

The process of transitioning Åland as a society has evolved step by step over the years regarding organization, structure, competence development, collaboration, and resource allocation. There was no masterplan from the beginning, only a commitment towards a vision of a sustainable Åland 2051 and a decision to use the FSSD to guide the work. The work today involves hundreds of people in different sectors and with different decision-making power all the way from the politically elected Head of Government to businesses, academia, third sector actors and the wider citizens' community. The past 10 years of experience provide valuable insights and learnings for other regions and this moment in time is good evaluation point for Åland itself.

2. Methods

To understand what was done in terms activities in relation to the elements of the implementation model described above, we studied documented material in a desktop review and conducted semi-structured interviews with process leaders and stakeholders. Key success factors and key challenges were sought for the purpose of finding potential confirmation as well as potential needs for improvement of the model.

2.1 Desktop review

The main source for the desktop review was the website for the established collaboration network at Åland, bärkraft.ax (Bärkraft.ax, 2022d). From this site, several other relevant documents could be found, such as the Development and Sustainability Agenda (Bärkraft.ax, 2017a) and yearly status reports (Bärkraft.ax, n.d.). The information found was cross-checked with process leaders at Åland to confirm its validity. Website text and documents were reviewed by scanning for 'evidence' in relation to each key element of the implementation model described above.

2.2 Semi-structured interviews

Based on semi-structure interviews with three process leaders at Åland, 30 potential additional interviewees were identified and approached. Convenience sampling across public, private and the third sector (NGOs) was utilized. A broad representation across stakeholder groups was ensured. Because of its size there was higher participation in the public sector. Our selection criteria for interviewees from public sectors were that they represent various types of operations, such as exercise of authority (e.g. government, parliament, police) culture, education, healthcare, and municipal administration. In addition, both people with significant experience and insight in the strategic sustainability work and people with little to almost no experience and insight were interviewed.

Fifteen people agreed to be interviewed, each interview lasted 30 to 60 minutes and took place online (via Microsoft Teams). An invitation and ethics information (GDPR: https://gdpr.eu/) had been sent to each interviewee beforehand along with information about the study. The interviews were recorded and transcribed with support from an AI-tool (Sonix) and later reviewed to correct errors. The interviewees were anonymized.

The questions were developed to not require any pre-knowledge of the implementation model and were phrased in general terms to gain insight of the interviewees perspectives. For example, *how were you introduced to the work? Did you take part in any trainings? Are you aware of any important support and tools? What do you believe are key success factors of the development and sustainability work at Åland? What has been challenging and could perhaps have been done better? What do you think is needed for Åland to succeed in line with the Development and Sustainability Agenda for Åland?* If the interviewee seemed to be familiar with the FSSD terminology, then more precise questions were asked, such as *what is your opinion of the methodology applied?* The goal was to understand how they have received, interpreted and been part of the work done so far, and what they considered to be key success factors and challenges. Starting each interview, the stakeholder got to rate how experienced they are in Åland's development and sustainability work on a scale of one to ten, and state if they felt satisfied or not with that level of experience.

2.3 Data analysis

Two analysis processes took place. The first was intended to give an understanding of alignments and misalignments of Åland's work in relation to initially intended work for the FSSD implementation, including how the intended implementation was received and interpreted by process leaders and stakeholders. Building on this first analysis, the second analysis was intended to give a deeper and more nuanced understanding of key success factors and challenges noted by process leaders and stakeholders,

considering their pre-understanding, for us to be able to better judge if a challenge was likely related to insufficient application of one or more of the essential elements stated in section 1.1, or if particular elements were themselves seen as challenging. Insufficient application of an element could be due to the latter, or other reasons.

Interview transcripts were analysed by using the software Atlas.ti and quotes were linked to relevant element and coded as either factors reflecting specific activities, key success factors or key challenges. A memo was commonly also noted in relation to each quote to support development of a synthesis.

3. Results and Discussion

For each of the seven model elements presented in section 1.1, a summary of activities, key success factors, key challenges, and noted alignment/misalignment to the element are provided in table 1. In the running text we discuss potential relations between success factors, challenges, and the elements of the model. We conclude by discussing our learnings and how that could influence forthcoming development of the implementation model.

Table 1. *Summary of results from desktop review and semi-structured interviews with process leaders and stakeholder. Challenges related to insufficient application of the element are marked in italics*

ELEMENTS	ACTIVITIES	KEY SUCCESS FACTORS	KEY CHALLENGES	ALIGNMENTS/MISALIGNMENTS
A formal decision to apply the FSSD (along the implementation model) is made by the highest council, a core team tasked to lead and facilitate the implementation is appointed, and communication channels are established	• 2011: an all-party political campaign for a more systemic, systematic, and strategic leadership approach for sustainability • 2012: an all-party committee was tasked to develop a strategy • 2014: approvement of the strategy 'Transition Åland - Strategic Planning for a Sustainable Future 2013-2051' • 2016: Launch of the network Bärkraft.ax, formation of core team and Sustainability council • 2017: A communication strategy was launched	• Competent people run processes • Consensus in Åland society • Good and repeated communication • Initial decision at the highest level • Perceived support from Agenda 2030 • The created procedures and structures provide a foundation • The Sustainability Council manages change of political majority	• Endurance long-term • To find structures that uphold democratic processes	Alignment • Broad basic knowledge and understanding of the development and sustainability work at Åland. Well-established organization. Misalignment • The process management does not highlight the ABCD procedure as a common planning structure to a sufficient extent
The FSSD (and the implementation model) is introduced to all involved. This part is part of continuous capacity building as people are recruited into the work	• Initial trainings in the FSSD for the all-party committee • Competence building activities on the FSSD at launch of Bärkraft.ax • The sustainability principles background material for visioning process • Mandatory 3-hour introduction to the FSSD for the government administration • Basic introduction to the FSSD core elements linked to	• Sustainability principles are well communicated and spread (project leaders)	• *Gaining peoples interest and understanding for specific methods (such as the ABCD)* • To know and clarify what type of information people in different roles want and need • *To spread knowledge about the function of the sustainability principles* • *To spread knowledge of how to work strategically together and avoid goal conflicts*	Alignment • The sustainability principles are adopted as a definition and well spread Misalignment • The function of the sustainability principles as boundary conditions in combination with how to apply them (the ABCD procedure) are not systematically introduced, nor communicated as a common

ELEMENTS	ACTIVITIES	KEY SUCCESS FACTORS	KEY CHALLENGES	ALIGNMENTS/MISALIGNMENTS
	some specific ABCD procedures			planning procedure that would concretize the Åland Agenda.
Overall ABCD procedures are performed repeatedly which are deepened over time	• Solid process for developing vision, applying the sustainability principles (A) • Vision presented in Åland's Development and Sustainability Agenda (A) • Vision well-known (A) • Yearly status reports produced whereof the first based on the sustainability principles (B) • Several brainstorming procedures (C) • Development of action road maps (D)	• Common and supported vision • 24 main indicators for follow-up	• *Taking the sustainability perspective in political debates is difficult* • *Lack of comprehension of the stepwise journey* • Stuck in planning, want action • The comprehensive work is difficult to grasp • *Too much focus on ecological sustainability* • *Åland's smallness complicate how to address the biggest gaps for sustainability (such as shipping and agriculture)*	Alignment • The overall A-step and developing of the vision and initial work on status reports (as part of the B-step) applied the sustainability principles Misalignment • Succeeding steps of the overall procedure and iterations have not been based on the ABCD procedure
ABCD-procedures for specific focus areas or organizations are performed repeatedly, which are deepened over time	• Specific ABCD procedures performed to a varying extent (see section 3.4)	• Sub-goal 7.2, that organizations work towards keeping their goods, services, and purchases within the sustainability principles • Main indicator #23 measuring number of organizations that report their sustainability work in annual reports.	• Concrete action more rewarding than systematic analysis • *For managers to translate abstract goals to operational services* • Frustrating to be in the frontline, no good examples to follow • To actively involve operative organizations • *To bridge built-in silo structures* • To gain interest in ABCD • *To find balance between strategic work and concrete actions* • *To integrate a sustainability perspective into daily practices*	Alignment • Some example ABCDs as inspiration and the Sustainability pilot function as potential capacity building center for the ABCD procedure Misalignment • The ABCD procedure is currently not communicated as a common planning procedure

ELEMENTS	ACTIVITIES	KEY SUCCESS FACTORS	KEY CHALLENGES	ALIGNMENTS/MISALIGNMENTS
All relevant actors in all relevant sectors are involved over time	• Initial decision emphasized the importance of working together • Initiatives to create societal contract and to engage civil society and business • Establishment of Bärkraft.ax • The Bärkraft.ax day • Establishment of Sustainability Council • Low thresholds to join different networking groups • Establishment of the Sustainability pilot function	• General awareness among citizens • The Agenda is available for many • Ideas, actions, and hard work to include as many as possible • Involvement of informal leaders • Large business organizations are active • Small scale favor collaboration	• Changing habits and behavior is hard • *Finding ways for continuous capacity building on how to integrate sustainability into operations* • The Bärkraft.ax work can be interpreted as fuzzy for an outsider • *The more hands-on work, the more difficult to apprehend abstract goals* • Time consuming, but necessary, to introduce new people • To actively involve operative organizations • To make new people feel ownership • *To make the work concrete and real for specific actors* • To reach uninitiated or uninterested groups • To take advantage of momentum	Alignment • Åland's work with inclusion and participation is an inspiring example of this element Misalignment • Involvement has so far only happened at an overall level and are not generally evident in specific ABCD procedures
Collaboration is supported through formal and informal structures and networks and decision makers' active participation is ensured	• Well-developed formal collaboration within the network Bärkraft.ax through support functions and structures for collaboration (see table 2)	• Consensus in Åland society • Different type of trainings provided • Gear shifting between decision-makers and stakeholders through active participation • Government leaders adopted systems thinking • Inclusive, relatively equal terms for people • Large business organizations are active	• That sustainability as a concept become political • To keep business leaders active even when work is delegated • Too much administration, at the expense of more straight forward work • To strike a balance in the distribution of power	Alignment • Formal structures and role descriptions to facilitate collaboration fosters also informal collaboration Misalignment • Collaboration is not informed by a strategic sustainable development perspective

ELEMENTS	ACTIVITIES	KEY SUCCESS FACTORS	KEY CHALLENGES	ALIGNMENTS/MISALIGNMENTS
		• Small scale favor collaboration • Step away from person dependence • The collaboration network Bärkraft.ax • The common vision gives a higher purpose to daily operations • The created procedures and structures provide a foundation • The different networking groups • The teams in charge of the respective strategic goals		
Iterative comparisons are performed between organizations, sectors, and specific plans, making use of the ABCD as a common structure to find ways forward together	• Procedures for Sustainable freshwater	• The collaboration network Bärkraft.ax facilitates general comparisons	• *To go from sharing and inspiration to concrete work where it matters the most* • To strike a balance in time invested for potential collaboration	Alignment • Bärkraft.ax has set the foundation for more systematic comparisons Misalignment • Iterative comparisons between organizations and sectors have not been implemented in a systematic way

3.1 Element 1: A formal decision to apply the FSSD, core team and communication channels

Activities. Following the decision in parliament to initiating a journey inspired by the FSSD, steps were taken to form a broad societal contract for the development of the strategic process and the realization of the vision of a sustainable Åland 2051. Because Transition Åland was initiated by politicians, the realization of this strategy received high political support. Nonetheless, the first few steps were somewhat tentative, and the initial work depended on one person (one of the key process leaders) who was tasked with setting up a societal contract. This key person within the government administration left the position and was replaced by a new person after one year. However, the path and groundwork had been set for the establishment of the societal contract.

As part of the process to structure and formalize a broad societal contract the network Bärkraft.ax was launched in 2016 as a platform for grass roots engagement through civil society organizations to offer a voice for citizens' movements (Bärkraft.ax, 2022b). Regular meetings update and coordinate the work among the members today called the 'Bärkraft.ax Day'. The Sustainability Council currently has 14 members and is responsible for overseeing and driving the Åland's Development and Sustainability Agenda' (the Agenda or the Åland agenda from here). Each sector chooses their own representation and the chair of the council is the Head of Government (Bärkraft.ax, 2022f).

Initially, the core team consisted of one person and a handful of people offering support from different positions within government, government administration and NGO: s. In line with the process development the core team has also developed over time based on different needs, experiences and competences required to support the process (see also section 3.6). The network is the hub of coordination and communication regarding the implementation of the Development - and Sustainability Agenda. The goals for the communication were that 80% of all people over the age of 13 should have heard about the vision by 2018, and that 50% of all people have by 2020 started to act in a way that supports the vision and the goals (Bärkraft.ax, 2017b).

How have activities been received and interpreted? Interviews with societal stakeholders gave a relatively solid picture of broad knowledge and understanding of the development and sustainability work at Åland, at least at a basic level. Being asked to judge their own knowledge about the work of Bärkraft.ax from a scale from one to ten, the stakeholders answered between three and ten, with an average at seven. All were satisfied with their own knowledge, and several said they knew where to find more information if needed. Arguing that the first decision to act upon transition was relatively easy to take, one stakeholder reflected upon the need for everyday-decisions based on basic sustainability knowledge to have concrete significance in terms of upcoming transitions within different areas (e.g. shipping) - *'what are the big, concrete, decisions needed for us to succeed*'? (Interviewee 5). One of the process leaders argued that for

this work to sustain long-term '*commitment and the common view that one must work with these issues as Åland society as a whole*' must stay present (Interviewee 11).

What were key success factors? Key success factors mentioned by stakeholders touched upon themes such as the UNs Agenda 2030, communication, competence, consensus, decision, policy, and structures, see table 1. One stakeholder representing large businesses at Åland said that it has been '*a very thorough process and it was a very good anchorage. They had everything from political support ... they invested ... they hired people who could coordinate and so on*' (Interviewee 12). Stakeholders also acknowledged the perceived support from the global level (Agenda 2030) that encourage to put effort into their own work: '*we have these UN sustainability goals which make you feel that it is something that the world has adopted and that we want to follow. It exists globally, so it's important'* (Interviewee 2).

What has been challenging? Challenges mentioned were mainly about how to keep up the work long- term and the importance of maintaining democratic processes. While emphasizing the brilliance in the set up and effort put into the Bärkraft.ax network one stakeholder reflected upon the importance to discuss details, '*... for example that the Sustainability Council has received a fairly large focus in this work. They are not appointed on the people's mandate, so in terms of democracy it can be discussed.'* (Interviewee 6). Further, in spite of the well anchored approach, several stakeholders emphasized potential political shifts over mandate periods as a challenge over time. Expressing this concern one stakeholder said: '*After each election, perhaps you should be able to get an assurance in some way. I do not know, but it might be good because time goes by. Even if there are some who are left, it is probably also the case that you may not feel bound if you are a new member of parliament who has other ideas*?' (Interviewee 2).

3.2 Element 2: The FSSD (and the implementation model) is introduced to all involved

Activities. Initial training helped facilitate the understanding and discussion of the strategy proposal of the committee, i.e. what are general strategic elements of working with sustainability and what questions belong to the political party conversation. In 2016, competence building activities on the FSSD guided the setting up of workshops and stakeholder dialogues.

Following the first Forum in 2016 with two hundred participants from all sectors, the invitation was extended to experts and civil servants representing key areas of society to provide their input on a vision and overarching goals for Åland. The sustainability principles were provided as background material and available on the website, but no training or other guidance was offered to the experts asked to give input.

How have activities been received and interpreted? Nine of the stakeholders had some knowledge about the sustainability principles while three were not familiar with them at all. Six had some knowledge about the ABCD procedure and of those, three had taken some kind of training about the FSSD. One of the relatively more active stakeholders, familiar with the ABCD procedure, acknowledged that training has come across as a one-time occurrence and not as something systematically introduced (Interviewee 2).

What were key success factors and challenges? Process leaders highlighted the need for sustainability principles to be as well communicated and widely understood as a key success factor. However, gaining peoples' interest in concretely applying the principles (through ABCD procedures), to develop understanding their function, and to provide people with sufficient information and trainings (see table 1) were mentioned as challenges by one well-informed stakeholder who had participated in specific trainings. This was partly confirmed by other stakeholders' lack of understanding and knowledge of the FSSD core elements. Illustrating the challenges of sustaining of people's interest, a stakeholder (Interviewee 6) rhetorically asked '*'Should nurses be trained in sustainability principles, or should they be trained in wound care?* And continued saying *'My opinion is that the backcasting method itself is quite forgotten. When the sustainability Agenda came, one of the big points that was launched was that now we have a common tool that we can work according to. But I would say that the ABCD method ... I hear very little buzz about it at the moment…a practical matter is in fact that the sustainability principles are almost an obstacle sometimes because people get stuck in applied use of them, due to a lack of training. For example, without an insightful moderator, a fish farm may be difficult to assess against the principles of sustainability, which makes it ignored instead.'* The understanding and acknowledging of the sustainability principles applied as boundary conditions for problem solving and design of futures is not generally present in politics (Interviewee 6).

3.3 Element 3: Overall ABCD procedures, repeated and deepened over time

Activities. The Åland Agenda (Bärkraft.ax, 2017a) including the common vision was presented at the second Bärkraft.ax Day in September 2016. Approximately two hundred people and a diversity of sectoral interests were represented among the contributors to the development of the Agenda. Several idea generating workshops and occasions were part of the process. The vision is framed by the sustainability principles which are described in the Agenda and seven overarching sustainability goals were developed (Bärkraft.ax, 2017a, p. 9).

Over the years the vision text has been kept the same. However one goal has been revised. All of the seven goals have sub-goals which have been revisited and revised to some extent for clarification and update. This is all part of an iterative process of refinement in line with experiences and new knowledge. According

to a study published in 2020, 66% of the respondents stated that they know about the vision and of those 62% declared that they understand the purpose and meaning of the vision (*Bärkraft.Ax*, 2020).

To analyse current reality in regards the sustainability principles and follow up on progress, the first status report was published in 2017 (Bärkraft.ax, n.d., 2017c). Since then, yearly status reports have been published with data for indicators for each specific strategic development goal. However a baseline analysis based on the sustainability principles has not been repeated. The status reports are developed by the Working Group for Coordination and Reporting.

Action roadmaps for each overarching goal have been developed in order to close the gap between current reality and the vision (Bärkraft.ax, 2022c). They include short and long term actions and are regularly revisited. Actors from all sectors of society are responsible for different actions. The process for the development of the roadmaps have differed between the goals. Some processes have included broad invitations to all parts of society and others have targeted mainly experts.

How have activities been received and interpreted? Based on interviews, the vision and the Åland Agenda are well-known. All stakeholders referred to the vision in some way, also those who were not particularly familiar with other work of Bärkraft.ax. Some of the more knowledgeable interviewees mentioned more detailed information that could be related to the steps of the ABCD procedure at an overarching level, such as the roadmaps and the 24 main indicators that have been developed to follow- up on the work done. Still, when asked about if and how the ABCD procedure and the sustainability principles are present in iterative planning loops, it became clear that this is now secondary to the continuous development and implementation of the Agenda rather than the opposite way around and that it is to some extent now considered redundant. Regarding the sustainability principles, one process leader said that '*they [the sustainability principles] have actually been realized in that we have developed both the seven strategic development goals, but also sub-goals and the roadmap. There they are permeated*'. This view was confirmed by a politician saying '*My opinion is that when the sustainability agenda was launched at the first Sustainability meetings, this ABCD method had a very strong focus. Then you were invited to workshops, and it was always the case that you would work according to that method. But I think it has been lost to some extent ...*' (interviewee 6).

What were key success factors? The development of a common vision that everyone supports is a clear key success factor for the strategic sustainability work at Åland and were emphasized by a majority of the stakeholders as well as by process leaders. Process leaders also emphasized the structures in place for how indicators have been developed and the production of the yearly status reports as key success factors.

What was challenging? Challenges mentioned related to political debates, the stepwise journey, to get to

action, to grasp the comprehensive approach, to embrace also social sustainability and the smallness of Åland (see table 1). For example, a frustration, according to one of the stakeholders, is when sustainability as a concept becomes an issue in the political debate in terms of if the work 'is worth it or not' due to the perceived unmanageable journey: '*…it is assumed that 'here we are now' and that the next step is perfection*' (interviewee 6) when it is in fact about following a very pragmatic iterative and step by step procedure. In addition, there is possibly too big a focus on ecological sustainability and too little on social sustainability, according to the same stakeholder, speculating if '*it is easier to engage in issues that are harder, or even impossible, to address? Then one can complain and point towards 'someone else'...*'. Similar thoughts were expressed by one of the process leaders saying that solely referring to the sustainability principles (and not how to apply them in planning [authors note]) '*creates frustration in individuals who have big sustainability ambitions, it becomes difficult in meetings with people who have other priorities' because it turns into a discussion of 'either or' rather than stepwise approaches 'for both'.* To that end, a process leader emphasized that politicians need support to make inconvenient decisions. Arguably, the dialogue and planning according to the iterative ABCD procedure would provide such support [authors note].

3.4 Element 4: ABCD procedures for specific focus areas or organizations, repeated and deepened over time

Activities. There have been a few specific ABCD procedures performed (see Appendix A). The degree of implementation ranges from just mentioning the Åland vision, the seven goals and the sustainability principles, to full scale strategic ABCD work including a cross-sectoral approach for stakeholders and experts. There are also examples of ABCD-like work in relation to the seven goals and/or the sub-goals but without clarifying the framing by the sustainability principles.

How have activities been received and interpreted? From stakeholder interviews, the importance of incorporating and streamlining the Ålandic goals into daily operations were expressed by many (Interviewee 4, 9, 11, 12). However, and again, iterative ABCD procedures for this, as the implementation model suggests, have subsided over time. Coherently, there is no evidence revealed by stakeholders of a clear systematic application of the ABCD procedure across sectors, organizations and focus areas, nor any signs of common understanding of how the principles and backcasting (structured through an ABCD procedure) could support actors in specifying the Agenda based on their specific purpose, goals, and prerequisites.

When prompted during interviews, the Sustainability pilots for the Bärkraft.ax network (see section 3.5) were by some of the well acquainted stakeholders referred to as the function that could support capacity-building and facilitate learning processes and thus support successful implementation of Åland's vision

for specific organizations and focus areas. However, this has not been adopted as a general approach. Although, one stakeholder that had followed the Åland work since the start, and highly endorsed all achievements so far, said that '*I think that such a methodology [how to apply the sustainability principles] is something we would need'* (Interviewee 9).

What were key success factors? On the question of whether there is any support for organizations to apply the sustainability principles, one of the process leaders emphasized as a key success factor that one of the sub-goals, number 7.2, state that all organizations '*work to ensure their operations within the sustainability principles*' (Bärkraft.ax, 2017a). In addition, the same person mentioned that one of the newly developed indicators, nr 23, will measure the number of organizations that report their sustainability work in annual reports (ref. status report 5, release June 1).

What was challenging? Stakeholders revealed several challenges that could be directly related to, and addressed by, the ABCD procedure. For example, how to deal with communication and training, inclusion, innovation and the stepwise approach to addressing the sustainability challenge. One stakeholder managing a large authority, but not very familiar with the ABCD procedure, said that it is important '*to describe what relatively abstract goals mean in practice. It cannot be the responsibility of individuals in operational services but should be handled by the organization'*. This stakeholder also said that it is important to find a balanced pace for strategic work along with efforts to implement concrete actions and that the work cannot '*end up as something to only review in annual reports'* (Interviewee 4). One process leader expressed a challenge for small businesses to engage in strategic sustainability work, saying that '*it works well for slightly larger organizations to make their own ABCD processes and develop a roadmap. But what about companies with a few people? Then it will not be reasonable to produce strategy documents or to run large individual processes'* (Process leader 2). While this might be true, ABCD procedures do not necessarily result in formal strategy documents to aid structuring of daily work and thinking for sustainability.

3.5 Element 5: All relevant actors in all relevant sectors are involved over time

Activities. In the ´Transition Åland´ strategy (Committee Transition Åland, 2013) it was concluded that Åland can only transition to full sustainability if all actors and sectors are working together and are doing their part. This was further emphasized in the early steps of implementation and through the ambition to create a societal contract and the connection to civil society and business. The network Bärkraft.ax was established at the first 'Bärkraft.ax Day' and the number of co-actors of the network has grown substantially over the years (Bärkraft.ax, 2022b). The event offers, among other things, hosts a Bärkraft.ax award ceremony where the public cast their votes for the nominees in different categories.

Equally important was the establishment of the Sustainability Council in 2016. The members represent

leadership from various sectors, and they are responsible for the vitalization of the Bärkraft.ax network and the work in general. It is a forum for politicians, civil servants, third sector, businesses, academia, municipalities, and farmers to meet and deepen the cross-sectoral conversation and understanding of sustainability.

In addition, there are also numerous other opportunities to get involved through the actions of the network co-actors', such as workgroups, roadmap actions and sector specific groups. The threshold to join is low and the groups decide themselves on the topic of involvement and level of ambition. The most important tool for engagement is the Åland Agenda. The sustainability pilot function of the Bärkraft.ax network supports businesses and individuals on the implementation of the Agenda based on their own declaration of needs.

How have activities been received and interpreted? The behaviour and attitude of citizens and societal actors are of the utmost importance according to several stakeholders and some of them provided evidence of how their organization had taken responsibility in involving relevant actors, such as introducing new colleagues and inviting process leaders of Bärkraft.ax to present at a board meeting. To also involve uninitiated persons one uninitiated stakeholder reflected upon the importance '*to start with children and youth in schools who in turn will affect their parents and other adults*' (Interviewee 3). Another stakeholder in a managing position said that '*employees at any organization need to have brief knowledge about the overarching development and sustainability work but should feel confident that management packages the overall concepts to what is necessary for them to know*' (Interviewee 4). Another stakeholder was concerned that the network almost had worked too hard with communication and attempts to involve people, advertisement in media, etc. Some criticism has emerged regarding this, '*if I am one of those people who is not engaged, I will hardly get into that kind of gimmick either*' (Interviewee 6).

What were key success factors? Key success factors mentioned touched upon inclusion, awareness, informal leaders, and collaboration (see table 1). That larger companies at Åland are active partners inspirers many according to one stakeholder because at Åland '*the self-image of being an entrepreneurial society is very strong. The desire to manage oneself and manage life… I think that one have thought about this and worked very hard to get people and associations involved, and that the companies' participation makes it a bit embarrassing to be outside'* (Interviewee 6). In addition, one process leader emphasized Åland's relatively small scale and the fact of being an island is an advantage when it comes to collaboration since people know each other to a large extent.

What was challenging? Despite an overall success so far in involving relevant actors, several challenges related to behaviour, communication and inclusion were mentioned., see table 1. For one, it has been noted as challenging to continuously introduce new people to the work. A school representative said that '*those*

who have been teachers for twenty years do not have to be told every August what they should do as a teacher. On the other hand, new teachers may definitely need it and then the management needs to have good routines for introducing them so that they gain an understanding of values etc.' (Interviewee 1). When organizations have been involved, it can still be challenging to reach out to operational levels '*The more you go hands-on at work, the more challenging it becomes to receive abstract goals*' (Interviewee 4).

3.6 Element 6: Collaboration is supported through formal and informal structures and networks, decision makers' active participation is ensured

Activities. Collaboration takes place in many ways through formal and informal structures. Table 2 offers an insight into current organization and structures, including groups of the Bärkraft.ax network and people responsible for the implementation of the goals.

Table 2. *Opportunities and structures for collaboration.*

Opportunities for collaboration	Purpose	Additional comment
Development and Sustainability Strategist	Overall coordination of work within Bärkraft.ax	Employed by the Åland government. Secretary-General for the Development and Sustainability Council.
The Development and Sustainability Council	Part of the Bärkraft.ax network. Responsible for the continuity and vitalization of the network.	Established in 2016 at the first Forum for Societal Development. The 9-14 members represents leadership from different sectors. Head of Government is chair and is, together with Head of Parliament and Head of Government Administration, a permanent member.
The Bärkraft.ax network	Acts as a platform for all forms of organizations on Åland working towards a common goal of a viable and sustainable region.	The backbone of the network is the Development and Sustainability Agenda for Åland. Established in 2016. Arrange the annual Bärkraft.ax day.
The Bärkraft.ax network sustainability pilots	Guides businesses and citizens in the implementation of the Agenda.	The pilot function for businesses was launched in 2018 and for citizens a year later. Public and private funding.
Individuals responsible for each strategic development goal	Represents each of the goals and oversees the implementation of the correspondent roadmap.	Societal representative appointed by the Development and sustainability strategist.
The network group for sustainable large businesses on Åland	To drive the Åland larger businesses' work to implement the Agenda.	Launched in 2017. Currently encompasses about 15 businesses.
The network group for sustainable municipalities	Support, strengthen and foster collaboration between municipalities in the implementation of the Agenda.	Supported by the lead Bärkraft.ax sustainability pilot and meets biannually. Launched In 2020.

Åland parliament group leader forum	Holds the overall political responsibility for the implementation of the Agenda. To foster dialogue and a deeper understanding for the Agenda within the Åland parliament and to support trust in society and democratic institutions and to support equality.	Supported by the Development and sustainability strategist. Established in 2020.

How have activities been received and interpreted? For collaboration to lead to real action, the creation of structures to facilitate dialogues are vital according to the process leaders. The sustainability pilot function has taken the role to coordinate collaborative work. However, according to several of the stakeholders there is need for an even larger coordinative function. '*We probably need the support of the provincial government ... someone who coordinates, keeps the work going, convenes and follows up*' (Interviewee 4). To better link societal work to policy makers, one politician explained how '*all group leaders in the parliament meet from time to time with Bärkraft.ax and discuss various issues. We have now ensured that we are also part of the Sustainability Project as a direct link to Parliament'* (Interviewee 5).

What were key success factors? Multiple stakeholders' and process leaders comments on key success factors linked to the Bärkraft.ax network and structure. In addition, common trainings, consensus, inclusion, forerunners, gear shifting, small scale, systems thinking, and the vision were themes considered as key success factors (see table 1). Reflecting on how everyone can be heard and that there are relatively equal terms for different stakeholders, one interviewee admitted that *'This collaboration model [Bärkraft.ax], that is really the most brilliant thing in this whole solution.*' (Interviewee 6). Another, although less familiar with work done, saw potential in working with others – '*the more we would work with other players the better, a win-win situation. It goes both ways, we may have something to teach, but also learn something from the activities of others'.* Stakeholders in the collaboration network enhance their influence and can more effectively apply pressure on decision-makers to accept their active participation: '*when you institutionalize in this way, it really puts pressure on decision makers as well*' (Interviewee 6). Åland's common vision facilitates different stakeholders to unite with a higher purpose and accomplish things together, e.g. associations and large companies discussing employments.

What has been challenging? Comments regarding challenges to collaboration also related to structure to some extent, as well as to administration, policy, and participation (see table 1). Wanting more straight forward work, one politician said that '*I sometimes think we use too many words, minutes, and papers. I would like to see a little straighter forward work. But it may be necessary for everyone to be onboard. I do not know'* (Interviewee 5).

3.7 Element 7: Iterative comparisons are performed between organizations, sectors, and specific

plans, making use of the ABCD as a common structure to find ways forward together

Activities. Iterative comparisons between organizations and specific planning procedures based on the ABCD has so far not been implemented in a systematic way, although there have been some occasions were this has happened. Currently the network Bärkraft.ax and the Sustainability Council offers more informal networking and sharing of general experiences inspired by activities in different organizations rather than systematic iterative ABCD comparisons.

One example of an ABCD-structured iterative comparison is when the ABCD work for Sustainable freshwater by the organization Åland Water fed into the ABCD roadmap work related to goal 3; All water has good quality.

Despite the follow-up tool for measures and roadmaps presented at the website, no structures seem to be available for follow up strategic work for sustainability.

How have activities been interpreted and received? Stakeholders touched upon iterative comparisons in terms of being inspired by and learning from actors in other sectors and that Bärkraft.ax supports this by continuously invite '*those who may not understand each other and who would not meet each other otherwise*' (Interviewee 4). Process leaders referred to the developed system for following up specific measures available at the Bärkraft.ax website (Bärkraft.ax, 2022a). However, while coordinating measures at an overarching macro level, this comparison is not done systematically between organizations' specific plans, nor from a strategic sustainable development perspective.

What were key success factors and challenges? All active partners in the Bärkraft.ax network are labeled 'co-actors' and networking were really important initially when the work was formed. However, now stakeholders consider it more important to be more strategic in the exchange to be more efficient with time and resources, one saying that '*now we need to focus on where the efforts are most needed, where it has the most effect*.'

Overall, in terms of alignment and misalignment with the elements of the FSSD implementation model described in section 1.1, Åland has done impressively well with the initial visioning process and regarding involvement of relevant actors, collaboration platforms and structures. These aspects are emphasized as important, or even vital, by scholars in the field (e.g. Frantzeskaki et al., 2014; Meuleman & Niestroy, 2015). Hence, much can be learnt from the Åland case. As confirmation, Åland has enjoyed great international attention for their work (Bärkraft.ax, 2022e). Agreeing with one of the process leaders, it would be interesting to explore as a future research orientation how Åland's work can be scaled up in a larger context.

Still, actions related to the elements that emphasize the strategic sustainable development perspective (SSD) were significantly weaker. While the initial activities introduced and applied the FSSD, and while there are some examples of specific ABCD procedures, the SSD approach seem to have been gradually forgotten. That is, knowledge of the function of the sustainability principles as boundary conditions in combination with how to apply them (the ABCD procedure) are not systematically introduced, nor communicated as a common planning procedure for specific organizations for how they can contribute to the Agenda (as well as other sets of goals, such as the SDGs). This is in fact a somewhat reverse procedure to what the implementation model prescribes. In the early stages of implementation the principles are there more for engagement, whereas they come into more active play in later steps (specifically B and D) and as more detailed problems are to be solved in different arenas.

As work has played out, a risk lies in that both policy-makers and stakeholders get hesitant and sceptical of the approach, rather than inspired to dedicating more effort into finding ways of applying the FSSD properly. Along with many studies (Bai et al., 2010; Evans et al., 2005), mandates, active participation and strategic decisions from politics and other leaders are often highlighted as vital for succeeding with sustainability transitions, but also as a common barrier (Dale et al., 2020; Measham et al., 2011). A reported challenge that exemplified the lack of understanding of the function of the sustainability principles (and thus to applying a systemic, systematic, and strategic approach to sustainability) was exemplified by the description of how sustainability principles sometimes get questioned during political debates when different measures are discussed. This is unfortunate as science-based sustainability principles are best refined in scientific work and discourses. Political debates are vital, though, to bring forward and discuss arguments for specific measures and strategies to handle trade- offs in the moment based on specific contexts and the outcome will vary dependent on which elected representatives who are in majority.

To learn from Åland's experiences and to supplement and formulate more sophisticated guidance for future introduction and implementation of the FSSD, a review of challenges for each element was done[2]. This gave that for the elements were Åland has done better the majority of challenges were related to specific work addressing the purpose of the element (such as 'finding structures that uphold democratic processes' related to element 1), while in the weaker performed elements, challenges were relatively more related to insufficient application or understanding of the element itself (such as 'lack of comprehension of the stepwise journey' related to element 3). In case of insufficient application there might be several reasons for this, such as change of people in key positions, misunderstandings, or lack of time. Nevertheless, most will come back to insufficient introduction to the FSSD essential elements upfront and over time. This is a lesson in action research and the learning process Åland is part of. Further instructions on capacity building around sustainability principles and the ABCD procedure had been required initially and a more in-depth dialogue

would probably have been needed to design this together. Both in case of insufficient application and if the element itself was challenging, additional support addressing the specific challenges are needed to realise a systemic, systematic and strategic approach to sustainability. For example, a reported challenge related to element 5 regarding involvement was that not all see themselves as a receiver of the methodology and perhaps do not see how the sustainability perspective is within their assignment. Arguably, the level of awareness and knowledge can vary between people dependent on their roles, therefore support that exemplify different levels of introduction dependent on target group and pre-requisites is needed.

To address the complex challenge and succeed with an effective transition towards full sustainability, both broad collaboration and an SSD lens is required (Robèrt et al., 2017). Whistler (Resort Municipality of Whistler, 2007) and Eindhoven (VinylPlus, 2016) provide inspiring examples of taking such an approach. However, the ambitious and honourable initiative at Åland is indeed pioneer work, which was also expressed by one stakeholder as how frustratin it is to be in the frontline with no good examples to follow. Therefore, this study is not only valuable for the work at Åland, but also as inspiration and learnings for other local and regional territories.

2 Challenges related to insufficient application of the element are marked in italics in table 1

4. Conclusions

Much can be learnt from how decision makers in Åland integrated, structured, and organized the initial work. However, parts of the SSD perspective are seemingly forgotten or in hibernation. Reintroducing and reinforcing concrete SSD informed processes and support could arguably address several of the expressed challenges while making use of key success factors, such as the Sustainability pilot function. This can also be brought back as learnings for how to better introduce and implement the FSSD to facilitate long-term, broad application in other municipalities and regions.

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APPENDIX A. Some examples of processes:

- Sustainable food strategy, The Åland farmers association. The sustainability principles are mentioned.
- Sustainable freshwater, The Åland Water company. Extensive ABCD procedure with several workshops.
- Sustainable destination, Visit Åland. Sustainability principles and ABCD introduced. A step performed.
- Sustainable wholesale and groceries, Goal 7. Sustainability principles introduced and ABCD tested during one afternoon session.
- Sustainable industry, Goal 7: (Hållbar industri). Sustainability principles and ABCD introduced.
- Roadmap for a sustainable Brändö, Brändö municipality. Extensive ABCD procedure with several workshops.
- Roadmaps for goal 1 and 2. ABCD procedure against social sustainability principles.
- Roadmap for goal 3. ABCD procedure taking into consideration result from 'sustainable freshwater'.
- Sustainable food production, Åland Nature and Environment Association. Extensive ABCD procedure with several workshops.

Teaching Smart City for Sustainable Guandu Plain in Taipei: A reflection on transdisciplinary education

Liling Huang[1], Shang-Hsien Hsieh[2], Yun-Tsui Chang[3], Ying-Peng Chu[4], Jiun-An Chien[5]

[1] Associate Professor, Graduate Institute of Building and Planning, National Taiwan University, liling@ntu.edu.tw

[2] Professor, Department of Civil Engineering, National Taiwan University, shhsieh@ntu.edu.tw

[3] Ph.D. Student, Department of Civil Engineering, National Taiwan University, ytchang1988@gmail.com

[4] MS Student, Graduate Institute of Building and Planning, National Taiwan University, r09544003@ntu.edu.tw

[5] MS Student, Graduate Institute of Building and Planning, National Taiwan University, r09544006@ntu.edu.tw

Abstract

In the age of globalization, transdisciplinary education helps to break down the professional training that is defined by departments and enables students to acquire new epistemology to face the social complexity. This is especially true for sustainability studies and education, which often involves multiple stakeholders, deals with the intersection of the social and natural sciences, and confronts issues of knowledge production and practice at the same time. This study uses the course offered by the Smart City Vision Simulation Team at National Taiwan University as an example to examine transdisciplinary teaching and learning experience. We identify its characteristics, potential contributions, and difficulties. The students come from urban planning and civil engineering. By employing big data analysis skills and innovative concepts of urban planning, they aim to develop a vision plan with multiple stakeholders for Guandu Plain, the largest agricultural area in Taipei. In the face of these wicked problems, we find that transdisciplinary teaching and learning is no longer a linear model, but it more fits a model of Incremental and Iterative Life Cycle. The static curriculum design and the dynamic social complexity have their knowledge ontology incommensurability. Thus, educators should actively seek various opportunities beyond the classroom to engage with stakeholders and create an opportunity-oriented problem-solving approach.

Keywords: transdisciplinary education, urban sustainability, incommensurability, social complexity, iterative process

1. Background

1.1 From integrated research projects to co-teaching courses

In the recent decade, transdisciplinary teaching and research has emerged in Taiwan's higher education. There are "Teaching and Practice Projects" advocated by the Ministry of Education, and the transdisciplinary research projects promoted by the Ministry of Science and Technology. These directions

emphasize the links between teaching, research and practice, as well as a problem-solving oriented educational approach. They challenged the existing educational framework of universities, which rely on individual discipline to produce knowledge and cultivate talents. Thus, in teaching we are witnessing a trend of increasing transdisciplinary interaction, emphasizing enhancing students' ability in social design and developing proposals. It requires collaboration with stakeholders in co- producing knowledge, an orientation that has also meant moving from interdisciplinary interaction model to transdisciplinary integration of knowledge and practices.

Located at the boundary between the social and natural sciences, and often affected by the complexity, the research and teaching of urban sustainability entails particularly transdisciplinary knowledge integration. Facing this situation, the educational programs can no longer stick to the conventional contents, but should turn to the contextual knowledge. This means involving diverse stakeholders in the process of research design, knowledge production and dissemination. However, the above approach brings multiple challenges. For example, it often involves cross professional interactions and thus induces diverse value conflicts. At the same time, it takes a long time to clarify problems and seek solutions.

By using the course provided by the integrative project of our Smart City Vision Simulation Team at National Taiwan University as an example, this article discusses the transdisciplinary teaching and learning experiences. Our team, a group of Taiwanese researchers, under the Ministry of Science and Technology's Sustainable Urban Integration Project, have conducted research on Shezidao and Guandu, the strategic development areas of Taipei City, from the perspectives of circular economy, urban eco- agriculture, and integrative blue and green infrastructures. The research team attempts to develop urban development scripts by using open data analysis and digital simulation to provide with stakeholders, including government agencies, civil organizations and communities, and a referential framework for social communication. The Taipei City Government is a key collaborator in this process, and its roles include jointly defining the problem, providing information, participating in meetings, and evaluating the feasibility of the plan.

The project is expected to run for three years. The work of our team in the first year mainly focused on the internal discussion and integration through dialogues with the city government. We have also developed alternatives to the main project on Shezidao, which was proposed by the government but still has many social disputes. However, due to the conflict of opinions within the city government, our proposal, suggesting to reduce the development volume and increase historical and ecological preservation, was not adopted by the government. In the second year's plan, however, the team and the municipal secretariat together set the Guandu Plain area to attempt the collaboration again.

1.2 Explore the sustainable development of Guandu Plain

Guandu Plain is the last remaining intact urban planned agricultural area in Taipei city, with an area of

about 314 hectares. The land use is still dominated by agriculture (Taipei Industrial Development Bureau, 2021; Taipei Urban Development Bureau, 2019). There are about 270 farmers and 7 substitute farmers (Taipei Industrial Development Bureau, 2021; Beitou District Farmers association, 2021). The development of Guandu Plain faces many restrictions due to the fragmentation of land ownership and backward zoning control of land use. Farmers conduct agricultural production in narrow lands, and the harvest can hardly balance its economic cost. On the other hand, the lack of proper infrastructure planning, such as farm roads and water channels, also limits agricultural production. Under these restrictions, many landowners choose to lease or sell their lands. This created the idling phenomenon of agricultural activities. For a long time, the government has ignored the ecological, educational, and cultural values of this land. There lacks adequate public investment or government policies to guide the local development in Guandu. In addition, many illegal factories squatted in. They polluted the air and water, and contributed to the fragmentation of the landscape.

Under the impact of climate change, the significance of the ecological, natural and agricultural environment in Guandu Plain has gradually attracted related NGOs and public entities. For example, the Wild Bird Nature Park managed by the Wildbird Society, apart from carrying out ecological rehabilitation, also hosts an international art season for several years to promote the ecological, educational and artistic values of the Guandu Plain. Guandu Junior High School and Beitou Community College also actively advocate environmental education and action on energy, food, water issues in Guandu Plain. In recent years, there are also some young farmers dedicated themselves to local brand products in Guandu, but the production is very small, and an organization in production and marketing for Guandu is still absent. It is worth noting that there are some corporate headquarters of media industry and high-tech industry around Guandu Plain. Some of them in the past few years have even bought land from farmers there. Can these companies make good use of their agricultural land under the climate change framework? Will it be possible to build mutually beneficial relationships with local communities through mechanisms such as ESG (Environment, Social and Governance) in the future?

***Figure 1(left)**. Ecological tour of Guandu Plain (photo: Jiun-An Chien)*

***Figure 2(right)**. Paddy field painting by Seven Star Irrigation and Water Conservancy Association and Guandu Farmers (by Jiun-An Chien)*

Guandu is experiencing a critical stage of urban transformation. Therefore, in addition to academic research, the research team expects to cooperate with relevant stakeholders to put forward proposals, thus influencing the future development of Guandu Plain. During the first year of the project, the team conducted internal cross-disciplinary dialogue and a basic survey of the Guandu Plain. In the second year, the principle and collaborative investigators of the team, who are two main authors of this paper, decided to establish a new course to cultivate students, and at the same time to develop further action plans. We recognized that in recent years, with the rise of the open data movement and the smart city policies promoted by the government, the analysis of big data has received increasing attention in urban sustainability research. Therefore, we invited the digital community In Visible Cities (IVC) as teaching partners to introduce possible digital application and development simulation to facilitate communication with stakeholders. We also notice that, in the past two years, the central and local governments have continuously announced the 2050 Net Zero vision. In December 2021, the Taipei City government also submitted its carbon neutrality ordinance to parliament for review. Some related mechanisms, such as ESG of enterprises and Climate Fund set up by the government, can be applied to agricultural development and ecological conservation in Guandu Plain.

2. Organizing Curriculum and its Evolution

This course is an extension of the integrated research project “Sustainable Urban Digital Governance Decision Supportive Platform in Response to Environmental Change” , funded by the Ministry of Science and Technology. In the summer of 2021, a year after the project was conducted, two researchers, who are also the main authors of this article, decided to start a joint course, mixing students with civil and planning

backgrounds for the transdisciplinary educational program. We collaborate with the Taipei City Information Bureau, digital communities and Community College for knowledge integration. The course is based on Guandu Plain, with teachers and assistants first identifying its features in land use, climate change, disaster potential, biodiversity, and human society. Instructors also led students to Guandu for site investigation, and then students continued to conduct field investigation in small groups.

Our course introduces the framework of the United Nations Sustainable Development Goals (SDGs) to evaluate the role of the Guandu Plain in the development of the Taipei metropolitan area. The course aims to train students to analyze and present urban issues by using open source and digital tools. On technology development, the course collaborates with In Visible Cities (IVC), a digital community that promotes open data. Its members serve as course coaches to assist students in GIS and open data application techniques, data analysis and presentation, etc. In addition, the Smart City Office of the Taipei City Government (TPMO) gave a talk to help students understand the smart city policy in Taipei. The course also has three teaching assistants to assist with teaching administration. The final requirement is that each team should develop a suggestive vision plan for the Guandu Plain based on the government's open data, and deepening it with stakeholders for the following revision. The result will also participate in the public exhibition of the TPMO Smart City Collaboration course in Taipei.

Our course is for three credits. In addition to class time, students will also spend about nine hours a week doing research, individual and group work. Since the teachers recognized that introducing relevant cases, domestic or international, would give students more concrete ideas, the Dutch digital group Waag was invited to give an online presentation to share their projects including Air Box and Positive Energy District. The former specifically presents the possible role of civic groups in environmental monitoring and data analysis, while the latter echoes the orientation of conducting energy transformation through urban regeneration.

After the above successful exchange with the digital community, one of the assistants (author 3 of this article) then further introduced LASS Taiwan, a civic group she was involved in, to introduce a river monitoring and water quality improvement project jointly proposed by LASS Taiwan and the WATER Resources Department. Their collaboration with local communities in the Tou Qian Xi area of Hsinchu successfully prompted local governments to initiate new regulations for industrial water intake policy. This project won the First Prize in the President's Cup Hackathon in 2021. Such cooperation model continues to expand from Hsinchu to other regions in 2021-2022.

During the semester, our program also developed another level of collaboration with the Taipei City government. At that time, the Taipei City government commissioned The Urbanist Collaborative planning consultants to conduct the Guandu Plain Development Vision Workshop in response to the requirements

of the National Land Plan. Since the company's planners supported our approach, they actively invited us to participate in the workshop, which gave us the opportunity to have a deeper understanding of the local issues. The planners also introduced our team to some farmers and Beitou Community College. Beitou University continues to concern issues of urban agriculture, renewable energy and water environment protection in Guandu Plain. In practice, it also offers relevant courses and guided Tours. Besides, it holds weekly farmers' markets at the community college, and there are farmers from Guandu Plain to participate. Therefore, through Beitou Community College, we further invited relevant NGOs and action organizers to give feedback to the students' proposals.

3. Conceptual framework

Urban sustainability is challenged by cross-disciplinary knowledge integration not only in research but also in teaching. Teaching is not an activity in which teachers pass on established knowledge content to students. Rather, teaching itself is an important knowledge reproduction. Among the knowledge related to urban sustainability, the Built Environment, including the fields of civil engineering and urban planning, often have to face systematic, complex and integrated topics, and thus in need to develop transdisciplinary research and teaching (Lawrence, 2021).

One of the key concepts in transdisciplinary knowledge production is the iterative process. In mathematics and computing, this means that one cannot solve a problem once, but need to iterate to get an approximate solution. In the field of social innovation and design, this means that educators or participating designers employ a constant cycle of hypothesis, trial and error, adjustment, and gradual convergence for getting results. In recent years, Menolli *et al.*(2013) further analyzed the development of iterative processes from the perspective of knowledge ontology. With multiple interlocking iterative steps, they built a "Incremental and Iterative Life Cycle" model. This model emphasizes the importance of defining, selecting, and incremental evaluation from the data collection, planning, and application stages.

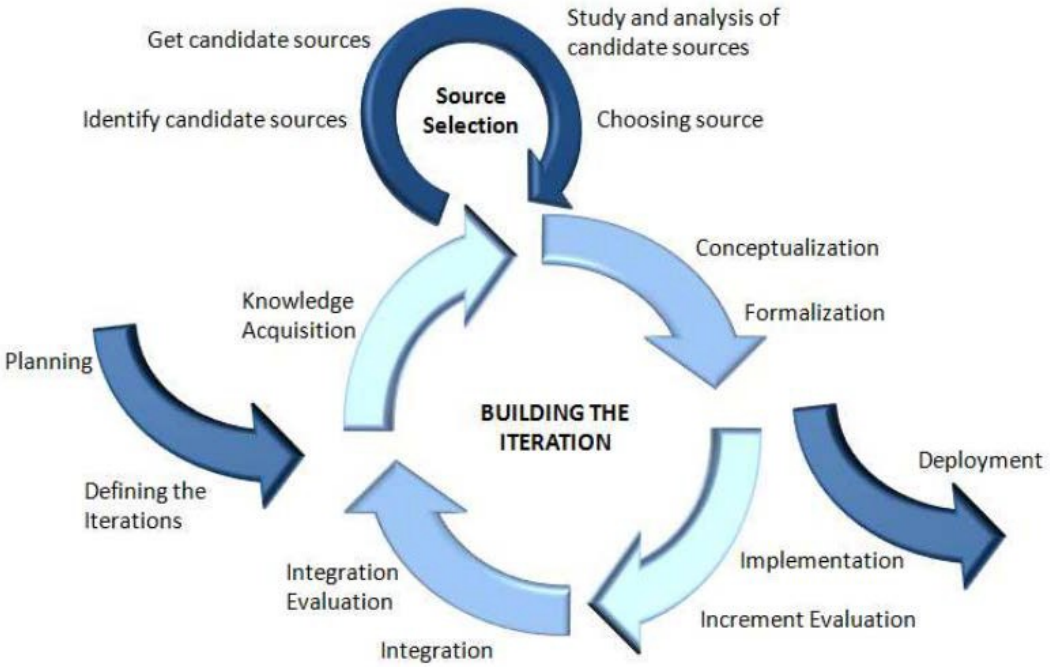

Figure 3. *Andre Menolli et al. (2013)*

Incremental decision-making is not an unfamiliar concept in the field of urban planning. Based on professional rationality, early government planners constructed a rational decision-making process for drafting master plans. However, this intellectual view has been challenged since the late 1950s. At that time, Charles E. Lindblom (1959) saw the limitation of traditional planning theories to deal with social complexity and proposed an incremental model. It aims to explain the phenomenon of continuous adjustment and modification, rather than one step in place, in urban planning decisions. During the historical period of high social mobilization in the 1960s and 1970s, Rittel and Webber (1973), in their famous book *Dilemmas in a General Theory of Planning*, It further negates "rationality of system, science and engineering" as the theoretical basis for urban planning, social science and other modern specialties. They define the former as a "tame problem," while the latter as an undefined "wicked problem" due to factors such as dissent, social movements, and political situations. They pointed out that this type of problem has many levels of causation and cannot be solved by general principles or linear logic, but rather has to do with the larger political and economic framework.

In the 1990s, the above orientation paved the way for communication action theory (Habermas, 1986) to be introduced into planning theory. This orientation also affects planning education. At the turn of the millennium, Oregon planning scholars Ozawa and Seltzer (1999), through questionnaires and interviews with a large number of senior planners, more clearly pointed out that college education in the field of

planning should focus first on the skills of communicative planning, including the ability to work with peers in organizations and understand the needs of the public, and the ability to communicate with them. By 2000, the concept of "wicked problem" was almost universally acknowledged. Environmental policy issues, in particular, are characterized by wicked problems because they cross social and scientific boundaries, involve an increasingly diverse public, and are shaped by the multi- layered forces of globalization (Crowley & Head, 2017).

On the other hand, social complexity is also driving changes in scientific research and teaching. For example, Takeuchi *et al*. (2020) investigated interdisciplinary education in Science, Technology, Engineering and Mathematics (STEM) and found that there was an increasing trend of standardization in problem definition. Thus they stress the needs of introducing inclusiveness, by focusing on the connections among people, knowledge and practice, for breaking the disciplinary hegemony of science. Tejedor, Segalas & Rosas-Casals (2018) pointed out that the curriculum structure of engineering education should be reformed, so do the teachers' ability and teaching methods, in order to cultivate engineers who can cope with social complexity and have a world outlook. They propose the discourse of "Transcendence", that is, training of engineers should transcend the mode of solving technical problems and shift to the mode of knowledge production by cooperating with stakeholders. They suggest the introduction of teaching methods such as campus LABS or living LABS to reinforce emotional abilities such as empathy for engineering students. They also suggested traditional service learning should be replaced by service learning that promotes social justice, so as to link engineer training with public welfare.

Bore and Wright (2009) points out that transdisciplinary education has gradually understood the nature of "wicked problem" and social complexity, and developed reflective practice, action research, and other methods in education accordingly. However, teachers still often design the syllabus in the mode of "tame problems" because they cannot identify the key factors in difficult problems. They also suggest that when confronted with difficult problems, the goal of interdisciplinary education should be to train students with "Netist" tendencies. This refers to someone who has the skills to create, service, and operate communications networks, and who has a keen sense of which role in the organization will make decisions that match their interests. Networkers can foster cross-sector cooperation.

But how do students from specific professional training perceive these boundary-crossing educational experiences, and how do they adjust their perceptions? This is critical for transdisciplinary education. Kuhn (1970 [1962]) proposed the concept of "incommensurability" to describe the transformation of the community of natural science from the original world view to another brand new paradigm. Incommensurability is defined as the situation in which existing research methods and concepts cannot

explain phenomena when the changes of the world conflict with the original assumptions. The theory of incommensurability distinguishes semantic incommensurability from methodological incommensurability.

Guillermin *et al*. (2014) extended the view of incommensurability to examine current public policy studies that combine natural science and social science. They believe that boundary-crossing research should actively examine the obstacles that incommensurability poses to disciplinary dialogue. For example, social complexity may conflict with established disciplines' perceptions of validity, resulting in methodological incommensurability. They also define the difference in the strength and strength of incommensurability in cross-border cooperation and present relevant suggestions. Weak incommensurability can be overcome through participants' open mind, innovative communication, flexible definition of goals, etc. And strong incommensurability depends on institutional reform.

In this study, we see the potential of curriculum as a way of dealing with weak incommensurability, including integrating the diverse backgrounds of teachers and students, and introducing new research methods through curriculum design. Existing interdisciplinary research discusses the role of some disciplines as facilitating communication. For example, due to the mutual learning implicit in STEM, all participants expanded each other's understanding of sustainability. Both students and teachers can become partners and objects of learning with each other and learn and share knowledge with the larger community. The interdisciplinary education that brings the arts into STEM, and then merges into a comprehensive approach to the STEAM field, also demonstrates the process of applying creativity and innovation to teach and learn new skills required in the 21st century, including communication and collaboration (Liao, 2016).

Furthermore, "problem-driven visualization" could be adapted as a team knowledge integration tool (Hall, *et. al*. 2020). In this regard, the open data application of smart cities and the rise of digital communities have brought new possibilities. For example, the rise of the smart citizen discourse in Europe underscores the IoT as an open urban infrastructure and the power of citizens to hold information and participate in decision-making. It also highlights a new trend of collaboration between higher education and innovation communities and government units (Hemment & Townsend, 2013). These orientations redirect cross-domain educators to think about the connections between technology, skills, and value. For example, Khoo *et al*. (2019) further pointed out that interdisciplinary education in higher education not only challenges existing research and teaching methods, but also requires responding to issues related values, such as social justice in the process of globalization. In the design of the curriculum, educators should be aware of the formality of professional cooperation, as well as whether the citizenship rights of the stakeholders are included or not. However, the lack of an institutional basis for reconciling the distribution of benefits and risks makes it difficult for stakeholders at both ends of the development and preservation spectrum to

engage in dialogue. This limits students' imaginations when developing solutions, and also confuses them in their value choices.

4. Research Method

First, we reviewed the relevant research literature on interdisciplinary education, identified key concepts, and then designed this research framework to analyze our own experience. We explore how students perceive issues, develop solutions, interact with and adapt to students from different backgrounds in group work. In addition to the researcher's observation, we also invited all students to participate in a small panel discussion after the course. We organize students' learning experiences through semi-structured interviews. We also analyzed how students viewed their interactions with stakeholders and dealt with their feedback.

Since some students continued their original learning by participating in relevant research projects after the course, we also conducted individual interviews to understand how they viewed this role transformation and the significance of learning. This study also focuses on instructional design, and therefore includes the reflection of course teachers on the process of instructional design and implementation. We try to clarify the distance between curriculum design and social complexity, and gradually eliminate the incommensurability of these two dimensions by connecting the social actions of stakeholders and cultivating more students with network connectivity.

5. Groups' Proposals

Ten students take our course, including three from the Department of Civil Engineering and seven from the Graduate Institute of Building and Planning. We divided the students into three groups, and each group consists of students from both departments. Among the ten students, one is a doctoral student, one is undergraduate, and the rest are in the second and third year of their master program. The ratio of male to female students is equal. In terms of cultural background, there is one student from Japan and one from Middle East Asia, but they both are adequate to communicate with the group members and stakeholders in Mandarin.

In the sixteen-week course, students spend more time in the first half to master technologies such as GIS and Open Data Analysis. From the middle of the course, the data and site survey were gradually combined to identify local development problems, and then the students develop proposals. As a result, they delivered the following three proposals:

(1) Guandu as Slow City

In terms of research methods, this group participated in the art festivals hosted by Taipei National University of the Arts and Guandu Wetland Natural Park in their early stage. Then, they reviewed the related literature, sorted out the international wetland value assessment and related data, and used QGIS to analyze the population and land use data for visualization.

The group examined the current situation of Guandu from five aspects, including wetlands, land use, natural ecology, artistic and cultural characteristics, and transportation environment, and finally focused on its infrastructure and its transportation system. Starting from the concept of environmental conservation, the group attempts to connect the natural ecology, humanistic and artistic resources in the Guandu area by introducing green transportation. The concept of "slow travel" and "slow life" is employed with the initiative of shared service points and transit service spots.

(2) Guandu Agricultural Experiment Community

In terms of research methods, the group first reviewed related materials, including the white paper on agricultural policy of Taipei City, the overall review of the Beitou District urban plan, and the detailed plan for the Guandu Plain. They tried to connect Guandu's land use zoning to the national land plan. Then they matched agricultural and spatial data to grasp and evaluate the production profile of Guandu agriculture. Students also participated in related workshops in Guandu Plain to understand the claims of government departments, farmers and other stakeholders. The students also reviewed the Sustainable Development Report of one of the local enterprises to understand their social investment strategy, as a way to conceive an action plan to apply the ESG framework for the development of Guandu.

This group anticipated that the experimental farming community in Guandu may encounter difficulties due to the lack of agricultural expertise and insufficient farming funds in the beginning. Although government departments have relevant subsidy programs, it is not sufficient to introduce new agricultural practices. Therefore, the group proposes to introduce the resources of enterprises in corporate social responsibility or ESG to help cultivate potential agricultural communities. They expected to connect enterprises and small farmers to jointly develop projects with concepts such as carbon neutral, green environment or friendly agricultural investment.

(3) Guandu Plain: A Living Natural Park

In terms of research methods, this group first identifies Guandu Nature Park and nearby green spaces with GIS. They calculate the environmental value with carbon sequestration (the NDVI value converts the carbon sequestration of the area), and evaluate the social value with psychological indicators (quantitative and qualitative surveys on place attachment, mainly by interviews). After calculating and translating the

data, students try to provide the basis for cognitive establishment and interactive communication using visual images.

The vision plan they proposed is “Living in Guandu Nature Park”. It aims to expand the approach of the current Guandu Nature Park Reserve to the entire Guandu Plain. However, in order to maintain Guandu’s natural resources, function in climate regulation, and flood control and societal value, new policy mechanisms must be proposed, and local farmers must be compensated. Therefore, the team combined the two aspects of “green space value (cultural landscape) in society” and “development and compensation mechanism of NDVI value” to calculate the social and ecological cost of the development plan of Guandu Plain in the future to visualize its values.

Figure 4 (left). *Our proposal was exhibited at the municipal government (Photo by Liling Huang)*

Figure 5(right). *The team visited other schools’ smart city proposals (Photo by Liling Huang)*

The content of students’ proposals was also commented on by teachers and technical coaches and presented as the proposal of the National Taiwan University team to stakeholders. At the end of the semester, Beitou Community College and The Urbanists Collaborative assisted us in inviting six NGO workers to commentate on our proposals. Their feedback enhanced our understanding of the site. They also identified several ongoing or future development projects that will threaten the sustainability of the area. The workshop also turned out to be an opportunity for our team to expand the network. We discussed some possible future collaborations with the attendees, who also suggested others we could contact in the future.

***Figure 6(left)**. Members participating in the Guandu Plain Development Vision Workshop (Photo: Liling Huang)*

***Figure 7(right)**. Conducting Workshop with NGO representatives at Beitou Community College (Photo: Liling Huang)*

After the semester ended, the two teachers decided to continue to invite students to develop the proposals into an action plan. On the one hand, these proposals need to be revised, and it is also necessary to connect local farmers, enterprises, and other stakeholders, who may lead to changes to jointly develop actions. Three out of ten students decided to continue researching on the course-related topics. One of them joined the action plan of LASS Taiwan, which is a stakeholder network for the governance of the Tamsui River Basin, and it includes concerning groups in the Guandu area.

The other two students integrated the above-mentioned three proposals, using an agricultural transformation action plan to connect potential stakeholders. The goal is to jointly construct land use plans in response to urban transformation in the future. After the course, this project has been continued for half a year till now. At the time of writing, through interviews, students and project assistants have networked farmers, farmers' associations, water conservancy associations and other local groups in Guandu. We developed an action plan based on the original proposals, aiming to introduce the enterprise to support an agricultural experimental community of Guandu under the ESG mechanism and promote the agricultural transformation of Guandu.

6. Course Review and Follow-up Development

Course instructors evaluated the outcomes. We believe that this course crosses over our original knowledge boundaries, and shows the characteristics of transdisciplinary education. Combining the two methods of site survey and open data analysis, it did make the analysis of urban sustainability more powerful. But we also found some shortcomings. For example, due to the differences of students' background and the complexity of the issues, it is difficult to fulfill the training of both skills in one semester.

In addition, although students "discussed" the proposal with the stakeholders in the process, it is still far from the ideal of "developing" the proposal with stakeholders. In fact, the ambiguity and absence of stakeholders is the key difficulty of research. We concluded that researchers must also have their core values and judgments on where to take a side, when facing various stakeholders with different interests.

We use the final discussion to understand the students' learning experience. Most of the students were impressed by the various interactions with stakeholders on different occasions, including the Guandu Plain Development Vision Workshop organized by the Taipei City Government and co-organized by the Urbanist Collaboratives, as well as the workshop at Beitou Community College. There are many sharp opinions that are difficult to reconcile. For civil engineering students, whose training in the past was mainly in the classroom and working on engineering design, they rarely have to face stakeholders. Although students with a planning background have relatively richer experience in site visits, they still lack experience to come up with solutions in face of the real issues.

Many students pointed out that they understood the importance of selecting and synthesizing data in defining problems; on the other hand, the digital community's communicative way is impressive and could be applied for other community collaborative work. However, foreign students in the course especially felt that the government's provision of open materials was still very limited. They also senese that the government or civil society was slow in renewing data. This makes them often need guidance to find the data sets, and therefore degrades their ability to grasp the topic.

When asking students how to decide the content of the proposal at that time, most of them are related to the training background and research interests of the group members. Groups will also adjust their own topics based on the suggestions by other groups or the teachers. However, some students pointed out that because they participated in the vision workshop, they adjusted the proposal according to the opinions of the public, hoping to respond to real issues. After receiving comments from community colleges, they realized the complexity of the problem. However, since the course is only three credits, it is difficult to deal with problem definition, technical learning and knowledge integration all in one semester.

Although faculty presupposes interdisciplinary student collaboration, some students pointed out that

students from different backgrounds did have difficulties in the early stage of cooperation, and there are many times they stop at the boundaries when communicating, so they need to learn how to communicate effectively. She originally was confident about her skill in mastering techniques, but as the topic unfolded, she needed to communicate with team members with different professional backgrounds and digital communities frequently. She found herself playing the role of a "middleman" connecting various communities. After the course, she and other classmates participated in a hackathon on environmental issues organized by government departments, and also changed the subject of her master's thesis research to the collaboration of digital communities, civic groups, and government units in urban sustainability.

Two other students who went on to work on the project after the course also reviewed their learning experiences. They believe that the application of open data can assist in the communication and persuasion of public policy. Especially in the face of development conflicts, scientific evidence can help to justify planning directions. However, she thinks that in the course, students were not yet equipped with enough knowledge of the site and related stakeholders, and could not make more appropriate use of the data. But after continuing the project, now she would like to go back and ask the technical coach how to further employ the knowledge of data.

One student also recalls that during the course, her group defined the issue in a relatively simple way, and they believed that the only solution was to oppose development to keep Guandu as a natural zone. So they use the NDVI value of carbon emissions and carbon stock as the judgment of Guandu land sustainability. However, in the follow-up interviews, she realized that the key issues include the backwards land use zoning, the difficulties of urban agriculture and husbandry, and policy and institutional resistance. She starts to think differently about solutions.

After six months of development, the students now can make some suggestions on how to improve the course structure. They believe this process has refined the research methods. Although the agricultural community experiment plan was proposed last semester, there was a lack of methods for how to implement it and understanding of the community. In the following six months, the issues are to be tackled one by one, and then put into communication with the public. They also realized why the interdisciplinary communication in the last semester was sometimes frustrating. Mostly, it is because the students had only limited practical knowledge.

After these studies, students also have a different understanding about actors and solutions. They found that although the farmer is the main stakeholder, it is difficult for them to put forward a complete and clear vision of Guandu's future. Students comment that now as our team is trying to introduce an action plan, although it is difficult to solve multiple problems at one time, it may catalyze following changes.

7. Conclusion

This study explores the role and contribution that transdisciplinary teaching may play in the co- production of knowledge in the face of sustainable urban development. Our experience shows the "incommensurability" (Kuhn, 1970) between semi-structured course design and evolving social complexity. This concept helps us to better understand the nature of the wicked problem, and how to break the uncertainty of reality and shape the possible relationship between imagination and practice.

Both teachers and students see the limits of teaching in the classroom. The educational scene should go beyond the classroom to seek out opportunities to engage with stakeholders and accept their challenges. Aware of the potential and limitations of the curriculum, we designed a continuous process between the curriculum, research program and social action plan. Our experience shows that the process of teaching and learning can brew possible changes, interweaving programs and actors to generate possible agenda.

Our research echoes the concept of an "incremental iterative life cycle" as pointed out by Andre Menolli *et al*. (2013). Faced with the intractable problems related to urban sustainability, we believe that educators should abandon the idea of clinging to the original professional knowledge and define education as a process of re-learning, creation, and interpretation. We believe that the attempt of the course provides an opportunity to recognize the problem, but more scenarios and networks are needed to continue the life cycle of this iteration. That is, in the face of the wicked problems, it may be feasible for educators to introduce short-term action plans and take the opportunity to expand networks and new collaborative issues. This dynamic model can bridge the gap between classroom teaching and social complexity.

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Transforming Interface Spaces for Urban Sustainability in Taipei

The role of landscape design in mainstreaming nature-based solutions

Sue-Ching Jou[1], Yung-Chen Cheng[2]

Department of Geography, National Taiwan University. Email: jouchen@ntu.edu.tw Department of Geography, National Taiwan University. Email: yuchzheng@gmail.com

Abstract

The concept of Nature-based Solutions (NbS) has emerged in policy and practice to improve the efficiency of climate change mitigation and adaptation and potentially accelerate urban transformations towards sustainability and resilience. There is an urgent call to scale up and mainstream NbS best practices to maximize its co-benefits for biodiversity and human wellbeing, as well as to solve wider environmental, socio-economic and social-cultural challenges. While present research focuses more on the framework of NbS implementation and assessment, the spatial dimension of NbS and its potential for long-term influences on entire urban systems has not garnered much attention. In this paper, we argue that 'interface spaces', where different people and species interact frequently, are strategic sites for NbS experimentation. Furthermore, landscape design plays a pivotal role in NbS mainstreaming, as landscape can serve as a medium and a method that may facilitate positive change of urban socio- ecological systems. Under the 'Sponge City' program of Taipei City, these interface spaces are drawn into the new policy discourse of re-naturing the city, becoming experimental sites of NbS implementation. In this practice, landscape design acts as an intermediary bridging transdisciplinary knowledge with the diverse interests of multiple stakeholders and translates imaginary visions of urban futures into realizable actions. By comparing and interconnecting these cases at the site-level, the evolution of ecological design also has the potential to scale up NbS implementation and enhance system transformations on a landscape scale. Three iconic NbS cases in Taipei are presented in this paper—Huanggang River Reengineering Project, Yongchunpi Wetland Park, and Sanchong World Trade Park. These cases represent different types of interface spaces in Taipei and are involved with different stakeholder networks. We conclude that landscape design can contribute to the reduction of flood risks, the restoration of ecosystems, and the enhancement of social interactions in an integrative way. To mainstream NbS in Taipei, current experiences of interdisciplinary collaboration and citizen participation should be institutionalized in policies and regulations, so that different social values and ecological could be better mediated.

Keywords: Interface spaces, Nature-based Solutions, Urban transformation, Landscape design, Urban

socio-ecological system

1. Introduction

In the past few years, Nature-based Solutions (NbS) have drawn extensive attention in policies, research, and practices, both in Europe and beyond (Davies et al., 2021; Faivre et al., 2017; Nesshöver et al., 2017). Stemming from related approaches such as 'ecosystem-based adaptation', 'green infrastructure', and 'natural capital' (Pauleit et al., 2017; Ruangpan et al., 2020), NbS are conceived of as an umbrella concept that bridges different knowledges and has the potential to address climate change mitigation and adaptation in a more holistic and cost-efficient way (Dorst et al., 2019; Kabisch et al., 2016). With innovative and experimental strategies that are 'inspired by, supported by or copied from nature' (European Commission, 2015, p. 4), NbS can tackle interwoven environmental, societal, and economic challenges while simultaneously delivering multifunctional co-benefits of biodiversity, ecosystem services, public health and human well-being (Cohen-Shacham et al., 2016; Tzoulas et al., 2021). Furthermore, NbS are characterized by transdisciplinary collaboration and polycentric governance, which invite diverse stakeholders to participate in co-design, co-creation, and co- management process (Dorst et al., 2019; Tzoulas et al., 2021). Recently, researchers show a growing interest on the particularity of urban NbS (Dorst et al., 2021; Kabisch et al., 2022; Raymond et al., 2017a; Tzoulas et al., 2021), not only because the densely populated and human-dominated urban areas are vulnerable to natural hazards, but also because cities are often the testing ground of innovations and can be drivers of sustainable and resilient transformations (Frantzeskaki et al., 2021; Wolfram et al., 2016). Under the motto of 'renaturing cities' and 'bringing nature back to cities' (European Commission, 2015), Nature-based Solutions can therefore serve as a leverage point that reshape a more harmonious human–nature relationship in cities (Welden et al., 2021).

In Taipei, the notion of Nature-based Solutions is a relatively new concept that has not been officially adopted in urban policies, but some initial attempts to introduce NbS-like projects, such as ecological parks and river restoration, can be observed. These sites were formerly used for agricultural, industrial, or military purposes, and they are mostly located at peri-urban areas in proximity to suburban hills or riverfronts. These sites are drawn into processes of urban redevelopment due to the pressure of residential, economic, or recreational needs. Whereas a general tendency to follow path-dependency may lead to the continuation of unsustainable, pro-growth, developments (Davies & Lafortezza, 2019), the natural surroundings, stakeholder types, and planning regulations of these sites will also affect decision-making about future land use. Often through process of public participation and negotiation, concepts of urban sustainability

and resilience will emerge and have the chance to integrate pro- environment advocacies into the dominant discourse of property-led urban redevelopment, if the latter cannot be entirely altered. Furthermore, landscape design plays a crucial role in this wave of 'renaturing cities' in Taipei. While urban planning can demarcate land use zoning for public parks and waterways, through landscape design, the ideas of ecosystem services and sustainable developments can be realized. Landscape design can actively respond and adapt to various natural-ecological and socio- cultural processes, at the site-, urban-, and landscape scales, thereby bridging the gap between sustainability science and urban landscape change (Arts et al., 2017; Nassauer & Opdam, 2008).

The aim of this paper is to untangle the complexities and context-embeddedness of (quasi-) NbS experiments in Taipei. We use three case studies to demonstrate the spatial distribution and characteristics of these projects and to explain why they are strategic to Taipei's urban redevelopment and transformation. The three cases represent different urban settings under which NbS can be implemented. Considering the place-specific conditions, physical geographies, regulatory systems, and actor networks (Dorst et al., 2021), we exemplify the contribution of landscape design in achieving a balance between social demands and environmental/ecological concerns. As urban redevelopment proceeds, our research findings will inform possible pathways of NbS upscaling and indicate the opportunities and barriers of NbS mainstreaming for urban sustainable transformations in Taipei.

2. Literature Review

2.1 Nature-based Solutions in Urban Areas

While Nature-based Solutions can be implemented in rural and urban areas, a focus on the particularity of Nature-based Solutions in an urban context is emerging (Dorst et al., 2021; Kabisch et al., 2022; Lafortezza et al., 2018; Tzoulas et al., 2021). Ongoing processes of urbanization and the constant land use conflicts may result in the loss of biodiversity and degradation of ecosystem services, causing cities to be exposed to natural catastrophes (Kabisch et al., 2022). Since the human-dominated urban environment with its pre-existing 'grey' infrastructure may shape lock-in conditions, it is crucial to cultivate a city's transformative capacity and prevail over unsustainable urban pathways (Elmqvist et al., 2019; Wolfram, 2016). This is, however, never an easy task because in urban areas there are contrasting values, ways of living, and social demands held by diverse stakeholders, which must be negotiated prior to any interventions like NbS (van der Jagt et al., 2019). A polycentric governance structure that entails citizen involvement and public participation is thus necessary to avoid unjust and undesired impacts (Dorst et al., 2019; Frantzeskaki, 2019). Furthermore, cities are regarded as hubs of innovation that shape grassroots niches for urban sustainability transitions (Dennis & James, 2018; Wolfram, 2018), and the urban units are the suitable

scale to probe new approaches and experiments (Mendes et al., 2020; van der Jagt et al., 2020). Acknowledging the key characteristics of cities, Kabisch et al. (2022) proposed five distinct principles for urban NbS, they are: (1) need for a systemic understanding; (2) benefitting people and biodiversity; (3) inclusive solutions for the long-term; (4) context consideration; (5) communication and learning.

Sarabi et al. (2019) mapped the spatial distribution of Nature-based Solutions from city center to city outskirts, and pointed out that the nearer a NbS project is located to inner city, the higher level of artificial intervention and management is required. This indicates that the selection of a certain type of NbS—from the conservation, protection, maintenance, and restoration of nature, to the creation of a new, man-made, ecosystems—will depend on the urban environment and conditions. In highly- urbanized and densely-built areas, small-scale NbS such as green roofs, green walls, and rain gardens may be widely installed (Dorst et al., 2019). Brownfields regeneration, parklands, or river valley may form another category that test NbS at a larger scale (Dorst et al., 2021; Frantzeskaki et al., 2020; Raymond et al., 2017a). While most NbS cases are presented in a European context, Elmqvist et al. (2018) suggested that urban transformations in Asia or Africa may take place in different forms of 'urban tinkering'. The design of small-scale, sometimes piecemeal, green-grey hybrids that reuse existing urban structure to provide new services and functions may be more effective and flexible.

Although research on NbS has informed general principles, frameworks, step-by-step planning procedures, and best-practice experiences (Cohen-Shacham et al., 2019; Kabisch et al., 2022; Raymond et al., 2017a), it remains unclear how these principles can be adapted to local conditions in NbS design (Albert et al., 2021). Clearly, NbS are context-embedded and place-based actions that are closely bounded to a particular urban circumstance (Dorst et al., 2019; Wickenberg et al., 2021). Albert et al. (2021) warned that NbS may fail to function as solutions and even result in negative consequences, if the proposed actions are not compatible with the social-ecological context. Dorst et al. (2021) suggested eight 'structural conditions' that must be considered in NbS planning. These conditions may hinder NbS uptake in cities, but they become unstable when hit by external disturbances, giving novel approaches and alternative solutions the opportunities to emerge (Dorst et al., 2021; van der Jagt et al., 2020).

If local conditions and contexts have an impact on urban NbS, a second research gap emerges concerning the upscaling and mainstreaming of NbS. It has been recognized that there are barriers and opportunities to the transfer of NbS experiences and the institutionalization of NbS in cities (Kabisch et al., 2016; Mendes et al., 2020; Sarabi et al., 2019). For Raymond et al. (2017a), NbS transfer and upscaling is considered an important phase to demonstrate successful experiments through policy learning and to bring best practices into the mainstream market. But a detailed discussion about why certain places are selected as laboratories to test NbS and what criteria these pilot projects have set up for upscaling is lacking. Cohen-

Shacham et al. (2019) advised that NbS should be considered at a landscape scale, because a site-scale NbS may have an impact on other places across different scales. This indicates the need and possibility of NbS upscaling, as dispersed NbS sites should together form a comprehensive solution to urban challenges at a larger scale (Arts et al., 2017). Fastenrath et al. (2020) pointed out that 'scaling directs attention to specific social and material contexts and the importance of translation processes that embed and fit solutions into their localities' (p. 64), indicating that 'to scale up' is not a linear process of reproduction but has to take place-specific conditions and cross-scale dynamics into consideration.

Chini et al. (2017) studied the policy feedback cycle of green infrastructure and introduced the term 'knowledge broker', whose task is to translate expertise knowledge into feasible actions, intermediate the diverse interests and values among stakeholders, and to inform best-practices for future decision- making. While Chini et al. (2017) conceived of non-governmental or research organizations as potential knowledge brokers, we argue that landscape designers can take this crucial role in mainstreaming NbS. Following Nassauer and Opdam's (2008) conceptualization of landscape design as a link between sustainability science and real-world practices, landscape design has a strength in brining what is invisible—ecosystem services for example—to the visible and tangible realm—the landscape (Nassauer, 2012). The importance of landscape design in NbS implementation has been evident, as Frantzeskaki (2019) argued that for NbS to be widely accepted and appreciated, they must be aesthetically appealing for citizens. This means that technical solutions alone are not sufficient because these interventions in the built environment will be perceived and experienced by its users. To ensure the effectiveness of NbS realization, Albert et al. (2019) identified the multiple contributions that landscape planning can offer, which has a long tradition in gathering spatial information and employing participatory channels 'to suggest land use options, to achieve environmental objectives, to explore the respective impacts, and to provide recommendation for implementation in practice' (p. 16). A focus on NbS implementation and landscape design will help to gain insights into how upscaling and mainstreaming are made possible.

2.2 The Evolution of Landscape Design and Urban Sustainability Science

It is commonly agreed that landscape is "the scale at which people and nature interact most acutely … in a spatially explicit way" (Heymans et al., 2019, p. 11). As a process, landscapes are changed through which human activities try to intervene in and make use of natural resources for human benefits; as a product, these altered landscapes are perceived and experienced in everyday lives, delivering cultural meanings and aesthetic values that constitute people's place attachment and identity (Jorgensen, 2011; Nassauer, 2012). Understanding landscape's multiple functions across scales, Nassauer (2012) viewed landscape both as a medium and a method for creating human–nature synthesis. Landscape can serve as a boundary object that unite interdisciplinary knowledges, facilitate exchange of opinions, enhance collaboration among

stakeholders, and guide a more integrative approach to solve environmental and socio-economic problems (Ahern, 2013; Arts et al., 2017). Moreover, landscape implies the imagination, invention, and creation of an alternative future through landscape design (Steiner, 2011). Recent scientific progress in understanding ecosystem services, resilience, and landscape ecology can contribute to evidence-based decision-making about landscape change, and landscape design can be the bridge between science and practice (Nassauer & Opdam, 2008).

Landscape design has co-evolved with concepts of modern and postmodern urbanisms. In modern urban planning, human and nature were separate from each other through functional zoning, which was based on the premise of instrumental reasoning and logical positivism (Young, 2016). It was convinced that eople can better manage, control, and change natural processes for human needs through the use of new technologies and engineering (Heymans et al., 2019). The reductionist uniformity and mechanistic functionality of modern cities received massive critiques since the late 1950s. A call for the return to historical memories, local traditions, vernacular materials, and place identity thus highlighted a post-modern design approach. Attentions were given to the role of nature in cities by landscape architects, such as Ian McHarg, who advocated that landscape, rather than buildings and streets, should be the organizing principles in urban design (Steiner, 2011, 2014). Besides high-style design theories, the post-modern period also signified a time when plural forms of knowledge were produced, seeking to challenge the normative and dominant discourses through urban social movements (Nassauer & Opdam, 2008). These movements, including urban environmental movements, had a fundamental impact on communicative planning process and the change of urban governance (Heymans et al., 2019).

From the 1980s, advances in ecological and environmental science added refreshing impulses to urban and landscape planning. While ecologists had a growing interest in the ecology in and of the human- dominated urban areas (Andersson et al., 2014; Ernstson et al., 2010), landscape urbanists saw the need to incorporate evidence-based research into the practice of landscape design (Ahern, 2013; Opdam et al., 2018; Steiner, 2011). Steiner (2014) pointed out four research strands that landscape architects should learn from: ecosystem services, resilience thinking, green infrastructure, and urban renewal through landscape urbanism. These intersecting concepts can help landscape architects link advances in science to practical actions. For instance, landscape urbanism is an urban design approach that recognizes cities as part of the natural world (Spirn, 2014). In landscape urbanism, landscape becomes the basic building block of cities (Thompson, 2012), and natural processes and landscape performances can respond to societal and environmental challenges and delineate comprehensive solutions (Arts et al., 2017).

This short review indicates the evolution of landscape design in response to progress of scientific research and new urban challenges under climate change. Nature-based Solutions as a novel policy approach will

have to collaborate with landscape planners and architects. We need to ask whether current practices of NbS would follow, have advanced, or are confined to existing landscape design principles, and how landscape design can contribute to NbS mainstreaming in urban settings.

3. Research Framework and Methodology

Understanding that place-specific contexts and conditions have an impact on urban NbS and that landscape design has the capacity to merge NbS concepts with local knowledge into implementation, this paper tires to answer three research questions in relation to Taipei's NbS experiences. First, what kind of urban spaces can serve as 'testing grounds' for NbS in Taipei? We argue that these NbS-like projects are not carried out in a random order, but the urban redevelopment processes in Taipei open up opportunities for urban experiments with new ideas and practices. Since these places are mostly located in peri-urban areas close to hillsides or waterfronts, 'nature'—including the natural environment and its ecological systems—becomes a variable that must be taken account of. Secondly, how landscape design can physically embody NbS concepts in cities? It is clear that each city district has its own context and challenges. It is the responsibility of landscape designers to collect all necessary spatial, environmental, and ecological information, balance trade-offs, and make sure that the design outcome will be socially accepted and culturally embedded. Third, what are the opportunities and barriers to NbS mainstreaming in Taipei? We believe that these pilot projects will influence follow-up NbS planning and design. Landscape designers can draw lessons from current practices and transfer their knowledge and experiences to another site with similar contexts and conditions.

To answer these research questions, a research framework is developed and will help to contextualize the three case studies. This research framework consists of three interrelated and complementary parts. We first trace the *institutional context* of each case and critically examine the planning regulations and procedures. This analysis helps us to identify why certain places are drawn into NbS implementation in the process of urban redevelopment. We then analyze the *environmental context* of the three cases—encompassing their geographical, hydrological, biological, and ecological traits—which will set up for the prerequisite but also limitations of future developments. Lastly, the *actor network* involved in our case studies will be analyzed. Relevant stakeholders are engaged in different phases of NbS planning and design, and their knowledge and actions will have impacts on NbS. The institutional requirements, environmental concerns, and the diverse interests of different stakeholders, will be reflected in the implementation of NbS through landscape design.

We use qualitative methods to conduct our research, including the review of policy documents and semi-structured interviews. Policy documents and governmental publications are collected, reviewed, and analyzed for an understanding of urban planning rationale and objectives. These documents encompass

citywide policy initiatives such as the 'Taipei 2050 Vision' and the 'Taipei Sponge City', as well as the masterplans and detail plans of each case, planning and design reports, slides presented on public meetings, minutes of the meetings, and press release. Furthermore, nine in-depth semi- structure interviews were conducted with government staff, landscape planners and architects, NGO members, and community groups. An interview outline with open questions will be drafted before the interviews, asking our interviewees the context and background of policy creation, processes of NbS planning and design, experiences of participation, as well as their evaluation of the design performances, co-benefits, and future challenges.

4. Policy Change and the Practices of NbS in Taipei

Since Nature-based Solutions are yet officially included in Taipei's urban policies, an examination of the 'policy evolution' of green space and water management may shed lights on how new discourses like NbS may emerge. In Taipei, the management of natural resources is closely tied with disaster prevention. 'Grey' infrastructures and technical engineering solutions were mostly preferred to secure people's lives and to fight for building sites in the process of urban expansion. Although a more systemic approach to flood control and the use of ecological engineering methods were introduced since the late 1990s, these alternative solutions were taken mainly to reduce the use of reinforced concrete, rather than to actively restore ecosystems. Riverside and neighborhood parks and other types of green spaces were created for recreation and civic pride, whereas the protection of rare species and natural environment were confined to a few nature reserves or national parks.

A turning point appeared with the inauguration of mayor Ko in 2015. Under the framework of 'Taipei 2050 Vision', policy agendas of urban regeneration, public budgeting, and urban resilience were promoted. The 'Taipei Sponge City' program was one of the many new policy initiatives, which included three policy objectives: resilient water adaptation, sustainable water utilization, and friendly water environment. Integrative strategies to cope with climate change adaptation and mitigation were proposed, encompassing the implementation of pervious pavements, rain gardens, rain harvesting systems, low-impact developments (LID), and constructed wetlands. While these actions are often implemented individually on a single site, we are more concerned about whether they may transcend existing institutional structure and sectoral silos to embrace transdisciplinary collaborations.

We demonstrate three distinct cases, Huanggang River Reengineering Project, Yongchunpi Wetland Park, and Sanchong World Trade Park, and highlight how these cases may have potential effects on sustainable urban transformations in Taipei (Figure 1). These cases are selected based on three criteria. First, there are long-term, ongoing, discussions on urban redevelopment and land use change in all three cases, indicating

that testing new approaches like NbS is a value-based decision-making. Second, these cases are located on peri-urban interfaces in proximity to hillsides and waterfronts, which are strategic sites for NbS experimentations because of their natural characteristics. Thirdly, in the three cases, there are different type of stakeholders involved, including community members, pro-environment NGOs, and the private sector, showing different modes of cooperation with stakeholders and their local knowledges. We are keen to know if experiences learnt from these innovative and experimental actions may contribute to the institutionalization and mainstreaming of NbS.

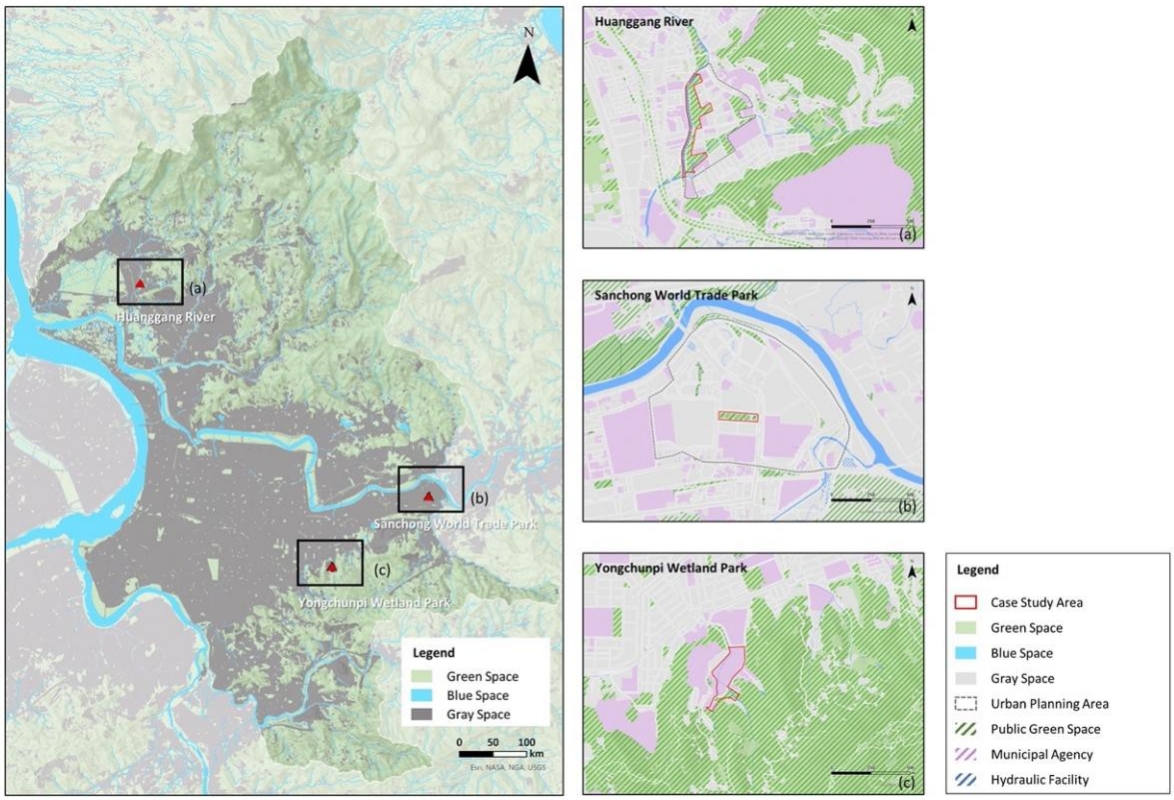

Figure 1. *The location of three case studies in Taipei.*

Source: National Land Surveying and Mapping Center, Taipei City Government; redrawn by authors.

4.1 Huanggang River Reengineering Project in Beitou

Huanggang River Reengineering Project is one pilot river restoration project carried out by the Hydraulic Engineering Office (HEO) of Taipei City Government since 2018. This project represents how waterfront NbS can be planned and designed in a densely developed urban area, enhancing both urban stormwater management, biodiversity, and the well-being of nearby residents.

Huanggang River is located in Beitou District, the northern part of Taipei. Fragmented natural terrain and intensive human activities have increased the risk of floods. To protect the built residential areas, Huanggang River underwent a series of modifications, changing the river landscape from a natural one to a channelized waterway with flood walls and embankments (Figure 2, left). A flood diversion work with underground culvert boxes was completed in 2009. Although these constructions could better reduce disaster risks, they also separate people from nature. In 2018, Taipei City Government initiated the Huanggang River Reengineering Project. By tearing down the embankments, it is anticipated to restore the river's biodiversity and ecosystem services, to promote natural water retention measures, and to enhance people's connection with nature. With the idea of 'making room for the river', this project can be

seen as a pioneering NbS action in Taipei.

Land availability is a key factor that determines the success of the plan. To facilitate the restoration of Huanggang River, the planning team carefully examined the availability of state-owned lands along the river, and two public parks adjacent to the middle stream of the river were chosen. It has to be noted that the two parks and the nearby neighborhoods used to be agricultural lands. When an urban redevelopment project tended to convert the entire area into a residential zone with high-end housing in 2006, local community members struggled for the protection of existing old trees, wild streams, and irrigation ponds on the farmland. As a result, the urban redevelopment plan was revised in 2009, and the two public parks along the river were laid out (Department of Urban Development, 2009). Although property-led redevelopment, instead of urban sustainability, was the main driver of urban planning, the two parks give new approaches like NbS the required 'room' for experimentation, which may bring nature back to city.

While past urban planning defined green spaces and waterways within a fixed boundary, an interdisciplinary team in this project has the capacity to transcend site-based design and to solve interrelated and cross-scale urban issues through a landscape approach. Besides flood control, issues like biodiversity, road safety, and access to green spaces have been raised in this project. The HEO thus needs to charge a landscape design company through a call-for-projects procedure. To win the competition, landscape architect cooperated with hydrologists, ecologists, and transportation consultants, contributing to a more integrative approach of landscape design in the project. For instance, considering the area's connectivity with nearby natural environments, the restoration of riparian habitats has been advised, but it can only be realized when meeting the requirement of flood protection. Hence, a gentle slope of grassland on the left bank of the river is designed, which can serve as a natural revetment for biodiversity and enables the storage of stormwater to reduce downstream flood risks (Figure 2, right). Furthermore, sidewalks and bike lanes are constructed along the river, making a human-friendly walking environment. In 2021, the masterplan of this area is revised again based on the design proposal, relocating the river channel attached to the parks (Department of Urban Development, 2021).

Landscape designer also plays a key role in mediating the diverse needs of stakeholders in this plan. Through co-design workshops, forums, and explanatory meetings, community members and pro-environment NGOs were invited to the discussion. In the workshops, residents doubted the effectiveness and necessity of tearing down the embankments, as they argued that the status quo functions well and worried about increasing flood risks. Also, the HEO has the pressure that this natural solution cannot be failed. As a result, the planning team installed culvert boxes under the restored river as a technical solution to share stormwater overflow and to resolve residents' anxiety. This indicates that new approaches such as NbS are yet fully accepted by the society. Green-grey hybrid solutions may be preferred, and sometimes

are compulsory, in a densely built urban environment like Taipei.

Figure 2. *Huanggang River. (Left: Huanggang River with embankments. Right: 3D rendering).*
Source: Left: Authors. Right: Hydraulic Engineering Office.
Retrieved from https://heo.gov.taipei/cp.aspx?n=9C34C7FFF50762A1. Access date: 2021/05/31.

4.2 Yongchunpi Wetland Park in Xinyi

Yongchunpi Wetland Park is Taipei's first metropolitan ecological park featuring constructed wetlands. The park was planned and constructed by Geotechnical Engineering Office (GEO), and is managed by Parks and Street Lights Office (PKLO) after its completion in 2020. Previously used as a military base, this case demonstrates how existing grey infrastructure can be turned into urban green spaces, which extend peri-urban ecological buffer zones and avoid continuous urbanization.

Yongchunpi Wetland Park is located in Xinyi District, between Taipei's new commercial center and famous hiking trails—the Four Beats Mountains. This place was occupied and used by the Ministry of Defense for more than thirty years (Figure 3, left). After lifting the martial law in the 1990s, many military bases near the city center were relocated in the process of democratization, and the state-owned lands were released to urban redevelopment. The site of the park was once planned as a residential area, showing that there was still a strong housing demand in the city. In 2015, Taipei City Government proposed the 'Yongchunpi Area Redevelopment Plan', expecting to revitalize the whole area, including another, larger, military base (Department of Urban Development, 2016). At the same time, considering the site's location on the hillside where two wild streams flow through, and to comply with the city's long-term vision for building urban resilience, the city government decided to turn this place into a wetland park. The wetland park can not only contribute to ecological restoration and ecosystem service provision, but also create a place for sport, leisure, and environmental education for citizens. To realize this idea, land acquisition from different property owners and the transfer of development rights were conducted as formal procedures for land use change, indicating that land availability is a key factor that enables the introduction of NbS in Taipei.

Whereas urban planning tended to make use of the wetland park for future urban redevelopment, a landscape approach was adopted in this project to connect the park as an ecological island with nearby natural systems. Because Yongchunpi is located on a hillside, GEO, which has engaged in water and soil conservation, was responsible for the project. Although GEO has rich experiences in using stone pitching and other ecological engineering methods for the protection of hill slopes, it has less experience in comprehensive landscape design. Therefore, An interdisciplinary team comprising landscape architects, planners, biologists, ecologists, and engineers was contracted by GEO for the planning and design of the wetland park. Rain gardens and bioretention were constructed for stormwater management, which can also be used for urban farming during dry seasons. An ecological survey was conducted to identify important species, their migration routes, and preferred habitat types. Different patches, including woods, grass swamps, and open water, were carefully constructed to create spatial heterogeneity for biodiversity and habitat restoration. The five constructed wetlands in the park can also function as water filtration and sedimentation, and can reduce flood peak when extreme rainfall event occurs (Figure 3, right). The idea of waste reduction, reuse, and recycling was also adopted. Two of the previous barracks was reused as community center and educational venue. Dismantled concrete debris from the other buildings were used in gabion revetments, façade design, and outdoor furniture.

Citizen participation was emphasized during the planning and design process. Instead of opening the whole park for public use like most urban parks in the city, the landscape planning team tried to mediate recreational purposes, environmental education, and ecological restoration in Yongchunpi Wetland Park. As a result, the park was divided into three zones. The educational zone is equipped with recreational facilities, providing access to the park for leisure and sport. The buffer zone is a transitional area for guided tours, educational programs, ecological workshops, and birdwatching. Lastly, the core zone is a restricted area only open for volunteers and maintenance staff, so that the habitats would not be interrupted by human activities. A pro-environment NGO played a key role in this case, which cooperate with the city government for the management, maintenance, and monitoring, of the park.

Figure 3. *Yongchunpi Wetland Park. (Left: Before construction. Right: The park with wetlands).*

Source: Left: Geotechnical Engineering Office. Right: Authors.

4.3 Sanchong World Trade Park in Nangang

Unlike the other two cases, Sanchong World Trade Park was not carried out by the city government but by a private enterprise, and it is not located in direct proximity to waterfront or hillsides. This is not to say that the case has no relation to its natural surroundings, but previous urban redevelopments have cut off the site's connection with nature. Hence, Sanchong World Trade Park can demonstrate another aspect of urban NbS: the creation and representation of man-made nature in a highly-developed built environment.

Sanchong World Trade Park is located in Nangang District of Taipei. Nangang is a natural river valley where Keelung River runs into Taipei Basin, and serves as an important corridor for railway and highway routes. In the 1990s, the industrial brownfields, later known as the Nangang Economic and Trade Park, were drawn into Taipei's neoliberal industrial upgrading and economic restructuring process. (Jou et al., 2012). However, in the Business Park, there was only a small piece of rectangular green space remained (Department of Urban Development, 1996). This indicates that urban nature is commonly sacrificed in the harsh land-use competition vis-à-vis economic developments.

Whereas green spaces in the Business Park is scarce, if well designed, the public parks can create an 'urban oasis' in the midst of concrete desert and provide benefits to human beings. The Sanchong World Trade Park was adopted by CTBC Financial Holding Group in 2011, whose new corporate headquarter stands directly next to the park. The adoption of public parks by private companies and civic groups was encouraged by PKLO as a way to reduce public expenditure. For the private sector, it is considered a plus to the promotion of corporate social responsibility (CSR). Hence, a landscape architect was commissioned by CTBC Group for designing the park.

The landscape architect made an agreement with the CTBC Group that the park should fulfil two purposes. First, as the only large-size green space in the Business Park, 'afforestation' contribute to temperature decrease and air purification. Secondly, the park should match well with CTBC Group's corporate identity, and the idea of construction an outdoor fern garden, which represents Taiwan's biodiversity features, can make this park unique to others. To realize these ideas, however, the climatic conditions of the site had to be considered. The northeast monsoon during winters produce a difficult condition for tree and plants growing. In this case, exotic tree species were selected for they could better resist strong breeze than some native species. Moreover, two 3-meter hills that shaped a valley were constructed in the park, creating a humid environment that ferns prefer. A footbridge across the hills facilitates close observation of tree canopy from above, while another route climbs slowly from the ground to the top of the hills, enabling a three-dimensional spatial experience in the park (Figure 4).

Besides CTBC Group's sponsorship, the landscape architect had to adapt to local regulations and urban design principles imposed by the city government. Underneath the park was a public parking lot, which restricted the depth of soil that can be put on the existing structure. Light materials, in this case high density polystyrene, were used to constructed the hills. Furthermore, a pedestrian overcrossing that connected different buildings in the Business Park divided the park into two sections. The landscape architect thus designed an area for terrestrial ferns on the east side, and for aquatic ferns on the west side of the park.

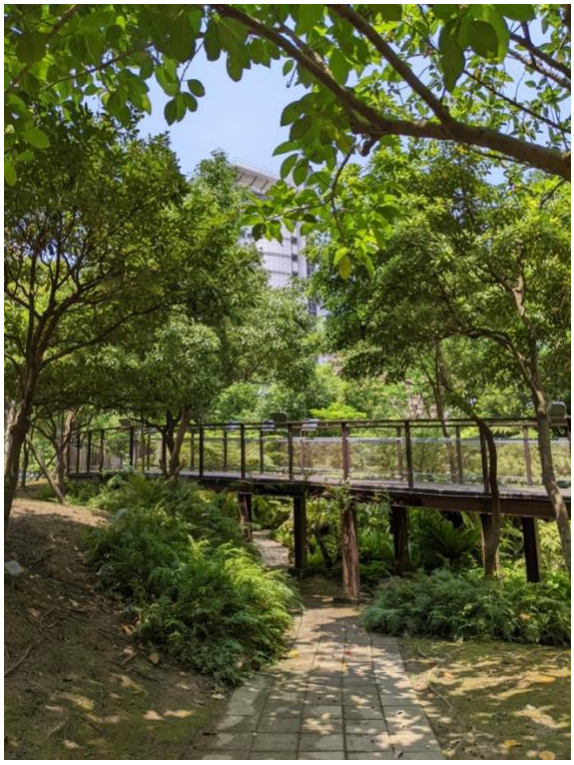

Figure 4. *The fern garden in Sanchong World Trade Park.*
Source: Authors.

5. Discussion and Conclusion

The three cases in Taipei indicate how Nature-based Solutions are planned and implemented in a particular urban context, where the institutional and regulatory systems, social values, actor networks, and ecological environments are different from that of NbS in Europe or in other Western countries.

Clearly, the promotion of NbS in Taipei is closely related to the city's urban redevelopment processes, yet NbS have not been included in the official urban policy discourse. Unlike in Europe, where NbS are conceived of as an organizing principle that guides ecological/sustainable urban regeneration and contributes to biodiversity and human wellbeing (Cohen-Shacham et al., 2016; European Commission,

2015; Raymond et al., 2017b); in Taipei, NbS often come after urban planning is done and are carried out individually, often on a small, site scale. We argue that the separation of NbS from urban planning is a result of Taipei's bureaucratic tradition that emphasized on professional specialization, as the planning department focuses more on land use zoning and the public works department focuses more on construction and operation. Due to sectoral inertia (Kabisch et al., 2016), land availability becomes a deciding factor for NbS implementation. Whereas in old urban areas, existing green infrastructure may serve for NbS test beds (Jou et al., 2020), in peri-urban areas, lands that were formerly used for military purposes, cemeteries, industrial sites, or agricultural lands provide greater 'room' for NbS experimentation. Peri-urban areas are characterized by their proximity to nature; they are interface spaces where frequent interaction between ecological and socio-cultural processes occurs. These peri- urban interfaces are critical to the implementation of NbS in Taipei, and they may correct and balance pro-growth urban redevelopments and lead to more sustainable urban transformations.

In practice, we confirm that landscape design—including the landscape architects and the landscape planning process—plays a key role to the realization of Nature-based Solutions in Taipei. Three different offices under Public Works Department are responsible for the NbS projects. Nevertheless, these authorities are specialized in their respective fields—such as flood control, water and soil conservation, and green space management—but they lack the required knowledge and experiences in landscape planning and design, ecological restoration, and public participation. To deal with complex urban challenges, the city government have to collaborate with an interdisciplinary team composed of landscape architects, ecologists, engineers, and scholars of different professional backgrounds. The conditions and limitations of a given site are considered in landscape design, including the site's vulnerability to natural disasters and its structural and functional connectivity to natural surroundings. The integration of stormwater management measures, habitat restoration, and human activities through landscape design has to be socially accepted and appealing to citizens (Frantzeskaki, 2019). Moreover, landscape design has to engage with local actors, NGOs, and the private sector, negotiate with diverse interests of stakeholders to avoid trade-offs, and translate professional knowledge and scientific findings into a common language that can be understood (Frantzeskaki et al., 2020).

Landscape design not only bridges the gap between science and practice (Nassauer & Opdam, 2008), but also informs the representation of different forms of nature based on the place-specificity of each case (Albert et al., 2021; Albert et al., 2019). Although urban NbS are highly artificial, there are nuanced differences of man-made nature from the restoration of ecosystems to the reinvention of urban green, considering the coupled social–ecological systems of the case. Landscape design can utilize the physical geographies to embed NbS measures in the natural environment (Dorst et al., 2021). For instance, in

Huanggang River Reengineering Project, the restoration of riparian zone for biodiversity can match well with the need of natural retention measures for flood control. Likewise, in Yongchunpi Wetland Park, the hill slopes and two wild streams provide a suitable circumstance for the construction of wetlands, which not only contribute to ecosystem services provision but also recall the place's history of irrigation ponds. In both cases, ecological restoration was the main objective. Conversely, the Sanchong World Trade Park illustrates another story of how nature can be created in a densely built urban environment. In this case, the natural connections of the place have been cut off by previous urban redevelopment. To bring nature back to city, the micro climate of the site, including wind, temperature, soil, and water, must be carefully examined. Moreover, the fern garden in the park tries to reinvent a urban 'wilderness' by adopting a vernacular landscape design approach (Nassauer, 2012), which may promote people's cultural identity to the city. Our findings extend the categorization of NbS by Sarabi et al. (2019) based on proximity to the inner city and managerial levels of intervention. Human intervention in implementing urban NbS has to take a place's natural environment into consideration, which will affect different 'forms of nature', its objectives and functions provided. Whereas biodiversity and the restoration of ecosystems will be stressed if the locations are close to hillsides or waterfronts, the representation of a 'vernacular' nature indicates another pathway of urban transformation in built- up areas.

In this paper, we identify that NbS implementation in Taipei is embedded in the process of urban redevelopment, which affects land availability for NbS. In particular, peri-urban areas provide great opportunities for NbS experimentation and sustainable urban transformation. Landscape design plays a critical role in bridging scientific knowledge with practices and in mediating different stakeholders. The environmental, ecological, and social needs of local government, private enterprises, community members, and NGOs have to be negotiated in NbS planning and design. Current experiences of transdisciplinary collaboration through landscape design have developed various strategies to the representation of nature in different urban context. We believe that these experiences should be encouraged, transferred, and institutionalized (Mendes et al., 2020), which will positively lead to NbS mainstreaming in Taipei.

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Unlocking Co-Financing Strategies for Urban Nature-based Solutions

A balancing act between social justice and scaling up of co-finance

Ismat Fatema Fathi

Student, Lund University, ismat.fathi@gmail.com

Abstract

The current reality is that cities are losing green spaces rather than creating more of them, leading to many urban challenges. Urban Nature-based Solutions, through renaturing urban landscapes, are seen as a promising solution to help cities deal with climate change and build a better future for communities worldwide. In Europe, specifically, NbS is also seen as a way of boosting green innovation and resilience in cities by delivering many benefits. Although, securing long-term investments is a recurrent barrier to its mainstreaming. Collaborative or co-financing NbS, which brings together multiple entities (across sectors, departments, or actor groups) to finance the project encompassing one or more financing mechanisms, can overcome this challenge. Moreover, there is growing evidence of research which shows that depending on how NbS is implemented, it may have potential implications on justice. This is exacerbated by the profit-driven nature of private actors involved in co-financing urban NbS. Elements of justice are often in contestation with scaling up of finance, and the balancing act between them can be pretty tricky for cities to achieve. Through a comprehensive literature analysis and expert interviews, the research develops a conceptual framework which elaborates on the relationship between scaling up of co-finance and justice. The framework provides an understanding of the roles of different public, private and community actors in a co-financing arrangement. It establishes five building blocks each for scaling up co-finance and social justice. This is used as a basis to examine four case studies in Europe - Glasgow, Nicosia, Malmö and Tilburg. The analysis reveals that implementing a just and scalable co-financing of urban NbS requires looking beyond the project and entering into the structural domains of governance and urban development. Further, the research brings to light seven strategic possibilities which offer promising pathways for urban actors and should be considered when formulating policies and planning to ensure that the co-financing of urban NbS is both scalable and just. As such, this research makes significant contributions to academic knowledge and practice.

Keywords: nature-based solutions, co-finance, scaling up finance, social justice

1. Introduction

Cities in Europe and globally are grappling with the effects of climate change, biodiversity loss and rapid urbanization. In 2018, 85% of the cities reported major climate change disruption events such as extreme heatwaves, floods, rains, droughts, and increased spread of vector-borne diseases. These will only become more frequent and intense in the future (European Commission, 2020; IPCC, 2022). These urban challenges are further exposed to unequal distribution of environmental risks, disproportionately affecting the most vulnerable groups (Anguelovski et al., 2018). Urban nature-based solutions (NbS) is seen as a promising solution to help cities deal with climate change and build a better future for communities worldwide. Although there is no standard definition in the literature, for this paper, the European Commission (2020) defines it as "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions''. Through renaturing urban landscapes, they can advance urban sustainability goals by providing solutions to climate change (mitigation and adaptation), bad air quality, loss of biodiversity, vulnerable coastlines and other threatened ecosystems, food insecurity and health, social injustice and economic deterioration (Kabisch et al., 2016). Owing to the diversity of the benefits to nature and humans, NbS is considered an innovative and cost-effective approach to development. In Europe, specifically, NbS is also seen to boost green innovation and resilience in cities, representing a feasible transition path to sustainable development in Europe (EC, 2015). Although NbS offers multiple benefits, how the benefits are distributed can play an essential role in the environmental justice[1] outcomes of NbS (Anguelovski et al., 2018). The recent pandemic has highlighted the societal disparity in access to greenspaces and re-emphasized people's basic requirement to be connected to nature for mental, physical, and social health and wellbeing (Mell, 2021; Schröter et al., 2022). The more cities can adhere to principles of equity and inclusion, the more likely they are to also enhance social and environmental justice in cities (Kotsila et al., 2020; Toxopeus et al., 2021).

Importantly, while the uses and advantages of NbS are known in principle, the actual implementation and subsequent maintenance are often regarded as problematic. Aspects related to financing (both public and private finance) is the highlighted as one of the major deterrents to achieving mainstreaming of NbS

[1] Environmental justice is the "fair treatment and meaningful involvement of all people regardless of their race, colour, origin, income or gender with respect to the development, implementation and enforcement of environmental laws, regulations and policies'' (US EPA, n.d).

(Toxopeus and Polzin, 2021). Public funding is often not sufficient to meet the urgency in investments,

especially for large-scale projects, where it often lacks high operation costs and requires capital injection from the private funds. Co-financing, thus, overcomes the barrier of NbS finance by bringing together multiple entities (across sectors, departments or actor groups) to finance the project encompassing one or more financing mechanisms. A synthesis of (co) financing arrangement and mechanisms is illustrated in the Figure 1 below.

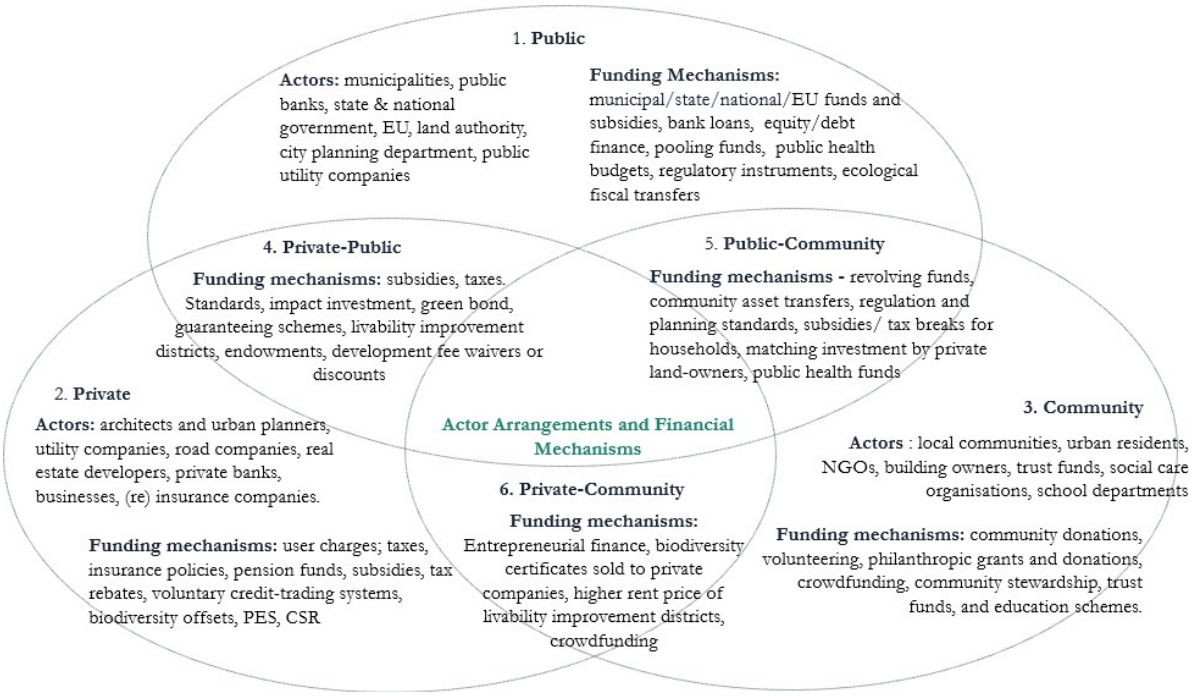

Figure 1: Synthesis of NbS Financial Mechanisms According to Actor Arrangements

Co-financing entails a flexible and learning-based collaborative approach to decision-making through the involvement of state and non-state actors, often at multiple levels, intending to adaptively negotiate and coordinate the management of social-ecological systems across different levels and scales (Dorst et al., 2022). However, after reviewing substantial case studies involving multi-actor arrangements to finance NbS, Toxopeus et al. (2020) observed limited collaborative and adaptive governance. This resulted mainly from a complex stakeholder landscape and silos in project management and the governmental organization, with responsibilities and budgets divided over various government agencies and departments. Moreover, it often overlooks the sensitivity to geographical and policy context, hampering tailored and possibly more effective approaches to co-financing solutions (Dorst et al., 2022). In connection to the aforementioned, there is growing evidence of research which highlights the complex relationship between justice and scaling up of co-financing. On the one hand, there is an urgent need to amplify the investments in NbS and diversifying funding to meet the growing demands of the cities. On

the other hand, the involvement of private actors reinforces social exclusion and inequitable distribution of risks and benefits (Sekulova et al., 2021). This stems from the so-called 'growth-obsession', and the profit-driven nature of the private actors. While the recent literature has started looking at systematic barriers to financing, they tend to overlook the sensitivity to the social, cultural, geographical and policy context, hindering a tailored and effective approach to a financial solution (Dorst et al., 2022). To demonstrate the full potential of NbS finance, future research needs to conceptualize better and integrate the trade-offs and synergies of NbS across multiple scales and systems (Schröter et al., 2022). This leads to the aim of the thesis research to explore the potential of co-financing urban NbS through the lens of scaling up of co-finance and justice. Based on the research problem and aim the following research questions (RQ) are proposed.

RQ1: *How does scaling up of co-finance and social justice outcomes for urban NbS relate to each other?*

RQ2: *What strategic possibilities can urban actors adopt to ensure scalable and just co-finance of urban NbS?*

2. Methods

To achieve the aim of the thesis, the researcher carried a systematic exploratory qualitative approach. Given the newness of the concept of NbS co-finance having a complex actor arrangement, a flexible, iterative, semi-structured process of collecting and analysing the data was appropriated which allowed the identification of new patterns. Multiple case study approach was adopted which used four pilot projects in Europe, where the qualitative case data was evaluated using the conceptual framework (developed by the researcher and explained in Section 3). As noted by Yin (2014), the use of multiple cases can provide a greater spectrum of representation of social phenomena as findings and conclusions are based in a broader number of studies. The study adopts an indirect method of difference for case study selection where both similarities and differences between cases are seen (Perry and Bellamy, 2011). The contextual differences and similarities offer a rich basis for comparison and allow for a deeper understanding of how structural conditions influence the potential of collaborative financing for urban NbS. These are summarized in the table below.

Table 1. *Case study details.*

Case	Type of NbS	Scale	Co-financing actors and mechanisms	Co-financing arrangement
Interpolis – Tilburg, Netherlands	Green roofs	Local-meso	Municipality – subsidies; insurance firm - market development	Informal partnership between the insurer, Interpolis and Municipality
Trees AI – Glasgow, UK	Urban forests, open spaces, SUDs, street trees, etc	Meso-landscape	Municipalities, regional, national – pooled budgets; institutional investors – carbon offsetting, pension funds, user charges, etc; private innovation funds	Indirect formal partnership between the municipality and the corporates through Trees AI
Adopt a Park – Nicosia, Cyprus	Neighbourhood and medium-sized parks	Meso	Corporates - CSR funds, municipalities - budgets, tax rebates; EU funds	Formal partnership between the municipality and businesses, supported by ANEL
BiodiverCity – Malmö, Sweden	Green walls, green roofs, SUDs, urban forests, etc.	Local-micro	Public-Private partnership between the municipality, developers & housing associations; national innovation funds.	Formal partnership between the municipality and the private actors.

Based on the research questions, data collection and analysis broadly took place in two phases, a) methods for the conceptual framework (which answered RQ1) and b) methods for case study analysis. The main sources of data collection included 20 semi-structured interviews, academic literature and grey literature. Thematic analysis was the primary form of data analysis and is argued as a valuable method for examining the highlighting patterns and, themes, perspectives of different research participants and generating unexpected findings (Nowell et al., 2017), aligning well with the aim. These two phases overlapped with each other and together formed the answer for RQ2.

3. Results and Discussion

The study looks at co-financing from the lens of scaling up and justice, where each public, private and community actor cluster plays a pivotal role. The author developed a conceptual framework, illustrated in Figure 2, which explains the relationship of scaling up and justice aspects of NbS co-finance. The framework further provides an understanding of their relationship through the role of public, private and community actors.

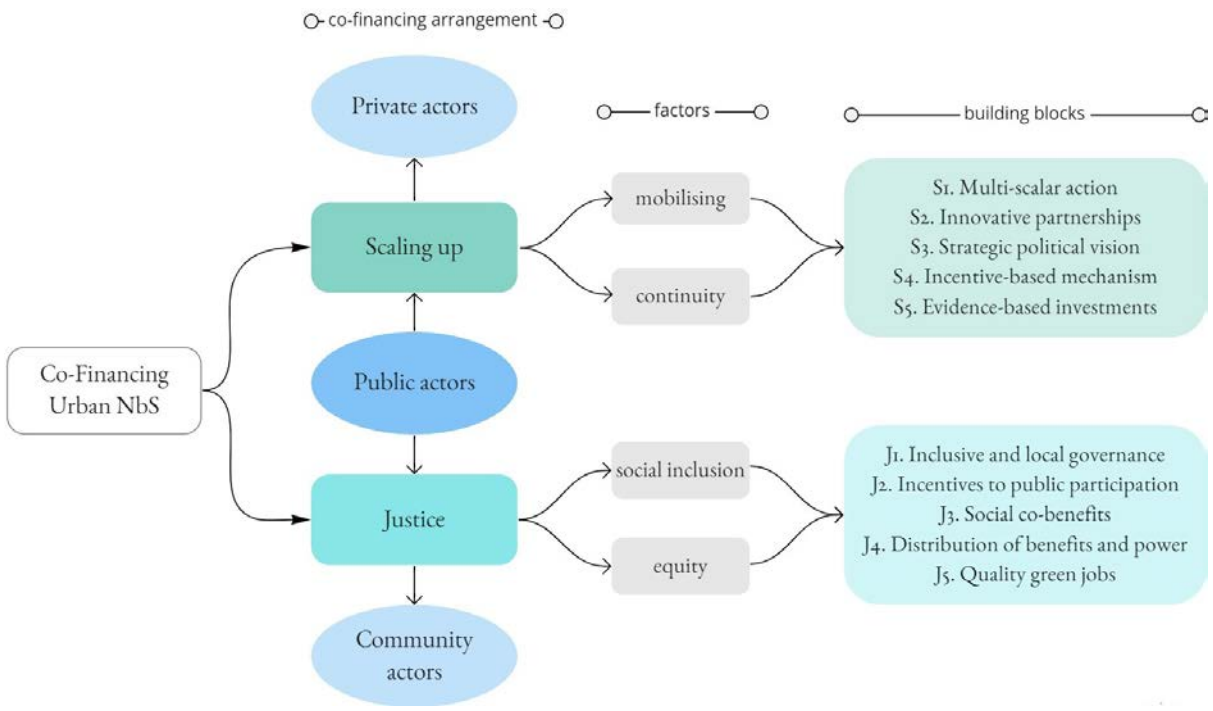

Figure 2: *Conceptual Framework*

From the perspective of scaling up NbS finance, **mobilization** of private sector funds is considered inevitable, especially for large-scale projects. Further, the **continuity** of the project is largely depended on covering maintenance costs. However, the inflow of private finance often contradicts the environmental justice outcomes, raising concerns on the neoliberal green growth agenda where **social inclusion and equity** concerns are often neglected. Here, contestations by community actors can be seen as a corrective measure to the issue mentioned above. Public actors can be seen as the balancing force in the room to ensure scalable co-finance of just NbS. Table 1 elaborates on different building blocks of scaling up of co-finance and social justice of co-financing along with the keywords. During the development of these building blocks there are some emerging win win situations as well contradictions, which were reinforced through case study analysis.

Table 1. *Building blocks*

Concept	Building Blocks	Keywords
Scaling up of co-finance	**Error! Reference source not found.** Innovative Partnerships (S1)	*horizontal and vertical levels of partnerships, innovative finance, procurement, tendering process, transaction costs, governance architecture.*
	Multi-scalar Actions (S2)	*economies of scale, multi-level governance structure, pooling of projects, matching scale.*
	Strategic Political Vision (S3)	*strategic visions, policy ambitions, synergies, internal and external co-creation, lifecycle approach, creative thinking*
	Incentive-based Mechanism (S4)	*branding, reputation, legal, standards, standardization*
	Evidence-based Investments (S5)	*performance, bankable projects, communication, credibility, valuation*
Social Justice outcomes of co-finance	Inclusive and Local Governance (J1)	*participation, stakeholder engagement, capacity building, awareness, political and policy commitment*
	Incentives for Public Participation (J2)	*acceptance, ownership, perceptions, volunteering, stewardship, socially led business models.*
	Error! Reference source not found. Co-benefits (J3)	*multiple social and health benefits, targeted investments, strategic perspective*
	Distribution of Benefits and Power (J4)	*exploration of trade-offs, investor alignment, transparency, policy measures, spatial distribution, stakeholder engagement*
	Quality Green Jobs (J5)	*local jobs, economic opportunities, economic regeneration, buy-in, maintenance jobs, upskilling*

Case Study Analysis:

The empirical study of four European case studies which adopted innovative co-financing solutions for urban NbS and supported in answering RQ2. The case studies offered insights into the relationship between the concepts of justice and scaling up of finance through testing the framework, which is depicted in Table 2. Findings from the case studies are presented in the table below in the form of constraining and enabling factors for a scalable and just co-financing of urban NbS. New themes or concepts were allowed to emerged which are highlighted in grey.

Table 2: *Enabling and Constraining Factors*

Case Study	Enabling Factors	Constraining Factors
Interpolis	S1: transaction cost, informal partnerships S2: economies of scale, matching scale S3: strategic vision, synergies S4: branding, reputation S5:performance, credibility, communication, valuation, data and modelling J1: awareness, stakeholder engagement J2: acceptance, perceptions J3: multiple social and health benefits J5: local jobs, economic regeneration, buy-in, maintenance jobs, upskilling Built strong narrative Rethinking Value Experimentalist approach	S1: tendering process J1: participation, political commitment J4: inequitable distribution of benefits Not applicable to other NbS typology
Nicosia	S1: transaction cost, governance architecture S2: economies of scale, matching scale S3: strategic visions, strategies, policy guides, synergies S4: branding, reputation, legal, standards J1: stakeholder engagement, political and policy commitment J2: perceptions, stewardship, socially led business models. J3: multiple social and health benefits J4: investor alignment, policy measures, spatial distribution J5: local jobs, economic regeneration, buy-in, maintenance jobs Rethinking Value Experimentalist approach	J1: participation J2: ownership, volunteering Not applicable to other NbS typology
Trees AI	S1: horizontal and vertical level of partnerships, governance architecture S2: economies of scale, matching scale S3: strategic visions, strategies, policy guides, synergies, internal and external co-creation S4: branding, standards S5: performance, bankable projects, communication, credibility and valuation J1: stakeholder engagement, political and policy commitment J2: perceptions, stewardship, socially led business models J3: multiple social and health benefits, targeted investments, strategic perspective J4: exploration of trade-offs, investor alignment, policy measures, spatial distribution Rethinking Value Experimentalist approach Use of technology and data	Still in the planning stage and, therefore difficult to predict the outcome

BiodiverCiti	S1: horizontal and vertical level of partnerships S3: strategies, policy guides S4: branding, standards S5: performance J1: policy commitment Feedback loops through learning and evaluation Experimentalist approach	S1: transaction costs S2: multi-level governance, matching scale S3: strategic visions, internal and external co-creation S5: bankable projects, communication, credibility and valuation J1: stakeholder engagement, participation, political commitment J2: acceptance, ownership, perceptions J3: strategic perspective J4: exploration of trade- offs, investor alignment, policy measures, spatial distribution J5: economic opportunities, local jobs, maintenance opportunities

Both trade-offs and synergies were observed in the case studies and the balancing act between them can be pretty tricky for cities to achieve. The complexity is increased when a range of diverse actors are involved in improving the share of funding. It became clear that a critical interrogation on the visions around renaturing cities, and how it is redefined, reimagined, exported and rearticulated is required. While co-financing NbS did create green jobs in the analyzed cases and most managed to achieve distributional justice, it remains unambiguous both in the literature and case studies, until which extend did the cases meet the social justice outcomes with or without the private sector involvement. Further, through the case studies, it was realised that all three actor groups can potentially contribute to a scalable and just co-financing of urban NbS. New actors (can belong to either private, public or community) namely, aggregators which bundle the projects to make it financially viable for the investor and Nature- based entrepreneurs which take away the burden from the governing actors by contributing to the local nature-based economy emerged.

Strategic Possibilities

A holistic approach to co-financing of urban NbS requires looking beyond the project, entering the structural domains such as governance and urban development. Overall, the analysis further brings to light seven strategic possibilities – Collective Leaderships, Integrative Business Case, Rethinking Value, Building Narratives, Use of Technology and Data, Experimentalist Approach and Feedback Loops, to overcome the contradictions of scaling up of co-finance and justice and realise their synergies.

These strategic possibilities can be considered as act upon this information and open the door for endless prospects. It urges the urban actors to take a collective leadership approach that encompasses political will, collaborative multi-scalar governance, and internal and external co-creation. An integrated business case should be developed which considers the characteristics of different types of NbS where funds are allocated throughout the project's lifecycle. Yet, a fundamental shift in how we think about our relationship with nature is required to realize its potential fully. Further, using technology and data such as GIS, blockchain in different phases of the project is extremely beneficial for distribution of benefits and risks, transparency, and monitoring and assessment. Lastly, the author prescribes an experimentalist approach that encompasses bold and creative thinking, followed by incorporating feedback loops for experiments to get mainstreamed where learning, capacity building, collaboration, knowledge dissemination, communication and monitoring and evaluation form strong elements.

4. Conclusions

The conceptual framework unpacks the concept of co-financing by looking at it from a holistic lens of justice and scaling up of finance. The newness of NbS co-financing implies there is also a lack of knowledge to understand and operationalize this concept. Crucially, before this concept is mainstreamed in practice, the author recognizes the critical need to investigate the topic in an integrated manner. In this regard, the research has practical implications for urban actors and academia. The study provides guidance to several urban actors to navigate the challenging task of balancing the trade-offs of increasing the share of finance with the social justice outcomes and capitalizing on their synergies. It advises the urban actors –policy makers, government officials, NGOs, businesses, and researchers who directly or indirectly help the public officials and other private and community actors to take an intentional approach to just and scalable co-financing solutions. Moreover, the four case studies further provide demonstratable examples for a just and scalable co-financing solution of NbS (through varying degrees), emphasizing bold and creative thinking. These successful case studies demonstrated a holistic and long-term approach to finance, featuring several innovative financing mechanisms and arrangements for the municipalities and cities to take inspiration.

Currently, research in developing pathways to mainstream NbS in cities is happening at a fast face. While the research thesis has provided a systematic outlook on co-financing urban NbS, it opens doors for further efforts to assist municipalities in catalyzing investment with high socioeconomic benefits and social justice outcomes.

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Posters

Can communities lead the way for socio-ecological urban transformation? The empiric experience of the "network of ideas" process in the Telheiras neighborhood, Portugal

Miguel Macias Sequeira

ISDRS Conference 2022
Sustainable development and courage: culture, art and human rights
Stockholm June 15-17
Track 6a. Urban and regional transformations

Can communities lead the way for socio-ecological urban transformations? The empiric experience of the "network of ideas" process in the Telheiras neighborhood, Portugal

Introduction

- The United Nations have enshrined a clean, healthy, and sustainable environment as a human right.
- Cities are a key arena for socio-ecological transformation.
- Communities can have a prominent role in sustainability transitions.
- However, the topic remains under-researched and there is still much to learn from empiric case-studies.

Methods

- We introduce the Telheiras neighborhood in Lisbon, Portugal.
- We summarize the ongoing "network of ideas" process by the Local Partnership while unfolding its key outcomes.
- The "network of ideas" process was launched in 2020, incorporating 3 stages (discover, analyze, act).
- First, an exhibition and an online survey collected sustainability-related ideas. Second, the ideas were systematized by key stakeholder ("type1": LPT, "type2": LPT plus local authorities, "type3": local authorities). Third, working groups were built encompassing a total of around 70 community volunteers.
- We draw from this experience to explore the role of bottom-up social innovation in a systemic transition.

Conclusions

- We believe this process showcases how community-led action can blossom even during trying pandemic times. This approach is replicable to other areas.
- Ongoing research is characterizing the community's engagement in this process, pointing towards environmental and social goals as main drivers and lack of time and other priorities as main barriers.
- While local activism is sprouting, we also intend to critically assess its inherent shortcomings, such as dependence on volunteers and lack of policy support.

Case-study: the "network of ideas" process by the Local Partnership of Telheiras

Figure 1: Location of the Telheiras neighborhood in Lisbon, Portugal.

Figure 2: The Local Partnership of Telheiras brings together around 20 local organizations.

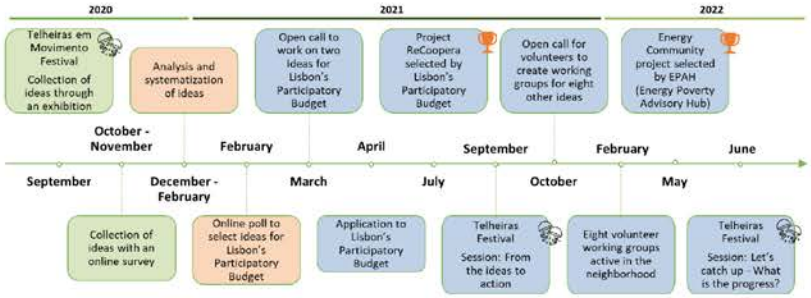

Figure 3: Timeline of the "network of ideas" process (green: discover, red: analyze, blue: act).

Figure 4: Collection of sustainability ideas.

Figure 5: ReCoopera selected by Lisbon's Participatory Budget.

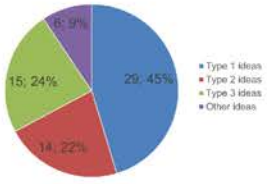

Figure 6: Systematization of ideas by key stakeholder.

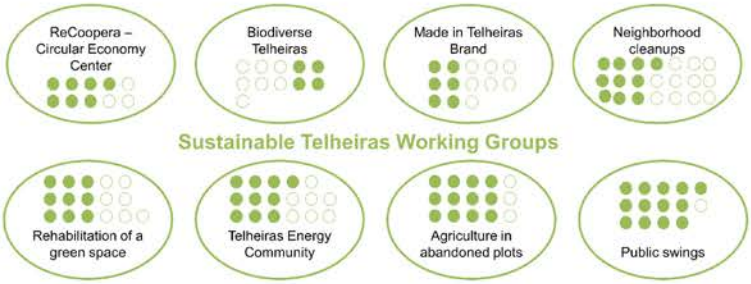

Figure 7: Eight active volunteer working groups in the Telheiras neighborhood and number of members (green circles are volunteers that belong to more than one group).

Miguel Macias Sequeira, CENSE FCT-NOVA – Center for Environmental and Sustainability Research, NOVA School of Science and Technology, NOVA University Lisbon, Portugal

6. Cities and regions

6b. Urban and regional resilience

Abstracts

Conceptual Perspectives on Urban Water Systems Transformation through the Lens of Social-Ecological and Socio-Technical Systems Frameworks

M.Sc., M.A. Tieza Mica Santos

Dresden Leibniz Graduate School, Dresden, Germany. TU Dresden, Dresden, Germany

Abstract

Urban water systems (UWS) play a vital role in urban development and transformation with sustainability and resiliency as central goals. Against the backdrop of rapid economic development, population growth, variations in land use patterns, and climate change, urban regions and cities are facing unprecedented water issues which include flooding, drought, and quality and security of supply provision.

The conventional body of literature addressing urban water challenges is primarily influenced by the narrow techno-centric perspectives of engineering, management, and hydrology. Practical solutions to water issues are limited by a blanket approach of predict-manage-and-control measures, often leading to systemic risks and failures. This contributes to a growing challenge among scholars and practitioners in defining sustainable and resilient approaches that are suitable to the rate and nature of urban water systems transformation.

This systematic review of literature examines the landscape of UWS transformation research between 1990 and 2020 that employs the social-ecological systems (SES) and socio-technical systems (STS) frameworks. It examines the fundamental ontological and epistemological assumptions used to derive the conceptual development of UWS and the dynamics of its transformation. It also presents a cursory analysis of emerging ontologies and epistemologies including the social, ecological, and technological dimensions employed by the references at various geographical and societal contexts as well as spatial and temporal scales. The findings illustrate that UWS ontology and epistemology cannot be limited to a narrow set of categories to address current and future realities. Current literature employing either SES or STS frameworks attempt to offer interdisciplinary approaches as they emphasize either the human-nature or human-technology relationships. While these distinct frameworks demonstrate limitations in their ontological and epistemological orientations, there are complementary concepts and approaches highlighting their strengths and appreciation of complex dynamic systems without antagonistically comparing their fundamental positions. The review also proposes a re-orientation of scientific inquiry and practical solutions that underscores the coupled and dynamic interaction of the ecological, technological, and societal dimensions of the UWS transformation. Furthermore, it suggests that normative goals of security, equity, sustainability, and resilience can only be achieved through a multidisciplinary and synergistic Social-Ecological-Technological (SETS) lens and approach. Such synergy offers an approach responsive to varying problem frames across temporal and spatial contexts in order to influence transformative change in research agenda, governance practice, and policy direction.

Finally, this research offers an understanding of a sectoral subset of urban transformation and resilience. It also relates to the Sustainable Development Goals (SDG) on (SDG6) Clean Water and Sanitation and (SDG11) Sustainable Cities and Communities, more specifically on the goals pertaining to balanced territorial development, positive economic, social, and environmental connections, and strong cross-sectoral cooperation to address water challenges in cities and urban spaces.

Track
Track 6b Urban and regional resilience

Contribution to the Preservation of the Cultural Heritage of Road and Rail Infrastructure: Characterisation of vulnerability to flooding as a basis for resilience building

Dr.-Ing. habil. Regine Ortlepp, Dr.-Ing. Frank R. Beyer

Leibniz Institute of Ecological Urban and Regional Development (IOER), Dresden, Germany

Abstract

Roads and railways are important cultural assets of human society. They connect and network, and with their structures, some of which are decades and centuries old, they have not only an important cultural but also historical value. With a view to the SDGs 11 and 9 of making cities and settlements inclusive, safe, resilient and sustainable - including the necessary resilient infrastructure - our transport infrastructure is of particular importance against the backdrop of increasing natural disasters such as heavy rainfall and flooding as a result of climate change. In order to reconcile the targets 9.1 and 11.5, it is necessary to know the vulnerability of such transport infrastructure systems as roads and railways to environmental hazards such as flooding in order to make them more resilient and thus more durable and sustainable. The contribution is dedicated to the development of a method to characterise the vulnerability of transport infrastructures. This method starts with an analysis of damage patterns as a result of flooding events. A classification of these follows with reference to considerations of the impact situation, and then a systematisation of damage types. The vulnerability is assessed by classifying different types of construction. An essential feature of the methodology is the inclusion and assessment of the structural condition, i.e. how well preserved the construction still is.

The methodology includes a set of common construction methods which are ordered in terms of their susceptibility to flood impacts and assigned to corresponding susceptibility classes. With the help of developed condition criteria specific to the construction methods, they are assigned to corresponding condition classes. A cross table methodically relates the susceptibility and condition class to each other and assigns the construction methods to a vulnerability class. The combined consideration of the susceptibility specific to the construction method and the structural condition shows that not only an unfavourable construction method per se, but also impairments of the structural condition can increase the vulnerability. A visualisation of vulnerability classes in a map representation provides good indications for localising damage potential and thus for addressing the corresponding need for action to increase resilience by reducing vulnerability. In addition to the possible reduction of vulnerability through the future choice of construction methods with lower vulnerability, which may be opposed by competing factors such as monument protection or design requirements, it could be shown that there is often potential in the avoidance of deterioration. The findings thus allowed the formulation of concrete recommendations for action. These include, among other things, the urgent recommendation of the consistent and regular implementation of maintenance measures at relatively low cost, as well as the strict control of the professional execution of renovation and repair measures.

In summary, it can be stated that relatively simple, but consistently implemented measures are required to preserve and design valuable building culture in the area of transport infrastructures by increasing resilience, even under climate change scenarios, in order to fulfil the human right to mobility in a sustainable manner.

Track
Track 6b Urban and regional resilience

Mainstreaming Innovative Funding Mechanisms: A case example of Gothenburg, Sweden.

Ismat Fathi

Lund University, Lund, Sweden

Abstract

Nature-based solutions (NbS) can support in tackling climate change mitigation and adaptation. They advance urban sustainability goals by providing services, creating benefits and offering value for different urban actors. We need to rapidly scale up our efforts to better protect, manage, and restore the ecosystems around us. Whilst the uses and advantages of nature-based solutions are known in principle, numerous barriers exist for their successful implementation. One of the challenges relates to the well-documented shortfall in financing and resource allocation for urban NbS. Finance, both public and private, seems to be a recurring theme when talking about barriers slowing down the mainstreaming of NbS. When dealing with the private sector, elements of justice and equity are elements concerning green gentrification, should be critically evaluated including how and why they are framed.

The aim of my thesis research is to explore ways to mainstream funding of urban NbS. For the funding mechanism to be sustainable and have the ease of upscaling they should be efficient and socially just. To achieve this goal, an integrated framework which along with funding mechanisms takes actors and business models into consideration would be developed. This framework would be a continuation of the framework developed in the pre-study. Moreover, various factors such as ownership properties, typology, scale, participation culture and narratives affect the uptake of funding of urban nature-based solutions. Further, I would like to apply this framework and explore how these factors can be leveraged to upscale the funding of nature-based solutions in the city of Gothenburg, a socially segregated city having a history of flooding. I would be working across significant areas covered with agricultural land, coastal zones, rivers and forests along with identifying innovative actors.

This would be done through a qualitative design method to collect empirical data through interviews and content analysis. On-site data (situation permitting) would be collected through interacting with different actor groups. I intend to identify who makes decisions, what kind of decisions and motivated by which factors, how to ensure that the right knowledge is taken up and how different actors work together. The study would potentially contribute to building a framework that can be used by policy and decision-makers in different contexts. Further, the city of Gothenburg would be a major beneficiary, where the government can leverage the interactions with various actors for the implementation of nature-based solutions. Additionally, various European and similar context cities can learn from the results to upscale NbS funding.

Track
Track 6b Urban and regional resilience

Pedestrian Thermal Comfort Mapping for Evidence-based Governance and Sustainable Urban Design; A systematic literature review

Claire Gallacher

Leibniz Institut für ökologische Raumentwicklung, Dresden, Germany

Abstract

Thermal conditions can greatly affect the quality of living in urban areas. Designing climate-adapted cities with thermal comfort in mind encourages the use of urban space and sustainable modes of mobility such as walking and cycling, and has numerous additional environmental, economic and social benefits. As evidenced from existing literature, thermal effects manifest themselves on humans through the four distinct categories of physical, psychological, physiological and social/behavioural factors (Antoni et al., 2020). Typically, these elements have been investigated separately and studies have crucially failed to facilitate links between multidisciplinary knowledge to inform evidence-based governance and sustainable urban design.

This paper presents a systematic review of research on pedestrian thermal comfort, drawing particular attention to methodologies used in interdisciplinary and multidisciplinary studies. It provides further commentary on the lack of "dynamic" studies which consider pedestrian's natural movements through urban space and the multitude of factors which have differing spatial and temporal affects on the thermal comfort of the individual. Finally, the study analyses previous works which have considered the implications for evidence-based governance and sustainable urban design with the overall aim of sustaining pedestrian thermal comfort.

Relevant sustainable development goals:

Sustainable cities and communities

Climate action

Relevance to conference:

Culture plays a large role in the extent of which individuals experience and adapt to excess heat: physically through the clothing they wear; physiologically depending on if they have been repeatedly exposed to heat stimulus, perhaps having lived previously in a warmer climate; and psychologically relating to the varying ways in which individuals perceive the environment which could be influenced by familiarity with the climate, expectations, experiences and perceived control over the situation. Cultural factors and attitudes are demonstrated within literature to be extremely relevant in affecting thermal perception which highlights further the need for emotions and cultural factors to be connected to research on pedestrian thermal comfort. Cultural background is also demonstrated to play a big role in the perception of space which links closely to perceived aesthetics, addressing the "art" aspect of the conference call. Outdoor space is crucial to the quality of life experienced by urban inhabitants. In many cities outdoor space provides a hub for culture and the meeting of communities and without thermally comfortable outdoor environments, these cultural spaces are at risk.

Track
Track 6b Urban and regional resilience

SDG targets and the Sub-national Scale – How to adapt a global agenda to the context of local authorities in developed countries

Paulo Miguel Madeira[1], João Guerra[1], Madalena Santos[1], Luísa Schmidt[1], João Ferrão[2]

[1]Instituto de Ciências Sociais da Universidade de Lisboa, Lisbon, Portugal. [2]Conselho Nacional do Ambiente e do Desenvolvimento Sustentável, Lisboa, Portugal

Abstract

The 17 SDGs that compose the United Nations 2030 agenda are an ambitious project that addresses the way societies organise their socioeconomic activities and how they can significantly reduce their impacts on the natural environment. They are also intended to bring about processes of adaptation to the changes that will take place, namely environmental and, more specifically, climate change. This would lead to a generalized resilience, although the word is not often used in the resolution that established these goals and their related targets (UNO, 2015).

If the SDGs and their targets are achieved, they should ensure a sustainable future, without jeopardizing the balance of ecosystems, which will lead to a high resilience of the territories where all this takes place. This is a comprehensive and transversal purpose that implies the involvement of all geographic scales of decision and action, in a process whose logic transcends the application of this UN agenda. For this reason, at least since Agenda 21 the literature has already expressed the need to root transformative innovation and actions for sustainability at the local level (Lafferty & Meadowcrogt, 1996; Lafferty & Eckerberg, 1998; Schmidt et al., 2005). This idea has recently flourished on academic agendas (O'Riordan 2021; Sachs et al., 2021; Loorbach et al., 2020), now in the perspective of being an unavoidable condition for the SDGs to be effectively achieved.

The OECD has estimated that 65% of the 169 targets underlying the 17 SDGs will not be achieved without an adequate involvement and coordination of authorities at local and regional levels (OECD, 2020). In this communication, based on the example of Portuguese municipalities, we propose an analysis of the relevance of the contribution of the local scale, in developed countries, for the achievement of the SDGs and how to move in that direction at local level. The involvement of a diverse set of actors and the local population is important to take full advantage of the possibilities of the municipal approach.

One of the issues to be addressed is the selection of the targets to which municipalities can contribute, to varying degrees, and those that fall outside their scope of action. With this in mind, we propose a set of criteria to select the targets that do not apply at this scale and to select those that require adaptation, depending on the contexts. We also present a general table with the results of this selection. The proposed communication is framed within the experience of the ODSlocal Platform (www.odslocal.pt), which involves more than 60 Portuguese municipalities.

This approach relates to all the SDGs and, in an overarching perspective, to the need to transform place-based cultures to meet the needs of the 2030 Agenda.

Track
Track 6b Urban and regional resilience

Understanding the Institutional Work of Boundary Objects in Climate-proofing Cities: The case of Amsterdam Rainproof

Dr Mendel Giezen, Dr. Jannes Willems

University of Amsterdam, Amsterdam, Netherlands

Abstract

Creating climate-proof cities typically comes with institutional barriers between public and private parties. Therefore, local governments are increasingly establishing local climate adaptation networks through which collective knowledge and action can be developed. We aim to understand how these networks can initiate institutional change that enables a climate-proof city. To this end, we theorize that boundary objects, as either conceptual or material artefacts, allow different groups to work together without consensus are important instruments of institutional work strategies that aim to change or disrupt established institutional structures. This combination of boundary objects and institutional work allows for triangulation between actors, institutions, their strategies and the instruments they use. We use it to assess the approaches within this network on establishing new institutional practices within their internal system, their interactional system and their external system. Based on a case study of Amsterdam Rainproof in the Netherlands, a frontrunner in urban climate networks, we conclude that boundary objects primarily contribute to capacity building (generating interdisciplinary knowledge about a climate-proof city), agenda-setting (underscoring the urgency of climate adaptation) and the creation of new normative identities (climate adaptation as the joint responsibility of urban actors). Accordingly, boundary objects can transform the cultural-cognitive and normative pillar of institutions, while the regulative pillar (enforcement and sanctioning) is more difficult to change. There is also a lot of energy in establishing or changing existing institutional practices in the internal environment of the founding organisations. For particular actors, it seems the establishment of a network on climate adaptation is not so much oriented into changing other actors practices but in pushing boundaries within their own organisation. Altogether, local climate adaptation networks do not result in a climate-proof city in the short term but can provide a better breeding ground for climate-proofing cities in the long run through their impact on existing institutional practices.

Track
Track 6b Urban and regional resilience

Full papers

Advancing Climate Resilience:

Exploring private sector efforts in the Great Lakes region's receiving communities

Vicki Lin[1], Lisa Greenwood[2], Jennifer Schneider[3]

[1]*Rochester Institute of Technology, vxl9530@g.rit.edu*
[2] *Rochester Institute of Technology, llgcem@rit.edu*
[3] *Rochester Institute of Technology, jlwcem@rit.edu*

Abstract

Climate change continues to impact communities and businesses through rising global temperatures and extreme weather events. In the United States (US), the responsibility of mitigating these risks has traditionally fallen to the public sector at the regional level, through urban planning for climate adaptation and resilience. In order to close gaps in resilience efforts in the face of accelerating events and stresses, it is necessary to engage the private sector, as they dominate many industries that are vulnerable to climate change, including agriculture, shipping, mining, real estate, and tourism. Many private organizations are aware of climate risks but may hesitate to mobilize due to lack of resources, local government support, or sense of urgency. Private sector climate change mitigation and adaptation efforts in the Great Lakes region are critical due to its economic, environmental, and political importance in the US and Canada, as well as its high vulnerability to climate change. Climate-related risk in the region is exacerbated by aging infrastructure and economic reliance on industries that are themselves vulnerable to climate change. This research examines private sector resilience efforts in the Great Lakes region, based on evaluation of climate- related commitments and actions of nine leading firms in the cities of Toronto, Chicago, and Cleveland. Corporate efforts are evaluated in relation to seven climate resilience criteria on a five- level maturity and sphere of influence scale. The research relates to UN Sustainable Development Goal 13, Climate Action, and target 13.1, to strengthen resilience and adaptive capacity to climate- related hazards and natural disasters in all countries. Advancing climate resilience will require, and research can inspire, courage among leaders in the public and private sector, from regional to global levels, to work together in new ways to protect our communities and the human right to health and well-being.

Keywords: Climate change, climate action, climate resilience, Great Lakes region

1. Introduction

The effects of climate change have become more obvious in the past decades through both acute and chronic hazards, such as increased extreme weather events and rising global temperatures and sea level (Goldstein et al., 2019). The public sector has been at the forefront of climate adaption and mitigation efforts, through urban planning and regulatory changes. However, it has been observed that local plans often fail to integrate smoothly with each other due to poor plan alignment, leading to increased physical and social vulnerabilities (Berke et al., 2015). In addition, the rising costs of natural disasters coupled with the decreasing capital of government bodies mean that there is a need to engage other key players in the fight against climate change impacts (Clarvis et al., 2015). In many ways, the participation of private sector organizations is the next step required to close the climate resilience gap.

The private sector dominates many industries affected by climate risks and can help address impacts through financial investments, technological developments, and human resources. Yet there are several common barriers against its participation. Many organizations cite a lack of incentives for long- term planning and a belief that climate impacts are not severe or urgent enough as the reasons behind their lack of participation. As such, although they are mostly aware of climate risks, it has not translated to a need to adapt or mitigate those risks (Chin et al., 2019).

The scope of this study is focused on the Great Lakes Region of North America, as the area faces increased vulnerabilities due to its geography, economy, and infrastructure (Hayhoe et al., 2010). There have been notable increases in water levels in the past few years, as well as slight increases in average surface water temperatures (Environmental Protection Agency [EPA], 2021). The lakes help to support fishing, tourism, and shipping industries that have been impacted by the changes in water level, precipitation, and temperature. However, if these risks can be managed, the Great Lakes can also serve as a climate haven or refuge due to its abundance of freshwater. Consequently, the region serves as an important location of research for climate adaptation and mitigation efforts, especially in this topic of how private participation can improve community resilience given that the fate of businesses and the local communities are both largely dependent on the status of the Great Lakes.

This study explored the status and progress of private sector climate resilience efforts to identify opportunities and trends that could inform climate resilience strategies in the Great Lakes Region's receiving communities. A climate resilience maturity matrix was developed and applied to evaluate the maturity of private sector climate-related commitments and actions in three Great Lake cities. Chicago, Toronto, and Cleveland were selected as cases to represent the region based on evidence of more advanced engagement on climate resilience and availability of related data from their previous resilience efforts. Nine leading companies based in those cities were then identified and their corporate

efforts were evaluated. The average climate maturity scores of each company were compiled and analyzed for patterns across the region and industries. These results were used to advance recommendations for encouraging broader resilience efforts.

2. Literature Review

To prepare for the study, literature from four general categories were reviewed: (1) private sector participation in resilience efforts, including industries studied, the location, and the drivers of participation; (2) growth opportunities for cities with increased climate resilience; (3) specific climate vulnerabilities of the Great Lakes region and its private organizations; and (4) current resilience status of Chicago, Cleveland, and Toronto, as a means to justify their use as case studies.

Motivators and Barriers

Economic drivers are common for private sector resilience efforts. For example, in studying the real estate industry, Teicher (2018) found that the most proactive firms regarded climate resilience as a competitive advantage. Climate adaptation measures such as retrofitting buildings for better flood protection were perceived as good selling points while the potential for climate risks to interrupt business were perceived as severe liabilities. A study by Boulatoff et al. (2012) noted that firms who participated in the Chicago Climate Exchange (CCX) emissions reduction program—a voluntary regulatory program with legally binding emissions reduction targets—saw financial and stock improvements within the first year of joining. This was supported by Gans and Hintermann (2013) who added that performance improved both during the announcement period and when environmental regulation was expected. In general, many private organizations see climate risk mitigation as a financial opportunity.

However, other drivers motivate change. Besides improving stock market value, voluntary adaptation efforts such as the CCX program can help prepare organizations for future legislation, to enhance their business strategies, and to innovate products and services so that they may emerge as industry climate leaders in the future (Gans & Hintermann, 2013). In addition, the collective impact of climate change imparts change to other aspects of the business such as its supply chain, customer base, employee health and safety, and employee commute. For example, extreme weather events can cause supply shortages, damage to transportation infrastructure, and climate migration (Surminski, 2013). Although these effects can translate to financial risks for the business, they are also social drivers given that they will principally impact the growth and livelihood of the local community.

Despite the growing need for climate mitigation and adaptation, the private sector is lagging in its

participation due to certain barriers and opposing motivators. In a study by Chin et al. (2019) regarding the hospitality and tourism industry in the Great Lakes region, some organizations considered climate risks as advantageous to their business. For example, rising temperatures can increase traffic to beaches and water recreation activities. Regions experiencing longer shoulder seasons may see increased traffic to indoor spaces due to the milder temperatures. Chin et al. (2019) described how some hospitality businesses plan to expand the length of their patio season or get large, heated tents for outdoor events to adapt to the longer spring and fall shoulder seasons. These short-term benefits were seen as advantageous by some interviewees in their study, especially because there was a lack of incentives from the local, state, and federal government to pursue long- term business preparedness and adaptation (Chin et al., 2019). The lack of incentives has also led to resilience strategies that consist of simply avoiding investments in high-risk areas altogether, contributing to further social inequity (Teicher, 2018).

Ignorance of the severity and probability of climate risks is also a major barrier. Goldstein et al. (2018) identified several blind spots in most private sector resilience strategies such as not understanding the magnitude of climate risks and adaptation costs, the need for adaptation strategies beyond direct operations, and nonlinear climate risks. These blind spots are indicative of how drivers rooted in financial motives can lead to superficial resilience plans with the organization capping its own investments and research (Teicher, 2018). Overall, private firms all around the world have noted being discouraged from participating in resilience planning due to inadequacies in the financial and educational resources available, and due to a perceived absence of local government efforts.

Climate Resilience Opportunities

There is an opportunity to cross the barriers through public-private cross sector collaboration. Public officials can provide training and subject matter experts while private organizations can help with better capital allocation of resilience investments (Clarvis et al., 2015). Collaborative partnerships can help cities steer private sector resilience efforts while the private sector can benefit from having a greater voice in urban planning (Klein et al., 2018). For example, poor plan coordination can lead to private organizations being zoned to vulnerable regions which can affect the resources needed for climate adaptation (Berke et al., 2015). Local government can also better measure their resiliency and vulnerability using scorecards and assessment products. Berke et al. (2015) developed a resilience scorecard to measure the physical and social vulnerabilities of a community and how well local plans are mitigating them. Loerzel and Dillard (2021) assessed 56 resilience frameworks to develop an inventory to assess resilience measurement and to search for frameworks that can be applicable for a particular system or hazard. Such existing tools and approaches could be utilized or adapted to suit

public and private sectors efforts. It is important, however, for both sides to avoid investing in reactive measures as this can hurt the community instead.

Climate insurance is a notable example of public-private sector collaboration. Private climate insurance can help communities bounce back from disaster events but if the underlying risk factors remain, the costs of the insurance will be passed onto the local citizens instead through increased premiums (Surminski et al., 2016). To improve community resilience, private sector efforts and investments should be focused on proactive measures and preventative responses.

The Great Lakes Region

Resilience efforts in the Great Lakes region are critical due to its economic, environmental, and political importance as well as its high vulnerability to climate change. The Great Lakes region holds 21% of the world's fresh water supply and is responsible for almost a quarter of Canada's agricultural production and 7% of American farm production (EPA, 2021). Its gross regional product is $4.1 trillion dollars, representing nearly one-third of the US economy (Campbell et al., 2015). However, the same characteristics that have allowed the region to prosper have also made it vulnerable to climate risks. The increase in average rainfall and extreme storm events have led to more runoff and flooding, which not only threatens infrastructure but also increases the pollution risk from cities with combined sewage outflow and surrounding Superfund toxic waste sites (Gallagher et al., 2020). The region's vulnerabilities are exacerbated by aging infrastructure, poor wastewater management, and its economic reliance on agriculture, ports, and tourism (Lydersen, 2020). It also has the potential to suffer from other risks faced by coastal cities including high asset exposure, decreasing land area, and insufficiencies in infrastructure following climate migration (Mafi-Gholami et al., 2020).

Case Study Cities

To explore the extent to which the private sector has engaged in resilience efforts, three Great Lake cities were selected as case studies. Toronto and Chicago were both part of the Rockefeller Foundation's 100 Resilient Cities program, while Cleveland has social conditions and land use patterns that increase its vulnerability to climate change. As a result, all three cities have extensive resilience plans. In a study by Klein et al. (2018), a positive correlation was identified between a city's adaptation progress and the likelihood of the private sector being included in resilience efforts. As such, studying cities with greater climate adaptation progress can illuminate the potential of private sector interests and participation in community resilience.

The 100 Resilient Cities program, sponsored by the Rockefeller Foundation and founded in 2013, was

intended to aid cities around the world to develop urban resilience plans. Cities had to demonstrate their commitment to urban resilience, their engagement process with different community actors, and plan to address vulnerable populations (The Rockefeller Foundation, 2020). Toronto and Chicago were the only two Great Lake cities included in the program. The Toronto Resilience Office was funded by a direct grant from the program. In 2019, the office unveiled Toronto's first resilience strategy, created with input from 8,000 citizens and 80 participating organizations. Thirty-three of them were non-profit organizations, thirteen were companies, and five were universities. The report outlined three focus areas with 27 action items. The action items list key partners, most of which are from the public sector (City of Toronto, 2019). In general, Toronto's resilience planning indicated some private sector engagement but is primarily supported by city organizations.

Most of the research discussing private sector participation in climate adaptation efforts in the Great Lakes focused on Chicago. Besides being a member of the 100 Resilient Cities program, Chicago has hosted a voluntary environmental regulation program before through the Chicago Climate Exchange (CCX) emission reduction program (Boulatoff et al., 2012). Its extensive history in resilience yielded an abundance of publicly available information. The city has experienced many extreme weather events in the past, which may explain its increased interest in climate resilience. It has diverse economic assets and is home to approximately 400 major corporations. Chicago's resilience strategy, known as Resilient Chicago, seeks to address socioeconomic disparities, critical infrastructure, and community preparedness. Like Toronto's plan, Resilient Chicago lists collaborating partners for each action item that helps to identify the private organizations engaged in resilience planning (City of Chicago, n.d.). Chicago also has a separate climate action plan that focuses on climate risks and mitigation, specifically with regard to greenhouse gas (GHG) emissions. There are some mentions of private investment and insurance, but it does not call out specific businesses (Makra & Gardiner, 2021). Besides the city's urban planning reports, private sector engagement is identified through the participating organizations list of the CCX program. The program had more than 400 members including Amtrak, Eastman Kodak, and Sony Electronics Inc. (Chicago Climate Exchange, 2011).

In Cleveland, temperatures are rising three times faster than elsewhere in the U.S., leading to increased heat waves, flooding risks, and storm events (Sridhar, 2021). The city also ranks high in poverty, food insecurity, and air pollution, with these issues affecting people of color and low-income people most. The Mayor's Office of Sustainability was established to spearhead these issues. The office has hosted annual sustainability summits since 2009 to engage the city's key players (Cleveland Neighborhood Progress, 2021). In 2013, the climate action plan was created, which outlined the city's engagement process, climate action goals, and monitoring of progress. The plan was guided by the Climate Action

Advisory Committee that consisted of several private organizations such as MetroHealth, KeyBank, and Eaton Corporation, and by resident leaders who participated through neighborhood workshops. The report also mentions collaborations with private sector and industry leaders to build a smarter city through smart grid technologies, and to improve access to public parks through more trails (Sustainable Cleveland, 2018). Overall, Cleveland has a substantial climate adaption plan in place and is committed to working with both the private sector and local citizens to improve community resilience.

Summary of Review and Existing Limitations

The literature on private sector engagement in climate resilience efforts largely consisted of qualitative, interview-based studies in specific industries and their approach toward climate change impacts, specifically hospitality, tourism, and real estate industries. While there is extensive research on the common barriers and drivers of climate change participation, these did not discuss specific public-private collaboration or engagement strategies. This study contributes toward closing some the literature gaps by providing a framework to evaluate private sector climate resilience efforts. The companies selected for evaluation represent key industries of the Great Lakes region not previously researched, including manufacturing, finance, food production, and energy. The maturity evaluation and analysis suggests trends and opportunities that can inform public-private engagement strategies.

3. Methods

Maturity models have often been used as tools for continuous improvement given the clear sequential steps between levels (Asah-Kissiedu, 2019). As such, they are well-suited for the research purpose of guiding organizational strategies, and can be applied as a means to consistently evaluate the status of private sector efforts. As no existing model was found for specifically evaluating private climate resilience, a matrix was developed with seven criteria across three evaluation categories based on adaptation and integration of the Smart Mature Resilience [SMR] Project's (2018) maturity matrix for city resilience, Williams and Greenwood's (2010) maturity matrix for corporate social responsibility, and climate mitigation and adaptation criteria from the International Organization for Standardization's [ISO] (2019) international standard on adaptation to climate change, ISO 14090. Five levels of maturity were defined based on adaptation of the Lowell Center for Sustainable Production indicator framework (Veleva & Ellenbecker, 2001). Consistent with the Lowell Center model, the levels in the matrix were defined based on the scope of climate resilience efforts and the extent that such efforts were extended beyond the organization's own facilities.

Criteria categories included organizational governance, the environment, and preparedness.The organizational governance category included the criteria of leadership and cooperation/collaboration. This measured the scope and alignment of resilience action plans, and the extent of the organization's resilience network. Climate resilience requires coordination within and between the private and public sector. As described by Chan et al. (2021), addressing climate change means that the entire world needs to undergo a socio-economic transformation. This would not be possible without goal coherence, which would be supported by the use of one standard guideline and greater collaborations.

The second category of environment included the criteria of climate change mitigation and climate change adaptation. This measured the actual programs and activities of resilience plans to see how they address climate impacts. Climate change mitigation involves efforts to prevent or reduce global warming impacts, usually done by addressing the source of carbon release. On the other hand, climate change adaptation involves efforts to address the existing effects or to prepare for expected effects (ISO, 2019). Both are required as current mitigation strategies are inadequate to manage climate risks (Bateman & O'Connor, 2016).

The last category was preparedness and included the criteria of risk analysis and assessment, education and training, and the reliability of infrastructure and resources. This measured how aware and ready organizations were with regard to climate change. Resiliency requires the ability to identify and prepare for all sorts of unexpected stressors (The Rockefeller Foundation, 2020). A comprehensive risk management program and a learning culture can help with the identification of climate risks, while increased reliability and flexibility measures for infrastructure and resources can help with the aftermath of a climate event.

The maturity scale ranged from 1 to 5, with level 1 representing basic legal compliance and respect for the rule of law, level 2 representing resilience efforts within an organization's facility or site(s), and subsequent levels representing resilience efforts expanded increasingly in scope beyond the facility, at the community level (level 3), across the supply chain (level 4), and at a broader international or systems level (level 5). Thus, each stage progression indicates a scope expansion for the organization's effort and sphere of influence. The resulting climate resilience maturity matrix is shown below, in Figure 1.

Maturity Levels		Level 1	Level 2	Level 3	Level 4	Level 5
Criteria		Respect for the rule of law	Resilience efforts at facility level	Resilience efforts at community level	Resilience efforts expanded to supply chain	Resilience efforts at system level
Organizational Governance	Leadership	Identifies requirements for resilience process and holds itself accountable for compliance	Integrates resilience into visions, policies, or strategies Has a resilience action plan with performance indicators to respond to shocks and stresses	Aligns resilience action plan with regional guidelines Monitors performance indicators at the community level	Includes supply chain considerations in resilience action plan (e.g., screening) Assess and monitors performance indicators across supply chain	Aligns resilience action plan with international guidelines Contributes to development of standards on resilience guidelines and policies
	Cooperation/ Collaboration	None	Identifies relevant stakeholders for developing a resilience plan at the facility level	Develops a resilience engagement and communication plan for stakeholders at the community level	Widens the resilience network to include suppliers	Supports self-organization among resilience network Contributes to an international resilience network
Environment	Climate Change Mitigation	Engages in mitigation efforts as needed for compliance	Maps material use and mitigation performance indicators at the facility level	Monitors mitigation performance indicators at the community level	Holds supply chain to high environmental standards and considers the total lifecycle of products and services	Accomplishes sustainable system production
	Climate Change Adaptation	None	Adopts climate change adaptation strategies at facility level	Establishes monitoring system across the community to address climate change related issues	Includes considerations for supply chain disruptions in climate adaptation plan	Promotes climate adaptation efforts at a system level
Preparedness	Risk Analysis & Assessment	Identifies and manages risks as needed for compliance	Takes into account interdependencies between risks Prioritizes critical services and assets	Assesses and prioritizes risk scenarios and their implications on the community	Undertakes regular and long-term risk assessments that includes impacts of suppliers	Assesses value added by organization contributions to resilience of wider system Shares data on regional or public platforms to increase transparency on shared risks
	Education & Training	Provides training as required by law	Develops resilience understanding/promotes culture of resilience at facility level Conducts emergency drills at the facility level	Develops educational programs on climate resilience for the community Establishes community volunteer network	Offers educational programs on climate resilience for suppliers	Promotes climate resilience education in a broader system
	Reliability of Infrastructures and resources	Maintains critical infrastructures as needed for compliance	Identifies interdependencies of critical services Develops periodical preventive maintenance procedures	Develops measures to increase critical infrastructure reliability Has flexibility measures in place	Identifies and plans for interdependencies of critical services and infrastructures, including across supply chain	Identifies and plans for interdependencies of critical services at an international level, taking advantage of shocks and stresses to improve or redesign

Figure 1. *Climate Resilience Maturity Matrix - Adapted from ISO, 2019;SMR, 2018; Williams & Greenwood, 2010; Veleva & Ellenbecker, 2001*

Given that the study is focused on climate change in the Great Lakes Region, it was important to choose organizations that would be most impactful. The factors considered were industry, size, financial performance, and location of headquarters. The organizations are a part of or related to the key industries in the area as identified by the Council of Great Lakes (2018), including manufacturing, agriculture, mining & energy, tourism, shipping and logistics, education and health, and finance. These industries are significant to the economy and employment of the region. The companies also had to be

large and high performing, likely to have higher contributions to climate change but also greater influence to address those impacts. However, this also meant that the companies usually had many diverse locations. To ensure a stronger connection between the organization and the region, the last criteria was that the global or North American headquarters was located in one of the three cities. Three leading companies from each city were evaluated, for a total of nine.

Table 1 shows the companies with their corresponding industry, headquarters, size, and financial performance. Their climate resilience maturity was measured using relevant, publicly available data, including any reports, press releases, policies, and news articles. The results were then averaged based on company, criteria, and city to identify potential trends.

Table 1. *Description of companies chosen for climate resilience maturity evaluation*

Company	Headquarters	Industry	# Employees	FY2020 Revenue
Archer Daniels Midland (ADM)	Chicago, IL	Food Production	38,332	$64.7 billion[1]
Exelon	Chicago, IL	Energy	32,340	$33 billion[1]
Allstate	Chicago, IL	Insurance	42,010	$44.8 billion[1]
Canadian Imperial Bank of Commerce (CIBC)	Toronto, CAN	Finance	45,282	$18.7 billion[2]
Hydro One	Toronto, CAN	Energy	8,085	$3.44 billion[3]
Royal Bank of Canada (RBC)	Toronto, CAN	Finance	85,300	$45.5 billion[4]
Sherwin-Williams	Cleveland, OH	Manufacturing	61,031	$17.9 billion[1]
Parker Hannifin	Cleveland, OH	Manufacturing	50,520	$14.3 billion[1]
Eaton	Cleveland, OH	Energy	91,987	$17.9 billion[1]

[1]Fortune, 2022 (https://fortune.com/)
[2]macrotrends https://www.macrotrends.net/stocks/charts/CM/canadian-imperial-bank-of-commerce/revenue
[3] Forbes, 2021 (https://www.forbes.com/companies/hydro-one/?sh=154df66823f3
[4] statista, 2021 (https://www.statista.com/statistics/461008/employee-headcount-royal-bank-of-canada/

4. Results and Discussion

Data and documentation from each of the selected companies was examined in relation to the seven criteria in the matrix, in order to evaluate the maturity of their climate resilience efforts in relation to individual criteria and overall. Out of a possible total score of 35, the average total score was 21.7, with a standard deviation of 5.1. The overall evaluation for the nine firms is shown in Figure 2.

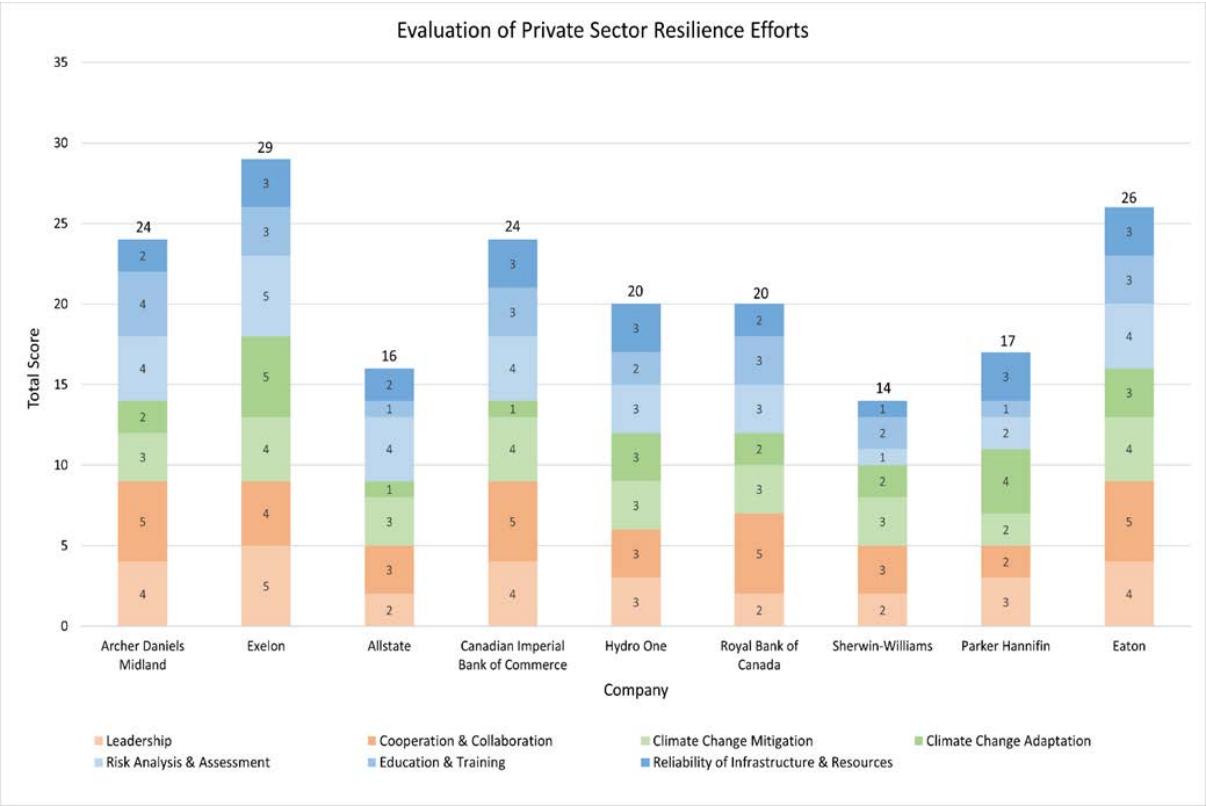

Figure 2. *Average climate resilience maturity scores by company*

Most companies fell within one standard deviation of the average. The exceptions are Exelon and Sherwin-Williams. Exelon displayed systems-level thinking for many of its climate resilience initiatives and programs. For example, its risk management process incorporates climate change scenario analysis and identifies greenhouse gas mitigation, transition, and adaptation risks. The process also considers its supply chain through a semi-annual supplier criticality and risk review, in which the organization will work with all suppliers on watch list to develop corrective action strategies (Exelon, 2021a). In contrast, Sherwin-Williams was observed to be more at the compliance level where there exists an environmental plan at each facility but there were no efforts disclosed on specific climate analysis or identification of critical services and assets (Sherwin-Williams, 2021b).

Common trends did appear between companies in the same or similar industries. CIBC and RBC both showed high maturity for collaboration and cooperation through their memberships and support for multiple international initiatives. Both are part of the Partnership for Carbon Accounting Financials (PCAF) and the United Nations Environment Programme Finance Initiative (UNEP FI). CIBC is also the first Canadian bank to join the Center for Climate Aligned Finance while RBC is part of the net-zero banking alliance. However, unlike for the manufacturing or chemicals industries, the majority of carbon emissions for the finance industry falls under scope 3 (Hodgson, 2022). For context, as defined

by the EPA, scope 1 emissions are direct GHG emissions from sources controlled by the organization; scope 2 emissions are indirect GHG emissions from the purchase of electricity, steam, heat or cooling; and scope 3 emissions are the results of all activities from assets not owned or controlled by the organization but for which the organization has an indirect impact in (EPA, n.d.). The most common scope 3 emissions in the finance industry are financed emissions, which are GHG emissions from the organizations that the financial institutions invest in. Thus, even if there are extensive efforts in place to prevent and mitigate their direct emissions, they would not be addressing their greatest impacts unless they implement and follow stricter climate policies for their clients (Hodgson, 2022). This is reflected in their scores for climate change mitigation and climate change adaptation.

Exelon, Hydro One, and Eaton represents the energy industry and on average, show higher maturity for climate resilience. This can be because climate risks have much more direct impacts on energy infrastructure. For example, the sustainability reports of all three companies mention improving grid resiliency and conducting climate-related risk assessments. In addition, given the type of service, there is greater interaction between the organizations and their communities. This is reflected in how almost all of their scores for each criteria are at least a three. The only exception to this is the education and training criteria for Hydro One as their training is more internally focused (Hydro One Limited, 2021).

On the other hand, organizations in the manufacturing industry—Sherwin-Williams and Parker Hannifin—showed lower maturity and more focus at the facility level. Neither of these organizations had published goals to reduce scope 3 emissions, and climate change resiliency seems to be an aftereffect to their initiatives. For example, Parker Hannifin's highest score was for climate change adaptation because the company utilizes dual sourcing to protect its supply chain. However, this was not in response to identifying potential climate disruptions but just as a general solution to the present supply chain risks (Parker Hannifin, 2021). This is reflected by its scores in the other criteria, which are primarily at a compliance or facility level. Similarly, Sherwin-Williams did not appear to have conducted any climate scenario analysis or climate risk assessments, but their environmental and safety management systems include requirements for periodic drills which can inadvertently help its employees prepare for climate change impacts such as extreme weather events (Sherwin-Williams, 2021a). A potential driver for climate resilience is integration into other operational or business priorities.

Trends were noted across the maturity categories. The highest average level of maturity was related to organizational governance. All of the companies evaluated are to some extent part of a resilience network whether through direct collaboration or organizational memberships. In addition, there appears to be a growing trend to align climate goals with science-based targets, with three of the nine companies

doing so publicly. Figure 3 depicts the average climate resiliency maturity scores by criteria.

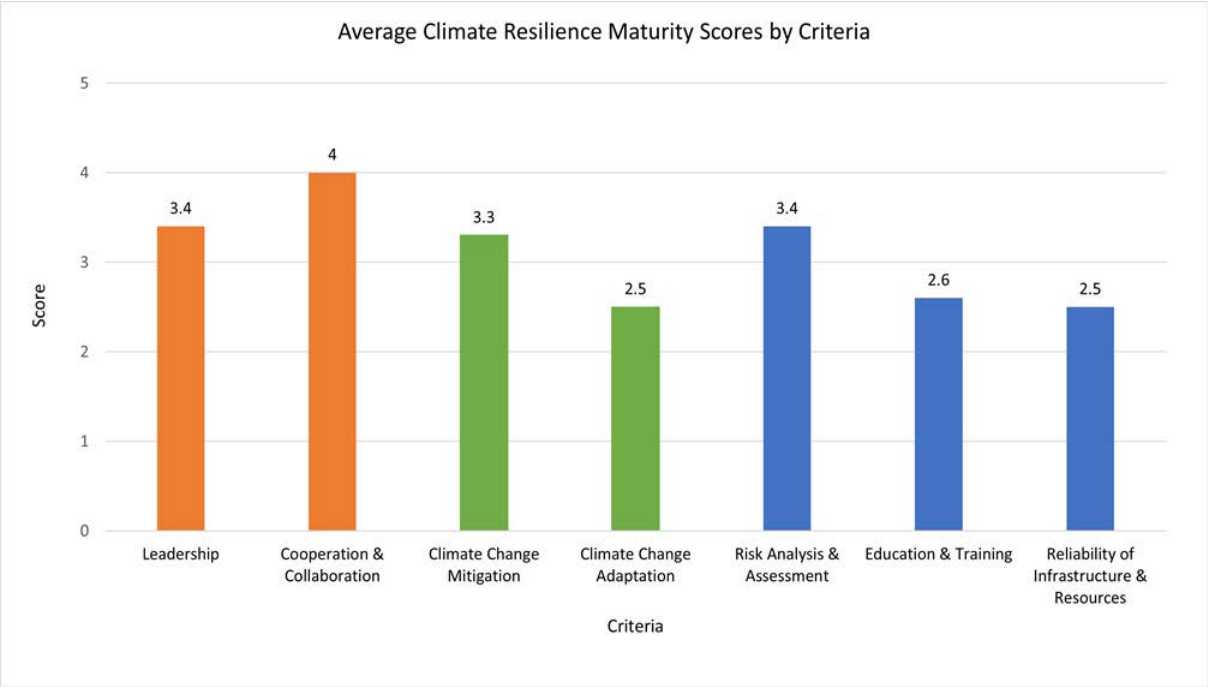

Figure 3: *Average climate resilience maturity scores by criteria*

Mitigation efforts appear to be more common than adaptation efforts. This indicates that organizations are approaching climate change with a preventative mind set, as seen by programs such as Sustainability by Design (Sherwin-Williams, 2021b) and public policy advocacies (Exelon, 2022). However, many of these mitigation goals are long-term efforts that may take decades to see substantial results. For example, CIBC set a net zero emission goal for 2050. No information was available for initiatives to address their current impacts, especially from financed emissions (Canadian Imperial Bank of Commerce [CIBC], 2021). Similarly, ADM has implemented energy efficiency projects and achieved the first carbon neutral milling operations but has not disclosed any information regarding how they plan to protect their supply chain, which is especially important for the food production industry (Archer Daniels Midland [ADM], 2021). Given that the Great Lakes region is especially vulnerable to climate risks, it is necessary for organizations to prepare for existing climate effects while also setting up mitigation strategies. Fortunately, it has been observed by Bateman & O'Connor (2016) that current mitigation efforts can make future adaptation easier and less costly. Identifying this gap in climate efforts and understanding the connection between mitigation and adaptation can potentially guide future attempts to drive private climate resilience efforts.

As for preparedness, all organizations had a risk management system in place. The differences lie in

whether their risk analysis specifically considers climate change. Only two companies did not have any climate scenario analysis or risk identification in place. Five of the nine companies included considerations of impacts to their supply chain, with high maturity organizations screening and auditing their suppliers. On the other hand, the other two criteria were much lower in maturity. Four companies had some form of climate education opportunities for their communities such as the CIBC Climate Center or the Eaton India Foundation. Two did not have any information available, and only one organization extended resiliency training to their suppliers. Five of the companies made improvements to their infrastructure or assets for increased reliability, yet none discussed plans to address interdependencies of critical services beyond their facilities. With the aging infrastructure in the Great Lakes region (Lyderson, 2020), the deficiencies in preparedness will likely be a key area of concern for resiliency.

Maturity Matrix

The maturity model was informed by the literature review and related maturity frameworks. It was successful in this regard and was able to adequately evaluate most of the selected companies, yet there were some limitations observed during the process. Maturity was evaluated by the scope of the climate resilience plan. However, there were instances where programs for the same criteria had varying levels of maturity. For example, Parker Hannifin employed dual sourcing which increased the reliability of its resources. However, no information was available regarding insurance for infrastructure (Parker Hannifin, 2021a). Similarly, RBC stated plans restrict financing for sensitive sectors and to invest $500 billion in sustainable financing by 2025 (Royal Bank of Canada [RBC], 2022a), yet news reports have revealed that the company had also significantly increased its financing for fossil fuels (Marsh & White, 2022). It is recommended that future studies looking to measure the actual effectiveness of the climate resilience plans should add an additional criterion to the maturity matrix to examine actual performance results, for overall impact.

5. Conclusions

Private sector engagement can lead to the development of products and services that reduce climate- related financial and human impacts, providing business advantages while enhancing and protecting human health and well-being in the communities in which they operate. Overall, the results of the study suggest that leading firms in the private sector are participating in climate resilience efforts but depending on their industry, have varying priorities that affect the initiatives they pursue. For example, the energy companies

indicated higher preparedness because improving their infrastructure is already part of operational goals. First and foremost, resilience efforts have to be compatible with their business strategies.

The maturity model supports evaluation of the strengths and weaknesses of each organization's plans and efforts. While this study was exploratory, the results suggest that private sector efforts in Great Lake cities may be lagging with regard to climate adaptation and preparedness for disruption, particularly in relation to education and training, and reliability of infrastructures and resources. Given the aging infrastructure in the Great Lakes Region, the deficiencies in preparedness will likely be a key area of concern for resiliency.

This study breaks down climate resilience plans into seven criteria, with analysis on industry trends. Existing literature have already identified common barriers and motivators to climate change efforts. The two pieces of information combined can inform private sector climate resilience strategies. Private organizations have a large impact on their respective cities' economy and resiliency and in the case of the Great Lakes region, improving their participation can potentially help to elevate it from a climate vulnerability to a climate haven. Public sector organizations can use the maturity model to identify potential collaborators and risks.

In addition, the study is a foundation for future research. One limitation of the study is the small pilot sample size. There is an opportunity to identify trends within each city by expanding this research, focusing on organizations in a specific locale. There is also an opportunity to study trends within specific industries across the region.

There is a potential bias in the companies selected. These three cities were chosen based on their extensive resilience experience which may be indicate of greater private sector participation than typical. This was necessary as the evaluations depended on publicly available information, but companies selected may not be representative of private sector efforts overall. Additionally, leading firms' level of maturity may be higher than other, non-leading organizations in the region.

Lastly, evaluation of maturity for each firm was based on publicly available data and documentation. It is possible that these organizations may be engaged in climate resilience efforts that were not reflected in the available information, resulting in skewed maturity ratings. Future research utilizing mixed methods research design that supplements document analysis with qualitative data such as from surveys or interviews can offer deeper insights on private sector engagement across the Region.

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The Role of Structured Decision-making in Community-based Adaptation: A systematic scoping review

Subhashree Nath[1]

[1] *Dresden Leibniz Graduate School, Leibniz Institute of Ecological Urban and Regional Development, Faculty of Environmental Sciences, Technical University Dresden, Germany,*
s.nath@dlgs.ioer.de

Abstract

Community-based adaptation (CbA) enables communities, especially marginalised communities to adapt and build resilience to the uncertainties climate change ensues. However, there are many barriers to the successful implementation of CbA. While existing literature has synthesised evidence on the types of barriers, there is currently no published evidence synthesis on how these barriers manifest as a CbA project progresses and how it affects the process of decision-making adopted in CbA. Uncertainty remains as to how to overcome these barriers to ensure successful CbA implementation with representative decision-making. This article argues that mapping when and how these barriers manifest in the CbA project cycle will help in overcoming them by facilitating their management through structured decision-making (SDM) processes. Therefore, through a review of peer-reviewed articles selected through a systematic database search, this article systematically scopes the literature to map the identified barriers to the typical steps of a CbA project cycle and explores how structured decision-making (SDM) processes (e.g., adaptive management) provide a way to navigate the heterogeneity within communities and multiple stakeholder interests, by engaging the community and coordinating amongst multiple decision-makers, bridging different interests, information required and values.

Keywords: Community-based adaptation, structured decision-making processes, boundary objects

1. Introduction

While the impacts of climate change are being felt in every part of the world, the poor and marginalised people, for example, those living in slums and informal settlements, are more exposed to these impacts and are predisposed to be adversely affected due to their socioeconomic and built environment conditions. For instance, slums are exposed to higher local temperatures as compared to other parts of the city, owing to high building density, poor roofing materials and limited open space and vegetation (Mehrotra et al., 2018; Wang et al., 2019). Further, these communities are often the last to receive the

benefits of any development or adaptation initiatives, due to their disputed legal identity (as in the case of slums) along with insufficient governance capacities and/or political will, (Satterthwaite et al., 2020). In case the government does take action, limited financial and human resources lead them to focus on reactive management and technical fixes, instead of long-term proactive approaches to climate adaptation (Measham et al., 2011 as cited in Spires et al., 2014). In addition, climate change is only one of the many challenges marginalised communities face and hence, it is unlikely that initiatives and interventions with the sole agenda of climate adaptation will reflect community priorities (Reid et al., 2009, p. 13). In such contexts, community1-based adaptation (CbA) is gaining traction, which frames adaptation as a continuum, that extends between development and adaptation (Heltberg et al., 2012, p. 150; McGray et al., 2007) strengthening resilience through development (Ayers & Forsyth, 2009; Ensor et al., 2018). It is a type of adaptation (i.e. adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities (IPCC, 2018)) that operates at the community level and focuses specifically on the empowerment of the community, 'helping people to help themselves' (Warrick, 2009).

CbA approaches focus on empowerment and the development process rather than only on specific adaptation interventions. This brings adaptive capacity and hence, the 'capacity of the actors in the system to influence resilience' (Walker et al., 2004) to the centre of CbA (Ensor et al., 2018). CbA has the potential to harness the ability to adapt by emphasising knowledge transfer and integration, focusing on 'not what is being done at the community level, but why, and with what knowledge – or, more specifically, whose knowledge' (Ayers & Huq, 2013, p. 212 as cited in Kirkby et al., 2017).

However, given the complexity of the problems and the need for systemic changes to truly address them, CbA is emphasised as part of the solution, one component of an integrated set of responses including natural resource management, disaster risk reduction, poverty reduction, ecosystem-based adaptation and sustainable development (Allen, 2006; Archer et al., 2014; Dodman et al., 2010). The success of a CbA project lies in representative participation in the decision-making processes, which has the potential to enrich the resilience of communities, as they become more informed, learn from each other and mutual trust is fostered (Evers et al., 2018). But this is challenging to achieve given the heterogeneous nature of communities resulting from local power structures, as well as communication barriers, lack of awareness and locally relevant, accessible and comprehensible

[1] Community-based adaptation in this paper refers specifically to communities of place, i.e. ties to a geographical location (Duane, 1997 as cited in (Clissold and McNamara, 2020)

information to base their decision on. These represent a bulk of barriers to a successful implementation of CbA. Barriers are defined as factors, conditions or obstacles that reduce the effectiveness of adaptation strategies (Hunage et al., 2011; Moser & Ekstrom, 2010 as cited in Antwi-Agyei et al., 2015). If barriers are not understood and overcome, they become limits (Piggott-McKellar et al., 2019), defined as 'conditions or factors that render adaptation ineffective as a response to climate change and are largely insurmountable' (Adger et al., 2007, p. 733).

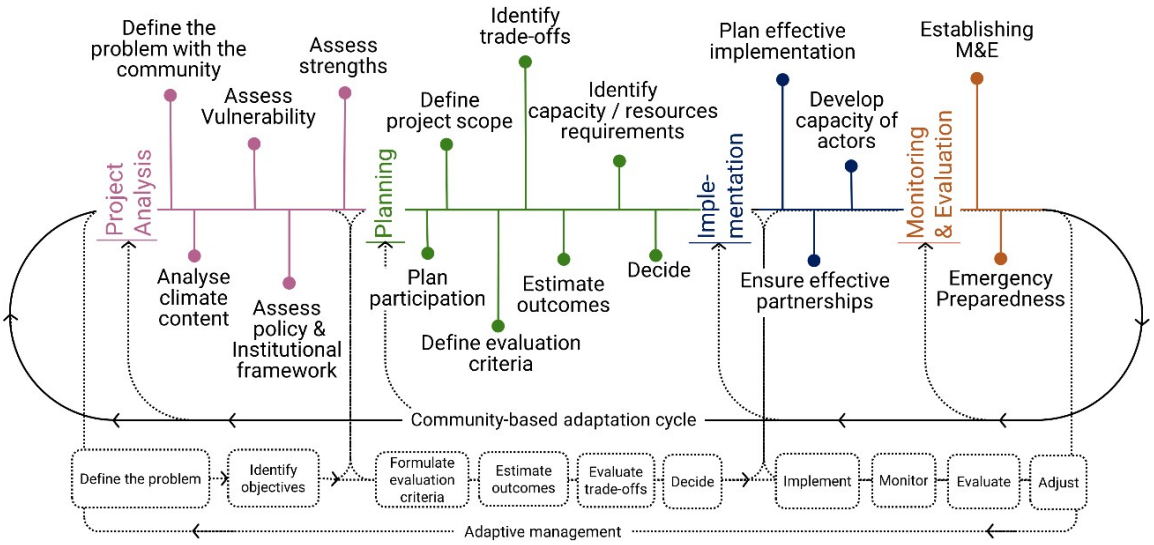


Figure 1 *Conceptual framework: Drawing parallels between CbA project steps (adapted from CARE 2010) & adaptive management cycle*

These represent a bulk of barriers to a successful implementation of CbA. Barriers are defined as factors, conditions or obstacles that reduce the effectiveness of adaptation strategies (Hunage et al., 2011; Moser & Ekstrom, 2010 as cited in Antwi-Agyei et al., 2015). If barriers are not understood and overcome, they become limits (Piggott-McKellar et al., 2019), defined as 'conditions or factors that render adaptation ineffective as a response to climate change and are largely insurmountable' (Adger et al., 2007, p. 733).

To overcome barriers, researchers have stressed on the importance of identifying barriers, understanding the conditions that create these barriers and how they operate (Antwi-Agyei et al., 2015; Spires et al., 2014). While there are precedents of systematic literature reviews of both peer- reviewed articles (Antwi-Agyei et al., 2015; McNamara & Buggy, 2017; Spires et al., 2014) and reviews of grey literature (Piggott-McKellar et al., 2019) where barriers were identified, there is currently no published evidence synthesis on how these barriers manifest as a CbA project progresses and the process of decision-making adopted in CbA. Uncertainty remains as to how to

overcome these barriers to ensure successful CbA implementation with representative decision-making.

To address this, this article systematically scopes the literature to map the identified barriers to the typical steps of a CbA project cycle (Figure 1) which consists of four iterative phases (CARE, 2010). Section 3.2 discusses these phases and the barriers encountered in detail. We illustrate that mapping these barriers to the CbA process is a step towards overcoming them by structuring the decision-making processes in CbA by informing when and how these barriers emerge. The article further explores how structured decision-making (SDM) processes (e.g., adaptive management) provide a way to navigate the heterogeneity of vulnerabilities and multiple stakeholder interests, by engaging the community and coordinating amongst multiple decision-makers, bridging various involved organisations, defining a clear community objective, and planning with long decision horizons (Allen et al., 2011; Chacko et al., 2018). Thereby, acting as a boundary object. Boundary objects connect various actors through a common interface for communication (Star & Griesemer, 1989) and help to bridge competing values (Willems et al., 2022). Such a boundary object can facilitate the community's ability to adapt by identifying the role various actors, stakeholders and organisations play at each step of the CbA project cycle, along with information-knowledge requirements and governance support required at respective steps. This article aims to build the foundation for such a boundary object. To do so, it answers the following questions:

a) What are the barriers encountered in different stages of a typical CbA project cycle?
b) What is known about the decision-making process involved in a CbA project?
c) How does structured decision-making (SDM) facilitate CbA?

The next section provides an overview of the steps taken to retrieve and analyse literature systematically and introduces the typology of barriers used to analyse the literature. The results and discussion section first reports on the key characteristics of the literature analysed and then discusses the research questions in light of the knowledge synthesised from the literature. The last section suggests future research pathways to apply the knowledge gathered for enabling future CbA projects.

2. Methods

Scoping reviews are exploratory evidence synthesis projects that take a descriptive approach to systematically chart the literature available on a topic, identifying key concepts, theories, sources of evidence and gaps in the research (Arksey & O'Malley, 2005; Sargeant & O'Connor, 2020). In this paper, a systematic scoping review is used to investigate how the barriers identified through the review

operate at different stages of a CbA project cycle. The process followed for the scoping review involved selecting and analysing peer-reviewed literature, based on the PRISMA guidelines for scoping reviews (PRISMA-ScR) (Tricco et al., 2018) While the author acknowledges that many CbA project implementation and evaluation reports are documented in grey literature, due to feasibility issues and lack of information in the format and detail sought in this review, grey literature has not been directly covered.

The following steps were followed for the systematic scoping review:

2.1 Document identification and selection

Documents were identified through a keyword search in the two databases: Web of Science and Scopus in August 2021. These databases were selected due to their extensive and current coverage of interdisciplinary peer-reviewed literature. The following keywords were derived from a preliminary search based on the research question(s): "community", "adaptation", "resilience", "community-based adaptation", "urban", "heat", "drought", "climate change", "decision", "decision-making", "enablers", "barriers". These were then classified to form a literature search logic grid: Focus, Assessment, Scale, Subject, Systems perspective (FAS3) derived from PICO (Population, Intervention, Comparison Intervention/ concept/ context, Outcome measures). This logic grid was used to develop an iterative search strategy where queries were various combinations of the categories as shown in Table 1. This helped in documenting change in search results (both in quantity and quality) as queries moved from a wide focus on urban CbA and decision-making (Iteration 1: Scale + Assessment + Subject) to a narrower query which included the specific subject of adaptation and/ resilience to heat and drought (Iteration 4: Assessment + Focus + Scale + Subject + System). For instance, although the initial idea for the search queries was to narrow the selection of articles to CbA to “heat” and “drought” (Subject) and “urban” (Scale) communities, the lack of quality results led to a widening of the inclusion to any human settlement and adaptation to general climate change.

Table 1. *FAS3 logic grid for planning and documenting search queries*

Focus	Assessment	Scale	Subject	Systems perspective
"decision"	"enablers"	"urban"	"heat"	"resilience"
"decision-making"	"barriers"	"community"	"drought"	"adaptation"
	"effective"	"community-based"		
	"requirement"	"neighbourhood"		
	"successful"			
	"drivers"			

Articles identified from each query were collated in Excel to remove duplicates. A total of 2307 unique articles were identified and uploaded to Rayyan (Ouzzani et al., 2016) for the title and abstract screening. Rayyan, a free web and mobile application, was used to expedite initial screening. Rayyan projects are accessible to multiple team members, making the screening process transparent and accountable. Exclusion criteria were tiered (Figure 2), ensuring that only articles that discuss human settlement community-based climate change adaptation were assessed for barriers, enablers and decision-making steps within the project cycle. Initial exclusion criteria removed articles that were not about climate change adaptation, not about human community, broad-scale adaptation (e.g. regional, national) and articles which were focused on policy and governance. After the first round of exclusion, 157 articles were selected which went through another round of eligibility checks by full- text screening (Figure 2). Articles that did not discuss community-led (climate change) adaptation, i.e., either they had a community/ neighbourhood scale but adaptation was 'done' to the community by an external agency or it dealt only with development, were excluded. Following this, 46 articles were selected for full-text reading. An additional 34 articles were also selected, that were found manually or through snowballing references cited in the 46 selected articles. A third exclusion round where articles that although were about CbA but do not discuss barriers, challenges to or enablers of CbA, nor mention any implemented case study to deduce these from, were excluded. 40 articles were finally selected for data extraction and mapping.

2.2 Document Analysis

The first step in the analysis of selected articles (n=40) was to categorise the identified barriers. Previous typologies of barriers ranged from classifications such as in Antwi-Agyei et al., (2015): financial, socio-cultural (incl. cognitive & normative barriers), institutional and technological barriers, to broader conceptual grouping as in Spires et al., (2014): social, resource and physical barriers.

Emphasising the causal relationship of barriers, this paper suggests two broad domains: the socio-political-cultural-economic domain(S) and the technological/infrastructure domain (T) (Table 2).

This clustering is derived inductively from the selected articles based on the causal relationship between the barriers: barriers which often manifested together were classified under the same domain. Among others, Domain S includes barriers related to local power structure resulting from cultural and religious norms, gender norms, and socio-economic status and leading to power imbalances and selective participation of community members in decision-making. While all of these barriers could be classified as power imbalances, they have been disaggregated as cultural and religious norms, gender norms and inter/intra-community power imbalances. These have been given a particular focus as they are well-established contexts of marginalisation and are some of the critical underlying causes of vulnerability. For example, a UNDP-Global Environment Facility programme on CbA recognises that 'without an express consideration of gender from the very beginning of the project cycle, the choice of adaptation interventions can have unintended gender implications' (UNDP, 2010, p.39 as cited in Dodman and Mitlin, 2013). Barriers related to domain S affect both the initiation and permanency of adaptation actions and are critical in influencing the conversion of adaptive capacity to adaptation actions (Adger et at., 2009; Grothmann & Patt, 2005 as cited in Spires et al., 2014).

Domain T includes barriers related to the built environment of the community and associated infrastructure like public transportation networks, information communication networks, as well their management. Table 2 enumerates the barriers identified under each domain. Clarify seemingly overlapping barriers.

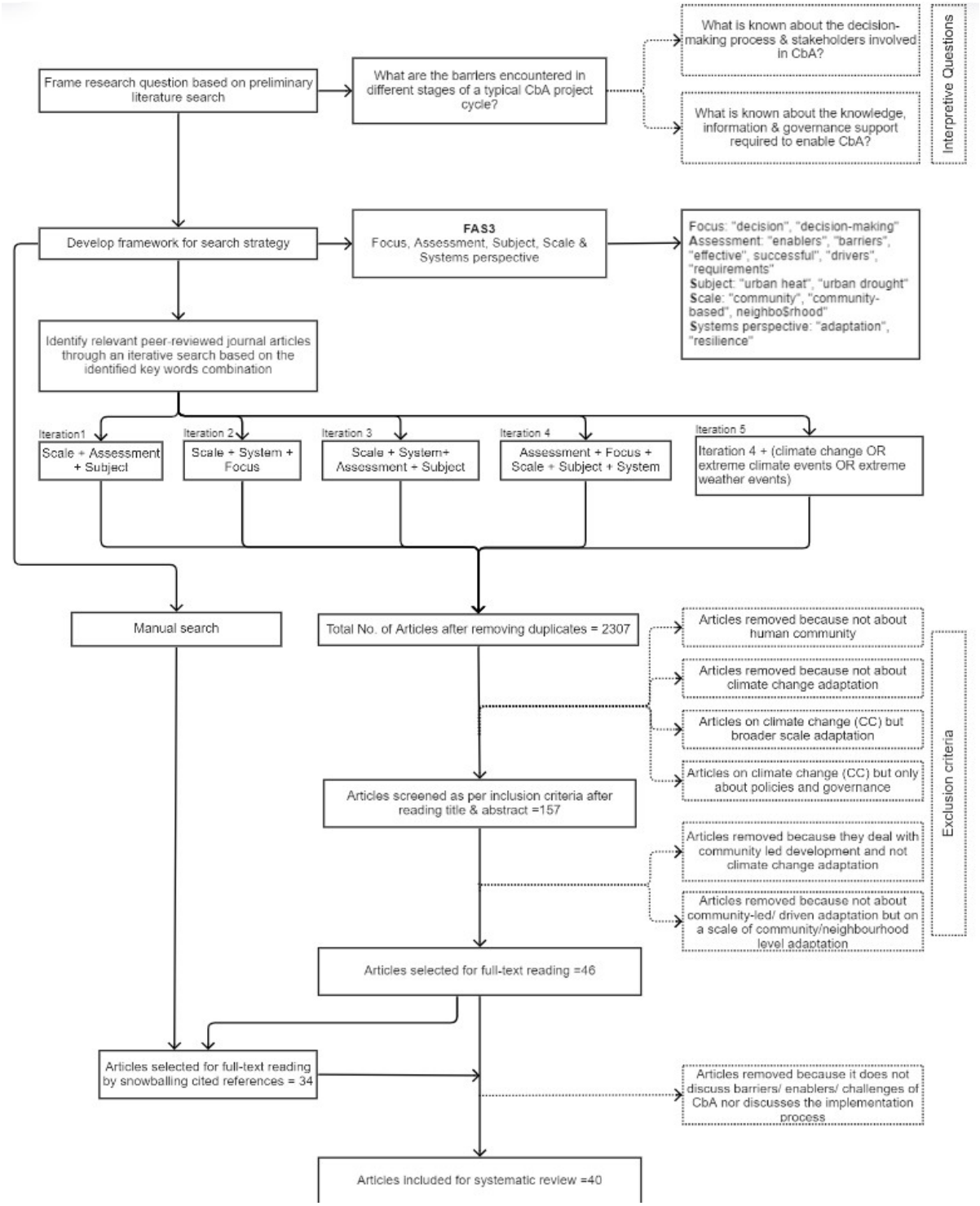


Figure 2 *Summary diagram of the search strategy and review steps taken (Refer to Appendix 1 for the selected articles)*

Table 2. *SETS typology of barriers classification*

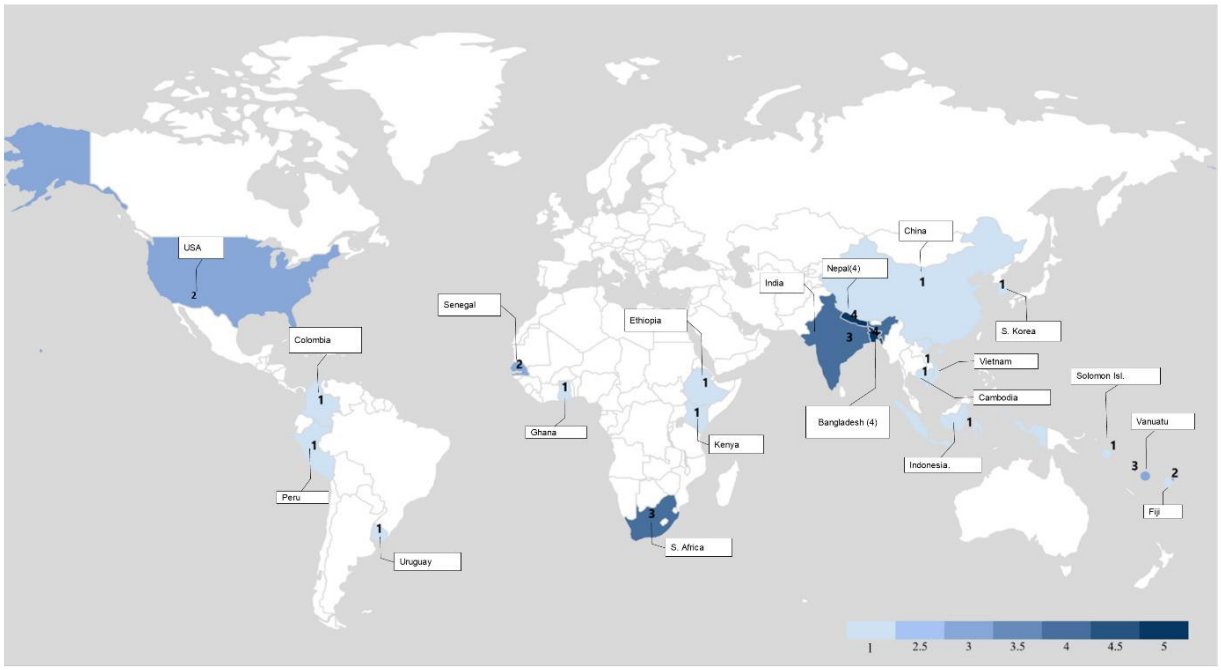
	(S) Socio-political-cultural-economic domain		**(T) Technological / Infrastructure domain**
1	Lack of motivation in community to engage	20	Lack of institutional skills/ capacity
2	Lack of meaningful participation	21	Lack of coordination among institutions
3	Lack of awareness (related to climate change and adaptation pathways)	22	Lack of relevant available info.
4	Lack of community skills/capacity (to comprehend information, evaluate decisions, take and monitor actions)	23	Lack of comprehensible info.
5	Lack of trust btw comm., facilitators & donors	24	Lack of infra. provision/ maintenance
6	Lack of knowledge transfer & integration	25	Lack of ICT
7	Communication/ language barriers	26	Lack of adaptable technology
8	Lack of consensus		
9	Gender norms		
10	Cultural & religious norms		
11	Power imbalances		
12	Lack of sense of project ownership		
13	Lack of time/ patience		
14	Tenure rights		
15	Policy gaps		
16	Unresponsive/ inefficient/ biased governance		
17	Lack of human resources		
18	Lack of reliable &/ long-term financing		
19	Donor requirements/ expectations		

3. Results and Discussion

3.1 Selected documents

The final list of articles selected for the systematic scoping review included those which discuss the barriers, enablers and challenges to CbA at a conceptual level (Dodman & Mitlin, 2013; Regmi et al., 2016) and ones which discuss the implementation of CbA and the barriers to and enablers of successful implementation. The second set of articles was the main focus, especially the ones which explained these through case studies. 29 articles or nearly three fourth of the articles selected mention case studies (Figure 3), most of which are located in countries in the global south.

However, of these 29, only 7 articles describe the implementation process. Although the majority of the selected articles and general literature on CbA emphasise the role of collective decision-making (e.g. (Galvin, 2019; Roy, 2018; Simane & Zaitchik, 2014)) for successful CbA, none of the articles explicitly mention how decision-making is integrated with the implementation process. This ubiquitous emphasis on collective decision-making but the contradictory lack of evidence on how it is addressed during the CbA implementation highlights a crucial gap in research. This article through the inductive analysis of selected articles addresses this, by first mapping the barriers encountered at each step of the CbA project



cycle and then, discussing the decision-making process.

Figure 3 *Location of CbA case studies discussed in 29 articles (out of 40)(Refer to Appendix 1 for the articles)*

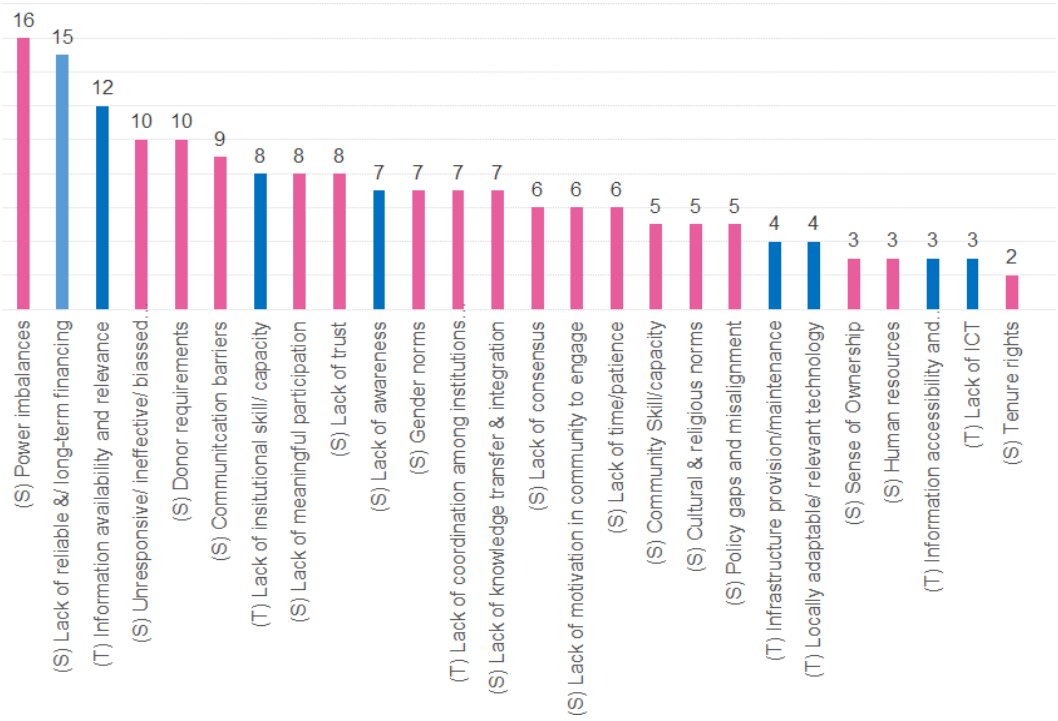


Figure 4: *Bar chart showing the no. of articles mentioning different barriers to CbA (barriers under domain S are in pink and barriers under domain T in blue)*

3.2 What are the barriers encountered in different stages of a typical CbA project cycle?

Barriers were derived from the selected articles and classified under domain S (socio-political- cultural-economic domain) and domain T (technological/infrastructure domain). Figure 4 provides an overview of the frequency in which these barriers were mentioned in the articles reviewed. For instance, barriers related to domain S were most mentioned, along with a lack of information availability and relevance (domain T). This is consistent with other reviews (Antwi-Agyei et al., 2015; McNamara and Buggy, 2017; Spires et al., 2014), where social barriers were the most reported.

Among the barriers classified under domain S, no. of papers reporting on intra- and inter-community power imbalances were the highest. It is closely tied to gender, cultural and religious norms. In Figure 5, a matrix illustrates how various barriers operate at various stages of the CbA cycle. This matrix was inductively derived from the literature reviewed and illustrates the steps which are particularly challenging as well as how few barriers manifest in clusters. It was found that some barriers like lack of trust between involved parties, lack of knowledge transfer, communication barriers; lack of meaningful participation, power imbalances, gender norms, and cultural and religious norms, appear frequently and in clusters. Barriers from domain T are particularly more active in the M&E phase.

The following subsections are categorised as per the different project phases (Figure 1) and explain how

different barriers (italicised) influence each other and hence, the success of each step along the project cycle.

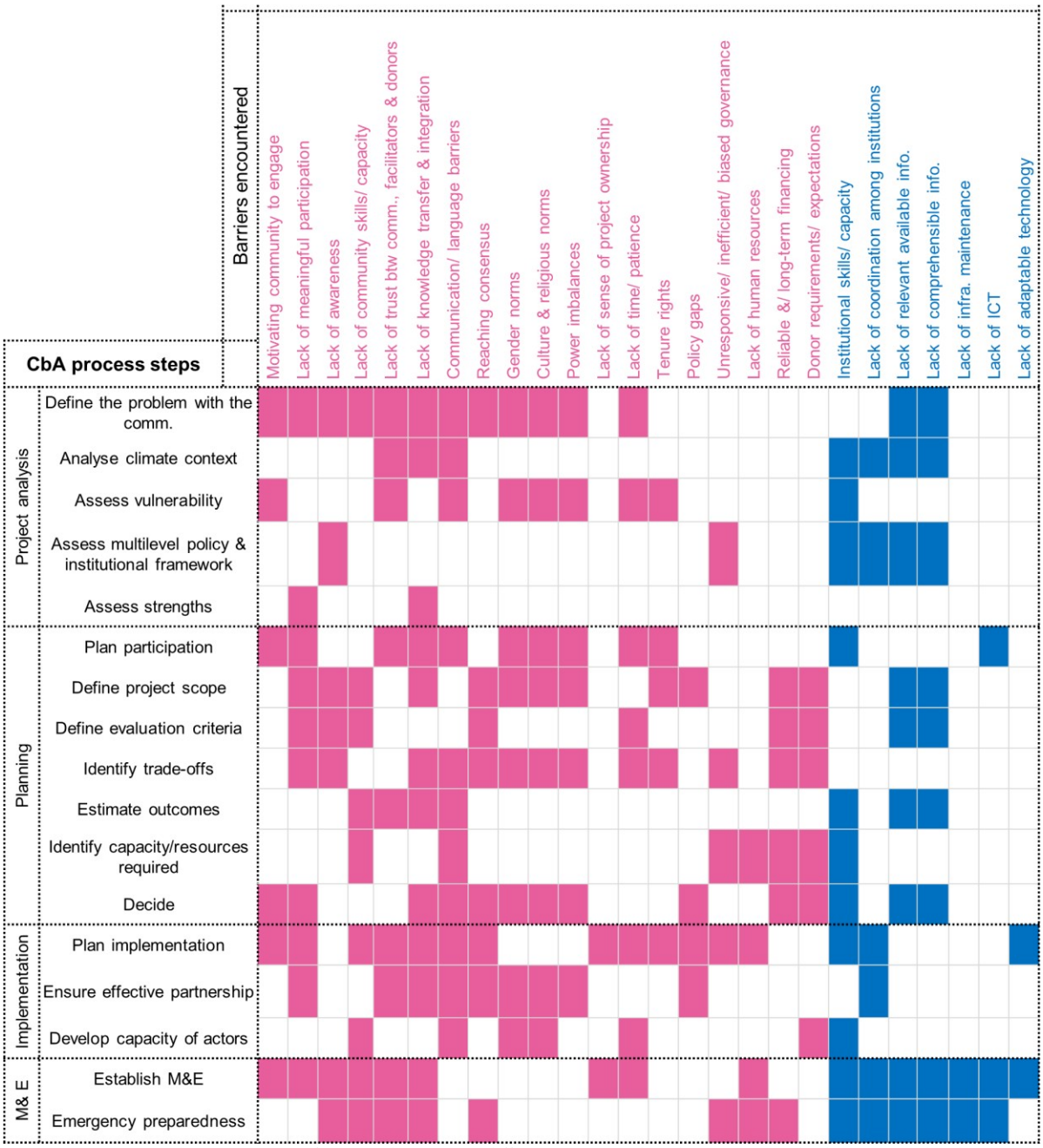


Figure 5*: Mapping the occurrence of various barriers at different steps on the CbA project cycle (barriers under domain S are in pink and barriers under domain T in blue)*

3.2.1 Barriers encountered during the analysis phase

Project analysis is the first phase, where the goal is to learn about the context of the project and its

socio-political and climate context. One of the crucial steps in this phase and the entire CbA process is defining the problem with the community. However, this is difficult to achieve in its true sense as several barriers are faced, starting with *motivating the community to engage,* especially in adaptation activities which are time-consuming with no immediate result, and when there is *a lack of time and patience*. Ensuring *meaningful participation*-where voices of all the various social groups within a community are heard, equally valued and incorporated, could become a barrier due to multiple reasons. For example, apathy to climate change adaptation especially if the community had no first-hand experience of major CC impacts (Roberts, 2010 as cited in Spires et al., 2014). Another recurrent driver of barriers is local power structures, which are at the heart of climate change vulnerability (Reid et al., 2009), resulting in *power imbalances, gender norms, and culture & religious norms* which significantly affect *meaningful participation*. A lack of involvement on the part of residents may also reflect a *lack of awareness* about pathways for participation and a *lack of capacity/skills* to self-organise (Guardaro et al., 2020). *Lack of trust* in the external facilitators also inhibits the community from sharing their problems while the perceived expertise of facilitators inhibits *knowledge transfer* to include local knowledge (Westoby et al., 2020). Along with assessing vulnerability, it is crucial to assess the strengths of the community and learn about the existing coping measures. *Communication barriers* like finding a common language to explain the issues the community is facing is a common barrier. Similarly, climate scientists find it difficult to communicate complex science and build capacity at the local level, and therefore information distributed about climate risk may fail to adequately inform the community or persuade them to respond to consequences (Harvatt et al. 2011 as cited in Khan, 2017). *Lack of comprehensible and relevant information at the community scale* are also barriers to integrating scientific information which is crucial for informing the decision-making process throughout the CbA project cycle. This also contributes *to lack of awareness and lack of capacity/skills.*

3.2.2 Barriers faced in the planning phase

The second phase is the planning phase, which begins with designing a strategy to ensure participation, making sure that the voices of the most vulnerable are heard and included in establishing the project scope and objective. However, planning meaningful participation and sustaining it throughout the project term, is one of the major challenges in CbA implementation. As Ayers and Forsyth (2009), Dodman and Mitlin (2013) and Regmi et al., (2016) state, simply organising participatory exercises does not necessarily empower vulnerable households and groups, nor does it guarantee participation (Kim & Kang, 2018). Facilitators must understand local power relations and plan participation and engagement accordingly (Regmi et al., 2016). Therefore, *power imbalances, gender norms, and*

cultural norms remain major barriers to planning participation, along with *motivating the community, lack of trust, and communication barriers*.

Tenure rights also influence participation as members with short or unsure tenure might not see any benefit in engaging in long-term adaptation benefits. It also influences the decision on project scope, with short-term measures favoured by those with no or temporary tenure rights. Particularly in the case of informal settlements, tenure plays a crucial role where lack of legal tenure rights leads to a *lack of trust* in external facilitators, fearing eviction. However in case, representative participation is achieved, the next barrier is the l*ack of knowledge transfer and integration*, where the local participants are not considered co-decision-makers and have tokenistic involvement to choose from pre-decided options. *Time and patience* are also major barriers since a participatory approach takes longer compared to other adaptation approaches (Kim and Kang, 2018) which might not be acceptable to donors or feasible for the community.

Participation planning and implementation also require substantial *institutional capacity*, requiring time and human resources, which often becomes a barrier. In addition, *lack of access to information and communication (ICT)* at this stage slows down the dissemination of information in the community.

At the stage of defining the objective ad scope of the project, *lack of consensus* is a barrier as reaching consensus among diverse actors, stakeholders and donors is a challenge (Chacko et al., 2018). Locals need to understand the objectives of a project and the reasons why it is beneficial to adopt certain measures and trade others. *Lack of awareness* in such cases is a barrier to defining the scope, in addition to a *lack of community's skills and capacities* to identify trade-offs. *Lack of relevant, accessible and comprehensible information* adds to this. For instance, understanding the science and drivers behind climate impacts, for example, urban heat, hinder the residents from comprehending how increased urban heat was impacting their health, quality of life, and personal economic situation, therefore, influencing their decision not only on what measures to choose, the trade-offs or the outcomes but on the necessity or possibility of any adaptation at all (Guardaro et al., 2020). This also stems from *communication barriers* between climate scientists and the general public.

In addition, during the steps of defining project scope, evaluation criteria, identifying trade-offs, the *availability of reliable/long-term financing* and *donor requirements* are two major barriers. Donor restrictions and guidelines often attempt to dictate how projects should be implemented while a lack of long-term financing is a barrier to the sustainability of CbA projects (Westoby et al., 2020). The development-adaptation continuum approach of CbA is also a challenge when existing pathways for adaptation financing stress that CbA activities must singularly respond to climate change (Dodman

and Mitlin, 2013), which often is not possible in the most marginalised and vulnerable communities, where adaptation is only possible through development.

Estimating outcomes requires a clear visualisation of likely scenarios, the benefits and disadvantages of each measure, and time and cost implications. Without developing easy-to-comprehend visualisation techniques and awareness generation, residents often fail to see a solution pathway, or the threshold of response need and feasibility (Guardaro et al., 2020). Kim and Kang (2018) suggest that scenario planning can be applied to the community planning process for visualising climate change information, depicting likely outcomes and therefore facilitating the identification of capacity and resource requirements. At this stage*, lack of community skills, lack of trust, knowledge transfer and clear communication* are major barriers, in addition to *institutional capacity, and lack of relevant and comprehensible information*.

The final step of this phase is deciding on the interventions or strategy, which must be taken through a transparent process, taking stock of all social groups. A major barrier to this step is the *lack of consensus,* balancing immediate problems against a strategic, longer-term perspective (Few, Brown & Tompkins (2007) as cited in Archer et al., 2014). It is unlikely that all stakeholders will unanimously support any prospective adaptation measures (Kirkby et al., 2015). It is a major challenge to moderate different and possibly conflicting goals of stakeholders, some of which will be dependent on their roles in the process (Balcik, et al., 2010; Chacko, 2015 as cited inChacko et al., 2018). *Lack of meaningful participation, motivating the community to engage,* integrating local knowledge into the decision *(knowledge transfer), power imbalances*, and *gender roles* dictated by *cultural norms* restricting women's involvement in the process, all influence the final decision. This is aggravated by a *lack of institutional capacity* and *readily available comprehensible and relevant information.*

3.2.3 Barriers faced in the implementation phase

Project implementation is the third phase, where the effectiveness of the project is ensured by establishing a transparent accountability method and clarifying the roles and responsibilities of all involved. Barriers faced during this phase include *motivating the community to engage*, ensuring *meaningful participation and* generating a *sense of ownership* among the community members and local authorities. If local participation and priorities that reflect people's needs and wishes are not part of the implementation plan, the community might not identify with the project and take ownership of the initiative (Remling & Veitayaki, 2016), leading to a *lack of sense of ownership*. For permanent and long-term interventions, *tenure rights* could be a determining factor and a barrier. It affects the

willingness to share maintenance responsibility or cost for interventions in common areas as well as rented properties (Guardaro et al., 2020). In the case of local authorities also, *a lack of sense of (project) ownership* may lead to failure in providing technical and financial resources to implement the adaptation plan (Regmi & Star, 2014). Bureaucratic rules and procedures as well as ambiguous mandates from superiors within an institution, *lack of coordination among involved institutions* and therefore *inefficient governance* is also a barrier to the implementation phase (Antwi-Agyei et al., 2015). Implementation might also fail due to failure in completely realising the ideas of self-governance that CbA projects tend to instil, because of *policy gaps* and limits placed on the devolution of authority, funding and other resources (Gautam & Pokharel, 2011 as cited in (Regmi and Star, 2014). Similarly, various local legislations might also be barriers, although the literature review doesn't make any statement on this. *Policy gaps* also lead to a *lack of coordination between involved institutions at different administrative levels and actors,* causing ineffective partnership and sustainability of CbA projects (Berquist, Daniere, and Drummond 2014; Middelbeek, Kolle, and Verrest 2014 as cited in Piggott-McKellar et al., 2019). Without a commitment to integrate CbA into national policy and planning with a commitment to dedicate resources to the local level, there is a risk that climate finance will continue to support top-down, centralised activities that may struggle to address the needs of vulnerable communities (Remling and Veitayaki, 2016), resulting in *lack of reliable/ long-term financing*.

Developing the capacity of the actors for successful implementation depends on good *communication skills* which remains a barrier due to a *lack of institutional capacity*. Scepticism raised by *gender, cultural and traditional norms* can also be a barrier to the adoption of new information and technologies required for implementation, especially if there are no preceding successful pilot cases and new practices fail (Spires et al., 2014). *The lack of locally adaptable technology* is also a barrier since communities can only employ the adaptation tools and options that have been developed, and which are applicable in the local context (Antwi-Agyei et al., 2015). These are further aggravated by *donor requirements* since developing the capacity of the local community might not be defined as a direct contribution to adaptation, especially in the absence of means to quantify capacity development and how it contributed to adaptation.

3.2.4 Barriers faced during the monitoring and evaluation (M&E) phase

Once the project is implemented, the monitoring and evaluation (M&E) phase checks the effectiveness of the actions taken and assesses areas of improvement. In this phase, the focus is on learning from the actions taken in previous phases, leading to rounds of feedback to ensure better and

equitable planning and implementation in subsequent rounds. Technical barriers like *knowledge and information management, required infrastructure provision/ maintenance, coordination among various institutional members, and timely and relevant information* availability are dominant in M&E. Access to suitable *information & communication technology (ICT)* could also become a barrier, for instance when information transfer is restricted due to a lack of access to smartphones or internet coverage. The M&E phase might often focus on demonstrating value for money and results of the interventions, instead of focusing on learning and feedback due to *donor requirements* (Faulkner et al., 2015) influencing how the projects are monitored and evaluated, for upward accountability purposes, in line with the information needs of funding agencies. In addition, a *lack of human resources* is a key barrier in establishing M&E due to varied and detailed data collection requirements. Owing to the *limited capacities of institutional staff*, and *lack of community skills*, project outcomes are often not sufficiently recorded and consequently limit the effective evaluation of projects in identifying lessons learnt (Piggott-McKellar et al., 2019). Further, if a participatory M&E is not ensured, for instance, due to *power imbalances, gender norms, cultural norms*, the *lack of trust, communication and knowledge transfer/integration* among the community members, inhibits information and skills transfer, which is crucial for initiating learning and facilitating self-organisation in the face of emergencies and uncertainties.

3.3 What is known about the decision-making process involved in a CbA project?

Of the 40 selected articles, while 7 articles discuss the implementation process, none discussed the decision-making process behind the CbA implementation. However, that CbA projects should empower the community to make decisions about adaptation themselves, has been reiterated by various authors like Dodman and Mitlin (2013, p. 3), who emphasised the criticality of ensuring residents' involvement and engagement in the decision-making processes involving their local areas. Fox et al., (2021, p. 8) mention that top-down decision-making processes often result in negative implications for the community, while describing the case of informal settlements in Cape Town, South Africa. Rashid & Khan (2013) emphasises the long-term and uncertain nature of climate change which makes top-down planning adaptation plans unviable since they cannot plan for a 30-50 years spectrum. Therefore, without the development of collective decision-making capacity, the community will always be dependent on external support, which is difficult to get in marginalised communities.

Rather than external actors predetermining solutions, which is common in top-down adaptation planning, CbA must capacitate communities to shape adaptation interventions, recognising local communities' essential roles in the process of assessing climate and environmental risks, as well as in

planning, implementing, and the monitoring and evaluating of actions (CARE, 2010; Dumaru, 2010; Remling & Veitayaki, 2016). Therefore, 'community-driven decision-making blended with scientific predictions on the impacts of climate change' (Roy, 2018, p. 6) is one of the salient features of the CbA project.

While the literature reviewed doesn't chart a clear process for decision-making, the following steps were found critical in facilitating collective decision-making:

- The initial steps of the CbA project must include thorough interaction with the community to learn not only about their challenges aggravated by climate change but also their coping mechnaisms
- Exclusion of certain groups from the decision-making process is inevitable in a community-driven decision-making process due to a variety of power relations, gender roles, and cultural and traditional norms. Therefore, existing community-decision making processes must be analysed, misrepresentation noted and the disadvantages communicated to the community.
- Climate change awareness workshops facilitate informed decision-making. Such workshops also form part of the initial steps and should ideally be conducted before or during the project planning phase.
- Awareness generation about the CbA process is critical to ensure inclusive participation and sustained engagement of the community, as well as securing long-term funding. Awareness about the process might positively affect the motivation of the community to engage in a time intensive process and resolve conflict with donor requirements of immediate results.
- Information needs and accountability requirements for various stakeholders must be identified. Gathering accurate and relevant information is a key necessity to inform local decision-making processes.

Based on the CbA adaptation toolkit developed by CARE (2010) and integrating the above-mentioned points, a set of guiding questions is suggested in Table 3, pairing diagnostic questions with each step of the CbA implementation process.

Table 3. *Guiding questions to facilitate decision-making throughout the CbA implementation process*

S. No	CbA Process Steps	Guiding questions
1	Define the problem with the community	Who defines the problem? Who influences problem framing>
2	Analyse climate context	What are the community observations/perceptions of CC?
3	Assess vulnerability	Which social groups are most vulnerable? Who has access to & control over common resources?
4	Assess multilevel policy & national framework	Which are the key institutions? What are relevant policies & plans?
5	Assess strengths	What are the existing coping measures?
6	Plan participation	Are the voices of the most vulnerable & marginalised heard? How is equitable participation of women ensured?
7	Define the project scope	What are the community adaptation/ development priorities? Who is financing?
8	Define evaluation criteria	What are the community decided goals across spatial & temporal scales?
9	Identify trade-offs	What are the potential harms and benefits to different social groups within the community?
10	Estimate outcomes	What are the expected results realistically achievable?
11	Identify capacity/resource requirements	What community/ institutional capacities are required? What are the human/information/ knowledge/ financial resources required?
12	Decide	Is the final decision-making process transparent & participatory?
13	Plan effective implementation	What are the monthly/ annual goals?
14	Ensure effective partnerships	What are the roles & responsibilities of each actor & stakeholder? How is accountability maintained between all stakeholders?
15	Develop the capacity of actors	Which capacity development requirements need to be prioritised and acted on?
16	Establish a monitoring & evaluation process	Do the community & partners have the necessary capacity to monitor & evaluate? What are the evaluation criteria?
17	Emergency preparedness	What are the criteria to adjust the project approach in case of an emergency?

3.4 How does structured decision-making (SDM) facilitate CbA?

A decision-making process suitable for community-based adaptation projects must address the involvement of multiple decision-makers, defining a clear community objective and planning with a long decision horizon (Chacko et al., 2018). Frameworks used in structured decision-making

processes are designed to enable self-organisation, transparent and accountable decision-making, in the face of uncertainties in future climate change and its impacts. Using tools like models to illustrate uncertainties and demonstrate trade-offs (Nay et al., 2014) or simulation models to estimate the consequences of actions (Power, 2002), they provide an overview of different adaptation pathways and/or emergency coping measures, with trade-offs and benefits highlighted, ensuring periodic revaluation to facilitate strategy development even as systems are being impacted by ongoing climate change. When these decisions are made by the community, these frameworks also work as checks and balances to avoid power abuse and elite capture, ensuring that the voices of every community group are considered and benefits equally shared. With the adoption of SDM in CbA processes, learning through ad hoc trial and error, which is common in autonomous coping strategies of communities, is replaced with learning by careful design and testing ((Walters, 1997 as cited in Williams, 2011).

Further, SDM processes like adaptive management when integrated with the CbA process will provide an opportunity to learn not only about the adaptation measures but also about the decision process itself (Williams, 2011). This is very crucial in communities where the decision process is influenced by power imbalances within the community and between affected communities, gender, culture and religious norms, along with influences from external facilitators, government and non- governmental organisations. In such cases, SDM processes also provide a way to navigate the heterogeneity and multiple stakeholder interests, by engaging the community and coordinating amongst multiple decision-makers, bridging various involved organisations (Allen et al., 2011; Chacko et al., 2018). Therefore, SDM processes act as a boundary object, where decision-makers of varied backgrounds, worldviews, expectations and interests can cooperate and communicate in a standardised interface that acts as a common language (Star & Griesemer, 1989). Boundary objects can be both material or product (a tool, maps, models, shared infrastructure) and conceptual or the process itself (procedural instructions, frameworks)(Star & Griesemer, 1989; Steger et al., 2018, pp. 154-155, as cited in Willems et al., 2022). Therefore, SDM can facilitate CbA in two ways. First, by creating a process, which ensures transparency and accessibility to all stakeholders, ensuring and facilitating their commitment to a process for adjusting strategies over time, based on M&E status and learnings (Williams et al., 2009). Second, as a supporting tool which collects and processes information into actionable knowledge, creates a portfolio of acceptable outcomes of each adaptation measure, paired with trade-offs, cost-benefit analysis, the time required to implement and time required to benefit from the process, thereby creating an objective pathway of reaching consensus in the presence of multiple decision-makers.

4. Conclusions

Despite CbA's potential in enabling communities, especially marginalised communities, to adapt and build resilience to the uncertainties climate change ensues, there is still a relative scarcity of implementation of CbA interventions. This article adds to the existing literature reviews which highlight the barriers contributing to the lack of adoption of CbA practices. It also furthers the conversation on overcoming these barriers by mapping them to the typical steps of a CbA project cycle. The resultant matrix makes the interconnection of various barriers explicit. Therefore, we argue that knowing when and how these barriers emerge can help in overcoming them by facilitating their management through SDM. In general, there is a predominance of barriers related to the power structure, like power imbalances, gender norms, cultural and religious norms, and lack of community participation, highlighting the embeddedness of CbA in existing institutions of social, cultural and traditional norms, which could lead to a failure in addressing broader structural issues, power and social relation. Therefore, we suggest a set of diagnostic questions for each step based on the barriers and what is already known about the characteristics of the decision-making process adopted in CbA practices. Further, we explore the role of SDM processes in facilitating the CbA process by acting as a boundary object – both as a product and a process. Future research must explore such a boundary object that would help in multi-way communication and knowledge transfer, providing an enabling environment for the community to develop its adaptive capacity while challenging existing power structures with transparent and accountable, collective decision-making.

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Appendix 1: List of 40 selected articles. **Articles with case studies are mentioned in bold**

followed by non-case study articles

1. **Antwi-Agyei, P., Dougill, A. J., & Stringer, L. C. (2015). Barriers to climate change adaptation: Evidence from northeast Ghana in the context of a systematic literature review. *Climate and Development*, *7*(4), 297–309. https://doi.org/10.1080/17565529.2014.951013**
2. **Archer, D., Almansi, F., DiGregorio, M., Roberts, D., Sharma, D., & Syam, D. (2014). Moving towards inclusive urban adaptation: Approaches to integrating community-based adaptation to climate change at city and national scale. *Climate and Development*, *6*(4), 345–356. https://doi.org/10.1080/17565529.2014.918868**
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11. **Galvin, M. (2019). Making Community-Based Adaptation a Reality: Different Conceptualisa- tions, Different Politics. *Human Geography*, *12*(1), 50–63. https://doi.org/10.1177/194277861901200104**
12. **Guardaro, M., Messerschmidt, M., Hondula, D. M., Grimm, N. B., & Redman, C. L. (2020). Building community heat action plans story by story: A three neighborhood case study. *Cities*, *107*, 102886. https://doi.org/10.1016/j.cities.2020.102886**
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6. Cities and regions

6c. The power of art and culture in sustainable cities and communities

Abstracts

Artful Organizers: Images of cultural entrepreneurship practices in urban and suburban settings

Associate professor Malin Gawell[1], Senior lecturer Ann-Sofie Köping Olsson[2], Professor Monika Kostera[2,3]

[1]Södertörn University, stockholm, Sweden. [2]Södertörn University, Stockholm, Sweden. [3]University of Warsaw, Warsaw, Poland

Abstract

We are interested in two aspects, in the sense Johan Asplund used the term, meaning facets of a complex social reality (Gawell, Kostera, Köping Olsson and Marja Soila-Wadman, 2020) of cultural entrepreneurship: the everyday work and life of the organizers, as well as the overarching values of how they can contribute to the development of society. How do human beings engage in and organize activities that aim at changing the world for the better, while, at the same time, ensuring a sustainable existence for themselves and their creative and artistic endeavours? The area of our interest intersects social entrepreneurship (Gawell, Johannisson and Lundqvist, 2009), alternative organizing (Kostera, 2019) and organizing in the cultural and creative industries (Köping Olsson, 2012). The cultural entrepreneurial leaders are visionaries, they engage others. They are not only able to find sustainable solutions for their own use but they provide an example for others to follow and so, even if they are marginal in economic and political terms, they can be seen as a valuable resource for local and regional development. They can be seen as pathfinders and teachers useful for the forward-thinking policy-makers, as they may provide ideas for solutions responding to today's needs, not yesterday's (Gawell et al., 2009). We present a number of practical examples from four different urban contexts in England, Poland and Sweden, to sketch a preliminary map of our field of interest and outline initial reflections for sustainability and entrepreneurship. The aim of our paper is to propose some implications for future research in the area of interest.

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Gawell, Malin, Monika Kostera, Ann-Sofie Köping Olsson and Marja Soila-Wadman (2020) ”Att se klart, i förundran” [To see clearly, in amazement], in: Om undran inför företagsekonomin [Wondering about Management Studies, Johan Alvehus and Daniel Ericsson (Eds.). Stockholm: Santérus Förlag, 2020, p. 108-126.

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Track
Track 6c The power of art and culture in sustainable cities and communities

Climate Artivism or Death. Extinction rebellion, school strike for climate and earth strike – case of Krakow, 2018-2021

dr Michal Palasz

Department of Contemporary Culture, Institute of Culture, Jagiellonian University, Krakow, Poland. JU Climate Council, Krakow, Poland. Humanistic Management Network, Geneva, Switzerland

Abstract

Artivism is activism through art and climate artivism is activism through art for the climate. In this paper I explore the climate artivism of Extinction Rebellion, School Strike for Climate and Earth Strike from its beginnings in 2018 till the end of 2021 on the example of Krakow, Poland – in the perspective of Culture and Heritage Management (CHM).

Culture Management is understood widely, from managing cultural projects and institutions, through governing the sector of culture by higher authorities, to shaping culture in local (national, ethnical, organizational etc.) and general dimensions, as the fourth pillar of Sustainability. In the face of the climate-ecological crisis it can be expressed in bottom-up artivist operations aimed at drawing public attention to the problem and, by achieving this, influencing policymakers (to change state organizing and to influence businesses). Heritage Management is understood as not only caring for what we have inherited, but also for what will be our legacy, as in the popular understanding of Sustainable Development. In the face of the climate-ecological crisis it is expressed in the intention of protecting the heritage of culture and civilization from impending catastrophe.

The main research questions are: What activities in the field of climate artivism were carried out in Krakow, 2018-2021? How is climate artivism related to CHM? How do climate artivists see these connections? What does CHM have to offer to climate artivists? During the presentation an illustrated catalogue of climate artivism in Krakow in 2018-2021 will be presented, based on virtual ethnography of respectful local climate movements virtual communities. Artivist cultural and artistic projects will be embedded in the existing and progressive research reflection on CHM, both theoretically and empirically, thanks to in depth interviews with the artivists. The research is ongoing and therefore it is impossible to write here about any results, findings, conclusions or to perform a discussion but it will be finalized in the beginning of 2022 and the aforementioned will be included in the Conference presentation. It aims at widening the theoretical recognition of the relationship between CHM and the climate artivism; a diagnosis of how CHM can contribute to climate artivism for the purposes of preventing/mitigating/adapting to climate-ecological crisis; developing of the results with the involvement of the representatives of the studied groups for application purposes; understanding the tension between past mistakes, saving the future and acting in the present through the lenses of CHM in the field of climate artivism.

Abstract relates to SDG + Target: 13.3 and to the theme of the Conference by addressing the issues of climate activism that use art as a tool of resistance and social change: It takes courage, it is done for the climate with the highest awareness of what sustainability is, it relies on culture, art and human rights.

This research was funded by the Priority Research Area Heritage under the program Excellence Initiative – Research University at the Jagiellonian University in Krakow.

Track
Track 6c The power of art and culture in sustainable cities and communities

Differences in Sustainability Approaches of European Contemporary Art Museums

Zsuzsanna Fehér, PhD Katalin Ásványi

Corvinus University of Budapest, Budapest, Hungary

Abstract

Sustainability is a major challenge for many cultural institutions in the first quarter of the 21st century. Changing levels of government, corporate and individual support, the evolution of new demographics, the rapid development of information technology and environmental change are also encouraging museums to rethink and develop their sustainable strategies. In the future, museums are expected to go beyond their core collection, research and exhibition functions, play a key role in enhancing the role of informal education and, as a social institution, act as catalysts for social cohesion for a sustainable future.

Museums are linked at several points and can contribute to the UN Sustainable Development Goals, to which more and more museums are joining in practice and setting a good example. Museums can be directly linked to two main goals (SDG13 and SDG17). Museums now have the professional potential to ensure that they become valuable and exemplary actors in sustainable development. Sustainability is based on three pillars: economy, society and environment, so many authors in the literature interpret the issue of sustainability based on these three pillars, but more and more studies point to the importance of a fourth pillar, the issue of cultural sustainability. Environmental sustainability means the attitude of museum towards its environment in terms of its building and operation. Social sustainability contains social problems, the role of museum education, achievement of all groups in society, supported target groups and audience involvement. The economic sustainability is mostly captured in terms of funding. The cultural sustainability of a museum is to collect and conserve artworks, to determine the tastes and preferences of visitors and to involve the artists.

In our research, the general phenomenon of sustainability in European contemporary art museums were examined and whether there are regional differences. The following main research question was formulated: *What sustainability practices characterize European contemporary museums based on the information set out in their mission statements and on their website?* In the present study, mixed methodology research was used. Quantitative content analysis examines what European contemporary art museums communicate about their sustainability and social responsibility in their website communication and what factors influence this. Using the method of qualitative discourse analysis, we analyze what social roles are thematized, what role sets and discursive procedures are used by European contemporary museums in their mission statements.

There are four main implications of our research. First, our research systematically examines the criteria and requirements for sustainable museums. Museums have a primary responsibility to preserve their collections, so they should strive for cultural sustainability as a priority. Second, we present the current practice of contemporary art museums in Europe, which provide an opportunity to compare expected future changes. Third, this article provides an insight into the differences between the practices of different European countries and identifies the common elements behind the concept, regardless of context. Fourth, our research complements the empirical literature on sustainable museums. Through our research, we contribute to expanding the theoretical background of sustainable museums from the perspective of contemporary art museums.

Track

Track 6c The power of art and culture in sustainable cities and communities

Practices of Listening

Dr Sofia Wiberg

Royal institute of technology, Stockhlm, Sweden

Abstract

In a Swedish context, public authorities have over the past ten years implemented a number of initiatives to make art a central part of not only sustainable development, but also of urban planning as a practice, processes and knowledge area. Art and artistic methods are seen to contribute with new methods for site analyzes (often in combination with citizens involvement), to enhance embodied and situated knowledge and to give space to critical reflection (Metzger, 2016).

One of the Swedish initiatives is called *Art is happening*. Between 2016-2018 the Swedish government assigned the Swedish Arts council money to work with public art and citizen inclusion in million program areas. The initiative was framed as using artistic methods to increase democracy and together with local organizations in civil society work out practical examples of how the "million program" can be artistically enriched.

Fifteen places around the country were selected. In this article, the focus is on one of those projects in Karlskrona, where an artist collaborated with citizens to create a public art work and a local meeting place. During the process the artist partly lived in the area and used listening as method to relate to the inhabitants/place.

What happens when art is given a democracy mission in certain residential areas? But also, what kind of new understandings can artistic and cultural methods enable in a planning context? Rather than discussing the project from a binary logic as disempower/empowerment, consensual/agonistic and political/antipolitical it's examined as a process exhibit a mixing of both, where power unfolded that were both problematic and valuable at the same time. This moves away from "good or bad" to a complex and nuanced way of discussing how artistic methods can contribute to more sustainable cities and communities.

This topic connects to SDG goal 11 and SDG target 11:3. In order to find ways to create sustainable societies we need to find new paths. Art and culture can offer new ways of tackling societal problems, frame problems in unexpected ways and explore embodied, affective and emotional ways of knowing. To work with artistic and cultural methods are at the same time far from easy which makes it an important topic to discuss from both critical and optimistic perspectives

Track

Track 6c The power of art and culture in sustainable cities and communities

Shedding Light on City Tunnels: Problematic boundary work in city development

Christina Vildinge[1], Dr. Elena Raviola[1,2]

[1]Academy of Art and Design, Univerisity of Gothenburg, Gothenburg, Sweden. [2]Business and Design Lab, University of Gothenburg, Gothenburg, Sweden

Abstract

Attempts to use arts and culture to make cities more sustainable are widespread in Europe. The latest text of the so-called New European Bauhaus instrumentally assign to arts, design and culture a prominent role of function as vectors to bringing new values and new ways of working in city planning processes and structures. These calls for the values of arts and culture to make cities more sustainable are often accepted as unproblematic and intrinsically good.

This paper explores a specific use of arts and culture to make cities more sustainable, specifically how lighting design and art are used to improve social sustainability in an urban environment. The question of light in the city, particularly urgent in the Nordic countries, crosses many dimensions of sustainability and thus many administrations in the municipality: sometimes a technical question of security and safety for the traffic and pedestrians, other times an aesthetic question of making the city beautiful and attractive, other times a biological question of the night animal life, and more. In the city of Gothenburg, concerns about lighting design have gathered under the label "the night city".

The study presented in this paper focuses on the case of "Light Art Tunnels" in Gothenburg. Popular in the '60s city planning when urbanization was increasing, like many other Swedish cities, many tunnels were designed in the city's built environment to connect different areas and often to make possible walking apart from car traffic. Today, many of these tunnels remains in vulnerable areas and are perceived as some of the darkest and most unsafe places in the city. The project "Light Art Tunnels", financed and promoted by the municipality of Gothenburg, took place between 2013 and 2018 to transform some of the tunnels from non-places, that were avoided by walking bypassers, into safe and beautiful places by means of art and lighting design. Our qualitative study of the project concentrates on the remaking of three tunnels – Briljantgatan, Hjallbo and Kviberg – and is based on archive material, interviews and evening walking meetings with local residents.

In the Light Art Tunnel project, we have highlighted how light as a relational material becomes a boundary object shaping collaborative municipal organizing, allowing work to make the city beautiful, safe and sustainable. The Light Art Tunnels project functioned as a boundary organization, related to other boundary organizations, like the international interest network LUCI and the cross-administrations initiative Safe, beautiful city, and working around the relational materiality of the light with an effort to transform the built architecture of the tunnels. The study highlights also the role of the lighting designer at the critical boundary workers, spanning across different boundaries with different expertise. Finally, our study shows that architectural lighting might have many implications for sustainability but given the built environment the impact of lighting can only change the physical and the social connected to it to a certain extent.

Track

Track 6c The power of art and culture in sustainable cities and communities

Spaces for Creative Entrepreneurship in the Art City - Venice as an incubator

Angela Nativio, Professor Fabrizio Panozzo

Ca' Foscari University of Venice, Venice, Italy

Abstract

In the wake of the pandemic, both public policies and academical debate are focusing on creating sustainable models for cities, and discussing the role of Arts and culture within them. Can cultural and creative entrepreneurship truly achieve its socialising function? Can this be done in a sustainable and inclusive manner? The currently widespread interest for creative entrepreneurship is, we argue, one of the persisting fascinations with the economic potential of art, culture, and creativity, which ignited at the end of the last century. Over time, a plethora of spaces dedicated to fostering its growth was devised, each one supposedly targeting a different aspect or need of cultural and creative work. A taxonomy of the most frequently used and publicly acclaimed models is offered as the starting point of our argument, combined with a reflection on their unexplored dark sides. We then move our attention to a particular empirical case. For Venice, creative city par-excellence, the discourse about its creative potential - and the creative entrepreneurs born within its borders - far pre-dates the current debate. Nevertheless, past attempts of regeneration through spatialisation have failed to make their mark. As the city tries - once again - to offer itself as a safe harbour for creative minds, we look back upon such attempts, examine their inability to generate satisfying empirical results, and envision a new approach to the mobilisation of art and culture for the creation of sustainable living and working environments: one that overcomes the spatial constraints of the incubator and extends its borders to the entire urban context, directly involving Higher Education Institutions in its planning and management. We ponder whether this new configuration might truly be an inclusive and sustainable one.

Keywords: Creative Entrepreneurship, Academic Entrepreneurship, Sustainable Urban Development, Public Policies, Incubators

Track
Track 6c The power of art and culture in sustainable cities and communities

Full papers

Engaging Culture Phronesis for Cities in Future

Sharma Anjalik[1]

[1]*Professor & Director School of Architecture, Planning and Design, DIT University; Dehradun, India*
anjalikrishansharma@gmail.com; director.arch@dituniversity.edu.in; anjali@anjalikrishansharma.com

Abstract

Geopolitical decisions accelerated the Global economy adequately supported by communication and information technologies. However, economic operations of Globalizations are accompanied by waves of cultural transformation: the rhetoric of infrastructure facilities have reinforced the domination of global mega cities for urbanization, that mutated local cultures for their origin to transform to the migrated locations. Typically, each of the cities cherished their respective contextual identities and responded to global economy differently whilst the technologies are common in sync with the global economies, however the responses varied and so were the design solutions driven by lifestyles and local cultures. Culture the thematic indicator of UNESCO for the 2030 Agenda redefined the tri-pillared sustainability of Environment, Economy and Social. The hegemony of globalisation impacted the cities often interspaced with precincts that are culturally driven by the inhabited communities. The paper shall enumerate the role of culture that balance/imbalances the nature of development parallel to the algorithms of economies in cities. The expected conclusion is to engage culture that enables each city for its disparate identity; that connects people, facilities diversities of all kinds that are sustainable. The narrative of sustainability derived from synergies between drivers of transformations arising from economy growing with environment for the social to construct the culture of the city. The process has been skewed with one pillar governing the others which has resulted in the environmental imbalance i.e climate change, social equity, diversities among other. The backdrop of global cities is compelling cities to orient toward economic activities that enables them to position themselves in sync at the global level, often underpinned by the cultures heritage of the city. Each of the cities in future need to demonstrate their core strength with resilience for transformations of all kinds that may have occurred reflected such in all art forms, lifestyles, food, language, beliefs and others. Today the future cities are exceptionally placed to observe the global cultures while recognising their respective cultures' as well.

Keywords: Globalization, Culture, Contexts', Transformations and Cities.

1. Introduction

‘Phronesis’ is a Greek term stems from Aristotelian philosophy and developed further by many scholars in Social sciences since then. Greek words and concepts have constituted to academic vocabulary especially in social science and over time multiple layers and dimensions explored for meanings in their conceptual roots. The concept of *Phronesis* (practical wisdom) and *hexis* (dialogues theory and texts).

> *“Aristotle repeatedly claims that character-virtue “makes the goal right”, while Phronesis is responsible for working out how to achieve the goal. Many argue that these claims are misleading: it must be intellect that tells us what ends to pursue.*
>
> *There are no good textual or philosophical reasons to reject this straightforward interpretation. Contrary to widespread opinion, Aristotle does not characterize Phronesis as supplying ends. Instead, its ethical import lies wholly in its ability to “determine the mean”. Moreover, because character involves non-rational cognition of the end as good, Aristotle can restrict practical intellect to deliberation without abandoning his anti-Humean view that we desire our ends because we find them good’’.* [8]

With climate change emerged as a key the concern for future cities the same was addressed globally through numerous events and workshops wherein all the dimensions were outlined, debated and census drawn for the way forward i.e. communicating the connection between cultural heritage and climate action by ICON; mainstreaming Culture and Heritage into Climate Planning by ICOMOS; using Culture to Promote Climate Resilient Sustainable Development by United Cities and Local Governments (UCLG)- -BEFS -UN-Habitat -Cal SHPO -ICOMOS -INTACH -IITC -UCSD -Historic England; Supporting Climate Action by Local Communities and Indigenous Peoples by CCAC and IITC; building the Arts, Culture and Heritage Constituency for COP26 by Historic Environment Scotland and Cal SHPO--BEFS -UN-Habitat -Historic England - INTACH -CACC -UCSD –UCSUSA; [7]

Globalisation has accelerated large scale urbanisation across the world and that has inherent challenges of diversities i.e. economic, social: ethnicity, caste creed, lifestyles and the list goes on and within this framework culture being the key anchor. Typically, cultures are region and geographic specific and nurtured by the local population that shaped up as communities. Global economy propelled the growth and urbanisation and as it was financially driven the developed nations lead the path with global cities emerging as hubs of growth; influencing nations across boundaries around the globe. However much the urbanisation driven by economy was largely translated as numbers with large floor areas built; rather as a mathematical solution proportionate to the requirements that ignored the social connotation. The social aspect was looked upon as human resource rather than communities or a set of population with cultural threads of ethnicity, region, colour, castes, creed, indigenous groups among others. Ironically the said diversities equip them to

deliver; typical underpinned by culture is responsible for health and wellbeing that equips them to deliver. Further, despite technology at its best is compelled to look at the behaviour responses and patterns connected use of resources both natural and manmade. The behavioural patterns are directly proportionate to the culture of the said population; and in this realm culture is emerging as key determinant for cities to be sustainable in future. The urbanising globe demonstrates that nations across the world are at varying threshold of urbanisation, which is both a challenge and an opportunity as well to explore the correction if so required for our cities in future. Challenge because the trajectory of standard UN SDG for the globe shall take longer than desired while an opportunity as the strategies for the ones lagging behind can be worked out with informed choices.

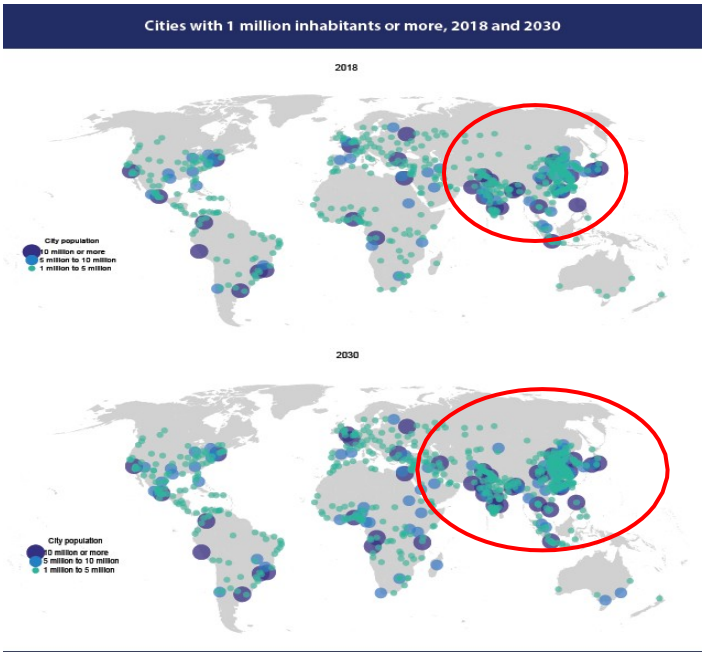
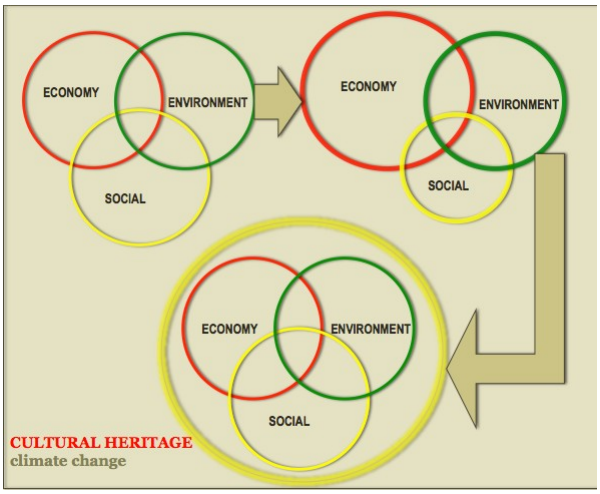


Fig 1.1 Cities with 1 million population (UN:)

Cultures are region and geographic specific within the contextual connotation. Therefore, each of the contextual framework varies and if the geographical location may be common but the social connotation makes it place specific thus often unique. While at the regional scale the culture may be similar often not identical due to the place connotations. The transition is often marginal but fine- tuned such in the culture; such transitions may be attributed as challenges of diversities with Culture the key anchor. Traditional Cultures' nurtured by the contextual framework developed practices, that used local resources and responded with their wisdom of knowledge. Typically, the traditional cities demonstrate' practices that evolved over the time they and were enriched to be resilient. Thus these cultural practices may be referred as best practices for the respective geographies; as the responsive to climatic conditions as well; are richer for their value too. Traditional communities are abode of cultures' and with global economy diluting

boundaries of all kind, further introduced a type of development that was rather a mathematical solution as quantified as numbers and over looked the qualitative including culture.

The structure of the paper is based on cultural practices: wisdom of traditional communities under pinned by culture. Next inclusion of thematic indicator for culture by UNESCO in the agenda 2030 validates the same. However, the transitions that are critical for climate change also inherent for sustainability of the globe are centre stage for the world for collective roadmap ahead. The impacts vary for the pillars of sustainability; ironically even the global mega cities with similar set of resources demonstrated varying thresholds of sustainability. These variations are largely attributed to behavioural responses rooted in cultures'. However, Culture embraces social, economy, political for the ecology of the place; it's about people and most significant determinant for all other aspects of life on this planet. The relevance of the



paper gains significance as majority of urbanisation is concentrated in Asian and African nations and one of the World bank report documents that these continents are rich with traditional cities of which a large number are living cities as well.

Fig 1.2 Connecting Culture to Pillars of Sustainability (author)

2. Method

The method adopted largely focuses through qualitative analysis of the Synergy between Culture and pillars of Sustainability: Social and Economy with environmental addressed as contextual. Culture as the fourth pillar of sustainability, Cultural practices are contextual phenomenon. Sustainability and climate change ideally when addressed at contextual level yields maximum results; the same implemented through policies, strategies, norms and standards conventionally executed through practices. Culture outlines the common thresholds of thermal comfort and thereby resource consumption which has the potential to contribute to achieve the global targets. However, the culture is insightful not only for context but often extends to regional as well. These cultural connotations are translated n the built environments

and has principles and practice embedded such for resource consumption and related carbon footprint. Often these built environments have tradition of living such for centuries on that has an identity of its own. Globalisation triggered an unprecedented set of transformations across all pillars of sustainability that impacted the continuing contextual practices. Additionally, political has been included as indicator as it influences the decision making. The mapping has been for cities at global level to connect with contemporary issues that are universal i.e. climate change, security, health among others. The narrative is constructed at global forum and validated through a specific case example of a world heritage city of Jaipur in India (2019).

3. Culture an evolution of regional context

The broader narrative of local cultures' is typically woven within the social fabric of a place that gets translated in the built morphology of the city. Cultural connotation can be understood when placed in correct perspective with respect to geographies and climate. Each region is geographically rich with a set of natural resources and the habitats that evolve with the said resources through indigenous design solutions are in sync with the natural environmental framework for their lifestyles i.e. deserts' that have limited availability of water with high temperatures have lifestyles that utilises minimum quantity of water for their basic needs, and built their habitats such that provided thermal comfort through passive systems however, the thresholds often varied. Traditional settlements are contextual specific and so is the culture, translated in the built morphology of the settlements/ towns/cities. This direct relationship between the cultural practices and spatial requirements is the essence of these traditional rich architectural styles. Conventionally the economic activities were agriculture produce and economic activities limited to the set of natural resources available thus economy was largely local with nil transportation for local production. These activities governed the lives of the local communities that resulted in social structure with norms and practices. The said practices were responded and driven by political, environmental to economic needs of the local communities. The necessary flexibility to adapt to the changing needs over time exposed the societies to be resilient and with time the thresholds too revisited. Such resilience enriched the cultures and the traditional cultures demonstrates them loud and clear. The strength of traditional cultures' is its resilient nature that responded for political, social to economy for the contextual framework. Typically, the local cultures' nurtured indigenous technology utilizing the local infrastructure facilities in an optimum manner. Each of the culture was/is geographically specific but not identical and varies with varying social connotation that evolved with time as culture of the place demonstrated through its practices. A loud example may be that of thresholds of thermal comfort, born and brought up in a certain culture the constitution has inherent strength to withstand temperatures, humidity etc and thus their DNA enables them

to limit resource consumption and manage with less carbon footprint .i.e case excessive summer deaths in Europe is an issue while the same temperatures isn't a concern for people in African and Asian nations.

Cities have existed for centuries on thus urbanisation is inherent to the globe. Each of the cities located for specific geographies was endowed with set of natural resources and each of the cultures' evolved strictly within the said framework. Thus there exists a synergy between the contextual identities of local Communities and Culture. Culture determined the nature of built morphologies, hierarchies of built environs' i.e developments, public spaces, scale, nature of development, to selection of locally available building materials, indigenous construction technologies that evolved as the architectural styles with culture as the key. Conventionally the spaces were determined by the social and economic activities and the Space syntax demonstrated its efficient usage, as the work and residences were under one roof that provided flexibility and assured optimum use of spaces. Often the spaces were adapted responding to the changes due to social, political, economic and others if any; displays the resilient nature of people, places and spaces. The Culture of urbanisation in the name of growth and development are cloning the local identities, cultures for the hegemony of globalization.

3. 1 Social aspects of Transformations of Culture:

Cities developed with an inherent social structure typically determined by religion and political governance. Initially they mushroomed in geographical locations that were rich with natural resources especially water. Lifestyles and livelihood emerged from geographical location, climate and set of natural resources available, which translated as culture of the place. The spaces required for social and economic activities were designed as both open and covered. The disposition of spaces and their relationships shaped up as culture of place that determinant the spatial requirements for all building typologies. Further the practices of respective cultures ended up defining the communities as their identities; something that is getting lost with global architectural virtually cloning the cities like other diversities i.e cul-de-sacs in residential clusters are standard where women have restricted movement while others have seamless pedestrian movement otherwise; the same even reflected in spatial usage within living quarters as well. In case of walled city of Jaipur, Rajasthan, India the city was designed as grid-iron pattern with each of the grid designated for specific social group based on caste and continuing till date (for about three centuries) essentially cultural ingrained through ownership, economic activities among others. Each of these mixed used residential clusters have traditional courtyard planning however the spaces varied from large spans to standard spans; often dictated by the economic activity and further determined by the locally available building materials.

Population of global cities is essentially an agglomeration of communities with diversities of all kinds, hailing from all regions, making it complex and challenging from sustainability and climate change. The wisdom of knowledge evolved the mind-set of the local communities to use resources often propagated by cultures'. Thus in global cities the use of infrastructure largely continues to be determined by cultural backdrop of the communities i.e. energy consumption key for climate change varies through behaviour responses. Numerous scientific studies have validated that through BPE/ POE (building performance evaluation/ post occupancy evaluation) among others. Typically, in each of the contextual it was uniform while in cities its rather an agglomeration of such groups that live with global lifestyles often along with their respective cultures' as well evident through the diversities.

3.2 Political aspects of Transformations of Culture:

Political indicator along with governance played a significant role for the contextual framework that facilitated cultures' that sustained for centuries and proved to be resilient as well. While the role of political in contemporary framework for global economy has impacted resulting in global challenge of pushing the world toward unsustainability. The political decisions are strongly influenced by capitalism and vested global economic interests that are governing both natural and human resources equally. Such congregation of economic opportunities are typically concentrated in cities and is encouraging migration across nations across geographies and this movement pattern is broader in nature unlike the historical one, which was from neighbouring rural to urban. Further it spans across all disciplines too from academicians, think tank to industrialists, businesses etc. when such movement happens the cultures too migrate and respond to the new contexts which varies from culture to culture. Most of the global cities may have similar set of communities i.e. African being one of them but responses may vary based on the political governance. Often based on the strength of the cultural roots each one may stand tall as isolated ones; a loud example is that of china towns in most of the global cities. In traditional city of Jaipur, the political framework facilitated and contributed for the wisdom of knowledge with the local communities that developed the indigenous technologies and vernacular design solutions both for lifestyles and economic activities shaped up as culturally rich architectural heritage. Global economy manipulated the political power and governance for their vested interest in the name of growth and urbanisation. Typically based on the stage of development the city/ nation is and with nature of governance the model was strategized, often exploited for resources i.e. developing and poor economies especially African nations are loud example of them. Such strategies off loaded the carbon foot print as the canvas got widened with global political agenda. Whilst the local synergy between natural resources local communities under pinned by local cultures were impacted whilst the ones deep rooted were resilient to sustain despite the

global pressures; these were culturally strong. Thus despite the global pressures the local communities that were culturally rich curtailed the climate change to some extent, which varied for cities and nations respectively.

3.3 Economy aspects of transformations of Culture:

Traditionally the local economies were inherent connecting social structure with the economic activities that largely contributed as cultural practices. The geo-context governed the economic activities that were sustainable for the context. The access was limited to locally available natural resources and the said set of natural resources were processed through indigenous technologies developed by the wisdom of respective local communities. The continuity of said socio-economic setup was the key attribute of the culture of the place that continued for centuries on until Capitalism triggered the Global economy. The global economy focused on resources: natural & human across the globe for the vested agenda of multinational business groups. Global economy diluted local economies for scale of mass production, concentration of power- mainly financial and political. This shift of scale impacted the human resource from the local economy to global, driven by consumerism and better buying capacities; an indicator of developed nations that developing economies aspired for. Further the global economy diluting local economies impacted the social equity. Although departing from the local cultures could not sustain and surfaced through related aspects i.e. behaviour, energy use, consumption pattern among others.

Wherever the global mega cities have grown the foundation of local cultures the impact of globalization attested parallel to the sensitivity of local cultures' are proving to be more sustainable i.e. Tokyo, London, Sydney and so on some of the loud examples. However, these global mega cities have embraced diversities of all kinds with their respective cultures' embedded within the city's fabric demonstrating the essence of the place; an identity for the city. Globalisation that triggered the paradigm shift from Socio-Economic to Economic-Social; currently needs a relook more so with pandemic as well and in this backdrop the role of culture cannot be negated, rather establishes the need for it to be acknowledged such.

4. Discussions: CUTURAL PHORONESIS

Cultural Phronesis needs to be relooked at considering the concept has had layers of understand and narrative drawn now for centuries on. In the contemporary world understanding and developing knowledge base is inter-disciplinary enable one for a comprehensive awareness of the concept as rich as phronesis. Further it gets complex when viewed for cultures'.

The strength of Phronesis laid down by Aristotle has been explored among researchers from social sciences and over time with other disciplines as well. The trend of understanding and developing knowledge base from silos to extending to related and other disciplines has widened the canvas and with this backdrop the Cultural Phronesis has the potential to contribute more in sync with the contemporary approaches and strategies. Phronesis as practical wisdom is connected to ground zero for available resources and feasible solutions executed with aesthetic sensibility of the local population. Further due to its broader canvas encompasses most of the disciplines' thus inclusive by inherent nature. The cultural practices are insightful for a range of aspects i.e. through lifestyles food habits if locally grown then sustainable, often even the cooking habits too in sync with the quality of water, climate, access and availability of water and so on. Food habits are mainly responsible for the issue of food security, production and consumption patterns i.e. walled city of Jaipur for the geographical location had limited access to water and thus grew millets and mostly indigenous produce as the production was adequate to feed the local population but when wheat was introduced the production dipped and also from digestion point of view proved to be heavy. This deviation from the cultural practice got multiplied manifold with globalization when people started consuming food products that were not indigenous often transported that had carbon footprint and environmental impacts and often with better buying capacities had access to greater quantities; all these impacted food securities, widened the social gap reinforcing economic hierarchies diluting the social equity omnipresent in the contemporary world today. Next even the cooking and eating habits too transformed took additional tool making it unsustainable. The case example of Jaipur clearly demonstrates that during the early years of city developing agriculture proved to stabilised the economy till the other economic activities were taking roots. [9]

Typically, the Phronesis was nurtured in traditional cities which were characterised by mixed land use; thus work and residences were under one roof that ruled out any travel to work and related carbon footprint, a major concern for our future cities. The economic activities utilised the locally available materials and technologies thus transportation costs minimised. Such product enjoyed their uniqueness and lower costs too, something that was integral to the cultural practices of the place. Sometimes when the local communities wee enterprising enough they explored as well i.e. in Jaipur the craftsmen were creative and innovative thus excelled in processing semi-precious stones which were transported from other nations and exported. Jaipur for centuries on contributed for processing of semi-precious stones ranking as top five products for the nation till the turn of the century. [9] As both men and women contributed for all activities economic and domestic the society was healthy, symbiotic and inclusive; as a strong cultural connotation norm of the society. Such unsaid dimensions added to the quality of life that was unique to each culture that was healthy and ensured the wellbeing of the local communities as well.

In the compelling race of globalization such norms and standards are being overlooked i.e. in a global mega city is essentially an agglomeration of various cultures with varying thresholds the responses too vary. One of the example may be of excessive summer deaths that occur in UK each year as when mercury touches closer to forty degrees centigrade the local population especially older people cannot sustain; [10] whereas there are nations where such mercury levels are normal and they function such mainly due to the DNA such. The climate change as a major challenge the thresholds need to be reviewed and may be contextualised geographically; wherein the cultural Phronesis emerges as a time tested proven solution that can contribute for future cities. Nature created the diversities vivid in geographies that was adequately recognised by respective cultures something needs to be cherished. Globalisation tapped on all potential areas that could yield monetary gains and in the process the tourism sector too. Largely the tourism sector across the globe draws from the cultures of the respective place, wherein cultural Phronesis is integral. Conventionally the cultural practices evolved for the contextual framework and with globalisation enabled access to resources in every way; reducing the said practices more a product with a price tag rather than for its value and virtue. Such transformation of cultural Phronesis requires sensitivity wherein the inherent value needs to be upheld and integrated within the city's fabric such. Culture takes years of perseverance and nurturing to shape up and such transformation is more a paradigm shift which isn't healthy from sustainability point of view and needs serious review as the way forward.

This dichotomy may be recognised as gaps and bridges for cultural Phronesis as follows:

Gaps are pronounced in cities and more so in megacities due to the scale of cities. Interestingly the global mega cities have elevated to prominence mainly due to their strategic geographical location that are rich with infrastructure facilities as global financial hubs. Conventionally, each of these cities are rich for their culture from old to contemporary i.e. London and Sydney. The global mega cities are growing at a pace fastest ever in the history; virtually bursting at its seams resulting in transit oriented development i.e New South Wales with its longest ocean bay in the world, Mumbai and new Bombay, London and Greater London and so on. When these cities expand are often characterized with condominiums that are community specific from economic class grouping to social grouping. Migration of communities creates a mosaic of city's texture and behavioural patterns of the communities that are culturally governed are evident such. i.e. energy use etc. However, demography of a city is strongly contextual (Tokyo with higher older population [geriatrics]), despite the diversities of varying communities these cities have taken measures for inclusivity for the city for a constructive fabric of the city, however each of the cultural Phronesis are legible in the city's texture.

The bridges at the global level are Information and Communication Technologies that has enabled sharing of knowledge, practices, norms, standards among others. This facilitates collaborations with informed

choices that may be executed with political will through policies and strategies in sync with the contexts; with the common thread of culture. Global economy has brought the nations at single platform with UN outlining the minimum common agenda of Sustainability; that recognised culture as an integral pillar of sustainability for effective output. Infrastructure facilities were put in place that facilitated the global economy has taken up the onus of facilitating the common agenda. However, the cultural practices that have sustained for decades and centuries on are adequately documented and now as Best practices accessible for Knowledge sharing. Such dissemination of traditional cultural practices –Phronesis enriches the lives of the people. As global economy triggered need for sustainability and circular economy cultural Phronesis completes the circle.

5. Conclusions

Engaging Cultural Phronesis is the need of the hour with UN recognizing Culture as fourth pillar of Sustainability establishes and reinforces it's inherent strength. Cities with diversities of all kind: Social- ethnicity, colour, creed, caste, and others; Economic- classes stratifying population and Political: type and nature of governance, peoples' participation, recognition of local communities is a challenging; as its taking its toll on security, health and well-being in addition to the carbon footprint and climate change. Measures taken for climate mitigation are falling short despite a large body of scientific studies already in place and growing by the day. The gap exists for diversities, inclusivity, ethnicities largely attributed to behavioural responses of the users which is strongly under pinned by the respective cultures' of the communities within the city's population. Narrative on transformations for pillars of sustainability enumerates how dynamic it is and varies with geographies'; as the framework for each cities is typical so are the transformations' and thus the solutions too cannot be generic and in this realm cultural Phoronesis emerges as the key for future cities.

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7. Social-economic aspects of sustainability

7a. Global inequality and poverty

Abstracts

Addressing Historical Inequalities: National and global challenges in the post-pandemic era

Professor Shobhana Madhavan

University of Westminster, London, United Kingdom

Abstract

This paper falls within the purview of Sustainable Development Goals (SDGS) 1and 10. The theme of this year's conference: Sustainable Development and Courage- Culture Art and Human Rights underpins these two goals and sets out the values of human engagement. The pandemic highlighted the serious inequalities of income and opportunities, within nations and globally. Concerns about the nature of economic growth and the imperative of promoting sustainability have underpinned policy responses at national and international levels. It has been increasingly recognised that measures to promote economic development have unequal economic and social outcomes. Therefore issues of inequality have to be addressed at national and international levels. The "net zero strategy" developed at COP26 Climate Summit places responsibilities on individuals, governments and businesses. The challenges, and opportunities presented must be reflected in governmental policies and strategic business decisions. But there are resource costs and trade-offs and these must be acknowledged.

Track
Track 7a Global inequality and poverty

Full papers

Memories of Resistance of Solid Waste Collectors to Institutional Voids that Promote Poverty in four Recycling Cooperatives in southern Brazil

Maria de Lourdes Borges[1], Rita de Cassia da Rosa Sampaio[2], Jorge Nascimento[3]

[1]*La Salle University - Brazil, prof.marialborges@gmail.com*
[2] *La Salle University - Brazil, sampaio.ritadcassia@gmail.com*
[3] *La Salle University - Brazil, jorge.nascimento0472@unilasalle.edu.br*

Abstract

The economic and social inequality that characterizes the Brazilian reality has deepened during the pandemic, so that 7% of the population (more than 14 million people) live in extreme poverty (less than U$ 5.50 per day), while, in this period, the profits of big companies and banks increased. So, the search for underemployment increases, as in the collection of solid waste in the cities. To face growing environmental problems, the Brazilian government instituted the National Solid Waste Law in 2010, which sought to bring together federal, state, and municipal government bodies, industries, companies, and communities, with the municipalities responsible for the waste generated there. Twelve years have passed, despite some actions implemented by governments, institutional gaps are identified (Mair and Marti, 2009). The aim is to analyze the memories of solid waste collectors who resist institutional voids that promote poverty, and their relationship with group identities through case studies in four recycling cooperatives in southern Brazil. Methodologically, qualitative research centered on the interpretive paradigm. Four qualitative case studies behaved, totaling 27 interviews carried out in two stages, 13 documents, and 45 ethnomethodological observations from 2014 to 2020. After being systematized, the data were analyzed according to thematic content analysis. The case studies took place in two recycling cooperatives in the municipality of Canoas/RS (COOP1 and COOP2), one in the municipality of Sapucaia do Sul (COOP3) and one of Esteio (COOP4) in the state of Rio Grande do Sul. Results point to three thematic categories of analysis: (i) institutional voids: associated groups (individual waste pickers and street pickers) collectively came together to generate work and income in the form of recycling cooperatives; extinction of the National Secretariat for Solidarity Economy in 2015 by the federal government, with a decrease in the promotion of cooperatives; on the other hand, the presence of contracts with the municipalities and some companies and NGOs (Non-Governmental Organizations) was evidenced, which guarantee the continuity of the structure, leaving the management in charge of the group in a model with perverse characteristics, since the group receives income for its production, impacting poverty. (ii) poverty: cooperatives formed by marginalized people such as illiterates, the elderly, addicts, LGBTQI+ people, mostly black, obese, ex-

convicts, 90% women with several children; deal with the complexity of a company, two of them in a self-management model (where decisions take place collectively according to solidarity economy precepts) and two in a hierarchical management format; conflict is usually overcome by dialogue and the union of groups, impacting on identity; (iii) group identity: for each cooperative to achieve its objectives of generating a minimum income for the cooperative members, several meetings for the search for joint solutions is sought, which generates collective resistance and solidarity. Although the groups face prejudice for working with garbage, they are proud of their professions, are aware of their environmental role, and see themselves as caretakers of the planet. They have courage for collective development. SDG+Target: 1.1

Keywords: Memories, Solid waste, Poverty, Institutional voids, Recycling cooperatives

1. Introduction

The economic and social inequality that characterizes the Brazilian reality has deepened during the pandemic, so that 7% of the population (more than 14 million people) live in extreme poverty (less than U$ 5.50 per day), while, in this period, the profits of big companies and banks increased. So, the search for underemployment increases, as in the collection of solid waste in the cities. To face growing environmental problems, the Brazilian government instituted the National Solid Waste Law in 2010, which sought to bring together federal, state, and municipal government bodies, industries, companies, and communities, with the municipalities responsible for the waste generated there. Twelve years have passed, despite some actions implemented by governments, institutional voids are identified (Mair and Marti, 2009). Institutionals were created to facilitate human relationships and also to decrease the uncertainties present in group behaviors through regulatory, normative, and cognitive rules (Scott, 2008). Institutional voids refer to the deficiencies where formal institutions should operate on behalf of society, do not do so to the extent necessary. Initially the term Institutional voids came from market rules. They occur when institutional arrangements (rules, regulations, etc.) do not work, allowing actors with more power to have access to more resources than others, generating a legitimacy problem (Mair and Marti, 2009). For this paper we agree with Mair and Marti (2009) in that institutional voids the institutions responsible for those environments or groups are insufficient and not deficient. The post- consumer solid waste recycling cooperatives in Brazil are contexts where different institutions prove to be insufficient. People do not have access to decent housing, formal jobs, education, health care, nor to basic sanitation and treated water supply. These people are left to band together to live off the waste of others, drawing on their memories of resistance (Le Goff, 1990) to precariousness and poverty (Souza et al, 2019) and to institutional avoids.

In 2010 the Brazilian government established the National Policy for Solid Waste (Law No. 12.305/10), which defines how each government agent needs to manage waste, with a ban on landfills, for example. Solid waste management is now under the responsibility of the municipalities. Some municipalities have provided incentives for individual waste pickers to join together in groups and form cooperatives. In 2015, with the political change in the Brazilian government, the National Secretariat for Solidarity Economy was extinguished, as well as almost extinct public policies that benefited people in situations of poverty and vulnerability, increasing institutional voids.

The aim is to analyze the memories of solid waste collectors who resist institutional voids that promote poverty, and their relationship with group identities through case studies in four recycling cooperatives in southern Brazil. These case studies took place in two recycling cooperatives in the municipality of Canoas/RS (COOP1 and COOP2), one in the municipality of Sapucaia do Sul (COOP3) and one of Esteio (COOP4) in the state of Rio Grande do Sul.

2. Methods

Methodologically, qualitative research centred on the interpretive paradigm. Four qualitative case studies behaved, totalling 27 interviews carried out in two stages, 13 documents, and 45 ethnomethodological observations from 2014 to 2020. After being systematized, the data were analyzed according to thematic content analysis. The four recycling cooperatives studied were:

COOP1: The Cooperative of Collectors of Recyclable Material of Mathias Velho started its collection and sorting activities in 1986 with five residents of the Mathias Velho neighborhood in the city of Canoas/RS. In 1995, the group was formalized as an association. They then received in loan a 1449 m² piece of land with a small building where it is currently located. The building received, which is now used as a cafeteria, changing rooms, offices and bathrooms of the association of residents of the Mathias Velho neighborhood. Some years later (the cooperative does not have the record of the date), a German company donated and built the shed for the sorting work, totaling a built area of 601.85m². In 2003, the group was formalized as a cooperative. reform of the bathroom, reform of the cafeteria, reform of the office, all the members have three meals a day in the cooperative (breakfast, lunch and afternoon coffee) that they did not have before. In 2013, they bought a truck to help them in the work of collection along with another truck that they already had received as a donation from the Bank of Brazil Foundation in 2012. In 2015, they expanded the sorting conveyor from seven to 13.5 meters to increase production capacity. In 2010 it was integrated into the activities of the Incubator of Solidarity Enterprises of Unilasalle in projects promoted by FINEP and CNPq with training actions, group training, monitoring of technicians in the areas of administration, logistics,

environment and health, participation in the Forum of Recyclers of Vale dos Sinos and encouragement in the autonomy to build projects. Coopcamate has 29 members.

COOP2: The origin of the collective work of the Renascer Cooperative dates back to mid-1983, a period when they started collecting recyclable materials at the sanitary landfill in the city of Canoas. In this period each collector used to collect and sell individually, only after some time they started to sell collectively and also to share the collected material. In 1995, the ACCMC - Association of Carts Collectors of Canoes Materials was called by the city government to take over the landfill "group", which remained part of the ACCMC until 2006. Along the time, Renascer Cooperative has established several partnerships: Community of Volunteers of the Lutheran Church (CELSP), DRS, Unilasalle Canoas, CAMP - Center of Multiprofessional Advisement (it is a non-governmental organization convened with La Salle Foundation in 2010 to assist the implementation of the selective collection process in the city of Canoas), VONPAR Company and the City Hall of Canoas. There are 25 cooperative members. (Image 1).

COOP3: The Recyclers and Collectors Association of Esteio - ARCA, was founded in 2003 having as its headquarters the Neighborhood Association of the Votorantin neighborhood of Esteio/RS. During 2005 it was transferred to the Sorting Center belonging to the Municipal Secretariat of Environment located in the city of Esteio. The composition of this Association began with eight members performing the selective collection one day a week. Between 2005 and 2012, ARCA sought training and capacity building with the municipal government, regional forums of collectors (CATAFORTE), national movement, partnerships (Unilasalle, Gerdau, CAMP and others). The formation of a new coordination, aware of the cooperative work, provided a great growth of the group. Since 2012 ARCA performs the Selective Collection of Esteio with approximately 33 members through a contract with the Municipality of Esteio. It was formalized as a cooperative, changing its name to Esteio Recyclers Work Cooperative - COOTRE.

COOP4: The Popular Recycling Cooperative of Sapucaia do Sul (Cooprevive) was founded in 2009, had its first shed burned down. In 2016 the municipal government helped with the construction of a new shed. Currently there are 32 cooperative members, mostly women responsible for the families and Venezuelans who support from 4 to 17 people per family. It currently has three trucks that collect solid waste on routes throughout the city.

***Image 1**: Renascer cooperative (first author collection)*

Image 1 shows the very similar work environment of the four cooperatives, where the waste is received containing leftover products and mixed together. The sorting is done manually, usually by women who separate the material into giant bags, then the material goes to a hydraulic press to be pressed and baled, and then it becomes available for sale. The cooperative members receive the equivalent value of what they manage to sort and the product of sales is divided among them, except for the functions they receive directly from the contracts with the respective municipalities as coordinators and drivers of the trucks.

3. Results and Discussion

The results of the data analysis can be understood in three broad categories:

(i) Institutional voids: associated groups (individual waste pickers from dumps and from the streets) joined together collectively to generate work and income in recycling cooperatives format; extinction of the National Secretariat of Solidarity Economy in 2015 by the federal government, with a decrease in fostering cooperatives evidencing institutional voids (Mair and Marti, 2009).

On the other hand, it was evidenced the presence of contracts with municipalities and some companies and NGOs, which guarantee the continuity of the structure, leaving the management in charge of the group in a model with perverse characteristics, because the group receives the income for its production (without having training or even subjective psychic structure), impacting on poverty. At the time of the pandemic, there was a lot of instability in the arrival of post-consumption materials and some families became more needy (Bastos, 2021).

(ii) Poverty: the cooperatives are made up of marginalized people such as illiterate people, the elderly, addicts, immigrant refugees, LGBTQI+ people, mostly black, obese, ex-convicts, 90% being women with several children. A large part living in extreme poverty (UN, 2022). In addition to waste pickers living on meager resources, they subject themselves to the stigma of dirt and social and public invisibility (Souza et al, 2019). People who even without preparation and low education deal with the complexity of a business (accounting, permits, authorizations, personnel department), two of them in a self-management model (where decisions occur collectively according to precepts of the social and solidarity economy) (Gaiger, 2013) and two in a hierarchical management format; the conflict is usually overcome by dialogue and the union of the groups, impacting on identity (Borges et al., 2014; Gutierrez et al., 2019).

(iii) Group identity: in order for each cooperative to achieve its objectives of generating a minimum income for cooperative members, several meetings take place and a search is made for joint solutions, which generates collective resistance and solidarity (Gaiger, 2013). Although the groups face prejudice for working with garbage, they feel proud of their professions, are aware of their environmental role, and see themselves as caretakers of the planet (Schwengber et al, 2017). The memories of the obstacles overcome by the cooperatives studied help them to keep resisting.

4. Conclusions

The objective was to analyze the memories of solid waste collectors who resist the institutional voids that promote poverty, and their relationship with group identities through case studies in four recycling cooperatives in southern Brazil. The analytical results pointed out that the memories of resistance concern the resistance for survival of a class of workers that are the collectors of recyclable materials.

The results pointed out that institutional voids were associated groups (individual waste pickers and waste pickers) came together collectively to generate work and income in the form of recycling cooperatives. Another evidence of institutional voids was generated as a consequence of the political change that occurred in Brazil after 2015, where several government secretariats and even the Ministry of Labor were abolished, opening a vacuum on workers' rights. On the other hand, it was evidenced the presence of contracts with continuity since and some companies and NGOs, which guarantee the guarantee of the structure, leaving the management responsible for the group in a model with perverse characteristics, the group receives income for its production.

Poverty was also evidenced, where survival represents the memories of resistance. The cooperatives welcome marginalized people who resist to continue living. Even without cognitive preparation and with often weakened psychic structures, they manage and self-manage the cooperatives in a democratic way, where conflicts are usually overcome by dialogue and group unity. Collective resistance and solidarity influence group identity. Although the groups face prejudice for working with garbage, they are proud of their professions, are aware of their environmental role, and see themselves as caretakers of the planet.

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Posters

Living in an oilfield – Images and voices from Patos-Marinza oilfield, Albania

Sara Persson and Sidonie Hadoux

Dr Sara Persson and Sidonie Hadoux
Södertörn University and Photographer from France

Living in an oilfield – Images and voices from Patos-Marinza Oilfield, Albania

A photograph *by Sidonie, taken in the oilfield during 2014, decorates the cover of Sara´s dissertation. Black tanks where oil is deposited in the middle. An oilrig and a gas flare as part of the oil infrastructure. Green agricultural fields in the foreground. Mount Tomorri in the background. The oilfield looks almost beautiful. The exhibition of photos from the area is closed. The dissertation about Patos-Marinza oilfield is finalized. What now? How can they keep speaking about life in Patos-Marinza? What do they say together?*

This exhibition *examines how it is to live in an oilfield through photographs and quotes from actors working and living in the Albanian oilfield Patos-Marinza. It is a collaboration between Sidonie Hadoux (Photographer) and Sara Persson (PhD in Business Studies) and a collection of material from a photo exhibition and a dissertation, assembled in a new way to keep speaking about oilfield realities. It will take place at Södertörn University Library between the 22 May and 16 June 2022.*

7. Social-economic aspects of sustainability

7b. The future of employment and good work

Abstracts

Circular Jobs: Exploring sustainable business practices that contribute to social justice in Latin America

Dr Monica Ramos, Dr Vanessa Prieto-Sandoval, Dr Juan Pablo Stifken

Pontificia Universidad Javeriana, Bogotá, Colombia

Abstract

A paradigm shift towards circular business models (CBM) requires firms to transform obsolete jobs into new employment and good work. However, there is increasing skepticism about whether the circular economy can create meaningful jobs, greater conviviality, social justice, and solidarity. This paper explores how a circular economy (CE) promotes sustainable human development and creates meaningful jobs that improve social justice and how the social value of circular jobs can be considered an innovation result. This qualitative study has documented the quality of jobs that have been created by ten companies recognized as successful circular businesses in Latin America. The study followed Krippendorff's content analysis research process (1989). First, the research design defined the context, the research objectives, and the potential participants. Then, the sample units defined are the semi-structured interviews to circular companies, recorded to be transcribed and reviewed in symbolic material. Then, the researchers systematically analyzed the interviews' content (Bell, Harley, and Bryman 2019). Finally, the transcribed data were coded based on the literature review. According to the literature, five main categories of social value creation from CE were identified: (1) Novel technologies (that push the demand for new occupations).

The results of this study start by defining "circular jobs" as *"the meaningful work that contributes to social well-being, improves human capabilities, and enhances its role of responsible resources administrator, performed in circular activities that contribute to the creation, delivery, capture, and conservation of the value of biological and technical materials."* It has uncovered two key features of circular jobs that contribute to social justice, i.e., promoting solidarity and capabilities. The second major finding was that CBM provides formal jobs that promote the development of managers and staff capabilities related to dignified treatment, environmental and social values, technological skills, and specialized skills machinery in some cases. Likewise, the study showed the high impact that top managers and entrepreneurs have in developing circular jobs, building organizations that develop people's capabilities, and increasing social justice. In addition, CBMs usually consider their staff collaborators rather than employees, which offer competitive salaries, extra-salary benefits, and training.

Therefore, this study suggests a useful model for any company that is interested in creating social value with circular jobs based on the five key aspects determined in this study: (1) Novel technologies, (2) novel occupations, (3) processes from informality to formality, (4) gender inclusion/equity, and (5) new forms of organization. In this sense, it is essential that training in technological skills be promoted, the design of new jobs in managerial and operational positions, facilitate the development of formal jobs.

Finally, some significant limitations need to be considered. First, the study's exploratory nature allows us to see a photo of prominent companies in the region. However, future research would be interesting to highlight a sector or country's specific conditions with a larger sample. Second, this study evidences the perspective of entrepreneurs and company managers, but it would be valuable to evaluate the same categories of analysis from the employees' perspective.

Track

Track 7b The future of employment and good work

Posters

How a proper design and governance of technology development can serve an inclusive labor market

Tineke Lambooy and Penny Simmers

2022 ISDRS Poster 263, track 7b
Tineke Lambooy & Penny Simmers

Title: *"How a proper design and governance of technology development can serve an inclusive labor market"*

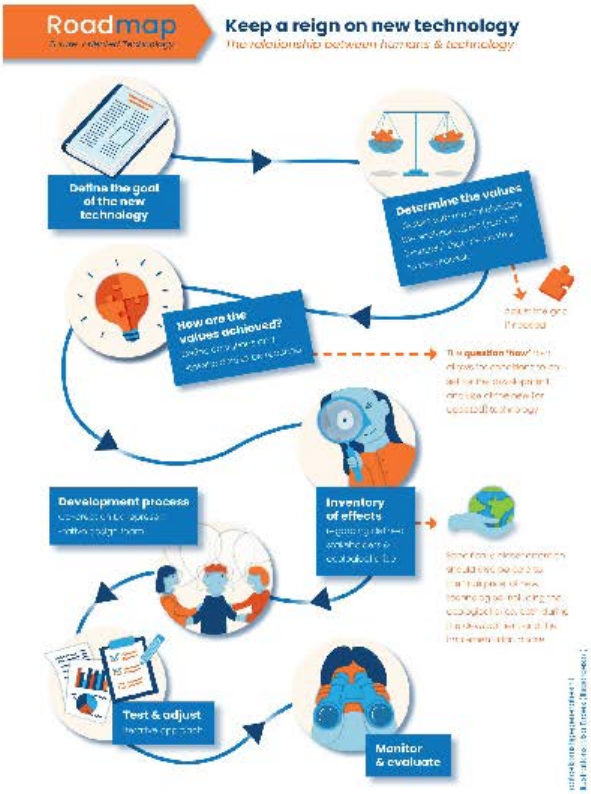
Research Question: *"How can we design, introduce, deploy, and guide (future) technology in such a way that it contributes to an inclusive labor market, and in doing so, to a more inclusive society?"*

Methods: *Doctrinal and qualitative (experts and stakeholder interviews as well as focus groups)*

LAB TOEKOMSTIGE GENERATIES

Key takeaways & recommendations:

- **Clear determination of objectives: what do we want technology to do for us and under what conditions?**
- **Access: make knowledge of technology accessible to all.**
- **Inclusiveness in development: diversity, inclusion, well-being as essential values in the development and deployment of (future) technology in the labor market.**
- **Involve stakeholders in the development process.**
- **Use the roadmap when developing and applying technology. The step-by-step plan should ideally be followed and repeated at regular intervals because it creates a clear framework within which ethical questions and concerns can be addressed in a systematic and constructive manner.**



7. Social-economic aspects of sustainability

7c. Sustainable economic models

Abstracts

General Collective Intelligence and the Sustainable Development Goals

Mr. Andy E. Williams

Nobeah Foundation, Nairobi, Kenya

Abstract

General Collective Intelligence is an emerging science that creates the possibility of exponentially increasing our general problem-solving ability as measured by our collective intelligence factor (c), which has been equated with our ability to solve any problem in general. This translates into radically increasing capacity for social impact. One way of achieving this is defining patterns through which projects might be combined into networks of cooperation that increase impact on collectively targeted goals. In the case of the sustainable development goals, there are three patterns that together can be demonstrated to represent an exponentially greater number of potential solutions than currently available, and which can be demonstrated to have the potential for this exponentially greater impact so that "wicked" social problems might be more reliably solvable where they have not proved to be in the past. This paper explores both GCI and these patterns as well as how they might be leveraged to achieve this radically increased social impact, and why doing so is the most important possible way to care about impact on any SDG.

Track
Track 7c Sustainable economic models

Towards Sustainable Economic Models through Technological Eco-innovation in Developing Countries

MA Justyna Tomala, Prof. Dr. Maria Urbaniec

Cracow Uniwersity of Economics, Krakow, Poland

Abstract

Sustainable development in developing countries contributes to socio-economic transformation through eco-innovative technologies. Eco-innovation is extremely important due to various global challenges. These challenges include the transition to a low-carbon economy, combating climate change and global warming, dwindling natural resources and uneven socio-economic development of different regions around the world. Therefore, the need to strengthen the achievement of global sustainable development goals through eco-innovation is increasingly emphasised. Eco-innovation can be treated as one of the key tools for transformation towards sustainable development. In the literature, research on the impact of eco-innovation on sustainable development is still fragmented.

The aim of this paper is to examine the impact of eco-innovation on sustainable development in selected developing countries. The paper attempts to answer the following research question: what is the impact of possible technological eco-innovations on sustainable development of selected developing economies? The method used is a comparative analysis based on secondary data sets from official World Bank statistics.

The results show that eco-innovation in developing countries should be considered as one of the key tools to support the transition towards sustainable development. Different countries show different levels of eco-innovation. This is due to, among other things, the very high vulnerability of developing countries to climate change and natural disasters, as well as uneven socio-economic development. These factors have a significant impact on the implementation of eco-innovation in developing countries.

This paper contributes to the theory of ecological modernisation by examining the role of technological innovation in the ecological transformation of developing countries towards sustainable development. It can contribute to assessing the extent to which environmental technologies play a role in the transformation towards sustainability in these economies. The socio-technological approach, which considers environmental issues already at the design stage of technological and organisational innovations, enforces the need to effectively use new solutions to create an innovative and competitive economy. This study can help policy makers understand how eco-innovations can support sustainable development.

Track
Track 7c Sustainable economic models

Full papers

Purpose and Resilience in the Context of Corporations: The mediating effect of sense of community

Florez-Jimenez, M.P.[1], Lleo, A.[2], Rey, C.[3]

[1] *Universidad de Navarra, Facultad de Ciencias Económicas y Empresariales, mflorezjime@alumni.unav.es*
[2] *Universidad de Navarra, Facultad de Ciencias Económicas y Empresariales, alleo@unav.es*
[3] *Universitat Internacional de Catalunya, Department of Business Administration, carlosrey@uic.es*

Abstract

The world is dynamic and constantly presents economic, social, and environmental challenges. In this way, organizations should develop abilities that help them tackle the challenge of sustainable development in an environment of uncertainty if they want long-term prosperity. Some authors have proposed and demonstrated that when corporations are resilient, it means, when they adjust to uncertainty and building a risk-aware culture, they could be better positioned and prepared to deal with the demands of high-impact events and seek opportunities and gains through uncertainty. On the one hand, a resilient organization, can anticipate threats and opportunities and, on the other hand, can respond and recover to daunting challenges they may face. For the above, some researchers have investigated variables that positively impact organizational resilience. Having a shared purpose seems to be a motor to make corporations more resilient. Collaborating around a common purpose creates a sense of belonging among stakeholders and a stable relationship, making corporations more resilient. However, there is a lack of empirical evidence that explains the relationship between purpose implementation and organizational resilience. In this work, we explain the above relationship drawing the organizational identification theory and theory about organizational resilience. We tackled an empirical study to validate through partial least squares path modelling that organizations could be more resilient when the corporate purpose is shared, and the sense of community mediates this relationship. Using a sample size of 3615 employees of 5 different organizations, we tested if shared purpose impacts organizational resilience and the mediation effect of the sense of community on the above relationship. Results validated these hypotheses and evidence that shared purpose is a clear predictor of organizational resilience and demonstrated that a sense of community partially mediates the relationship between shared purpose and organizational resilience. We end the paper with implications that can help scholars and practitioners deliver their corporate purpose.

Keywords: shared purpose, organizational resilience, sense of community, PLS, mediation

1. Introduction

Increased complexity of economic, environmental, and social systems causes crises, uncertainty, and risk to become a common issue of the world (Gorzeń-Mitka, 2016). Adjusting to uncertainty and building a risk-aware culture could help organizations be better positioned and prepared to deal with the demands of high-impact events and seek opportunities and gains through uncertainty (Gorzeń- Mitka, 2016). Ortiz-de-Mandojana and Bansal (2016) sustain that resilience prepares organizations for the unexpected, coping positively with it, and sense and correct maladaptive tendencies {Formatting Citation}.

Organizational resilience implies sustaining dynamic capabilities, flexibility, and the ability to adapt to influences of the environment (Ponomarov and Holcomb, 2009; Williams *et al.*, 2017), helping firms behave as complex dynamic systems operating within dynamic systems (Ortiz-de-Mandojana and Bansal, 2016). For the above, resilience is also a source of competitive advantage under uncertainty (Ponomarov and Holcomb, 2009). Resilience facilitates continuous improvements and contributes to firms' sustainability (Ortiz-de-Mandojana and Bansal, 2016) because it permits more effective solutions to social, economic, and environmental problems (Metcalf and Benn, 2012). Resilience permits organizations to function before, during, and after adversity (ISO, 2016; Williams *et al.*, 2017).

According to the above, there is a need to find and validate variables positively impacting resilience. As Duchek (2020) sustains, more knowledge is needed about how organizational resilience can be developed. Some authors have proposed that resilience has been linked to the ability to make meaning in terrible times and having a sense of purpose (Collins and Saliba, 2020; Hillmann and Guenther, 2021; McKinsey and Company, 2021; Zapata Cantu and Mondragon, 2016). A shared purpose creates a sense of ownership among stakeholders and a stable relationship with them, making corporations more resilient to change and the daunting challenges they may face (Collins and Saliba, 2020; Polman and Winston, 2021). The above, inasmuch corporate purpose is a goal beyond profit maximation that integrates what the organization is (identity), what it is significant for it (meaning) and how it reflects its impact on its main stakeholders (mission) (Florez-Jimenez and Lleo, 2021). In this order of ideas, a shared purpose is achieved through a purpose implementation and implies a shared identity, a shared meaning, and a shared mission. "Those who perceive themselves as sharing the common organizational identity see themselves as relatively interchangeable members of the same organization." (Kessler, 2014). The same occurs when meaning is shared (Missimer et al., 2017) and when the mission is shared (Cardona and Rey, 2022).

However, to the best of our knowledge, no studies deeply explain deeply the relationship between

purpose and resilience. Therefore, drawing on the organizational identification theory, this paper aims to explain the relationship between purpose and resilience in the context of corporations. Organizational identification theory sustains that someone who perceives themselves as sharing the organizational identity, sees themselves as a member of the same organization (Edwards, 2005). The above makes possible employees' coordinated and collective activity, which is part of a sense of community (Milliman et al., 2003) and is an organizational resilience predictor (Dubey et al., 2019). Additionally, this paper proposes hypotheses about the relationship between shared purpose, sense of community, and organizational resilience. Finally, it offers a quantitative study case and an empirical model to validate them.

The article contributes to the organizational identification theory. It empirically shows the relationship between shared purpose, sense of community, and organizational resilience and proposes shared purpose and sense of community as key elements of organizational identification. Additionally, it explains how resilience could be an outcome of the organizational identification phenomenon. Further, this paper contributes to the organizational resilience theory, bringing variables that improve its development. This paper serves as reference material for professionals, researchers, consultants, and business leaders working in organizational management, organizational identification, resilience, and long-term organizational prosperity. The paper is organized into the following sections: Section 2 presents a theoretical background and hypotheses definition; Section 3 describes the research methodology we used; in Section 4, we present the results and implications; and Section 5 states the conclusions and future work.

2. Theoretical background and hypotheses definition

2.1 Corporate purpose

Corporate purpose is proposed as a concept that integrates all three dimensions: what the organization is (identity), what it is significant for it (meaning) and how it reflects its impact on its main stakeholders (mission) (Florez-Jimenez and Lleo, 2021). For the corporate purpose to truly impact flexibility and adaptability, it should be shared with the organizational members (Lleo et al., 2021). Shared purpose is the result of an effective purpose implementation, which is the deployment and activation of the purpose impacting the mode that organizations operate and the creation of a shared meaning between employees (Gartenberg et al., 2019; Lleo et al., 2021). In this way, for the purpose being shared, it must light out the direction of an organization (purpose knowledge), delude and motivate the people (purpose internalization), and be put into practice in the daily life of the organization (purpose contribution) (Lleo et al., 2021).

Corporate purpose also provides an anchor in a world of uncertainty because it gives direction to the corporations even if everything is changing (Horváth, 2016). Further, corporate purpose creates the sense of common cause without which it is impossible to hold the firm together (Garrard et al., 2016). Collaborating around a common corporate purpose creates a sense of belonging among stakeholders and a durable relationship with them face (Collins and Saliba, 2020; Polman and Winston, 2021).

2.2. Organizational resilience

Organizational resilience is an organization's ability to anticipate, respond, and adapt to change arising from sudden or gradual changes in their internal and external context (ISO, 2016). It is the capacity of a system to absorb disturbance and reorganize while changing to retain essentially still the same function, structure, identity, and feedback (Williams et al., 2017). A resilient corporation needs to constantly plan and be prepared to deal with the consequences and impacts when the risks materialize (Sin et al., 2017). A proper resilient corporation also must have the ability to respond and adjust itself to disruptions and failures (Sin et al., 2017). Lee et al. (2013) proposed that organizational resilience has the planned and the adaptive dimensions. Planned resilience occurs pre-disaster, whereas adaptive resilience typically emerges post-disaster and requires the ability to learn from past experiences (Prayag et al., 2018).

If organizations want to achieve resilience, they should seek and procure resources that will sustain tit until recovery or until the adversity subsides (Munoz et al., 2022). Dubey et al. (2019) propose as predictors of organizational resilience: resources, capabilities, behavioral uncertainty, trust, commitment, and cooperation. Duchek (2020) proposes as predictors: the firm's prior knowledge base, resource availability, social resources, and power and responsibility.

2.3 Sense of community

A community can be defined as "a form of unifying relationship between human beings" (Wells et al., 2019). Community implies an expectation of unity and a sense of togetherness that form a shape of 'we' (Wells et al., 2019). A firm or organization can be considered a community or a group of people with common characteristics or beliefs or interconnected or organized around shared values. In this way, sense of community goes into interactions between employees and their co-workers (Milliman et al., 2003). Its foundation is in the belief that people see themselves as connected to each other and that there is a deeper interpersonal connection and support among employees (Milliman et al., 2018).

2.4 Organizational identification theory

The Organizational identification theory implies an overlap between the individual and his or her organization's goals, values, and norms (Kessler, 2014). In this way, organizational identification contemplates what Lleo et al. (2021) call shared purpose. As we said before, sharing purpose means sharing identity, meaning, and mission. For achieving the above, it is necessary to implement purpose through three processes: purpose knowledge, purpose internalization, and purpose contribution (Lleo et al., 2021). Purpose internalization implies sharing values; hence when values are shared, and their members know the purpose and contribute to its development, it facilitates belief in organization's norms and goals. MacArthur (2022) sustains that when it gets clear the impact of the organization on stakeholders the most, it is easier for employees to understand organizational decisions and efforts, and why the company should be supported (Goel, 2022).

Further, organizational identification reflects a sense that the organization's members are part of it and have a coordinated behavior and collaborative endeavor to advance the group's interests. The latter could be framed on sense of community (Srivastava and Gupta, 2022).

2.5 Corporate purpose and organizational resilience

Purpose is considered a North Star to help navigate through change and uncertainty (EY, 2020). The above, as far it guides the organization toward effective decision making in an environment of uncertainty (DDI, 2020; EY, 2020). A Purpose-driven company inspires its people to pursue its purpose (EY, 2020). Employees at a company with a clear purpose are more engaged (DDI, 2020; EY, 2020) and will help fight through a crisis when they come (Polman and Winston, 2021). The employees' willingness to adapt improves the prospect of organizational resilience (Kantabutra and Ketprapakorn, 2021).

As we said before, Collins and Saliba (2020) and Polman and Winston (2021) sustain that a common purpose creates a sense of ownership among stakeholders and a stable relationship with them, making corporations more resilient to change and the daunting challenges they may face. A shared purpose acts as a unifier (DDI, 2020), creates trust (Henderson, 2020; Missimer et al., 2017), relational contracts within the organization (Henderson, 2020), and enhances cooperation (Polman and Winston, 2021). Co-workers will sit together and discuss how to handle problems (Coutu, 2002). They can exchange information, processes, and skills, which improve the organization's ability to combat business challenges (Collins and Saliba, 2020) and the agility to drive transformational change and innovate in

times of disruption . It provides support (Polman and Winston 2021) and flexibility of organizations' management (Missimer et al. 2017) when difficulties come. According to the above, our first hypothesis is that when the purpose is shared in an organization, it will perform their resilience:

H1. Shared purpose has a positive relationship with organizational resilience.

2.6 Corporate purpose and sense of community

When work activities and purpose are aligned, employees can experience engagement as they believe they contribute to the community (Franco et al., 2022). Employees feel a sense of accomplishment in being part of their communities or organisations (Franco et al., 2022). A commitment to a common purpose increases alignment within the firm, making more likely that employees will work hard for the organization's good (Henderson, 2022). Organizational identification theory sustains that those who share the organizational identity, see themselves as organization members (Kessler, 2014). As identity is one of the organizational purpose's dimensions (Florez-Jimenez and Lleo, 2021), it is possible to say that those who share the organizational purpose see themselves as organization members. Therefore, we consider the hypothesis that when the purpose is shared in an organization, it will perform a sense of community:

H2. Shared purpose has a positive relationship with sense of community.

2.7 Sense of community and organizational resilience

Kantabutra and Ketprapakorn (2021) propose that the resilience development practice implies arranging organizational members for adaptations, turning them into collaborative agents who can be deal with the issues that come and the constantly changing environment. They sustain these organizational members are the medium for knowledge and information transmission, and their individual learning leads to organizational learning when cooperation exists among the system's parts (Kantabutra and Ketprapakorn, 2021). The synchronized efforts of organizational members allow the organization to effectively perceive, develop strategies for, and adapt to potential damage interruptions and strain. (Kahn et al., 2016).

According to the above, Dubey et al. (2019) sustain that cooperation and information sharing as well as trust and commitment, are important antecedents of organizational resilience. These antecedents can be framed in the sense of community concept, since it goes into interactions between employees and their co-workers (Milliman et al., 2003) and an expectation of unity and a sense of togetherness (Wells et al., 2019). Therefore, we consider the hypothesis that a sense of community has a positive relationship with organizational

resilience.

H3. Sense of community has a positive relationship with organizational resilience

2.8 Sense of community as mediator between corporate purpose and resilience

In section 2.5, we explained the relationship between corporate purpose and resilience. Some authors that explain this relationship, do it through shared-purpose outcomes that could be framed by sense of community concept. For example, Polman and Winston (2021) sustain this relationship through 'sense of ownership' and 'engagement', Missimer et al. (2017) by way of 'cooperation', Henderson (2020) through 'trust' and 'relational contracts' (Henderson, 2020). Additionally, section 2.6 presents outcomes of shared purpose, and section 2.7 predictors of organizational resilience, which can be framed in the sense of community concept. Therefore, we consider the hypothesis that sense of community mediates the relationship between shared purpose and organizational resilience.

H4. Sense of community mediates the relationship between shared purpose and organizational resilience.

3. Methodology

Data Gathering and Sample

An empirical study was carried out to collect data and validate the measuring instrument. Data was collected from five banks during the COVID pandemic in 2021. Table 1 shows the sample characterization.

Table 1. *Sample characterization.*

Variable	Category	(n)	(%)
Gender	Female	1816	50.1%
	Male	1799	49.6%
	No information	11	0.3%
Age	Less than 25	284	7.8%
	25-35 years	1453	40.1%
	36-50 years	1513	41.7%
	More than 50	373	10.3%
	No information	3	0.1%

Seniority	Less than 5 years	1536	42.4%
	5-10 years	1036	28.6%
	11-20 years	772	21.3%
	More than 20 years	275	7.6%
	No information	7	0.2%

COVID pandemic has demonstrated the importance of resilience in all aspects of banking (Bellens and Watson, 2021). Banks have faced a prolonged environment of stress to continuously provide customers with access to products and services (Bellens and Watson, 2021). Banking stocks were impacted during COVID-19 (KPMG Global, 2020). However, the industry has shown that it can do much more at high speed, when needed; that it is more resilient than many believe (Bellens and Watson, 2021). In order to continue financing the real economy and support its recovery, banks are forced to encourage the use of channels that have never been their strategic priority (KPMG Global, 2020).

Aside from COVID-19, banks will continually have to contend with persistent and dynamic disruption and change (Bellens and Watson, 2021). Most banks expect to expand risk competencies (Bellens and Watson, 2021). For this, they consider the need to implement a more agile and innovative work environment and, therefore, the search and retention of talent (Bellens and Watson, 2021).

Measurement instruments

According to the theoretical background, shared purpose and organizational resilience have three and two dimensions, respectively. Sense of community is a first order construct. Organizational resilience is a second-order reflective construct created from the first-order variables of planned resilience and adaptative resilience. The above variables were measured with reflective items proposed by Prayag et al. (2018) (Appendix 1). Shared purpose is a second-order formative construct created from the first- order variables of purpose knowledge, purpose internalization, and purpose contribution. The above variables were measured with reflective items proposed by Lleo et al. (2021) (Appendix 1). Sense of community is a first-order reflective variable measured based on the items proposed by Milliman et al. (2018) (Appendix 1). All items were measured on a 5-point Likert scale, using indicators ranging from strongly agree (5) to strongly disagree (1). Figure 1 illustrates the two tested models. First, was tested a model of the formative second-order corporate purpose construct as a predictor of reflective second- order organizational resilience (a), and then the model of the formative second-order corporate purpose construct as a predictor of reflective second-order organizational resilience, and the mediation effect of sense of community (b).

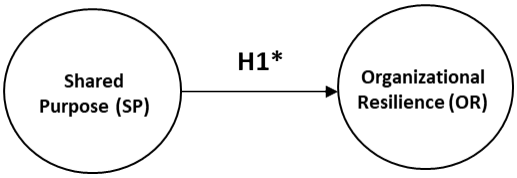


Figure 1a. *Shared purpose as a predictor of organizational resilience*

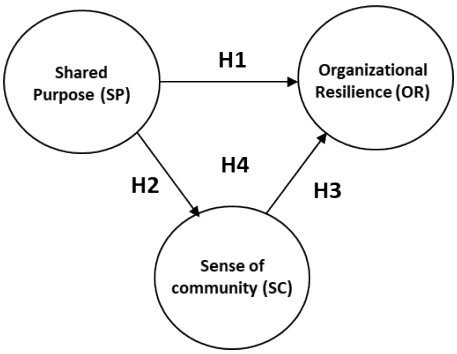


Figure 1b. *Mediation of sense of community on the relationship between purpose and organizational resilience*

We validated the hypotheses through the partial least squares path. We used SMART-PLS 3 software package. PLS is based on ordinary least squares regression, allows developing or revising both reflective and formative measured constructs (Al-Emran et al., 2019; Hair et al., 2019), and works well without distributional assumptions (J. Hair et al., 2019). We followed the process described by Hair et al. (2019) to validate the scale of the second-order constructs. We first validated measuring instruments, and afterward, we examined the analysis's predictive relevance and checked the structural model's goodness of fit.

4. Results and Discussion

As was mentioned, we followed the process described by Sarstedt et al. (2019) and Hair et al. (2020) to validate the scale. First, we validated the first-order reflective indicators. We measured reliability, convergent validity, and discriminant validity. We used Cronbach's alpha, composite reliability index (CRI), and reliability metric (ρA) to measure reliability. As Table 2 shows, for all the variables, the Alpha de Cronbach, CRI, and ρA were above 0.7, which validated reliability according to Hair et al. (2019). According to Hair et al. (2020), we used the average variance extracted (AVE), the values and significance of loads to measure convergent validity. For all the variables, the AVE was above 0.5, the loads were upper than 0.7 and significant (using bootstrapping with 5000 subsamples and p-value>0.05), so we found convergent validity according to Hair et al. (2020). For the discriminant validity, we used Fornell-Larcker criterion. As Table 3 shows, all square roots of the AVE of each construct were above its correlation with any other construct, so we evidenced discriminant validity.

Table 2. *Reliability and convergent validity for first-order level*

Dimension	Item	Median	SD	Load	T-Value	Aver.Load	AVE	Cronbach's Alpha	CRI	ρA
PK	PK1	4	0.785	0.957***	295.656	0.951	0.905	0.947	0.966	0.949
	PK2	4	0.802	0.955***	316.523					
	PK3	4	0.742	0.942***	304.052					
PI	PI1	4	0.776	0.903***	171.714	0.919	0.846	0.909	0.943	0.909
	PI2	4	0.782	0.938***	303.32					
	PI3	4	0.741	0.917***	186.008					
PC	PC1	5	0.642	0.897***	143.923	0.907	0.822	0.892	0.933	0.895
	PC2	4	0.821	0.906***	186.268					
	PC3	4	0.729	0.918***	203.971					
PR	PR1	4	0.903	0.858***	126.585	0.890	0.793	0.934	0.950	0.935
	PR2	4	0.971	0.876***	154.407					
	PR3	4	0.941	0.918***	255.571					
	PR4	4	0.899	0.899***	188.347					
	PR5	4	0.904	0.900***	189.45					
AR	AR1	4	0.958	0.809***	101.182	0.850	0.724	0.904	0.929	0.909
	AR2	4	1.018	0.803***	95.199					
	AR3	4	0.861	0.884***	173.759					
	AR4	4	0.819	0.889***	180.972					
	AR5	4	0.858	0.865***	131.748					
SC	SC1	5	0.731	0.832***	102.128	0.863	0.746	0.829	0.898	0.841
	SC2	4	0.830	0.908***	206.25					
	SC3	4	0.882	0.848***	109.018					

PR: purpose knowledge, PI: purpose internalization, PC: purpose contribution, PR: planned resilience, AR: adaptive resilience, SC: sense of community. *** p- value < 0.05

Table 3. *Discriminant validity with Fornell-Larcker criterion criterion*

	PK	PI	PC	PR	AR	SC
PK	**0.951**					
PI	0.765	**0.920**				
PC	0.749	0.828	**0.907**			
PR	0.520	0.572	0.556	**0.890**		
AR	0.507	0.549	0.541	0.791	**0.851**	
SC	0.545	0.623	0.615	0.642	0.664	**0.864**

PR: purpose knowledge, PI: purpose internalization, PC: purpose contribution, PR: planned resilience, AR: adaptive resilience, SC: sense of community

Once the first-order variables have been assessed, according to Sarstedt et al. (2019), we turn to assessed second-order constructs. For the above, we used the scores of latent variables obtained in PLS as indicators. The formative relationships between shared purpose and its first-order dimensions were analyzed in three stages according to Hair et al. (2019): the convergent validity assessed, the collinearity tested, and the significance and relevance of their respective weights evaluated.

The convergent validity was assessed by redundancy analysis. We used a reflective measure of shared purpose proposed by Lleo et al. (2021) for redundancy analysis. The redundancy analysis yielded a point estimate of 0.733, which is considered satisfactory to good according to Hair et al. (2020). Regarding the collinearity of the formative items, the variance inflator factors (VIFs) were all below 5 (VIF of PK = 2.683; VIF of PI = 3.748; VIF of PC = 3.540); thus, the criterion was met (Hair et al., 2019). The significance and relevance of formative constructs were evaluated using the outer weight obtained by bootstrapping. The outer weights were significant (Table 4), so the formative construct can be said to be significant and relevant.

Table 4. *Significance and relevance of formative constructs*

	Outer Weights	Weight Significance
PK→ Shared purpose	0.186***	4.916
PI → Shared purpose	0.480***	10.527
PC → Shared purpose	0.405***	9.546

PR: purpose knowledge, PI: purpose internalization, PC: purpose contribution. *** p- value < 0.05

The reflective relationships between organizational resilience and its first-order dimensions were analyzed through reliability, convergent validity, and discriminant validity (Hair et al., 2019). As Table 5 shows, for the organizational resilience and sense of community variables, the Alpha de Cronbach, the CRI, and the ρA were above 0.7, which validated reliability. Variances were above 0.5, and loads were upper 0.7 and significant (p>0.05), so we found convergent validity. For the discriminant validity, it was used Fornell-Larcker Criterion. As variance was higher than the covariance (Table 6), we validated discriminant validity.

Table 5. *Reliability and convergent validity for organizational resilience and sense of community*

Dimension	Item	Load	T-Value	Aver. Load	AVE	Cronbach's Alpha	CRI	ρA
OR	PR	0.946***	388.382	0.947	0.896	0.883	0.945	0.884
	AR	0.947***	396.895					

PR: planned resilience, AR: adaptive resilience. *** p- value < 0.05

Table 6. *Discriminant validity with Fornell-Larcker criterion criterion (OR PI SC)*

	OR	SP	SC
OR	0.946		
SP	0.620		
SC	0.690	0.650	0.863

OR: organizational resilience, SP: shared purpose, SC: sense of community

Results assessed both the measurement instrument and the structural model. Regarding measurement instruments, it is possible to say that reflective indicators are reliable, which means measures are stable and consistent (Al-Emran et al., 2019; Kimberlin and Winterstein, 2008). Reflective measure instruments are also valid, which means, instruments measure what they purport to measure (Kimberlin and Winterstein, 2008). In the case of the formative relationship between shared purpose and its dimensions, it is possible to sustain that second-order level instruments are valid and significant. The above, let us affirm that we use a good measure instrument and that from them, we could test a structural model.

Finally, was validated the predictive relevance for both models (Figure 1). Figure 2 shows path coefficients. It also shows the analysis of the goodness of fit of the structural models by combining the R2 values with the Q2 values after using the blindfolding sample re-use technique with an omission distance of five. The values concluded that the overall fit of the models is adequate.

As figure 2a shows, shared purpose has positive and significant relationship with organizational resilience ($\beta = 0.620$, $p < 0.05$), thus H1* is supported. As figure 2b shows, shared purpose has positive and significant relationship with sense of community ($\beta = 0.650$, $p < 0.05$) and sense of community with organizational resilience ($\beta = 0.497$, $p < 0.05$). Thus, H2 and H3 are supported. Further, Figure 2 shows that after sense of community was entered into the regression equation, the relationship of shared purpose to organizational resilience was still significant ($p < 0.05$) but declined from 0.620 to 0.297. Calculating the variance accounted for (VAF) (Latan and Noonan, 2017), we obtained a value of 52%. According to Baron and Kenny (1986) and Hair et al. (2021), the above result revealed that partial mediation happened on the effect of shared purpose on organizational resilience. Therefore, hypothesis H4 was also supported.

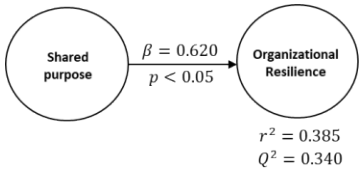


Figure 2a. *Model without mediation effect*

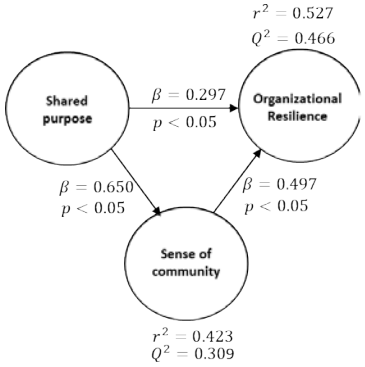


Figure 2b. *Model with mediation effect*

Figure 2. *Structural relations*

Structural models show that shared purpose has a significant and positive impact on organizational resilience. The latter validates previous theoretical research from authors such as Collins and Saliba (2020) and Zapata Cantu and Mondragon (2016) that sustain that a common purpose contributes to a stable relationship with stakeholders, making corporations more resilient to change in response to threats that arise. Additionally, after sense of community was entered into the regression equation, the R^2 of organizational resilience increased from 0.385 to 0.527 and the Q^2 from 0.340 to 0.466, which means that model with the sense of community variable (Figure 2b) explains better the variance of the organizational resilience variable than the model without it (Figure 2a). Nevertheless, this partial mediation revealed that sense of community is not the only mediator in the relationship between shared purpose and organizational resilience.

Theoretical contributions

Our theorizing offers three primary theoretical contributions. First, it explains and validates how organizational identification needs considering and is enhanced by the connection between shared purpose and sense of community.

A shared purpose creates a sense of ownership among stakeholders and a stable relationship with them, making corporations more resilient to change and the daunting challenges they may face (Collins and Saliba, 2020; Polman and Winston, 2021). As corporate purpose integrates what the organization is (identity), what it is significant for it (meaning) and how it reflects its impact on its main stakeholders (mission) (Florez-Jimenez and Lleo, 2021); hence a shared purpose implies a sharing identity, sharing meaning, and a sharing mission. Sense of community is preceded by sharing organizational identity (Kessler, 2014), sharing meaning (Missimer et al., 2017), and sharing mission (Cardona and Rey, 2022).

The Organizational identification theory additionally implies an overlap between the individual and his or her organization's goals, values, and norms (Kessler, 2014). The above is related to the three processes that should be conducted to achieve a shared purpose, according to Lleo et al. (2021) (purpose knowledge, purpose internalization, and purpose contribution). Sharing values is achieved through purpose internalization. Sharing goals and norms is achieved by integrating purpose internalization with purpose knowledge and purpose contribution.

Second, this paper introduces organizational resilience as a clear outcome of organizational identification since we explain the relationship between employees' relationships and organizational resilience. Organizational identification reflects a sense that the organization's members are part of it and have a coordinated behavior and collaborative endeavor to advance the group's interests. The latter could be framed on sense of community (Srivastava and Gupta, 2022) and precede organizational resilience (Dubey et al., 2019).

Finally, it contributes to an organizational resilience theory since it provides more knowledge about how to develop organizational resilience. It explains and validates that shared purpose and sense of community could help organizations to be resilient.

Practical contributions

We propose some practical implications that can help practitioners deliver their corporate purpose, inasmuch we demonstrated the positive impact that a shared purpose has on a sense of community and on organizational resilience. Considering that corporate purpose is identity, meaning, and mission (Florez-Jimenez and Lleo, 2021), it is essential to share these three dimensions. For the above, it is important to develop the three processes proposed by (Lleo et al., 2021) (purpose knowledge, purpose internalization, purpose contribution). Bellow, we describe three aspects that organizations should consider.

First, to develop purpose knowledge, the organization must ask the why of the business and communicate it. Knowing the brand's purpose also allows employees to understand how to adapt to the target audience's needs as they change and evolve (Kowalewicz, 2022). It becomes a cardinal direction that can orient an entire community and point them in the same direction (Coleman, 2022).

Second, it is important to articulate the organization's values with employees' values to develop purpose internalization. It is crucial to make employees reflect on their values and which of them coincide with the organization's values. When personal values coincide with those of business, it is possible to achieve meaningful work and manifest the best self (Ross, 2022). The above motivates the people Lleo et al., (2021), creating and an aspirational outcome for the firm's actions (McGahan, 2022).

Third, to develop purpose contribution, it is imperative to put the mission statement's words into practice because, as Shore (2022) says, "deeds speak louder than any mission statement ever could." When there is a clear alignment between work activities and purpose, employees believe they are contributing to the community, they can experience high engagement rates, and they feel a sense of accomplishment in being part of their organizations (Franco et al., 2022). Leaders must help employees align the organization's purpose to their daily jobs (Osibanjo, 2022). Further, the contribution could be proposed in a participatory way and be complemented with goals and indicators.

5. Conclusions and future work

This paper aims to offer a theoretical and empirical explanation of the relationship between shared purpose and organizational resilience, drawing the organizational identification theory and theory about organizational resilience. We consider the hypotheses that organizations could perform their resilience when the purpose is shared, and that a sense of community could mediates this relationship. We validated the hypotheses through the partial least squares path, using SMART-PLS 3 software package. PLS is based on ordinary least squares regression and allows developing or revising both reflective and formative measured constructs.

The structural model shows that a shared purpose has a significant and positive impact on organizational resilience. Additionally, it shows that the sense of community partially mediates the above relationship. According to the above, we demonstrate that organizations should consider the importance of implementing purpose and developing purpose-driven companies. We presented that it is crucial to develop their three dimensions: identity, meaning, and mission to deliver sense of community and organizational resilience. The above is undertaken by knowing the purpose, internalizing it, and operationalizing it daily.

Our paper offers theoretical and practical contributions. Regarding the theoretical contributions, it shows how shared purpose and sense of community could help to explain the organizational theory. Additionally, establish organizational resilience as a clear outcome of organizational identification. The paper contributes toward an organizational resilience theory, since it provides more knowledge about how it can be developed. With respect to the practical implications, we give some recommendations to develop corporate purpose and enhance shared purpose to achieve sense of community and organizational resilience. Considering that corporate purpose is identity, meaning, and mission, we stated that, it is essential to develop these three dimensions.

As a line of future research, we propose to find other variables that mediates the relationship between

shared purpose and organizational resilience. Additionally, what factors could strength the relationship between shared purpose and organizational resilience. Finally, we would suggest longitudinal studies to understand how this relationship evolves over time and validate the impact that organizational resilience has on shared purpose, as is proposed by some authors (Missimer et al., 2017; Paniccia and Baiocco, 2020).

Appendix 1: Constructs and scale items

Appendix 1: Constructs and scale items
Shared purpose (Lleo et al., 2021) Purpose knowledge (PK): PK1: I can explain the purpose of my organization in my own words, PK2: I could explain my company's purpose to people outside the organization, and PK3: I understand my company's purpose. Purpose internalization (PI): PI1: I believe that the company's purpose is important to society,
PI2: I accept my company's purpose because it is aligned with my individual values PI3: The company's purpose is important to me. Purpose contribution (PC): PC1: My work contributes to the company's purpose, PC2: I see that my individual goals are aligned with the company's purpose, and PC3: Projects that I am involved in contribute to furthering the company's purpose.

Organizational resilience (Prayag et al., 2018) Planned Resilience (PR): PR1: Given how others depend on us, the way we plan for the unexpected is appropriate PR2: Our organization is committed to practicing and testing its emergency plans to ensure they are effective PR3: We have a focus on being able to respond to the unexpected PR4: We have clearly defined priorities for what is important during and after a crisis PR5: We proactively monitor our industry to have an early warning of emerging issues Adaptive Resilience (AR): AR1: Our organization maintains sufficient resources to absorb some unexpected change AR2: If key people were unavailable, there are always others who could fill their role AR3: There would be good leadership from within our organization if we were struck by a crisis AR4: We are known for our ability to use knowledge in novel ways AR5: We can make tough decisions quickly
Sense of community- adapted from Milliman, Gatling and Kim (2018) SC1: I feel part of this organization SC2: There is a high degree of commitment to the mission and objectives of the company SC3: There is a high degree of cooperation among all employees

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8. Social foundations of sustainability

8a. Gender, inclusivity and human rights

Abstracts

Gender Equality at the Corporate Top – justifications for an open-minded view into gender equality

dr. LL.M. Rosalien van 't Foort-Diepeveen, dr. LL.M. Bart Jansen

Nyenrode Business Universiteit, Breukelen, Netherlands

Abstract

Intro – Women remain underrepresented at the top of companies. Besides focusing on the question why women should be considered for corporate top positions, the debate about female representation focuses mainly at female representation at the corporate top of companies, for instance when discussing gender quota. The question arises why there is a central focus on female representation at corporate top positions and not on for instance other layers within the organization and particular jobs. What justifications can be found that explains this narrow focus? This research discusses why other positions – the positions that are not corporate top positions – should also be discussed and covered in the debate in order to achieve gender equality.

Method – The research is conducted by means of a review of the literature into several disciplines, such as the social sciences and law.

Findings/results – the findings of the research show that there is much focus for and attention given to women in corporate top positions.

Discussion – The authors use feminist theories as an overarching theory. The authors discuss whether this narrow focus of female representation at the corporate top of companies and 'women in management' is justified, given the fact that this is only a small group of women. Attention should also be given to men and women in other organizational layers to achieve gender equality.

Conclusions – The representation of women at the corporate top is a rather narrow focus. To really achieve gender equality, also attention should be given to women's and men's representation in other jobs and organizational layers as well.

Relation to SDGs – SDG 5.1 and 5.5. The research contributes mainly to generate knowledge in how gender equality can be achieved, not only at top levels, but also in lower levels of organizations and jobs.

Relation to the conference – The proposed contribution relates to the conference topic, by focusing on the topic of human rights and how human rights violations, i.e. discrimination, can be eradicated in order to achieve gender equality.

Track
Track 8a Gender, inclusivity and human rights

Gender, Technology and Prosperity in Canadian and Swedish PPP: Interrogating connections and contradictions in Agenda 2030

Dr. Lindy Newlove-Eriksson

Swedish Defence University, Stockholm, Sweden

Abstract

Does it matter if women are present in political and corporate decision-making, and in technological and industrial development? It would seem so, as all UN member states are signatories to Agenda 2030 since 2015 and gender equality is a top goal, as is sustainable innovative industrial development. The final 17th Sustainable Development Goal (SDG) identifies, as a systemic issue, policy and institutional coherence, something that "multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources" can utilize to support achievement of all the SDGs (A/RES/71/313 E/CN.3/2021/2, page 22). But are the top Agenda 2030 goals commensurable and what might be missing in the targets and indicators that might inhibit goal realization? Closer comparison of goals, targets and indicators is warranted, as is deeper introspection on women's participation not only in decision-making, but as co-contributors to technological and industrial development, which in turn is connected to education, particularly in applied Sciences, Technology, Engineering and Maths (STEM) fields. Similar to much work in multi-stakeholder or Public-Private Partnerships (PPP) generally, and like Corporate Social Responsibility (CSR), SDG reporting and implementation in Agenda 2030 is voluntary and non-binding. Comparisons of adoption and measurement of SDGs is thus most accurate in countries where Agenda 2030 is a political priority and government agencies are compelled or centrally persuaded to abide, measure and report on their activities. However, even in countries where Agenda 2030 is a political priority, the degree to which normative SDGs are internalized and holistically reflect commitment to Agenda 2030, its' 17 SDGs and 169 tasks varies greatly. Moreover, contradictions between SDGs and their normative aspirations are apparent. This paper interrogates aspirations and achievements for sustainable development by focusing on connections and contradictions in the areas of gender, industry, technology and infrastructure. This is accomplished in part by comparison and assessment of: SDG 5 - Gender Equality and corresponding targets 5.1, 5.5, 5.b and 5.c; SDG 9 – Industry, Innovation and Infrastructure and target 9.5; SDG 16: Peace, Justice and Strong Institutions and targets 16.7 and 16.10; and SDG 17 – Partnerships for the Goals and targets 17.6 and 17.16 in two countries. Canada and Sweden are the comparative cases selected primarily on most-similar case grounds – both countries share similar demography, political parameters, are founding OECD members, and rank similarly on the Global Innovation Index, and importantly, with respect to SDG measurement and performance, which is a political priority in both countries. Given that the countries have important differences, such as reflecting different regional perspectives from two separate continents, something that also influences e.g. patterns of investment, the comparison provides insight into dissimilar cases, providing novel empirical observations.

3. a) included in the above abstract b) My paper relates to the conference topic as it is courageous to interrogate questions of gender inequality in a holistic and novel manner investigating under-researched links and areas where female representation is typically limited; gender inequality is a fundamental human rights issue.

Track
Track 8a Gender, inclusivity and human rights

Globalizing Dissent for an Inclusive and Sustainable Society: A postcolonial reading of Arundhati Roy's The God of Small Things and the Ministry of Utmost Happiness

Fr. Sunil Macwan SJ

St. Xavier's College, Ahmedabad, India

Abstract

This essay will argue that, through her two novels, The God of Small Things (1996) and The Ministry of Utmost Happiness (2016), Arundhati Roy, the Booker-Prize winning Indian writer and human rights activist, globalizes dissent by highlighting the plight of the socioeconomically, culturally, and communally marginalized people in India. In particular, through her fiction, Roy draws the world's attention to the persecution, discrimination, and exploitation of the Dalits, transgender, and Muslims, who challenge varied forms of systemic oppression. To highlight their real-life issues, Roy describes India from a localized perspective in her novels. She depicts rural and urban India from the viewpoints of marginalized characters and attempts to connect it to the wider world by presenting local issues as human-rights concerns. Her localism focuses on the small: small things, small stories, small events, small narratives, and small persons. Yet Roy's celebration of the small directly challenges the big represented by national and global discourses that often overlook the interests of the vulnerable sections of Indian society: women, children, minorities, and transgender. In the process, Roy develops a dissent that at once highlights the injustice and oppression of the 'small' in traditional local societies, perpetuated by the unjust socioeconomic structures and the lived conditions of inequalities, ideologies of globalization, and fundamentalist nationalism. In so doing, Roy appeals to the cosmopolitan sensitivity of readers to recognize the plight of the marginalized in twenty-first-century India. At the heart of Roy's critique lies her concern for their discrimination, dehumanization, and destruction.

This essay will employ the analytical method to interpret, discuss, and evaluate Roy's perspectives on the critical issues mentioned above. Especially, this essay will include literary criticism's method of close reading to examine social oppression of the Dalits, economic exploitation of the artisans, and patriarchal suppression of women in The God of Small Things. Further, applying the same method, this essay will also analyze the dehumanization of India's transgender community, Dalits, and the Kashmiri Muslims depicted in The Ministry of Utmost Happiness.

The discussion section of the essay will examine (a) how culture and politics combine in rural India to oppress Dalit voices; (b) how neoliberal capitalism seeks to commodify India's art forms and artists for economic gains; (c) how the transgender in modern India are still treated with disdain and cruelty; and, finally, (d) how globalizing a protest against these issues can lead to a gender-sensitive, inclusive, and sustainable society. Overall, in light of Arundhati Roy's novels, this paper will address gender-based discrimination, caste and religion-based oppression, and ecological imbalance. It will also underline the counter-measures Roy advocates to make India a healthier democracy based on the social foundations of equality, inclusivity, and sustainability through international support.

Track
Track 8a Gender, inclusivity and human rights

The Good Ancestor, Dag Hammarskjöld

Ms. Dr. Monica Bouman

Independent researcher, Heemskerk, Netherlands

Abstract

The NOAA Arctic Report Card 2021 describes the environmental state of the Arctic region as 'dramatically' deteriorating. This article comments on the environmental state of and the mining development in the Arctic region from a 'good ancestor's' perspective as derived from Roman Krznaric's criteria's and the life and legacy of Dag Hammarskjöld (1905-1961).

For the challenges we are facing in the 21st century we need a new solidarity and a generative leadership. In this sense we may be hopeful; the development of the Sustainable Development Goals is the fruit of a three years unique process of international consultation, deliberation and cooperation by tens of thousands people from all over the world. The evolution of this process goes back to the late UN Secretary-General Dag Hammarskjöld (1905-1961). Dag Hammarskjöld was the Swedish senior civil servant, who became UN Secretary-General in 1953 until his untimely dead in 1961. It was the time of Cold War, decolonization and post war reconstruction. He died in Africa in a plane crash, while he was on a peace mission to negotiate an armistice in the Congo crisis. UN investigations to the cause of his death, reopened in 2013, did not until now find conclusive evidence, despite many indications of Hammarskjöld having been murdered.

But, we may be pessimistic about the influence of multilateral institutions, when we look at the fragmentation of societies all over the world, which - reigned by greed, conservative ideologies and vested interests - have in their wake millions of uprooted people and an unprecedented incomes inequality. In his latest book 'Adrift, How our world lost its way' the French-Lebanese writer Amin Maalouf suggests to analyse the years of his youth in Lebanon as an antidote to what he calls 'the poisons of our time.' He describes a tolerant society, where Christians, Muslims and Jews lived peacefully together with their Arab neighbours, open to Western values and influences and guided by pragmatic wisdom. What Maalouf does not mention is how the United Nations, lead by Dag Hammarskjöld, in 1958 helped Lebanon those peaceful conditions to be retained for two decades.

The historic casus of UN intervention in the Lebanon crisis (1958) illustrates the development of solidarity despite cultural and interest differences and the leadership necessary to uphold and spread the principles of the UN Charter. Hammarskjöld's successful interventions marked the beginning of an evolution of UN processes. Guided by the principles of the UN Charter Hammarskjöld was both steadfast in purpose and flexible in approach. He saw the evolution of UN processes 'with faith in the creative evolution in which it is our privilege to cooperate.' From his public speeches and his posthumously published spiritual diary Markings Dag Hammarskjöld emerges as an authentical and generative leader, who we may call 'a good ancestor.'

Track
Track 8a Gender, inclusivity and human rights

Transformative Interventions for Gender Equality

Dr. LL.M. Rosalien van 't Foort-Diepeveen[1], Dr. LL.M. Bart Jansen[2]

[1]Nyenrode Business University, Breukelen, Netherlands. [2]Nyenrode Business Universiteit, Breukelen, Netherlands

Abstract

Intro – Liberal feminism is the one of the most dominant feminist streams developed in literature. Liberal feminism's point of departure is that women and men should have equal rights and that social arrangements that uphold discrimination should therefore be eradicated. Liberal feminism is premised on the idea that the oppression of women can be ended by providing equal opportunities to men and women. Interventions mainly focus on equipping women for corporate top positions. However liberal feminism falls short in taking into account structural arrangements in organizations and the concept of the gendered organization that prevent women from progressing to the corporate top.

Method – The research is conducted by means of a review of the literature.

Findings/results – The findings of the research show how other feminism streams besides liberal feminism, such as socialist feminism and the intersectionality and post-structuralist feminism, propose interventions that could transform organizations in such a way that they become gender equal.

Discussion – The authors use feminist theories as an overarching theory. The article analyzes how feminist streams such as socialist feminism and post-structuralist feminism provide an answer to the question how gender equality in organizations can be achieved.

Conclusions – Liberal feminism does not propose interventions that systematically address the gendered organization. This literature concludes by claiming that interventions proposed by socialist feminism and post-structuralist feminism are necessary to achieve gender equality.

Relation to SDGs – SDG 5.1 and 5.5. This research generates knowledge pertaining to the question which interventions are needed to structurally address the gendered organization and to achieve gender equality.

Relation to the conference – The proposed contribution relates to the conference topic, by focusing on the topic of human rights and how human rights violations, i.e. discrimination, can be eradicated in order to achieve gender equality.

Track
Track 8a Gender, inclusivity and human rights

Full papers

Agricultural Air Pollution Impacts on Rights to Health in Myanmar

Mya Moe Khaing

[1]*Associate Professor, Department of Law, Mawlamyine University, Myanmar myamoe85@gmail.com*

Abstract

Clean and healthy environment is one of the fundamental requirements of human well-being and health. Many people in both urban and rural areas are suffering from air pollution by various factors. Especially, air pollution in agriculture is actually affecting public health. Using fertilizers and pesticides, burning farm waste and crop waste operation are, direct or indirect threat to human health and the environment. Although many people know these impacts on their environment, they are neglected. Despite there are numerous international norms and national laws, agricultural air pollution still continues to be not only one of the major environmental issues but also human rights problem because air pollution impacts the right to health contained in Article 12 of the ICESCR. Myanmar is a state party to the ICESCR and so Myanmar has a duty to promote the right to health against dangers such as air pollution. International standards to protect health against air pollution are provided in international environmental instruments such as the Stockholm Declaration 1972 and the Stockholm Convention on Persistent Organic Pollutants 2001. The government has tried to protect against air pollution through laws and regulations but it remains a challenge. This paper aims to study challenges to the public health from air pollution in agriculture by identifying relevant laws, rules and policies. This study seeks to clarify the impact on public health rights due to air pollution. It will provide the gaps between international standards and domestic laws, plans, and policies on air pollution, by analyzing, particularly in terms of identifying the weakness of prevention and control of agricultural air pollution within Myanmar's legislation, plan and policies. This study also contributes to the healthy lives and human well-being in accord with the sustainable development.

Key words; air pollution, right to health, legal protection, implementation.

1. Introduction

Air pollution is a common impediment to the realization of human rights: nine out of ten people globally live in areas that do not meet the World Health Organization's (WHO) guidelines for air quality, and air pollution causes seven million premature deaths annually (Report of the Special Rapporteur, 2019). Almost 99% of the global population breathes air that exceeds WHO limits concerning pollutants, notably low and middle income countries (WHO, 2021). The World Bank

estimates that Myanmar experienced over 45,000 thousand deaths due to air pollution in 2017. Air pollution is higher in Myanmar than in other country in the region and is almost twice the average for Southeast Asia (The World Bank, 2019, pp. 69). Myanmar is facing a double burden of indoor and outdoor air pollution (WHO, 2019) with agricultural waste burning a major source of outdoor pollution (WHO, 2021, pp. 2).

Myanmar is an agriculture-based economy and in farming systems large and small burning is one of the most commonly used methods for removing crop residues after harvest and for preparing lands for cultivation after they have been fallowed. According to Air Quality Index in Yangon, although most people believe that the main causes of air pollution are vehicles and industries, in fact farm waste management around Yangon is one of the major sources of particulate matter (PM) pollution (Page, 2021). One agribusiness expert, however, stated it could not be said conclusively without any studies that agricultural burning is the main reason for poor air quality (Eaint Thet Su, 2020). Unfortunately, such burning is not well managed in Myanmar because little is known about its potential risks and benefits.

Some studies have been made on the health effects of air pollutants in Myanmar, focused on those exposed to dust or pollutants at the workplace in industrial zones (Phyu, 2017; Oo, Haung & Thu, 2018; Myanmar Environment Institute, 2017). For instance, under the air quality assessment in Yangon, both PM 2.5 and PM 10 in the morning and evening during the winter are found to be far in excess of 24-hour health-based standards. They found that ambient air pollution and industrial and transportation vehicles cause respiratory symptoms such as coughing and sneezing, salivation and chronic sore throat, affecting public health (Ohnmar, 2018).

There are many studies that address some of the challenges of waste management as well as suggestions on how they can be properly managed (Phyu, 2017, Oo & Haung & Thu, 2018, Myanmar Environment Institute, 2017, pp. 52). Related to agricultural air pollution, there are no significant legal cases nor complaints in Myanmar. There is no specific existing literature that discusses legal mechanisms or protection in the Myanmar context for any damage arising from agricultural air pollution. Therefore, this study will discuss legal protections for public health from air pollution from agriculture, use of pesticide and fertilizer in agriculture practices, and burning of farm waste. This study aims to identify legal challenges to preventing violations of public health due to agricultural air pollution in accordance with international legal standards.

This paper begins with a brief discussion of agricultural pollution impacts on the environment, especially human health. It then briefly reviews the links between air pollution in agriculture and the right to health and discusses how to protect public health through national legislation and procedures in line with international standards. The next section of the paper examines the implementation of existing

laws and regulations that protect health and environmental rights. Finally, the study makes recommendations based on its findings in protecting public health and the environment in Myanmar.

2. Methods

This study used a qualitative research design. In order to understand the protection of public health against threats from air pollution, this study used a mixed-methods approach based on data derived from both primary and secondary sources. This study reviewed international human rights and environmental protection instruments such as the International Covenant on Economic, Social and Cultural Rights 1966 (ICESCR), the Stockholm Convention on Persistent Organic Pollutants 2001, the Universal Declaration of Human Rights 1948 (UDHR), and the Stockholm Declaration 1972. This study focused mainly on these two conventions because Myanmar is a state party to them. In addition, national laws were considered, including the Myanmar Environmental Conservation Law 2012, Public Health Law 1972, Pesticide Law 2016, Fertilizer Law 2002, Myanmar Environmental Conservation Rule 2014, and Law of Protection of the Farmer Rights and Enhancement of their Benefits 2013, to identify the legal context of protection of the environment and public health. This analysis will be further assisted by the general comments of relevant bodies. This is supplemented by a review of relevant literature from practice and scholarship which provides international findings concerned with agricultural air pollution and violation of human rights, especially the right to health. The study collects primary data from qualitative semi-structured interviews with key informants that seek to identify challenges to protecting the environment and public health and understand the implementation of laws and regulations.

2.1 Primary Data Collection

Semi-structured interviews were made with pesticide and fertilizer sellers and agents to generate information on their contributions to reducing air pollution in agricultural areas. The researcher also conducted interviews with farmers and those living in agricultural areas to share their experiences. Research questions explored perceptions and experiences of experts on agricultural air pollution, human rights, and the implementation of laws and procedures for public health protection.

Field sites selected were Khanyan township in Yangon Region and Mawlamyine and Mudon townships in Mon State since they host different types of agriculture and a large number of agricultural activities. Khayan township is an area that primarily cultivates rice, beans, and seasonal crops while Yangon region has been included in monitoring for health effects related to air pollution. Mawlamyine and Mudon townships have both perennial and annual crops such as rubber, various kinds of peas, beans and seasonal crops.

Data collection was conducted in the Regional Department of Public Health in Yangon, and the Public Health, Agriculture and Environmental Conservation Departments of Mon State. Interviews were carried out face to face, by e-mail and on the phone and zoom. A total of 15 experts and informants were interviewed, for between 45 and 60 minutes.

Interviews made are listed in Table 1.

Table 1 Profile of interviewees

No.	Code	Occupation	Gender	Date of interview
1.	IE 1	Officials from Environmental Conservation Department	M	5.10.21
2.	IE 2	Officials from Environmental Conservation Department	M	5.10.21
3.	IE 3	Official from Public Health (Yangon)	F	14.10.21
4.	IE 4	Official from Public Health (Mawlamyine)	F	9.10.21
5.	IE 5	Official from Agriculture	Mx2	15.11.21
6.	IE 6	People in Agricultural Activities	Mx5	1.11.21
7.	IE 7	NGOs (Agriculture sector)	M	9.11.21
8.	IE 8	NGOs (Environmental health sector)	M	16.11.21
9.	IE 9	Sellers and agents of Pesticide and fertilizer	M	4.10.21
10.	IE 10	Sellers and agents of Pesticide and fertilizer	M	17.10.21

Prior to the interview, the researcher explained the purpose and scope of the project; affirmed that the interview would be conducted with their informed consent; stated that the interviewee's personal details (name and affiliation) would be kept confidential and would be used anonymously; and told interviewees that they are free to leave at any time without obligation to provide information. A signed consent form was obtained, and a copy given to the interviewee, while in some cases oral consent was obtained.

The researcher encountered many obstacles in collecting the primary data, including a demand for letters from senior officials in order to interview government officers. Some experts were reluctant to record the interview, and when conducting interviews by email, there is no opportunity to ask follow- up questions. The current political situation makes it impossible to contact some government departments and so relevant data from reports or official websites was used.

3. Result and Discussion

3.1 Literature Review

A. Nature of Agricultural Air Pollution

There is no specific definition for agricultural air pollution at international and national level. Generally, air pollution has various causes such as burning, using household or industrial chemicals that cause chemical reactions and release toxic gases in the process, or producing large amounts of dust (Woodford, 2020). Some researchers and air quality experts assert that air pollution in agriculture occurs when a range of pollutant gases, and especially nitrogen compounds (NO2, NO, NH3, N2O) are emitted to the atmosphere due to agricultural activities that include, pesticides and fertilizer use, as well as farm machinery and livestock waste (Courtney Lindwall, 2019, Air Quality Experts Group, 2018). Many farmers in the world burn cultivated fields to clear stubble, weeds and waste before sowing a new crop. This activity produces large amounts of black carbon particle pollutants that are a major contributor to air pollution (Climate and Clean Air Coalition, 2015). Some researchers believe that while fertilizers are not a primary source of air pollution in agriculture, they are a major form of pollution in watersheds since vast quantities of excess fertilizers wash off fields each year (The Earth Institute, 2016).

The WHO suggests that the single largest environmental risk to human health was fine particulate air pollution (i.e. PM 2.5) such as tiny particles of soot, black carbon, sulphates, and nitrates that are breathed into the lungs and then pass into the bloodstream (WHO, 2016). Farm workers, their families and those living adjacent to farming areas may face long-term health risks associated with the use of pesticides. For instance, in South Africa, there have been many cases focused on the occupational health risks of pesticides for farm workers and some in which people living adjacent to agricultural fields have reported symptoms associated with exposure to spray drift (Policy Department, 2021). These studies confirm that the burning of farm waste, use of pesticides and fertilizers, and other agriculture practices produce harmful effects. It should be noted that human health and environmental issues related to pesticide handling often occur because farmers and agricultural workers do not have adequate personal protective equipment.

B. Agricultural Air Pollution and Health Effects in Myanmar

According to the data from the Ministry of Agriculture, Livestock and Irrigation, about 70% of the population in Myanmar resides in rural area and agriculture is their main means of livelihood. P.M 2.5 can travel long distances, and agricultural burning even 200 miles away (Page, 2020), while farm burning remains common in the country. In some cases, the burning of farmland has covered entire townships with smog, demanding mask wearing at home and causing tears, shortness of breath and coughing (Myat Moe Aung, 2019). However, this is considered a minor event and not treated as a legal issue. Chemical use is a major health and environmental concern in the context of Myanmar with institutional capacity and low general awareness of risks and the impact of toxic emissions.

The interview data allowed for an understanding of some of the issues around agricultural pollution.

Farmers in Myanmar cultivated rice, seasonal corps, beans and rubber in their farms according to the season. In the cultivation of perennial rubber, after the harvest (from December to March) land is cleared, typically by burning (Interviewee no.IE.7 and IE.5). After cultivation, herbicides and pesticides are used to clear weeds. Burning practice is almost universally used to clear land for shifting agriculture, known as taungya, in upland rural areas, to clear weeds before the next planting season, kill pests, and to replenish soil (Interviewee no.IE.6). At that time, some people experience coughing and shortness of breath due to breathing smoke from the burning but don't know the impacts of air pollution on their health and environment (Interviewee no.IE.6). Farmers have never worn any protective clothing while burning, not even a mask (Interviewee no.IE.7). Burning affects passers-by, causing coughing, shortness of breath, and eye irritation, even when collecting the waste materials before burning (Interviewee no.IE.5).

The burning practices in agriculture could result in serious problems to human health from toxic gases and particulate emission. The pollution from these practices become more noticeable when the rainy season subsides and the winter months begin. The overwhelming majority of illnesses and premature deaths caused by air pollution affect people working and living close to agriculture. Another factor is use of fertilizers and pesticides effects, even where these are known, they are ignored. Farmers can feel dizzy after spraying but take no action (Interviewee no. IE.7). When passers-by feel symptoms they run away and recover, with most not seeking treatment (Interviewee no. IE. 5), demonstrating public lack of knowledge of the issue.

Farmers from Mon State buy herbicides and pesticides imported from Thailand (Interviewee no. IE. 5) but are unable to understand how to use them or their potential consequences (Interviewee no. IE.7). As a result, famers don't know the appropriate doses of these products, or on which plants they should be used (Interviewee no.IE.8 and IE.7). This can lead to dangerous overuse, impacting the environment and working place as well as consumers of crops. No effort is made to measure the ambient air quality to track problems (Interviewee no.IE.8 and IE.2).

3.2 Legal Analysis on Protection of Public Health

There are a number of national laws and regulations to protect public health and the environment from pollution. This study examines whether these provisions and procedures are in line with international standards and the extent to which they do protect public health from agricultural air pollution.

Many international environmental and human rights conventions recognize environmental impacts on human rights. The linkage between human rights and the environment is prominently accepted in the Paris Agreement on Climate Change (Paris Agreement, 2015, Preamble). While the right to health has long been established, the Universal Declaration of Human Rights does not include any direct

reference to the environment. There is also no agreement on agricultural activities in terms of the health effects of agricultural air pollution. However, some important international environmental conventions recognise the relationship between the environment and human health. For instance, the Stockholm Convention on Persistent Organic Pollutants 2001, controls and eliminates production and use of pollutants and mandates that, to prevent impacts on the environment, the state shall take all measures for preventing the use of such pesticides (Stockholm Convention on Persistent Organic Pollutants, 2001, Art.3 (3)). The Convention also lays out how implementation must involve consultation and public awareness.

For citizens to enjoy the highest attainable standard of physical and mental health (ICESCR, 1966, Art. 12) government should seek to improve the environment and prevent, control and treat all diseases, including occupational disease. The right to health demands that the state adopt measures against environmental and occupational health hazards. Such action should target exposure to hazardous substances and reducing the impact on human health and the environment, including through education and prevention and national policies to reduce and eliminate air pollution (UN Doc E/C.12/2000/4 (2000)). The Committee has also encouraged individual states to increase their efforts to reduce air pollution, as a means to protect human rights (Fourth Periodic Report on Mongolia, 2015).

The Stockholm Declaration 1972 was the first international instrument to expressly recognize the relationship between individual human rights and the quality of the environment (Stockholm Declaration, 1972, Principle 1). Although it does not specify the right to a healthy environment, it does claim the right to adequate conditions of life and to safeguard the environment and the air (Ibid, Principle 2). The ASEAN Human Rights Declaration also includes the right to a healthy environment as an element of the right to an adequate standard of living (DHR, 2012, Art. 28 (f)), but with no enforcement mechanism. According to UN General Assembly Resolution 45/94, individuals have the right to live in an environment conducive to their own health and well-being. WHO guidance 21, 24 and 25 concern the control of agricultural pollution, mandating regulations to reduce or prohibit the burning of farmland: strategies should be put in place to prevent forest and compost burning (WHO, 2021).

In Myanmar, the Environmental Conservation Law 2012 establishes a comprehensive framework for the government to implement environmental protection plans and defines the terms pollution and pollutant (Ibid, Sec. 2(e-g)). It contains however no provisions to deal with air pollution but creates a mechanism responsible for standards on emissions (Ibid, Sec.7(d)). Those who own businesses that cause pollution are responsible for installing equipment to monitor, control, and reduce or eliminate environmental pollution (Ibid, Sec.15). The polluter must pay compensation for various forms of environment damage (Environmental Conservation Rule, 2014, Art. 30) but there is no specific provision

for damages. Neither the law or rule provide the specific definition, conditions or preventive measure of air pollution in the agriculture sector nor protection of right to health.

Environmental damage caused by an action or product that is harmful is punishable by law (Environmental Conservation Law, 2012, Sec.32 & 33(a)) but there is no explicit provision for the impacts of air pollution caused by agriculture or for violation of health rights. This law does not include specific provisions for the prevention of such hazards. Everyone has the right to a clean and healthy environment (National Environmental Policy of Myanmar, 2019, Principle 1). The Environmental Impact Assessment (EIA) system identifies and manages potential impacts of air pollution on health rights and national emissions guidelines provide regulations for pollution and emissions control for a variety of environmental aspects (National Environmental Quality (Emission) Guidelines, 2015, Chapter I. Para.4 & 6). The Public Health law 1972 obliges the government to protect public health from environmental damage (Public Health Law, 1972, Sec. 3) and protect the environment from air pollution that endangers public health (Ibid, Sec. 3(1)(c)). There are no specific provisions in relevant laws and regulations to control the public health effects of air pollution caused by pesticides and fertilizers, only an obligation of the user to follow the directions regarding the handling and use of such chemical products. However, these laws and regulations do not include consumer or environmental regulations.

With regard to the use of fertilizers in agriculture, the relevant body shall issue directives to prevent environmental pollution and human endangerment, and to prohibit such hazards or pollutants (Fertilizer Law, 2002, Sec.5). However, this law does not specify measures to protect the environment and public health from the effects of fertilizers nor to protect farmers.

In summary, this range of laws and rules does not have provisions in line with international standards on how to effectively address the health effects of air pollution caused by agriculture. Similarly, the Public Health law should be revised in accordance with international standards. Existing legislation at the national level contains provisions related to air pollution control but they are not specific on implementation arrangements. While Article 45 of the Myanmar Constitution (2008) states that the Union government has responsibility to protect and conserve the natural environment, Myanmar did not incorporate the right to a healthy environment into its 2008 Constitution. Only the National Environmental Policy of 2019 recognises the right to a healthy environment but prevents legal action to address infringements of this right.

3.3 Challenges in Implementation of Public Health Protection

The Environmental Conservation Department (ECD) is responsible for implementing national environmental policy and managing pollution control. While the EIA Procedure was published in 2015and has responsibility to monitor the use of agro-chemicals, the integrity of the EIA process is

weakened by a lack of transparency. The World Bank has found that that compliance actions are only made in response to complaints from the local community and there is no effective regular monitoring and inspection system (2019). As a result, there is little implementation of the EIA in practice and air quality is mainly measured in busy road areas. It is not possible to assess the impact of agricultural air pollution on environmental health.

The Occupational and Environmental Health Division (OEHD) has plans to control, protect, treat and promote information related to chemicals that endanger public health along with plans to establish a professional support centre (Myanmar Health Vision 2030, Para.92-93). In practice, the relevant authorities investigate only where there are complaints of environmental pollution and hazardous health conditions (Interviewee no. IE.4).

While those suffering from disease cause by pollutants can be given relevant treatment, there is no public health focused investigation capacity. In particular, the public health centre does not have any program nor does it investigate health impacts of agricultural air pollution (Interviewee no. IE.3 and IE.4). There is no compensation even for hazardous health issues in practice, and even in the event of a death there is no effective sanction (Interviewee no. IE.8).

The agriculture department supervises procedures on producing, importing, exporting and distribution of pesticides and herbicides under the control of the Pesticide Law (Interviewee no. IE.5) but The Agriculture Policy 2016 does not include prevention or control of agricultural air pollution and health effects. The agricultural department is making farmers aware of the environmental pollution caused by burning farm waste and using pesticide and fertilizer (Interviewee no. IE.5). According to sellers and agents, they import and sell products with the registration certificates and explain to buyers how to use products when they are sold (Interviewee no. IE.9 and IE.10). In practice, however, people in the sector have not received good training in handling or using these products. They receive no directions and instruction from any relevant departments related to burning practices and in practice, most people in agriculture do not wear protective equipment, and are unaware of relevant regulations (Interviewee no. IE.6).

Some experts pointed out that protection from and regulation of pollution in the agricultural sector cannot be managed effectively. The government lacks capacity to regulate the sale of illegal pesticides in rural markets as well as farmer to farmer exchanges (Interviewee no. IE.7). There is a need to consider prohibition of hazardous chemical insecticides, investigation on their environmental affects, and decrease in harmful activities (Interviewee no. IE.8). The capacity of the extension system is inadequate to train farmers in the correct use of approved pesticides, and government agencies do not conduct regular checks to assess environmental damage they cause.

3.4 Findings

Concerning environmental pollution, especially air pollution arising from agricultural activities, Myanmar's laws, rules and procedures do not define relevant terms or constitute measures to prevent such pollution or protect the right to health. No specific provisions exist to monitor agricultural air pollution and its impact on public health. The Myanmar Environmental Conservation Law does not include provisions on monitoring and implementation processes, despite outlining the obligations of the Environmental Conservation Department to control and monitor environmental pollution. This law is an umbrella law and does not provide any enforcement procedure related to maintenance of a healthy environment.

In protecting public health, the Public Health Law cannot address all health impacts caused by agricultural air pollution. Such pollution can cause sudden death as well as gradual or chronic diseases. In addition, there are no laws or procedures providing protective measures for rights to health i.e., it provides no provisions or regulations to prevent impacts on public health by illegal burning, remedies for health impact, or enforcement of health impacts. . Myanmar is a party to both the Stockholm Convention and the ICESCR and as such has a responsibility to address air pollution in every sector, including agriculture, and to ensure a healthy environment and protection of the right to public health. However, it does not have adequate laws and regulations in place to govern air pollution and public health protection from it.

Myanmar has a pollution control department within the Ministry of Natural Resources and Environmental Conservation, but which makes no specific assessment related to air pollution in agricultural activities. To satisfy its obligations to eliminate health threatening environmental pollution, the government is obliged to ensure comprehensive monitoring, but has yet to establish nationwide ambient air quality monitoring networks. This constrains its ability to measure and limit ambient pollutant levels. Although the implementation of health programmes is the responsibility of the National Health Committee, it lacks a monitoring system of air pollution impacts on health in agriculture, except for a few sectors in Yangon and Nay Pyitaw. In particular, there is no effective control on burning of farm waste and dust from crop operations.

To ensure implementation of regulations, the respective bodies need to specify categories of hazardous waste generated from the use of chemicals or other hazardous substances in agriculture. They need to proscribe activities that can threaten a healthy environment and define categories of hazardous substance that may significantly affect the environment today or in the future. The major constraints to minimising open burning were lack of technology (e.g., recycling rather than burning straw and agricultural waste disposal practices) and knowledge of alternative practices to the burning tradition. These are accompanied by a public lack of knowledge and of the law and a weak implementation

process.

The existing pesticide regulations and enforcement institutions represent an attempt to address some of the issues around import and sale. While useful, much still needs to be done in terms of training and education to support the correct and safe use of approved products, and the use of personal protective equipment. Due to lack of labelling in local languages and illiteracy among farm workers, critical safety information is often not communicated to the individuals that handle pesticides. As a result, the use of illegal pesticides may increase the danger to human health and the environment, and the enforcement of regulations is made more difficult. No data collection was made concerning the evaluation and treatment of such issues in a public health centre, because they have no projects or guidelines addressing the health effects of agricultural air pollution.

It is necessary to improve the health and safety of those working in agriculture through improved technology, personal protection, and greater awareness of hazards. To improve occupational and environmental health in agricultural practices, relevant bodies (especially, the Environmental Conservation bodies, agriculture departments, and public health authorities) need to define appropriate farming standards and promote public awareness of them. An ambient air quality monitoring network needs to be established in the agriculture sector, with systematic long-term assessment of pollutant levels, and types of pollutants in the environment.

4. Conclusions

Many people in agricultural areas suffer from the impacts of air pollution caused by the burning of crop residues, and the use of pesticides and fertilizers in the absence of personal protection and with a lack of awareness of potential hazards. The Myanmar government has enacted laws and procedures to prevent environmental pollution and protect a healthy environment in line with international standards. However, there are many gaps in these laws, which do not effectively protect public health. They represent only an overview of the respective areas: there is a need for a separate law or regulation to control air pollution in all sectors, including agriculture, as part of state responsibility to improve and protect public health. These issues need to be investigated and monitored by those with appropriate skills and as such, effective management, adequate funds and additional human resources should be supported. Monitoring programmes in particular should be initiated in the agriculture sector to assess the impacts of air pollution on public health. The government needs to cooperate with concerned stakeholders (environmental health experts, business people, agricultural experts) to seek funds and technical assistance. It also should enact a specific law to reduce agricultural air pollution and protect effectively against rights to health.

Enhanced oversight of pesticide sales and policing of illegal supply chains is also needed to control

the supply of unapproved products, where fake or illegal products can cross borders from neighbouring countries. The government should build a network to ensure the collaboration of academic health centre researchers, agricultural safety educators, and agricultural engineers to institute a multi-disciplinary approach to research and education in agricultural health and safety. For farmers, there is a need to provide training and practical support, such as field demonstrations, local-language education on the negative impacts of burning, and appropriate alternative approaches, including subsidies for alternative equipment to regulation of burning, such as using all crop residues which can aid preservation of moisture, and can be used as fertilizer. This would permit the agricultural sector to build trust in society and ensure that dangerous PM2.5 issues are not ignored.

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Algorithmic Authority and the Defence Sector

From a lens of social sustainability

Irja Malmio

Swedish Defence University, Department of System Science for Defence and Security, irja.malmio@fhs.se

Abstract

The purpose of this study is to look at algorithmic authority and its impact on the Defence sector from a perspective of social sustainability. Algorithmic applications are utilized in various contexts for tasks such as decisionmaking, communication, surveillance, information analytics, and risk assessments. These processes entails a sense of opaqueness and tend to pass us by without being noticed, entailing a pervasive power dimension that directs human action while also influencing and categorizing how information is validated and consequently valued. This presentation addresses the reliance on algorithms for risk assessment, information management and surveillance in the Defence sector and considers their impact on goals of social sustainability, such as social equity, inclusion and institutional justice. The presentation analyzes three examples that involves algorithmic applications connected to the defense sector: Geofeedia, a private surveillance company specialized in social media, COMPAS, a risk-profiling algorithm used for assessing recidivism among prison inmates and MAM (Military-Age Males), a practice of social sorting through the category of gender in accordance with the principle of distinction.

Keywords: Algorithmic Authority, Social Sustainability, Security, Big Data, Social Values

1. Introduction

Some say that the world in its current sociotechnical formation, has become so engulfed in the network of algorithmic communication and surveillance that separating humans from this technological grid is an impossible endeavor (Amoore, 2020; Beer, 2009; Cheney-Lippold, 2017; Hayles, 1999). Algorithms have become "the new powerbrokers in society" (Diakopoulos, 2013, 2) as big data and the algorithms that collect, predict and arrange them have developed into a ubiquitous entity that affects most parts of society. The processes under which algorithms operate appears as both obscure and authoritative in a way that scholars have described as a "black box society" (Pasquale, 2015), "a regime of computation" (Hayles, 2005), and "algorithmic governmentality" (Rouvroy & Berns, 2013). Algorithms builds on the mathematical idea that conditions all programming, and functions as a tool for probability calculus, but in

their application of machine learning or AI, their outcomes are clouded by a great deal of uncertainty (Saffiotti, 1988). Machine-learning algorithms have been described as non-transparent entities (Perel & Elkin-Koren, 2017), yet possess substantial abilities to influence how things are done, how the world is perceived and how people are classified and consequently treated (Beer, 2009; Eubanks, 2017; Halpern, 2015). From the perspective of social sustainability, the way that algorithms structure, and sort people, places and things, is something worth to consider.

The social practice of tracking and classifying individuals into "risk groups" depending on their financial ability has been the norm in the finance market for quite some time (Fourcade & Healy, 2013), but the same logic also increasingly affects how we assess security situations, described by Aradau and Blanke (2015) as a turn to "the computational regime in security governance". The appeal of algorithms in the defense sector originate from the prevailing "accuracy paradigm" (MacKenzie, 1993). This idea implies that a faster and more accurate application of complex information flows delivered by machine- learning, has the potential to lower the amount of civilian casualties (Shoker, 2021), find out where a crime will be committed (Egbert & Leese, 2021), or who on an airplane poses as a potential terrorist (Amoore, 2009). From this perspective, algorithms promise a sort of objectivity while also delivering an efficiency that far surpasses the abilities of human cognition, a position that can easily lead to automation bias, the uncritical assumption that machine-learning applications for decisionmaking performs better than humans (Osoba et al., 2019). However, a lot of research on algorithmic processes in AI have found problems with this assertion since algorithms are based on big data, and big data are susceptible to bias, resulting in a situation where algorithms are described as delivering objective solutions but in reality are just as prejudiced as the rest of society (Bucher, 2018; Diakopoulos, 2013; Kitchin, 2014). A further problem is also that the consequences of algorithmic authority does not affect people the same way; algorithmic processes can therefore consolidate inequalities (Browne, 2015; Eubanks, 2017; O'Neil, 2016).

Although there have been quite a substantial amount of academic contribution on how the use of algorithmic authority affects democratic processes in society (Aradau & Blanke, 2015; Diakopoulos, 2013; O'Neil, 2016; Van Otterlo, 2013), the link between social sustainability, security and the use of big data have not been sufficiently addressed. However, this issue is becoming increasingly topical and is, from a perspective of democracy as well as security, an important aspect in contemporary society to monitor and analyze. Therefore, my intention is to navigate this field from a perspective of feminist curiosity (Enloe, 2016), proceeding with two basic research questions: How do algorithmic

decisionmaking affect the Defence sector and what possible effects might this have for the goals of social sustainability, such as social equity, inclusion and institutional justice?

The structure of this paper is as follows. I will first start by giving a brief background on social sustainability in order to conceptualize how this can be approached from a security perspective. Second, I will describe algorithmic authority and the application of big data in a security setting. I will then discuss the three examples of Geofeedia, COMPAS and MAM, by focusing how these applications intersect, or diverge, with goals of social sustainability. After that, a discussion proceeds with analysis of what this means in terms of security applications and knowledge production followed by some concluding remarks on algorithmic authority and social sustainability.

2. Methods

In order to investigate the research questions specified above this paper compares three examples that involve algorithmic applications in the defence sector: Geofeedia, COMPAS and MAM (Military Age Males). The Defence sector in this context is understood from a broad perspective, and thus includes both military and police matters. The selected examples provide an understanding for the way that algorithmic processes are used in the security domain by representing different aspects of capabilities sought after in this context. Geofeedia is a private intelligence service company that provides security agencies with algorithmic analyses from social media, an application that was used for justifying the arrest and detention of minors during the protests that followed the death of Freddie Gray in Baltimore, 2015 (Amoore, 2016). COMPAS is a criminal risk profiling algorithm, which has been up for considerable debate both in the academic sphere and in the news media, for containing racial bias while the efficiency of its predictive accuracy also have been brought into questioning (Dressel & Farid, 2022). MAM provides an example of the practice of deciding in a war situation who counts as a civilian through the category of gender (Wilcox, 2016), while also problematizing on the overreliance on mathematical precision in statistics (Shoker, 2021). The three examples are meant to be illustrative, not comprehensive descriptions of the algorithmic applications that are under focus.

In addition to these examples a literature review on algorithmic authority and social sustainability was performed using a qualitative text analysis method (Bryman, 2015). The literature review focused on Social Sustainability + Algorithmic Authority + Big Data, and was performed in order to deepen the understanding for the academic research in this field, as well as providing a sense of how these processes actually work, or rather how researchers think that they work.

The three examples, Geofeedia, COMPAS and MAM, are used to identify how these applications intersect,

or diverge, with goals of social sustainability. After that, a discussion proceeds with analysis of what this means in terms of security applications and knowledge production followed by some concluding remarks on algorithmic authority and social sustainability.

3. Results and Discussion

3.1 Social Sustainability and the Defence Sector

As has been well established within the literature on sustainable development, the multifaceted concept includes a diversity of perspectives that influence decision-making processes, where social, economic, technical and cultural variables are taken into account based on their mutually complex interactions and dependencies (Brooks, 1992). The overall idea includes an holistic interdisciplinary approach where diverse social value lenses and areas intersect and diverge, which lays the foundations for a "mess of diversity" (Kenter et al., 2019). In the seventeen goals for achieving a sustainable future expressed in the Agenda 2030, there are several points linked to social sustainability, such as gender equality, increased institutional justice, and equal living conditions for the entire world population (UN, 2015). However, in spite of the urgent description of social goals in relation to sustainable development there is little consensus on what exactly an overall definition of social sustainability ought to include, with many discipline-specific descriptions focusing on various aspects depending on the context in which the concept appears (Dempsey, Bramley, Power, & Brown, 2011; Litting & Griesler, 2005; McKenzie, 2004). Amartya Sen has lifted the aspect of capabilities, as a way to approach the social dimension of sustainability goals, where capabilities refers to aspects of basic human needs (Sen, 2004). Research in urban development have focused on various aspects such as community resilience (Dempsey et al., 2011; Magis, 2010) social cohesion (Al-Homoud & Tassinary, 2004), and social inclusion and exclusion (Haddon, 2000). Attempts have also been made of proposing a definition that is functional for all contexts and Ballet et al (2020) have suggested that such a definition should include social cohesion, social equity and a level of safety, which relates to economic security (Ballet, Bazin, & Mahieu, 2020).

In the security context, discussions on sustainability have largely moved into two directions. Firstly, there is an ideological understanding of the intimate connection between security and the social goals of sustainability elaborated in the concept of "Human Security", which is detailed in the *Human Development Report,* released by the UN Development Program in 1994 (UN, 1994). The second perspective addresses a more pragmatic view that focuses on how sustainability requirements can be used as means of enhancing security capabilities and strengthening the overall operational effectiveness, therefore leaning on a more instrumental and practice orientated application of the concept (Carstens, 2012; Liwång, 2022;

Smaliukiene, 2018). When specifically zooming in on the social dimension of sustainability in this context aspects are highlighted such as social cohesion, from the perspective of inclusion (Malmio, 2022; Spindel & Ralston, 2020), societal resilience, which looks at society's ability to deal with crisis and conflicts (Carstens, 2012), and institutional justice, focused on gender mainstreaming and accountability aspects (Malmio & Nilsson, 2018). Other important aspects of social sustainability, when viewed from the perspective of the co-production of algorithms and security, are ideas connected to distribution, power asymmetries and social equity. Social equity has been described by Jost and Kay (2010) as a situation where benefits and burdens in society are equally dispersed; where procedures, norms, and other forms of decisionmaking preserve the basic rights of individuals and groups; and where people are treated fairly by authorities and other relevant social actors (Jost & Kay, 2010). Social equity can be distributive, procedural or relational, and involves an egalitarian perspective on the obligation of social institution to reflect fundamental moral principles of equality, fairness and transparency (Osoba et al., 2019).

3.2 Algorithmic Authority

Algorithms are made from data which can be described as raw elements that are abstracted from phenomena in various ways and provide key inputs to the various modes of analysis on which inferences are drawn (Cheney-Lippold, 2017; Kitchin, 2014). These processes are in reality extremely tricky and complex and involves numerous decisions on which data to include and how to weight them and link them to each other (Mau & Howe, 2019). The process that turns data into usable information starts with a collection of unfiltered big data, which is processed through datamining to identify correlations. This material is analyzed with different probalistic statistical methods in order to anticipate individual behaviors and associate them with profiles defined on the basis of correlations discovered through the datamining-stage (Rouvroy & Berns, 2013). The automated extraction of the relevant information forms the basis for statistical decisionmaking, forecasting and exclusion purposes (Cheney-Lippold, 2017). In this way, machine learning algorithms embody a regime of recognition that identifies what or who matters to the event, while simultaneously transforming a multitude of extractions to a single output (Amoore, 2020), transforming normativity into "facticity" (Lash, 2007). Thus, algorithmic information does not only give us an idea of how the reality is perceived, but also takes an active part in constructing this reality (Beer, 2009). Therefore, it could be argued that there is an embedded power dimension in the way that algorithms assign specific meaning to individual input factors and utilizes specific modes of selectivity (Mau & Howe, 2019).

Algorithmic Authority is defined by Lustig and Nardi (2016, 743) as "the trust in algorithms to direct

human action and to verify information, in place of trusting or preferring human authority". Scott Lash (2007) refers to this structure as "post-hegemonic", since it does not exercise domination from above, but rather indicates a domination that emanates *from within* the global information system. The idea that algorithms are superior tools for deducting knowledge proceeds from the notion that mathematical reasoning is a superior inference method. Alan Turing strongly favored this position and asserted that mathematical reasoning is comprised of two components, intuition and ingenuity. Intuition makes spontaneous judgements which is validated by the exercise of ingenuity through arrangements of mathematical propositions, in a way that "cannot be seriously doubted" (Turing, 1939, 215). Mathematical reasoning represents a form of normative objectivity, and is created from the digital truth which ideally does not hold any preconditions or bias, corresponding greatly with the idea of an "original position" stipulated by John Rawls (Rawls, 1999). The ideal of normative objectivity proceeds from the premise that information only moves in one direction, from the system to the observers, and does not take into account the reflexive nature of the process involved where the observers too become parts of the system that is being observed (Hayles, 1999). While algorithms are mathematically precise, the norms that govern them are often contested or ambiguous. They are also susceptible to reward hacking, which means that unintended and unforeseen consequences can occur (Osoba et al., 2019). This has led many scholars to the conclusion that since mathematical reasoning is formed in a social context, the influence of bias cannot be absolved (Amoore, 2020; Mau & Howe, 2019; Pasquale, 2015). Furthermore, the consequences of digital monitoring tends to affect marginalized groups in society more gravely, and consequently: "reinforces their marginality as its used to target them for suspicion and extra scrutiny" (Eubanks, 2017, 7).

In a military context machine-learning algorithms usually have three main areas of application: Lethal Autonomous Weapons Systems, cyber attacking software, surveillance and tracking systems (Crawford, 2021). While in policing the most common applications include predictive analysis, surveillance and information sharing (Egbert & Leese, 2021). The use of algorithms for decisionmaking and information management in the security domain is a sensitive area due to ethical concerns (Gunkel, 2012), the potential breaching of basic human rights such as privacy and consent (Macnish, 2018), or designating marginalized groups as suspects (Eubanks, 2017).

3.3 Three examples of algorithmic decisionmaking in the defence sector

Geofeedia is an example of a private tech company that supplied the Baltimore Police Department and the US department of Homeland Security with an algorithmic application used for surveillance on social media, in order to identify potential troublemakers. This activity became known to the public in connection with the mass protests on the streets of Baltimore that occurred after the tragic death of Freddie Gray in 2015, who died while in police custody. Several people were arrested and detained based on an algorithmic application provided by Geofeedia that scored an output of the incipient propensities of potential protesters based on data from Twitter, Facebook, YouTube, and Instagram (Amoore, 2016). Among the arrests were forty-nine children who had been adjudicated on the high risk they posed in the crowd (Laughland, 2015). In the ensuing aftermath, Facebook, Instagram and then Twitter all suspended Geofeedia's access to their data feeds, while denying they had provided access to Geofeedia to begin with (Leetaru, 2016), which was later questioned in an ACLU report (Cagle, 2016). Geofeedia is one company out of many that market social media monitoring as a security service, and is a powerful example of how surveillance technology can disproportionately impact communities of colour (Cagle, 2016), while also circumscribing the democratic right to protest (Amoore, 2020).

COMPAS is the acronym for Correctional Offender Management Profiling for Alternative Sanctions. It was first developed in 1998 and have been used on more than 1 million offenders since then. In the criminal justice system, predictive algorithms have been used to predict where crimes most likely will occur, who is most likely to commit a crime, and who is likely to reoffend at some point in the future (Egbert & Leese, 2021). The recidivism prediction component of COMPAS, which is a risk assessment scale consisting of 137 different items, have been in use since 2000. This software predicts a defendant's risk of committing a misdemeanour or felony after release from incarceration. Although the data used by COMPAS do not include an individual's race, other aspects of the data may be correlated to race that can lead to racial disparities in the predictions (Dressel & Farid, 2022). Several studies have concluded that the risk assessment tool is both unreliable and racially biased. The most well-known study was performed by Angwin et al (2016) who analysed the efficiency on more than 7000 individuals in Florida between 2013 and 2014. According to this study black defendants who did not recidivate were incorrectly predicted to reoffend at a rate of 44, 9 percent, which was nearly twice as high as their white counterparts were, with 28 percent. A study by Dressel and Farid (2018) made a similar conclusion; the risk assessment tool was no more accurate or fair than predictions made by people with little or no criminal justice expertise. They also found that the same accuracy made by the 137 items in the risk assessment list could be achieved with a simple linear predictor containing only two features (Dressel & Farid, 2022).

MAM is an acronym for Military Age Males and is a central concept in military lingua and closely related

to the principle of distinction, the idea that in a war situation, civilians and military casualties are treated as separate categories under international humanitarian law, which is of major relevance for Just War theories (Kasher, 2007). Wearing a military uniform is often a strong marker for distinguishing soldiers from civilians, but in situations characterized by insurgency where combatants intentionally disguise themselves as civilians, this distinction is hard to make. However, Sarah Shoker (2021) has pointed out that the military-age male category is not a legal category, but a technocratic creation that is used to identify and manage risky bodies in irregular wars, guided by the principle of just wars and civilian protection. The practice also marks how gender as a category is used as an indicator for risk- calculation, a practice that is exemplified by the use of algorithms and artificial intelligence in drone strikes (Wilcox, 2016). One incident, which is often mentioned as a fatal example of machine-learning algorithms aiding the wrong conclusion, occurred on 21 February in 2010, when three vehicles travelling outside of Shahidi Hassass, in the Uruzgan province of Afghanistan mistakenly where reported from footage of a Predator-drone as military targets which tragically resulted in the deaths of twenty-three civilians (Cloud, 2011). Another example is provided by Sarah Shoker who in her research highlights statistical malpractices such as when the military age males are removed from kill statistics, making the total amount of civilian causalities appear as less aggravating than what is actually is, which was a practice frequently applied during the war in Afghanistan under the Obama administration (Shoker, 2021).

3.4 Discussion

The three examples presented above provide arguments for the assertion that goals connected to social sustainability such as social equity, inclusion and institutional justice, are significant when considering the effects of algorithmic authority in the defense sector. The first example of Geofeedia exposes social surveillance as form of risk profiling which resulted in the detention of minors. The example shows how information from social media can be used without the consent of the users in order to target people as potential troublemakers. Even if people voluntarily share their information on social media, there is a crucial difference between information at an individual level, and knowledge that is being produced by profiling. This knowledge is not available to the individuals involved and they cannot perceive it, but it is nevertheless applied to them by inferring probalistic predictions regarding preferences, intentions and propensities which otherwise would not be evident (Van Otterlo, 2013). The example also illustrates how algorithmic applications determine what a social gathering is, and how properties that appear as “risky” are defined from a societal level (Amoore, 2020).

The second example of COMPAS highlights how risk-profiling assessments can harbor bias, which means that people are not treated fairly or without prejudice, even if such a category is not present in the material from which the assessment was made. What constitutes fairness is for many reasons difficult to encompass. However, when algorithms are applied in situations that have consequences for the freedom of the individual, many important juridical values are compromised such as; transparency, consistency, neutrality, proportionality, accuracy and voice, which thus gravely affect institutional justice (Osoba et al., 2019). The example also shows that the idea that algorithmic applications are better for making these decisions than humans, with their different personalities, opinions and sentiments, is not entirely accurate, since the algorithmic application in reality was not better at making conclusions than people who had little or no legal expertise (Dressel & Farid, 2022).

The third example of MAM shows how the central idea in western liberal war-culture "the principle of distinction", is sustained and promoted by the practice of distinguishing civilians and military in a war situation, a distinction that is primarily based on gender therefor being neither neutral nor accurate. In this way, political language institutionalizes masculinity and its link with violence as a relationship worth monitoring (Shoker, 2021). Lauren Wilcox has said that "the category of gender demonstrates a flaw in the supposed perfectibility of the algorithm or visual surveillance in removing issues of identity or prejudice from security practices" (Wilcox, 2016, 24). Another idea present is that statistics is not an absolute truth, data can be tampered with and propensities that do not fit the overall picture can be excluded.

When viewed together the three examples discussed above show how social implications of algorithmic authority in the security context are substantial, and that their consequences can be detrimental, both for individual citizens but also for society in terms of its democratic processes. This leads to the question: can algorithmic authority applications support values connected to social sustainability, such as fairness, inclusion and institutional justice? The basic perspective on this is that there tends to be a trade-off between the predictive accuracy of an algorithmic process and how fair or equally just the outcome of this process is (Kleinberg, Ludwig, Mullainathan, & Rambachan, 2018). Therefor it appears that algorithmic authority is not conducive for promoting pluralistic values of social fairness and diversity. In fact, democratic values linked to social sustainability, such as open and fair institutional processes are obscured by the opaque and secretive nature of an algorithmic operation (Bucher, 2018; Pasquale, 2015), but also appears as a consequence of the eradication-process that turns individuals into data of preferences, choices and deviant behaviors rather than actual persons (Van Otterlo, 2013).

Furthermore, algorithms contain a propensity that can amplify asymmetrical power structures in society, where algorithms "embody a regime of recognition that identifies what or who matters to the event" (Amoore, 2020, 69), which on a broader level affects knowledge production and justifications for truth.

The question of knowledge production is a serious one to address, since knowledge, famously stated by Francis Bacon in the 16th century, is power, and the ability to scrutinize others while avoiding scrutiny oneself is one of the most important forms of power (Balkin, 2008). The power of the algorithm is not only about classifying what is worthy of attention, but is equally about making "agential cuts" (Barad, 2007), which profoundly affects the way that reality is perceived and narrated. Realities are never given but brought into being and actualized in and through algorithmic systems, in a way that fortifies certain realities, while others are weakened (Bucher, 2018). The algorithmic process is blind, as it absorbs individuals into an single output where "every subject is itself a multitude, but it is multiple without otherness" (Rouvroy & Berns, 2013, XXVII).

When authority increasingly is expressed algorithmically, what is at stake is not only the democratic values on which we have built our societal foundations, but also a reconfiguration where "algorithms are generating the bounded conditions of what a democracy, a border crossing, a social movement, an election, or a public protest could be in the world" (Amoore, 2020, 4). The result is that we cannot observe the world "out there" as an entity that exits apart from us, rather we can see only what our systematic organization allows us to see (Hayles, 1999). From the perspective of security, it is worth to consider the shaping effects that algorithms possess, where the reliance on data and predictive analytics funnel security narratives that moves in particular directions. This all boils down to the larger question of who or what has the power to set the conditions for what in our world that can be known, which values that really count, and what trade-offs that are deemed acceptable.

4. Conclusions

This study has looked at the application of algorithmic authority in the defence sector and its impact on social sustainability. Algorithmic applications are embedded in socio-technical systems, which means that they can either fortify or diminish social sustainability goals. Furthermore, human existence have become so engulfed in the algorithmic network that it is difficult, if not impossible, to treat social goals and algorithms as separate phenomenon's. Therefore, the idea that algorithms are objective and less biased than humans is faulty since algorithms are reflections of our social world. Algorithmic authority in the defence sector challenges diversity and complexity by transforming a multitude of inputs into a single outcome. This practice has major implications for knowledge production since machine learning algorithms do not merely recognize people or things in the sense of identifying them, they actively generate recognizability as such, so that they decide what or who is recognizable as a target of interest. Complexity and diversity is thus obliterated, while normative values are turned into facts.

The co-production between technology, security and social norms is a premise that permeates and subsequently shapes society's foundations and forms a sort of digital truth-regime. Algorithmic processes are transforming this reality, and this reality is shaping us in turn. This notion also has strong significance from the perspective of ethics and knowledge production, where there is a need to think not just about the impact and consequences of algorithmic authority, but also to consider how notions and ideas about the algorithm circulate through the social world. The overall question boils down to how algorithms is shaping the perception of what security entails and what consequences that arise from such an understanding.

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Are Environmental Impact Assessments (EIA) a Suitable Tool to assess Human Rights Impacts?

Joana Pedro[1]

[1] joanajcpedro@gmail.com

Abstract

Environmental Impact Assessment (EIA) is a tool to assess the environmental impacts of projects and support decisions making. EIAs are legally mandated in every country in the world and are argued as an instrument for directing decision-making towards sustainable development. Human Rights Impact Assessments (HRIA) are an emerging practice increasingly demanded by civil society organisations, leading Human Rights Institutions, and even cooperates. This paper argues that instead of dissociating EIA and HRIA, integrating of human rights within an EIA is the best way to ensure that EIAs to continue to play the role to foster sustainable development as defined in the Rio Declaration on Environment and Development (Principle 17).

Keywords: Environmental Impact Assessments (EIA), Human Rights Impact Assessments (HRIA).

1. Introduction

The world faces different unprecedented, mutually reinforcing challenges: the COVID-19 pandemic, climate change, the loss of biodiversity and overuse of natural resources. These challenges have exposed human rights concerns and exacerbated deep fragilities and inequalities in our societies (United Nations, 2021), and those most at risk are persons in vulnerable and marginalized situations (DIHR, 2021).

While emerging from the COVID 19 crises the world have to build better and greener (UNOSD,2021), adopting environmental sensitive approaches (UN, nd) and keeping in mind the words of the UN Secretary General, Guterres (2020), in his call for solidarity "Let's not forget this is essentially a human crisis. Most fundamentally, we need to focus on people – the most vulnerable".

Such recovery will require putting human rights at the heart and reiterate the commitments done in the 2030 Agenda for Sustainable Development. The 2030 Agenda is the cornerstone of international development efforts, grounded in international human rights treaties (DIHR, 2020), signed in 2015 by the UN member countries. It comprises of 17 Sustainable Development Goals (SDGs) aiming to achieving sustainable development by 2030, while ensuring that *no one is left behind* (UN, nd).

Framed in this global context, this paper looks at the intersections and interlinkages between Environmental Impact Assessments (EIA) and Human Rights Impact Assessments (HRIA). In particular,

the author aims to contribute to the debate of whether EIAs should incorporate human rights, as instrument to foster public consultation and directing decision-making towards sustainable development (Retief et al., 2016 and United Nations Conference on Environment and Development, 1992), or if human rights should be covered in separate standalone studies such as HRIA.

2. Methods

This paper is based on literature review as well as the authors own experience as an EIA practitioner and as a Social and Environmental policy maker for Multilateral Development Banks.

Due to practical and time constraints, this paper cannot provide a comprehensive review of the theme, but hopes to contribute to the overall debate.

3. Results and Discussion

Environmental Impact Assessment (EIA)

"Principle 17 - Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority." Rio Declaration on Environment and Development, 1992

Environmental Impact Assessment[1] (EIA) is a tool to assess the environmental impact of projects with potentially significant environmental impacts and ensure that such impacts are taken into account before decisions are made. It can be described as a "forward looking instrument that is able to proactively advise decision-makers on what might happen if a proposed action is implemented" (Partidario, 2012). During the EIA, evidence-based predictions are made to determine impact for the environment if the project goes ahead, with the intention of subsequently find ways to avoid or minimize the likely adverse impacts, and to enhance or maximize the potential positive impacts.

The first known study similar to and EIA was done for the Equatorial Nile Project in Sudan in 1954 (CIEL, 201). In the following decades, pressure rose from conservation movement around the limits to growth. The United States was the first country to legally mandate an EIA through the National Environmental Policy Act of 1969. Nowadays, EIA is legally mandated in every country in the world (Bond et al., 2020)

[1] The author uses "Environmental Impact Assessment (EIA)" as an overarching term that includes all the Social and Environmental impacts. The author is aware that depending on jurisdictions EIA may or not explicitly include social dimensions, and such is covered also in this paper.

and is argued as an instrument for directing decision-making towards sustainable development (Retief et al., 2016). The EIA role and global spread can be traced to the Rio Declaration on Environment and Development (signed by over 170 countries) which specifies EIA as the tool to be used for projects with potentially significant impacts (United Nations Conference on Environment and Development, 1992 - Principle 17).

The right to information and corresponding obligation to acquire information through EIA, and to communicate that information to the public, are also included in the Rio Declaration, but also in the Aarhus Convention, the Espoo Convention on EIA in a Transboundary Context, the Kyiv Protocol, and a variety of other Global Multilateral Environmental Agreements (MEAs) (UNEP 2015). The domestic laws of numerous states also contain such requirements. In the European Union (EU), for example, the European Economic Community established the minimum EIA requirements for all member countries under Council Directive 83/337/EEC (CIEL, 2010), which was later codified together with its amendments by directive 2011/92/EU of 13 December 2011, and amended in 2014 by directive 2014/52/EU.

In this paper the author looks at EIA from an international perspective, recognising that EIA procedures vary considerably between jurisdictions (Morrison-Saunders and Arts, 2004). At an international level the practice is influenced through the work of organisations like: the International Association for Impact Assessment (IAIA), which publishes principles for best practice and organises annual conferences where experiences from practice are shared; United Nations Economic Commission for Europe (UNECE), which prepares conventions and protocols that influence macro level practice; and, by the funding banks signing up to the Equator Principles, which include best practice EIA requirements (Bond et al., 2020).

Legally mandated in every country, EIA is now a standard part of due diligence in most contexts, in particular in the case of large-scale projects such as mines, oil and gas projects, dams and in the case of infrastructure projects, such as roads, water supply or urbanization (DIHR, 2014).

In practice, the EIA process begins with screening and scoping, which determine whether an EIA is necessary and, if it is, what information it should include. Normally the decision for a project or activity to require or not an EIA is based on the likelihood of such activity to cause harm to the environment based on a set of criteria. Most EIAs include baseline information, legislative framework in which the project operates, likely project impacts, analysis of alternatives (including the no-project alternative), mitigation and monitoring measures (CIEL, 2010). These mitigation and monitoring measures and often wrapped as an Environmental Management Plan (EMP). The EMP includes the budget, timelines, roles and responsibilities to implement such measures. The EMP is argued as one of the most important outcomes of the EIA, and its correct implementation will ensure avoiding and minimizing the impacts identified during the EIA process. EIAs are typically paid for by developers (both public and private), who usually employ professional consultants. The report of this work is used by decision-makers, for example states,

to define how the project should be implemented (Morrison-Saunders, 2018). Crucially, the EIA process presents opportunities for members of the public, and other stakeholders, to engage with the decision process, with the exact opportunities specified in local legislation (Bond et al., 2020).

Figure 1 below presents a generic EIA process flow.

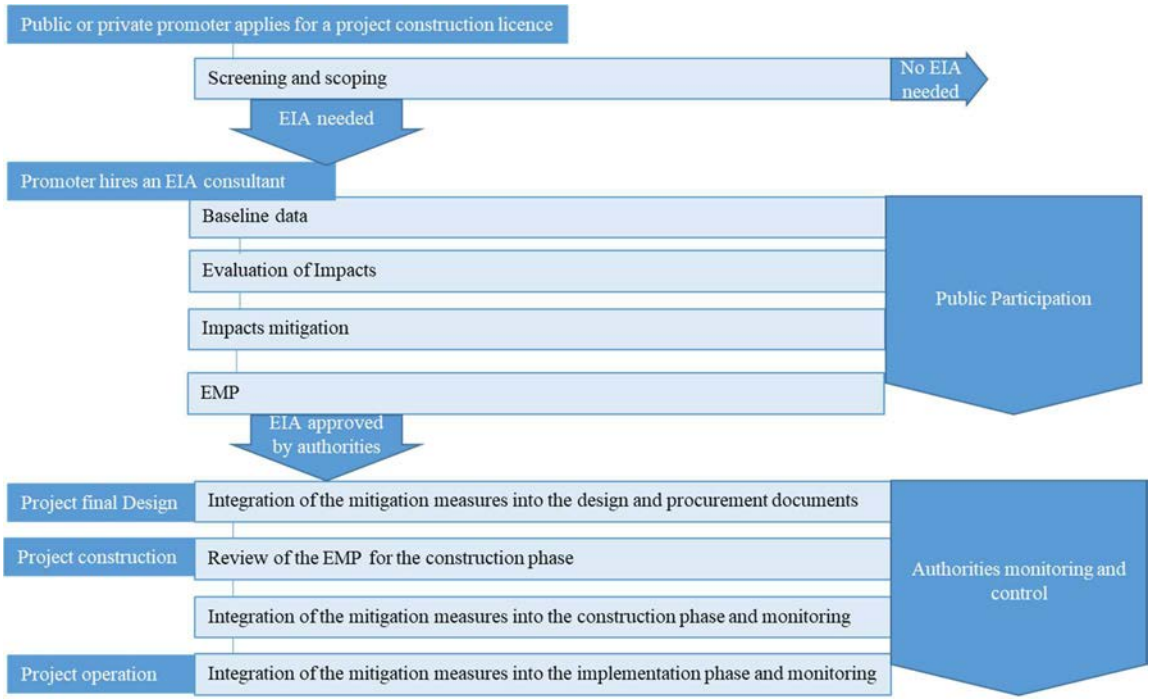

Figure 1. *EIA process flow until project operation (this is a generic flow, each jurisdiction will normally follow the process defined in its legislation)*

When properly applied the EIA process, has the power to:

- Include environmental considerations within the project design, implementation and in the decision- making process (CIEL, 2010), supporting the achievement of the 2030 Agenda for sustainable development.
- Enable public participation, allowing members of the public to express their views (CIEL, 2010), which promotes democratic inclusion and the principal of *leaving no one behind*.
- Produce information and improve democratic access to information (CIEL, 2010), a key principal of human rights.
- Offer a vehicle for cooperation and dialogue between States, especially in situations involving utilization of shared resources or threats of transboundary environmental harm (CIEL, 2010), contributing to promote peaceful and just societies.

Despite the power of the EIA its practice has been plagued with shortcomings (CIEL, 2010), such as the following:

- In many jurisdictions, EIA is required by law as part of the project approval process (DIHR, 2014), meaning that the project can only go ahead following the approval of the EIA. This means that the EIA has the potential to influence the final decision of going ahead with a project. However, the sequencing is frequently reversed, or in some cases the EIA is waived or compromised (United Nations, 2018).
- In terms of timing, often by the time an EIA is concluding, the most important project decisions are already made. These decisions might be irreversible or too expensive to reverse at the time the EIA is finally concluded (United Nations, 2018).
- Often public participation occurs late in the process (CIEL, 2010), and sometimes takes the form of information dissemination sessions, rather than a genuine exchange. The capacity to manage consultation processes in a rights-compatible manner is very limited in most jurisdictions (United Nations, 2018).
- Decisions on whether and how a project should proceed are ultimately and inherently political and political factors can affect the outcome of EIA, the level of controversy and the production and sharing of information (CIEL, 2010).
- Monitoring and mitigation measures recommended in the EIA are often ignored in the absence of external control (CIEL, 2010). In fact, one of the most important take ways from an EIA are the recommendations on which monitoring and mitigation measures will have to be implemented during the different phases of the project to mitigate any impact identified. But if no proper control occurs such measures will likely not be implemented.
- Social impacts considered in EIAs are often limited to demographic changes, job issues, financial security, and impacts on family life, rather than all issues that affect people and communities, directly or indirectly (Vancley, 2003). Indeed, while all countries have legal frameworks to evaluate environmental impacts, including formal information and public participation instances, as well as mechanisms to access justice in case of rights violations (FIO, 2019), just some jurisdictions include social dimensions, either directly or indirectly, in the EIA. Specific regulatory requirements for the explicit inclusion of social impacts remains limited (DIHR, 2014).

Human Rights Impact Assessment (HRIA)

"(…) all policies and measures adopted to advance sustainable development must be firmly grounded in, and respectful of, all internationally agreed human rights and fundamental freedoms, including the right to development. To these ends, all actors, in both the public and private sectors, should exercise due diligence, including through the use of human rights impact assessments." OHCHR, 2012

The Danish Institute of Human Rights (2013) defines Human Rights Impact Assessment (HRIA) as a process for identifying, understanding, assessing and addressing the adverse effects of a project or activity on the human rights enjoyment of impacted rights-holders such as workers and community members. HRIAs can take various shapes and be led by different stakeholders, but should share the ultimate goal of protecting human rights and improving accountability.

HRIA normally focus on the rights listed in the International Covenant on Civil and Political Rights, the International Covenant on Economic, Social, and Cultural Rights, and the fundamental International Labor Organization conventions. Depending on state obligations and salient issues, impact assessments can also integrate human rights enshrined in instruments such as the Declaration of the Rights of Indigenous Peoples and the African Charter on Human and Peoples Rights (Reynolds, 2019).

Compared to EIA, HRIA is an emerging practice and guidance and literature on HRIA, as well as public domain examples of actual assessments that have been undertaken, are sparse (DIHR, 2014). The same goes for specific legislation around HRIA. Contrary to EIA, that is legislated in all world jurisdictions and has known international best practices (Bond et al., 2020), HRIA for specific projects is not mandatory in any jurisdiction or as part of the international human rights law.

Nevertheless, International human rights law outlines states obligation to protect human rights. This means that state parties must implement legislative, administrative, and other measures to ensure that the implementation of a any project by either state or non-state actors (public or private developers) do not lead to human rights abuses. How this can be achieved is not clearly prescribed, but HRIA is one way for states and developers (if different from the state) to manage this risk and comply with these legal obligations (Reynolds 2019). This idea is supported by OHCHR (2012), whom on their key message for the United Nations Conference on Sustainable Development (Rio+20), in 2012, has stated that "both the public and private sectors, should exercise due diligence, including through the use of HRIA."

Other big impulse on the emerging of the HRIA practice has been the United Nations Guiding Principles on Business and Human Rights (UNGPs) established in 2011. Although the UNGPs are particular dedicated to business, their mandate for a human high due diligence have been referred to not only for projects led by private sector, but also to the ones led by public sector.

The UNGPs were the first authoritative guidance issued by the UN regarding business and human rights, building on the earlier "respect, protect, remedy" framework (Reynolds 2019). The UNGPs have become the first globally accepted standard covering the responsibilities of states and businesses in preventing and addressing business-related human rights abuse (European Parliament, 2017). The UNGPS provide a strong legal mandate and include the expectation that businesses implement due diligence to identify, avoid, mitigate and remediate the human rights impacts with which they are involved (Kemp and Vanclay, 2013). The UNGPs do not define which instruments to use in such due diligence, but indicate that a range of approaches may be appropriate for assessing human rights impacts (Kemp and Vanclay, 2013). In particular the UNGPs introduces the concept that all rights need to be considered, assuming an approach of screening out rather than screening in specific Human Rights. This does not necessarily mean that all human rights need to be considered to the same level of detail, but rather that the exclusion of any particular topics needs to be duly explained (DIHR, 2013 & 2014).

After a decade of the UNGPs, different countries are in different phases of translating the UNGPs into their legislation. In the EU, the European Commission has adopted, on February 2022, a proposal for a Directive on corporate sustainability due diligence, that aims at introducing business and human rights due diligence obligations throughout the EU (Debevoise&Plimpton, 2021). This makes the next decade decisive on defining how to ensure human rights due diligence and which instruments and tool should be used.

Such new legislation, couple with demands from civil society organisations (CSOs), leading Human Rights Institutions, and even cooperates for binding rules on human rights due diligences (see for example: ECCJ, 2019 and BHRRC, 2021) will likely push for HRIA to become a more common practice in the next years. One of the questions that will be asked more frequently, and that the next chapter tries to address, is whether assessing human rights impacts should be done in a "stand-alone" HRIA or as part of an EIA (Kemp and Vanclay, 2013).

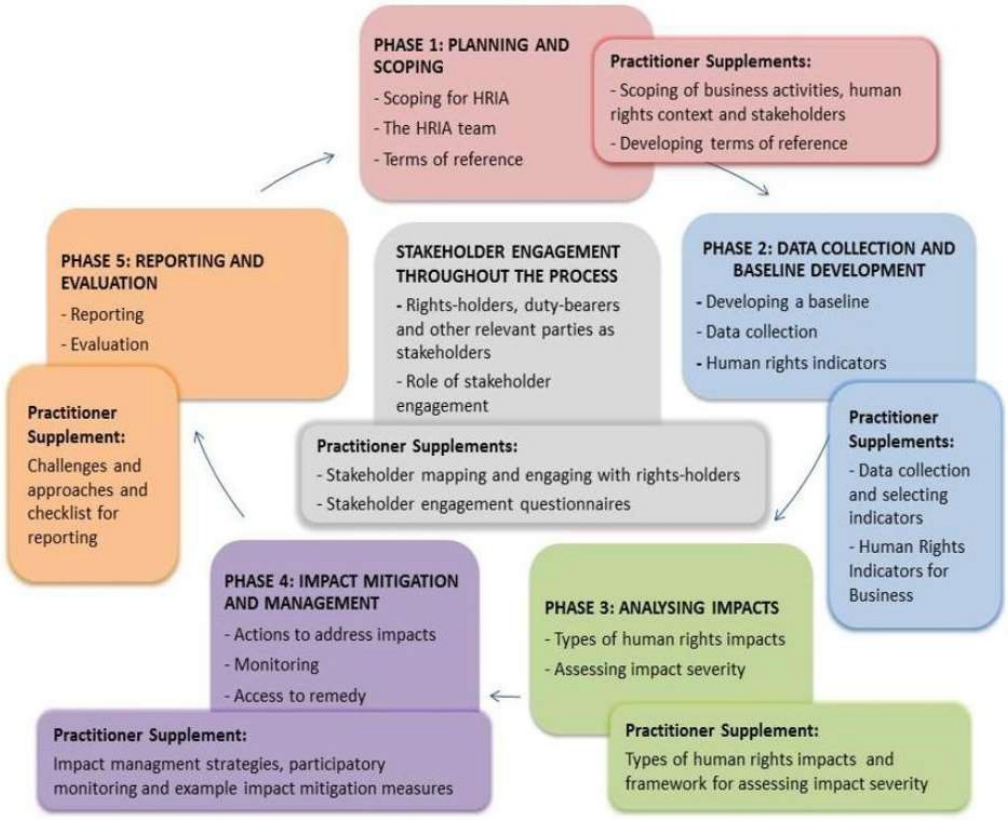

***Figure 2**. Phases of HRIA (DIHR, nd)*

EIA as a tool to assess of Human Rights Impacts

"All human beings depend on the environment in which we live. A safe, clean, healthy and sustainable environment is integral to the full enjoyment of a wide range of human rights, including the rights to life, health, food, water and sanitation. Without a healthy environment, we are unable to fulfil our aspirations

or even live at a level commensurate with minimum standards of human dignity. At the same time, protecting human rights helps to protect the environment. When people are able to learn about, and participate in, the decisions that affect them, they can help to ensure that those decisions respect their need for a sustainable environment." OHCHR; 2012

In recent years, the recognition of the links between human rights and the environment has greatly increased. The number and scope of international and domestic laws, judicial decisions, and academic studies on the relationship between human rights and the environment are growing rapidly (OHCHR, 2012) and has been further highlighted recently with the resolution recognizing access to a healthy and sustainable environment as an universal right (Human Rights Council, 2021). EIAs have particularly been referred to in regional human rights courts on cases related to the states obligation to assess and disclose[2] foreseeable environmental risks as part of their positive duties to protect, respect, and fulfil various human rights. This includes any environmental risks caused by government activity, as well as other environmental risks that threaten the exercise of human rights (UNEP 2015). For example, in instances where pollution caused by third parties has interfered with the right to enjoy private life to such extent as to call for State protection, the European Court of Human Rights has resorted to a proportionality test and scrutinized the governmental decision-making process, including whether proper assessment of impacts and alternatives have been undertaken (CIEL,2010).

These examples, make a case for the explicit consideration of human rights in EIA. Several scholar such as Kemp and Vanclay (2013), Esteves et al. (2017) and Majekolagbe et al. (2020) strongly advocate for an integrated approach, especially in projects affecting livelihoods, environment, health, safety and security, land and property, culture and gender dynamics. Also international organizations, such as the Ibero-American Federation of Ombudsman (2019) recommended incorporating a human rights-based approach

[2] The Universal Declaration of Human Rights and the International Covenant on Civil and Political Rights provide that the right to freedom of expression includes the freedom to seek, receive and impart information. Human rights bodies have stated that to protect human rights from infringement through environmental harm, States should provide access to environmental information and provide for the assessment of environmental impacts that may interfere with the enjoyment of human rights (UN, 2016).

in EIAs and OHCHR (2018) further states that "a host state's failure to implement the findings of an EIA and or the failure to integrate human rights risks within the EIA, may violate the state's duty to protect human rights".

There are lot of parallels and overlaps between EIAs and HRIAs. Issue areas typically considered in EIAs are similar to those that are key to human rights. And core human rights principles, such as participation, accountability and transparency are align in spirit with the IAIA social impact assessment best practices (DIHR, 2013 and Vanclay, 2003). Therefore their integration would allow to address human rights impacts

by building on existing systems and existing legal frameworks, enabling a more holistic assessment of the different impacts, more efficient use of project time and resources, and avoid stakeholder consultation fatigue (DIHR, 2013). Furthermore, it could help to overcome the shortcomings identified in the previous chapter and improve the EIA outcomes. The integration of HRIA within the EIA would potentially lead to the following outcomes:

- HRIA proceeds from a clear starting point of the internationally recognised rights. This means that the legal framework analysis that is normally done in and EIA would in this case include explicit consideration of international human rights standards, including analysis of the degree to which such international standards are reflected in domestic laws and practice in order to facilitate legal enforcement and actual enjoyment of human rights at the national level (DIHR, 2014). Considering human rights in the EIA would entail the approach of screening out contrary to an EIA that normally focuses on those human rights that are most salient in the given context understanding (Kemp & Vanclay, 2013). The approach of screening out rather than screening in specific issues has the potential to avoid the omission of any human rights impacts through requiring the initial consideration of a comprehensive set of human rights, and a considered explanation regarding the subsequent exclusion of any particular topics (DIHR, 2013 & 2014).
- Most, if not all, social impacts can be understood in human rights terms. Thus, human rights can be an enabling framework to include social impact properly within the EIA. The UNGP provides a stronger legal mandate than has existed in the past in terms of considering of social issues, now under the guise of human rights. Under the UNGP, project-affected peoples are no longer simply stakeholders or impacted communities; they are rights-holders3 with legitimate interests that need to be respected (Kemp & Vanclay, 2013; Esteves et al., 2017). This would also help paying special attention to specific persons or groups (indigenous populations, women, refuges and refugees and internally displaced persons, amongst others), guarantee substantive consultations to those groups potentially affected and effective reparation mechanisms in case of human rights violations (FIO, 2019).

[3] *Rights holders: all individuals, including communities and individuals who are impacted by projects, are human rights holders. Organizations or entities, such as States, trade unions or religious institutions, are not human rights holders, but may act in a representative capacity for individuals or groups who are human rights holders*. (DIHR, 2013).

[4] *Duty bearers: these parties are actors who have human rights duties or responsibilities towards affected communities and individuals. States are the primary human rights duty bearers—they have a legal obligation to protect, respect and fulfil human rights. Project promoters have a complementary responsibility to respect human rights, to avoid infringing upon the rights of others and to address those impacts with which they are involved* (DIHR, 2013).

- Majekolagbe et al. (2020) suggest that integrating human rights into EIA would not only help ensure consideration of rights which might otherwise be overlooked, but also may impose enforceable obligations on the project developers and their consultants as duty bearers4. Indeed, clearly identifying rights-holders and duty-bearers in stakeholder analysis supports an emphasis on the accountability of duty-bearers in international human rights law, duty-bearers have the obligation to provide effective remedies to individuals for human rights breaches.
- From a human rights perspective, the principle of inclusive participation goes beyond mere consultation or a technical add-on to project design. Applying this understanding of participation

in an EIA context would require that rights-holders are enabled to meaningfully take part in shaping and influencing the assessment process itself, as well as impact-related findings and decisions. (DIHR, 2014). It would also consider access to remedy, with operational-level grievance resolution available throughout an impact assessment process, as well as throughout the project lifecycle, to capture any shortcomings in impact identification and mitigation, including new issues arising (DIHR, 2014). The term 'human rights' resonates differently amongst people, and can in some countries be a very loaded term leading to confusion, concern and sensitivities, especially in jurisdictions where discussing human rights is forbidden or inhibited (Kemp & Vanclay, 2013). An integrated EIA has the benefit of addressing human rights while using a framework and language that can be context specific and allow for the treatment of human rights without putting people, and specifically human rights defenders, at risk (DIHR, 2013).

- Finally, in a more practical level, is important to consider that one of the most important outcomes of the EIA is the EMPs. The EMPs are to be follow during construction, operation and decommissioning phases of the project to avoid or minimize the impacts that have been identified. It is very important that the EMPs are implementable and that minimization measures defined for certain impacts will not exacerbate other impacts. For this reason it is important that the same team work on the EMP, ensuring that all the impacts of the project, be it environmental or human rights are considered when defining the measures that will have to be put in place. Furthermore, from a promoter and constructor perspective, having all measures in one document makes it easier to follow and monitor.

[3] *Rights holders: all individuals, including communities and individuals who are impacted by projects, are human rights holders. Organizations or entities, such as States, trade unions or religious institutions, are not human rights holders, but may act in a representative capacity for individuals or groups who are human rights holders*. (DIHR, 2013).

[4] *Duty bearers: these parties are actors who have human rights duties or responsibilities towards affected communities and individuals. States are the primary human rights duty bearers—they have a legal obligation to protect, respect and fulfil human rights. Project promoters have a complementary responsibility to respect human rights, to avoid infringing upon the rights of others and to address those impacts with which they are involved* (DIHR, 2013).

To achieve this outcomes is important that the integration of human rights with the EIA process goes beyond a tick boxing exercise, with EIA teams getting human rights expertise and legislations specifically requiring the focus on human rights. But, it is important to ensure that EIAs don't become so cumbersome that are too long to implement and don't allow for people to properly participate in it, particularly those directly affected by a project. Lessons learned from the years of implementing EIAs can and should be used when developing the best practices in which to fully introduce human rights within EIAs.

Furthermore, The Danish Institute of Human Rights (2013) also suggests that in most cases, while there are significant benefits in integrating HRIA within the EIA, there can be circumstances where a project may require a dedicated specific assessments incorporating a human rights analysis, when a particular topic warrants additional attention. For example, such assessments may focus on resettlement, indigenous people, conflict analysis or labour issues and supply chains. When considering how to integrate human rights considerations into EIAs, it important to look at all subject areas and understand whether such issues are best covered as part of the EIA process or through other assessments. Nevertheless, the rationale for exclusion of specific human rights issues from the scope of an EIA or an explanation of how these issues are covered under different assessments should be explained in the EIA (DIHR, 2013).

In this chapter the author doesn't defend that EIA should be the only tool used to assess human rights due diligences, but rather that whenever a project triggers the need for an EIA, integration of human rights should become mandatory. In this cases the EIA should clearly state how human rights due diligences were considered and only proceed to separate human right studies if there is an argument that some human rights aspects would not be possible to be looked at within the EIA framework.

The SDGs and the 2030 Agenda are considered transformative because of their human rights based approach (Rattray, 2019). For EIAs to continue to play the role to foster sustainable development as defined in the Rio Declaration on Environment and Development (Principle 17) it is imperative that they are re-invented to also fully introduce an human rights approach.

4. Conclusions

This paper aimed at identify the relevance of integrating human rights within EIAs. Based on the literature research the author concluded on the need to integrate human rights within EIAs. The analyses indicates that EIA can be an enabling framework to consider environmental and human rights from the outset of a project, giving decision makers enough information to decide on how a project can ensure respond to the needs while doing no harm.

The author have argued throughout this paper that:

- Despite its shortcomings, EIA practices can improve the environmental and social outcome of a project, support decision making, foster public engagement and access to information, advance transboundary cooperation, and, overall contribute to the achievement of the 2030 Agenda.
- Integrating of HRIA within an EIA has the potential to augment the EIA outcomes, while building on existing systems and existing legal frameworks, enabling a more holistic assessment of the different impacts. Therefore the author defends that, whenever a project triggers the need for an

EIA, integration of human rights should become mandatory and the need to specific human rights assessments dully justified in the EIA.

Based on these conclusions, guidance on how to integrate of human rights in both EIA should be considered. Such guidance shall be made in such a way that is properly understood by legislators, practitioners and public in general so that it goes beyond a tick boxing exercise, and, at the same time, doesn't become too cumbersome to actually be implemented.

UN and world leaders made a pledge to build better and greener (UNOSD, 2021), it is now important to "walk the talk". Human rights responsive EIA, are a good example of environmental sensitive approaches that puts human rights at the centre, ensuring that no one is left behind (UN, nd).

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Recycling and Poverty in Brazil:

New threats to the inclusion of waste pickers

Laísa Santos Magalhães[1] , Armindo dos Santos de Sousa Teodósio[2]

[1]*Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil, magalhaeslaisa18@gmail.com*

[2]*Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil, armindo.teodosio@gmail.com*

Abstract

This study analyses the possibilities and challenges of popular and solidary recycling in the reconfigurations of the field of contemporary recycling in the context of Minas Gerais state in Brazil. In this way, it covered discussions on sustainability and inequality, linked to the social and solidarity economy and the economy of functionality and cooperation. To carry out the study, a qualitative research approach was adopted, which had a semi-structured interview script, applied to the various actors involved in the recycling chain, totaling 26 respondents selected through the snowball method. The reason why we chose to study the context of Minas Gerais state, Brazil, comes from the diversity of scenarios that the state has, because it stands out for the emergence of the first association and for prohibiting incineration by Law n° 21.557/2014. However, the current scenario is marked by several turbulences faced by recyclable material pickers, which reflect the devaluation and stigma of pickers during their trajectory. In addition, it is a reflection of the actors that make up the contemporary recycling chain and that interact with each other. Despite these turbulences, the waste pickers seek to fight with resistance and resilience, a skill that they develop since the beginning of their trajectories due to the social impacts experienced, opening paths to several possibilities.

Keywords: Recyclable Material Collectors, Recycling, Solidarity Popular Economy, Solid Waste Management.

1. Introduction

This research analyzes what are the challenges and possibilities present in the contemporary recycling chain to maintain a popular and solidary recycling in the context of Minas Gerais.

In order to support this study, it is essential to mention the theme of Sustainability, which permeates the idea of care for society and nature through a connection between them and the conscious use of resources, inducing environmental justice (Ayres, 2008; Lozano, 2012).

In addition, it covers the issues of Political Ecology that seeks to understand the dispute and sharing of natural resources by various social actors at different levels of power (Loureiro & Layrargues, 2013). Ponders ecological, socio-environmental conflicts and environmental justice. Thus, it seeks to adhere to the principles of solidarity, respect for nature and living beings, in order to contribute to the construction of a just and democratic society in the social, environmental, political and cultural spheres.

Therefore, it goes against the Social and Solidarity Economy, as it seeks to expand work with human quality, it emphasises the logic of sharing, reciprocity, solidarity and cooperativism, where the social must prevail over capital. (Souza Santos, 2002; Tauile, 2002). And it is also in line with the discussions on the Economy of Functioning and Cooperation - EFC, which is characterised by establishing a dynamic of cooperation and sharing of non-renewable material resources, stimulating recycling, with a focus on reducing environmental impacts (Du Tertre *et al.,* 2019).

Given these approaches, it can be said that the issue of waste is characterised as a worldwide problem, as humanity raises its consumption levels year after year, increasing the number of waste generated and improperly disposed of in the environment (Kaza *et al*., 2018). Making the final disposal of these residues environmentally appropriate, an essential action to reduce the negative impacts in the environmental and social sphere (Gonçalves-Dias *et al*., 2015).

Therefore, the management of waste materials becomes essential, since the inadequate disposal of waste can impact groundwater, soils through the penetration of leachate into the subsoil and impacts on air quality (Maiello *et al*., 2018) .

Selective collection practices are of paramount importance for the proper disposal of urban solid waste (MSW), especially when done by autonomous recyclable material collectors organised in recycling cooperatives. Since they were the ones who started the selective collection activities in the country, when they saw in the waste a possibility of income and sustenance.

It is pointed out that there are different terminologies regarding the recycling carried out with the inclusion of recyclable material collectors. However, for the purposes of this study, the term popular and solidary recycling was adopted, considering that the principles of Solidarity Economy and Functionality and Cooperation Economy are part of the analysis of this study. Another reason is that this term refers to the inclusion of workers who are made invisible, marginalised and who deal with obstacles to entering the labour market. Thus, if there is no intention for solidarity and for the popular, guided only by the logic of the market, the collectors would not be included and would have even more precarious conditions in a perverse market.

For, what currently occurs is a precariousness of the work of recyclable material collectors, of their popular

recycling logic and their solidarity enterprises, considering that the contemporary recycling chain has several actors, with different levels of power, demands and interests.

Thus, based on what is exposed through the themes addressed, the objective of this study is to analyse the possibilities and challenges of popular and solidary recycling in the face of the reconfigurations of the contemporary recycling field.

This investigation becomes essential as, worldwide, 2 billion tons of MSW are generated annually, and much of it is still inadequately destined due to the lack of effectiveness of public policies, lack of environmental awareness and programs of selective collect.

In addition, this research becomes essential as the waste has become part of the service chain and the recycling value chain, where several actors have joined this chain, competing daily with recyclable material collectors who deal with the burden and the selective collection bonus for decades.

2. Methods

For the development of this research, a qualitative approach was adopted, since, Yilmaz (2013), gives us the idea that such a research method is used in a naturalistic environment, involving people, so that it seeks to understand the phenomenon as a whole, for a long term.

For data collection, initial conversations were held with various actors involved with the recycling chain, mainly the leaders of waste pickers and movements that support recycling with the inclusion of waste pickers such as the Nenuca Institute for Sustainable Development (INSEA) and the National Association of Recyclable Material Collectors (ANCAT).

This initial conversation made it possible to have a greater knowledge of the field and the experience of the collectors and their demands in the face of the reconfigurations of the recycling chain. Making it possible for these actors involved with the social-inclusive context of recycling to also participate in the interview that was later elaborated through a semi-structured script.

As for the interview script, it raised questions about the historical struggles and the progress that recyclable material collectors have experienced, as well as the threats present in the changes in legislation and that open space for new actors to reconfigure the recycling chain and exclude the collectors. And questions were raised about the relationships of recyclable material collectors with their various stakeholders.

It can be said that the respondents involved the leaders of the recyclable material collectors of the Association of Paper, Cardboard and Reusable Materials Collectors of Belo Horizonte (ASMARE), of the Association of Recyclable Materials Collectors of Nova União (UNICICLA), of the Association of Recyclable Material Collectors of Sarzedo (ACAMARES), the Association of Recyclable Material

Collectors of Itabirito (ASCITO) and the Solidarity Cooperative of Recyclers and Productive Groups of Barreiro and Region (COOPERSOLI) that are present in the State of Minas Gerais, autonomous and waste pickers dealing with the issue of composting.

Leaders of the National Movement of Collectors of Recyclable Materials (MNCR), the CATAUNIDOS Network, the Network of Collectors of the South and Southwest of Minas Gerais, ANCAT, the Observatory of Inclusive and Solidarity Recycling (ORIS), teachers and student researchers who work with the themes of popular and solidary recycling, working at PUC Minas, UEMG, UFMG and UNICAMP.

Finally, there were also respondents representing AVINA Foundation, environmental consultant for Vale operating in Brumadinho, consultant for Instituto Sustentar, advisors to deputies and councillors from Belo Horizonte, state deputy from Belo Horizonte, representatives of the Urban Cleaning Union of Belo Horizonte , owner and representatives of private companies that make selective collection, such as selective collection applications and representative of an intercity public consortium that manages solid waste in the municipalities of Congonhas, Conselheiro Lafaiete, and Ouro Branco - Minas Gerais state, Brazil.

It should be noted that the interviews took place individually and in depth, as they sought to capture detailed information from each individual. Also, it should be noted that they took place remotely, due to the Covid-19 pandemic.

To access these different actors, the “Snowball” method was used, which allowed the initial interviewees to indicate new individuals to be interviewed, and so on, until data saturation and the research objective was reached. It became extremely viable as it enabled contact and approximation with key elements for carrying out the research (Baldin & Munhoz, 2011).

26 semi-structured in-depth interviews were carried out in a virtual way, through the Google Meet platform and by telephone contact and recorded with the help of an electronic recorder, in view of the Covid-19 pandemic situation.

For the analysis of the collected data, an interpretative qualitative approach was used based on the reports collected through the interviews. The interviewees reports were analysed individually and together, aiming to cross the different points of view. Still, this study used multiple sources of data collection, such as documents, records of files and interviews, in order to complement the data and for the phenomenon to be based on more robust evidence.

3. Results and Discussion

In the last decades, solidarity enterprises with a focus on solidary recycling have increased significantly

in Brazil, which, recognized by the National Solid Waste Policy, began to be incorporated into some municipal recycling programs.

The creation of these solidarity enterprises (cooperatives and associations of recyclable material collectors) represented a low-cost solution, thus attracting the municipalities. This favored the dissemination of solidarity recycling programs in Brazil around the 1990s and resulted in 445 municipal recycling programs in Brazil effectively carried out in 2008 in partnership with these solidarity enterprises (Cândido *et al.*, 2018).

However, there are numerous challenges to maintain a popular and solidary recycling with the role of recyclable material collectors in the 21st century. It is undeniable that contemporary recycling has been suffering several turbulences due to a plurality of actors present in this sector, of different orders and that relate to each other and as environmental policy has become a big business (Lounsbury *et al*., 2003).

Initially, it is clear that one of the central points of this issue is the issue of discrimination and prejudice that recyclable material collectors deal with throughout their work in selective collection.

We were called the big bad wolf, animal, crazy and the bag man, each one gave a name to this representation [...]. So there was a lot of prejudice, prejudice on the side of the family and friends [...] (COLLECTOR 4).

The collector is already a public that is unfortunately marginalised by society. So a while ago I did a paper on the meaning of garbage and I went into the word branch to try to understand why people carry this stigma. The first challenge that I see they face is that people who work with garbage are seen like garbage. So this is related to prejudice [...] people believe that the worker who works with waste, with garbage, he went to that option because he wants to, because he is a bum, pardon the word, and not it's just like that. (TEACHER 2).

Due to their low level of education and the precariousness in which they live, waste pickers are considered disposable parts of the social gear and a perverse inclusion, seeing in the garbage a form of income and survival (Miura & Sawaia, 2013).

This stigma experienced, in addition to representing a lack of socio-environmental awareness on the part of society about the work performed by recyclable material collectors, also reflects the issue of support from public authorities at the federal, state and municipal levels. As well as the issues that involve the existence, applicability, inspection and effectiveness of public policies aimed at the inclusion of recyclable material collectors and their enterprises, whether associations or cooperatives.

Because, despite the practice of collecting waste being a regulated profession in the Brazilian Occupations Catalogue under the number 5192-5, many collectors still work informally in a situation of fragility and

non-protection by the public power. Consequence of non-investment by the State and a large number of cooperatives and associations of recyclable material collectors that still do not have agreements with the city halls.

This carelessness of the public power ends up impacting the performance of recyclable material collectors, because there are no social, technical and political investments, there is no ample space for dialogue and the construction of public policies together with the collectors. Thus, it allows new entrants to influence the performance of the recycling chain and make it excluding, as it does not adhere to the premises of popular and solidary recycling, as do collectors.

I have seen in the state of Minas Gerais why the selective collection does not advance, why the mayors do not have the view that the collector needs to earn their bread through recycling [...] the mayors do not want to give protagonism to the collectors (COLLECTOR 7).

The first challenge, which is still a big challenge, is for the city halls to recognize our work, but not a welfare work, an assisted work, but a service provision work [...]. Governments actually have policies and legal instruments, they don't do it because they don't want to. Because the federal government has the National Waste Policy, it has national waste plans, there are several things there to support waste pickers, they don't do it because they don't want to (COLLECTOR 10).

There is an indignation and an abandonment of the collectors, given the inexistence and the dismantling of the policies that were built in the past. This dismantling ends up making the solidary enterprises of recyclable material collectors precarious, leaving them without financial, technical investments and without assistance. This scenario is in agreement with the study by Spoann *et al*. (2018) by claiming that the merely political interest in a given situation weakens supervision and control, reducing the authorities' ability to enforce the laws.

In this context, Law No. 12,305 of August 2, 2010 is cited, which institutes the National Solid Waste Policy (PNRS) which aims to effectively manage solid waste with the inclusion of collectors' cooperatives in the selective collection process (Brasil, 2010). But, which has been moving slowly, as pointed out in the report of Waste Picker 4, faces several bureaucratic and financial obstacles for its effective execution, becoming limited (Silva *et al.*, 2016; Maiello *et al*., 2018).

We have the National Waste Policy at 12,305, since 2010. And there's so much in it that says it's good, that it's there to improve the work, to improve the issue of the work of the collectors. And since 2010, and we are in 2021, and there are few things that are being said in politics and that we managed to achieve, there is no inspection (COLLECTOR 4).

Thus, the incentive from the government to private companies to compose the contemporary recycling

chain is increasing, due to the lack of interest and understanding of municipal and state managers for the socio-environmental benefits that recycling with the action of collectors entails, and also due to prejudice with waste pickers, by associating their ability to perform quality work with poverty issues.

As pointed out by Assessor 1, the actions are often directed towards the environment, but do not focus on the collector. This shows the lack of political will to include waste pickers and a deep-rooted prejudice against them, to actually apply what is established in the National Policy on Solid Waste.

In Brazil, we see the dismantling of public policies, especially in the field of work, and the collector is inserted in the field of work. [...] There is a lack of actions aimed at inclusive recycling, an action aimed at strengthening cooperatives and associations in their organisation, buying inputs, scales, carts, mats, we don't see, we are not within the budget. [...] The public power itself, it doesn't put the pickers inside, it only calls when it's some action that it needs to highlight the pickers, then it calls. [...] things come from top to bottom, taking as an example the Public Notice number 1 of the Environment [...] that did not call nor does the name of the collectors appear inside, did not call for dialogue, for construction, it just came from the top down, and then we have to do these fights here (ADVISOR 1).

Thus, this carelessness leads to the scrapping of the solidary enterprises of the collectors, where they seek to privatise the waste management chain, in order to make room for other actors to enter and begin to make these policies more flexible or tamper with.

However, the government's relationship with waste pickers was not always marked by this lack of interest. In view of the collectors' statements, it appears that during the Lula (2003-2011) and Dilma (2011-2016) years of government there was more incisive support from the federal government. There were investments, incentives and training, which made it possible to leverage the solidary enterprises of the collectors, as this government had a perspective of solidarity and inclusion of this class.

This period had a partner government of the collectors, since there were many incentives for the collectors of recyclable materials. In this sense, direct investment programs in cooperatives are mentioned, such as Cataforte, which began in 2009 and the recognition of the professional category of collectors through code 5192-5 (Rossi, 2019; MTE, 2002).

Thus, distancing itself from the logic of the current government, which goes against these principles that were built and which has a capitalist perspective, of lack of interest in selective collection, with collectors and socio-productive inclusion.

There is no public policy with the current government! For the current government, there is no collector of recyclable materials, for the current management there are consortia, there is incineration, there is CDR, there is everything except the work and appreciation of the collectors, there is no dialogue with the current

government (COLLECTOR 6).

You have a lot of people who are not interested in selective collection advancing, the large landfills receive per ton buried, so the more material you can get through selective collection, people stop making money. So there is a very large lobby so that selective collection does not advance, and for it to advance, the first step is structuring and professionalisation (ADVISOR 2).

And as cooperatives and associations are not prioritised, they are unstructured, without training and management notions, collectors are increasingly facing barriers to direct marketing with the industry. That discourse of prejudice with the collectors, of incapacity and the need for assistance remains in the industry.

The work that pickers do is relevant, but I think they [self-employed pickers] should not be encouraged to continue as pickers. I think they should be trained to be able to integrate into the industrial process, and not simply to generate inputs for the industrial process, because this is very poorly paid. [...] The next step that, in my view, should be implemented is for the municipalities to implement selective collection, this collection will be done by qualified people, they are people from companies in the municipality itself who will do it properly protected, take this material to a shed that is equipped, with protected people also to make the selection and processing of what is to be sold to the industry (BUSINESSMAN 2).

It is very bad for the associations because they have no knowledge, right? And a company invests mainly in knowledge, it is able to get out of the way of associations (CONSORTIUM 1).

Thus, as this thinking of prejudice is perpetuated, it is also stimulated a thinking focused on the privatisation of the sector. Where only private companies will be able to carry out selective collection and sale to industries. This causes the recycling chain to get longer and longer and the collectors remain more and more at the base, excluded and in the hands of the so-called “middlemen” and “buyers”, with an increasingly smaller income, or change their solidary logic, to integrate in private companies in order to guarantee income and sustenance.

Middlemen, also known as intermediaries, scrap dealers and junkyard owners, who largely pay unfair values to collectors, make collectors at the mercy of unstable prices imposed. Furthermore, it ends up intensifying the exclusion of this category, inducing a logic of exploitation that supports the entire recycling chain and refers to a major obstacle that the solidarity enterprises of recyclable material collectors have to formulate marketing strategies for their materials (Silva *et al*., 2021).

Middlemen is imposing policy, right? At the end of the year they lower the price, they throw it down and what do we do if we don't have working capital? They want to impose on you [...]. The middleman sets the price he wants and if he wants it, that's it, if he doesn't want it, it's his problem, that's the relationship (COLLECTOR 1).

In addition to these issues with middlemen, another point where the goods production industry makes room for yet another challenge for collectors is the packaging developed. Often, the industry puts on the market a product with a certain package that does not have recyclability potential, not establishing a dialogue between packaging, consumption and disposal.

Thus, in accordance with what is pointed out by Collector 10 on the issue of mandatory for companies to manufacture packaging that is actually recyclable, Conke (2018) claims that the legislation spares the industry and that there are no laws effectively obliging them to be responsible for their post- consumer packaging. As a consequence, it is noted that current packaging design practices do not facilitate the work of recyclable material collectors, as many packages have no value due to low recyclability and also due to the absence of reverse logistics available.

We can't discuss something if we don't have an obligation for packaging manufacturing companies to manufacture packaging with greater recyclability potential. So, you have in the cooperatives various materials that are stranded in the cooperatives and unfortunately even return to a sanitary landfill, because they do not have the potential for recyclability, and it is not the cooperatives fault. Because the cooperative collects, processes, does not receive anything for this and the material is stopped inside the cooperative. The big culprit is the industries that manufacture these packages and have no recyclability potential. So you need to charge companies, so that they start to manufacture packaging that they have a recyclability potential (COLLECTOR 10).

It can be said that as the materials do not actually have recyclability, they, in addition to negatively influencing the issue of sales by collectors of recyclable materials, also influence environmental issues and environmental education, as they are sent to the sanitary landfill.

Therefore, it is essential that companies adopt truly sustainable technologies in order to develop products where the design and the issue of recyclability of products dialogue more with sustainability issues and less with strictly marketing objectives.

Also in the field of sustainable technologies, one can cite the socio-environmental impact businesses that, according to Comini and Roslen (2019), refer to a typology of hybrid company, whose mission seeks to solve social and environmental problems, associated with a perspective of produce positive and sustainable financial results.

These business trends arising from impact businesses seek to combat the cycle of poverty, exclude individuals from the base of the pyramid and address existing environmental demands. Therefore, it is similar to the Circular Economy (CE) perspective, which has an approach based on the regenerative production model, through the expression Cradle-to-Cradle (C2C). Which refers to the idea that waste

goes from “cradle to cradle”, that is, it is reused in new production processes (Leitão, 2015).

Within this perspective, startups are cited as a contemporary work trend demanded through smartphone applications, which connect users to different types of service, as in the case of the Uber company and even in the MSW selective collection sector. Thus, a new way of working is the protagonist of debates (Cardoso, 2020).

However, in the selective collection sector, some of these startups that claim to be a business with a socio-environmental impact are a threat to the popular and solidary action of recyclable material collectors, which can be seen in the reports obtained through the interviews.

I think it's a business that is growing a lot every day. We, collectors, are often not prepared for these issues, who will make money or who are already making money are the businessmen (COLLECTOR 8).

So you take it there, the guys build a technology with an application that collects the material and the industry pays for it, and the guys want to take the recyclable material from the pickers, they don't want to pay for the services and earn for the service (COLLECTOR 10).

It can be said that some of these applications are placed on the market, but they do not take into account the limitations of recyclable material collectors to work on these platforms. Therefore, it does not consider the portion of collectors who are illiterate, who do not have smartphones, internet access and a means of properly transporting waste.

This fact leads to the precariousness of the socio-environmental work performed by recyclable material collectors. As well, it leads to changes in ways of life, inequality and also environmental injustices. For, some technological innovations developed in the field of waste refer to new forms of exploitation and subordination.

Regarding startups, I think they are a phenomenon that is very much derived from this lack of funding in the sector to do what should be done. Which is the waste management system, which in fact manages to selectively collect and recover a large part of the material from the waste. If we leave waste management only for the market, the market trend is competition [...]. As you have this precariousness on the one hand, you open the way for other types of configurations to happen, and then you have something regulated by the market, but the market is not regulated, then what will prevail is the logic of competition (ACADEMIC 1).

Thus, it is plausible to say that this trend induces a logic of privatisation of the recycling chain, since it will be increasingly operated by private companies where the capitalist and competitive logic is prioritised. Where waste pickers would continue to represent a cheap workforce, largely benefiting startups.

I believe that in a cooperative way everyone will win, not only the company but also the collector. Because they can make us mediators for companies. Because this waste needs to reach large industries, we have access to them. So we need these collectors to come to us with these materials and we can pay them for the material and then they will see us as mediators of the product with the industry (APP REPRESENTATIVE 1).

Still, it is important to mention the applications that claim to be inclusive, but the focus is not on the collector. The speech of the APP 3 Representative refers very well to the idea that startups seek to solve a bigger problem than the problems of recyclable material collectors. In addition to making it clear that this model boils down to the amount of recycled waste, not a socio-productive inclusion as it should, opening space for new private trends and technologies to appear in this chain.

Our focus is on the consumer, we show the consumer that the collector exists, to structure the collector, which is a fundamental step. The collector is a service provider, I realize that in parts of the chain he does not complete the whole chain, so these applications in some things can be excluding, but in a market today that recycles 3% of the garbage, I think that anything that appears on the market, no matter how small, is valid [...]. It's the startup's segmentation, there are startups that won't work putting the collector in their process, that's a fact, you can be sure, that the focus of the problem will sometimes be on solving a bigger problem. The startup's focus is the consumer, it will not be the collector (APP REPRESENTATIVE 3).

This shows the lack of interest and awareness on the part of some startups to include collectors in their selective collection processes in a way that actually benefits them. Also because there are some startups that “include” the collectors in their processes, however the process does not take place in a fair way, referring to a situation of precariousness and “Uberization” .

Thus, another field that has been gaining strength through the political and private sphere, it is another challenge for popular and solidarity recycling, such a challenge refers to the incineration of waste. This method conveys an idea of quick and "magical" resolution of waste management problems. However, it has several negative points, which reflect damage to human health, the reduction of social inclusion and the high costs of operation and maintenance, not justifying the costs of its development.

In Minas Gerais, waste incineration is prohibited due to Law nº 18./031, of January 12, 2009. Thus, it is noted that many of these projects are coming with new nomenclatures aiming to find loopholes to circumvent the Law and implement the incineration in the state.

Thus, following a capitalist logic, the number of incineration companies is increasing, with the euphemized discourse of energy recovery through the burning of waste (Waste To Energy), which uses steam to drive the steam turbine coupled to an electric power generator. , aiming to generate “clean” energy quickly and

that requires little manpower (Soares *et al*., 2017).

They come with nice words, different names for incineration, to be able to inhibit and deceive the collector, when in fact, nothing more and nothing less than incineration. [...] The material goes to them, they will need a large amount of material to generate energy, and this material will come from the selective collection that today is solidary (COLLECTOR 6).

Thus, supported by their financial and selfish interests, when implementing incinerators, the only contact that companies want to have with the collectors is an employer relationship, therefore, they seek to attract the collectors to act as cheap labour in the segregation of waste.

In addition, incineration causes serious problems for the environment, considering that it ends up stimulating an exaggerated consumption, as incineration does not seek to act within the logic of rethinking the acts of purchase, in their reduction and recycling. , in the preservation of finite and infinite resources. This makes the speech of businessmen and people in the industry unfeasible when they claim that it will be a technology that will not burn recyclable waste, which will coexist with the collectors, which will have no impact on them or on the environment.

Therefore, it is necessary to think about social inclusion, the rescue of dignity and the empowerment of these individuals. Considering that selective collection is notoriously the best social inclusion strategy for recyclable material collectors. Because as a resource is incinerated, the opportunity is taken away from other people who already work in the selective collection sector (Gonçalves-Dias, 2009; Jesus & Barbieri, 2013).

In one scenario, the Covid-19 pandemic situation caused by an easily transmissible viral infection, called coronavirus (SARS-CoV-2) also resulted in an extra layer of vulnerability on recyclable material collectors and on their solidarity ventures (Dias *et al*., 2020). Who were already experiencing an economic "pandemic", making their work process complete and unique.

As collectors need to travel to carry out their collection work, it is extremely important to point out that waste has become a major vector of contagion and spread of the virus. Thus, it makes recyclable material collectors the main actors vulnerable to contamination, in addition to the fact that the lack of prioritisation of selective collection in municipal contracts also impacts on the issue of availability of PPE, such as masks and gloves for this category (Silva *et al*., 2021).

Therefore, this pandemic scenario caused cooperatives to experience a dilemma that is between stopping collecting due to fear of contagion and having their livelihood possibilities reduced even more, or putting food on the table and being susceptible to the virus during the collection.

Also as a result of this health and economic crisis, the reduction of jobs can be highlighted. Thus, there

was an increase in unemployment and consequently in the number of people collecting materials on the streets for sale and survival, thus acting as competitors of recyclable material collectors.

As a consequence, it is noted that the solid waste management system is currently disputed, characterised as necessary, but stagnant and unstable. There is a need for political support, for the role of collectors and their solidarity enterprises in the municipalities, for the restructuring and inspection of the PNRS (Anuário da Reciclagem, 2021; Teodósio *et al*., 2016).

Given this scenario, the joint action of waste pickers through the National Movement of Waste Pickers (MNCR) together with universities and NGOs that support the waste picker's cause is essential. Because from the moment that there is a greater articulation of this category, there is also a greater possibility of gains in the struggles to overcome the inequalities imposed in market relations (Oliveira, 2015)

The MNCR is a movement that for almost twenty years has been fighting nationally and internationally in search of recognition and appreciation of the category of recyclable material collectors. From its performance, several achievements have been registered for the collectors of recyclable materials, both in the legal sphere, in the recognition of the activity and in the construction of public policies with a focus on socioeconomic inclusion, as well as in the social sphere, encouraging the collectors to organise themselves and formalise it in their solidarity ventures (Silva *et al*., 2021).

It is a relationship of trust and belonging. Everyone needs to belong to something right?! And everyone has to have a goal and a purpose. So the movement gives this purpose to people and waste pickers (COLLECTOR 2).

The role of universities and NGOs with recyclable material collectors is also essential. Because when working with the collectors, it stimulates the issue of social inclusion, because it works with the guidelines of the category, uniting theory with practice. And based on the fact that the recycling sector has evolved, become professional and integrates the recycling value chain, it is also essential to professionalise recyclable material collectors through innovation, research and development projects.

And finally, another stakeholder of recyclable material collectors that can compromise their popular and solidary actions is civil society itself. Although society sees the recycling sector as fundamental, a large part of society still sees the collector as an invisible being.

Bastos and Carneiro de Araújo (2015) point out that although the profession of collectors of recyclable material is recognized, society still does not recognize the profession as a decent job that collects recyclables, associating them with garbage, as unworthy and dirty people, treating them them then with the term garbage collectors.

The population says they defend selective collection, but they don't do anything to make it happen, they

don't charge, there are contradictions (COLLECTOR 1).

From my point of view, I see that many people still do not have an understanding or are not connected. Here in my city there are people who didn't know there was selective collection, and there have been selective collection for 24 years. So I still see people who don't have this look at the work of waste pickers, they don't value it (COLLECTOR 8).

In view of what is exposed in the speeches, it is clear that there is a lack of formal and non-formal environmental education in society, of a community culture for reduction, reuse and recycling, making selective collection difficult and consequently the solidarity action of waste pickers recyclable materials.

Therefore, it is essential that there are some cultural changes in society in order to stimulate environmental education, conscious consumption and disposal, thinking about recycling and a solidary and inclusive selective collection. For, as Queiroz (2014) points out, the success of selective collection depends on effective social commitment and participation and public and private partnerships.

Therefore, it is important that the public power is active in the issues of popular recycling and solidarity with the work of waste pickers. Because, despite not being the only factor that stimulates this performance of solidarity enterprises, the public power is one of the strongest stakeholders of the collectors, given that, through it, whether or not one is invested in these enterprises and the importance is given to the collectors . Thus, it is expected that the public power will create objective conditions for solidarity and inclusion in the field of recycling to become viable.

Thus, it is noted that cooperatives and associations of recyclable material collectors, as well as the individual collector, are struggling with resilience and resistance against these new entrants in the contemporary recycling chain, which generate more challenges than opportunities in the recycling chain.

They develop resilience, because despite not being able to actually change governance throughout the recycling chain and not being able to have a more structured movement that guarantees this, solidarity enterprises and the category of collectors are not eliminated from the current perverse system, making dependent on who is at the top of the chain and who owns capital and technologies.

At the same time, it develops the ability to fight with resistance, because despite the current exclusionary system encompassing new actors in this recycling chain, collectors fight for recognition, for prioritisation in selective collection, for the reformulation of legislation on solid waste and its destination to collectors, for better working conditions, for an economy and for solidary, popular and cooperative recycling.

Thus, through flexible action in challenging environments and oriented towards sustainability, this type of organisation seeks to work in collaborative networks to overcome tensions. Therefore, they develop

skills that promote social recycling, through the rescue of individuals excluded by the dominant capitalist society (Jesus & Barbieri, 2013).

4. Final Remarks

The environmental and social sphere has suffered several negative impacts, which, when referring to inequality, put into play the principles of sustainability, socio-environmental justice, conscious use of resources, correct disposal of waste and also social inclusion.

In order to oppose the logic of a subversive market, this study dialogues with the perspectives of the Solidarity Economy and the Functionality and Cooperation Economy, together with the theme of Urban Solid Waste Management Systems. Which were essential for the discussion of this study, as they walk towards the collectors of recyclable materials and their solidarity enterprises, which are the focus of this research.

The activities of waste pickers and their enterprises contribute to sustainability, as they see recycling as a way of reversing environmental degradation. In addition, they contribute to urban cleaning, reduce the need to extract new natural resources, add aspects of income generation, environmental education and socioeconomic inclusion.

Despite being so important, it is clear that recycling with the work of recyclable material collectors is marked by a scenario of vulnerability, stigmatization and cultural discrimination.

It is clear that this scenario is a reflection of a lack of political support, technical support, an absence of infrastructure, a socio-environmental awareness of the work of collectors, the supervision and effectiveness of existing laws that value the socio-productive inclusion of the category. Such facts make room for new barriers to be imposed on waste pickers and their solidary endeavours, being considered as disposable parts of the social gear.

From the moment that recycling is seen by the public and private sectors as a form of profit, the enterprises of recyclable material collectors are put in competition with new entrants in the field of recycling. Which, because they do not have principles focused on solidarity and inclusion, start a process of scrapping these solidarity enterprises, taxing them as incapable of managing urban solid waste in cities.

Consequently, the work of collectors in search of income and survival is threatened by economic interests, which seek to privatise the entire recycling chain. Based on this scenario, what can be noticed is an “Uberization” of recycling that is encouraged by some startups and by some selective collection applications. And that has been trying to reconfigure the recycling chain together with the performance of incineration plants, which on the one hand refer to a quick solution for waste, but on the other hand, impact the environment, society and the inclusive action of the collectors.

In addition, in this scenario of reconfiguration of the chain, recycling industries, middlemen/intermediaries, the inefficiency of existing public policies, as in the case of the PNRS and the Covid-19 pandemic scenario that left the collectors in a most vulnerable situation.

Thus, these new entrants stimulate a relationship that perpetuates precariousness, subordination and unequal competition. Corroborating these facts, the relationship with society itself is also mentioned, which can compromise popular and solidary recycling, due to the lack of education and environmental awareness.

Therefore, there are several challenges that collectors and their solidarity enterprises are currently experiencing with the reconfigurations of the contemporary recycling chain. But despite so many challenges present in their trajectory and in spite of not being able to actually change the entire recycling chain to a popular and solidary logic. The solidary enterprises of the collectors have been developing the capacity of resilience to deal with the reconfigurations. But, at the same time, they also act with resistance, from the moment they fight for better working conditions, for recognition, for public policies that are actually inclusive and effective for the category.

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Reducing Disease Vulnerability with Health Education and Legal Framework for Sustainable Development: Perception of public health and legal practitioners

Samuel Adesina Okueso (Ph. D) [1] and Taiwo Odumosu [2]

[1]Faculty of Education, Human Kinetics and Health Education Department,

Olabisi Onabanjo University, Nigeria. Email: okueso.samuel@oouagoiwoye.edu.ng, sinaokueso@gmail.com

[2]School of Law, School of Postgraduate Studies, University of Nicosia, Cyprus (Lecturer, Olabisi Onabanjo University). Email: taiodu@gmail.com

Abstract

Vulnerability to several diseases is of great concern to public health practitioners because several variables have predicted this phenomenon, but just a handful of study have focused on this area involving the legal implications of the situation. This study showed the perception of health and legal practitioners on the application of legal framework and health education to reduce vulnerability among the rural populace. The researchers gleaned sample of rural men and women of mean age between 45-65 for the study, using multistage sampling procedure while legal framework for health care model and health belief model (HBM) were used to design instrument to collect data on the perception of the professionals. Standard deviation and mean, analysis of covariance (ANCOVA), t-test and chi-square were used to answer the research questions and test the hypotheses at 0.05 level of significance, to determine the differences in the perception of the practitioners and also to determine those variables that can help to reduce vulnerability among the people that are prone to a number of selected diseases. Several conditions like geographical, economic, and socio-cultural inaccessibility, health inequity were identified as factors affecting vulnerability while enforcement, prompt legal action to review health policy, increased access to health care services, legal framework and improved health education have been reported to be significant. Disease vulnerability have been identified to be of significant public health issues requiring multidisciplinary approach such as health equity to bridge the gap between the have and the have-nots and reduction of the effect of increased vulnerability among the identified population. Improved health promotion education with functional legal framework on health care are needed to reduce the level of disease vulnerability among the identified susceptible group for sustainable development goal 3, review of health policy should be of great concern to both the legal practitioners and the public health professionals.

Keywords: Disease vulnerability, Legal framework, Sustainable development, Public health.

1. Introduction

Reducing disease vulnerability is one of the primary processes of promoting active health in every given population. This is fundamental in epidemiological principles of reducing ill-health conditions among identified community where some diseases are prevalent and very important to promote health sustainability. Vulnerability generally can be referred to as "susceptibility" or 'proneness' and it has a given association to health care as it relates to people that are at risk of a given health issue. Moret (2014) described it as an elusive concept having posited that it is domiciled based on individual professional perceptions. Aday (2001) have described vulnerable population as those that are at risk of poor physical, psychological, or social health. Anybody can be vulnerable at any given point in time sequel to varied life circumstances or reactions to illness in health parlance or other environmental variables (Prokop and Kubiatko, 2014).

As a result of the foregoing, the notion of a vulnerable population is a universal concept that public health practitioners are of great concern which they refer to as being related to status; meaning that some groups are at risk at any given point in time compared to other individuals or groups (Chesnay, 2005). She classified vulnerability into two aspects: individual focus (individual viewed within a system context), and the other an aggregate view of what would be termed 'vulnerable population'. In the context of this study, vulnerability is conceptualized within a large population and not as an individual case of vulnerability but for a communal view of factors that makes people vulnerable to a wide range of diseases predicated by several predisposing factors including health equity and inequity variables as it affect the distribution of health resources not exactly in accordance with the felt needs of individual groups which should ordinarily be the main determinant of resource allocation in every clime. Improving access to primary health care for vulnerable population is important for achieving health equity but because of the existing state of health inequity in most developing countries of the world, public health practitioners especially health promotion educators have been in the vanguard of advocacy (Richard et al, 2016)

For one to be a vulnerable member of a group as an epidemiological population, does not confirm that one is vulnerable or must be vulnerable because several individual variables can make one resistant to a great deal of diseases in a given population such as improved socioeconomic status and other genetic background factors among others. And several strategies can be adopted to make health care delivery system more sustainable and resourceful despite the aforementioned factors (Odumosu and Okueso, 2021). In Africa and in this case Nigeria, many factors are responsible for increased vulnerability to diseases of different etiological and pathological structures and characteristics among the people. The biological vulnerability such as sickle cell disease condition, diabetes mellitus, high blood pressure and some other genetically related factors. Nigerians are vulnerable to conditions that are culturally and environmentally

linked such as type of food grown and are culturally allowed to be consumed which are also food fad and fallacy related, available health and medical resources accessibility, health inequality issues and political will matters.

In many countries of Africa, socioeconomic, geographical, cultural, and political factors are serious determinants of varied level of disease vulnerability (Kendall, and Zielinski, 1999; Dressler, 2004; Pell et al. 2011; Omoleke, et al. 2018). Socioeconomically, many members of the populace are either not employed or under-employed living with less than a dollar per day and many are not educated to be able to understand those things that can reduce vulnerability to a few both communicable and non-communicable diseases and develop health promoting health behaviour. Geographically, many of the people are inaccessible to health care services as both community and referral health services are far away from them finding it out of their immediate reach. Culturally, there are beliefs and practices which should have been demystified with functional health education programme that are inimical to health like some food fads and fallacies, traditional mental health care procedures, traditional maternal and child health principles and traditional hesitation to vaccinations among others (Umaru, et al, 2013; Sovran, 2013., Kahissay, et al. 2017; Bruns et al. 2020; Kaur, 2020). Political factors are preponderant as it affect vulnerability to ill-health conditions ranging from unequal distribution of health facilities having rural and urban dichotomy as an important variable, accessibility to social infrastructure in the rural area as a mirage with its numerous health consequences like absence of good cold- chain facilities for drug preservation such as vaccines; retaining good medical personals in the rural areas becomes difficult leading to active inaccessibility to good health care services (Shaikh and Hatcher, 2005).

The situation of increased disease vulnerability in Nigeria has remained unabated for several reasons ranging from daily decrease in the socioeconomic status which is presently becoming worse as a result of high rate of unemployment, increased number of school dropouts, poor per capital income, low level of literacy, poor payment of wages/underemployment, lack of political will, which relates to dwindling exchange rate of over five hundred Naira to a US Dollar (N500/$1) making the purchasing power of an average Nigerian to be very low leading to acute inaccessibility to health care resources. The poor rural agrarian community members of the populace can hardly afford the necessities of life such as nourishing food, good housing, and access to health care services is difficult due to increased cost of health care resources like drugs and other medical consumables (Gong et al. 2014; John and Stanley, 2014; Oladigbolu, et al. 2017).

In the Nigerian National Health Policy (NHP) 2016, the situational analysis revealed that the Nigerian health system is weak and, hence, underperforming across all building blocks of the World Health Organization. The health system governance is also weak. There is inequity in access to service due to

variation in socio-economic status and geographical location. For instance, the difference in ante-natal care among rural and urban dwellers is very wide because of the aforementioned variables.

The development of NHP, an initiative of the Federal Ministry of Health, its agencies, representatives of development partners, the private health sector, civil society organizations, the regulatory bodies, state ministries of health, and the academia was constituted to form the technical working group (TWG) that put in place the NHP. The goal of the 2016 NHP was to strengthen Nigeria's health system, particularly the primary health care (PHC) sub-system, to deliver effective, efficient, equitable, accessible, affordable, acceptable and comprehensive health care services to all Nigerians. There are ten policy thrusts which were derived from National Strategic, Health Development Plan (NSHDP) and the World Health Organization (WHO) health system building blocks which are: Governance, health service delivery, health financing, human resource for health, medicines, vaccines, commodities and health technologies, health infrastructure, health information system, health research and development, community ownership/participation, and partnership for Health. Despite the plan to make health care equitable, the level of inequity remained unimaginable which has caused significant effects on rate of diseases and high rate of vulnerability (Chukwudozie, 2015).

It is a known fact that the prevention and treatment of diseases are issues that have direct bearing with public health (Anuar et al, 2021). This function of public health is primarily predicated upon early detection through various investigations to allow the application of various preventive measures at an affordable cost. It also refers to the right facility for adequate and comprehensive treatment. Health Belief Model (HBM) since its application has been made easy for use to handle both communicable and non-communicable diseases. It has been applied to pin several health promotion interventions (Rosenstock, 1974). The model was originally built on four perceptive constructs of: perceived susceptibility, perceived severity, perceived benefit and perceived barriers which can be said to relate to several ill-health conditions that are health behaviour related (Okueso et al, 2018; Okueso et al, 2021). Several scholars and researchers of health promotion and health education have applied HBM in solving several public health issues relating to both communicable and non-communicable diseases and sometimes in phenomenon that relates to both situations. Health Belief Model have been used expansively in establishing the connections existing among health behaviour and health beliefs and also to create a loophole for research interventions (Skinner et al, 2015; Sharma, 2017).

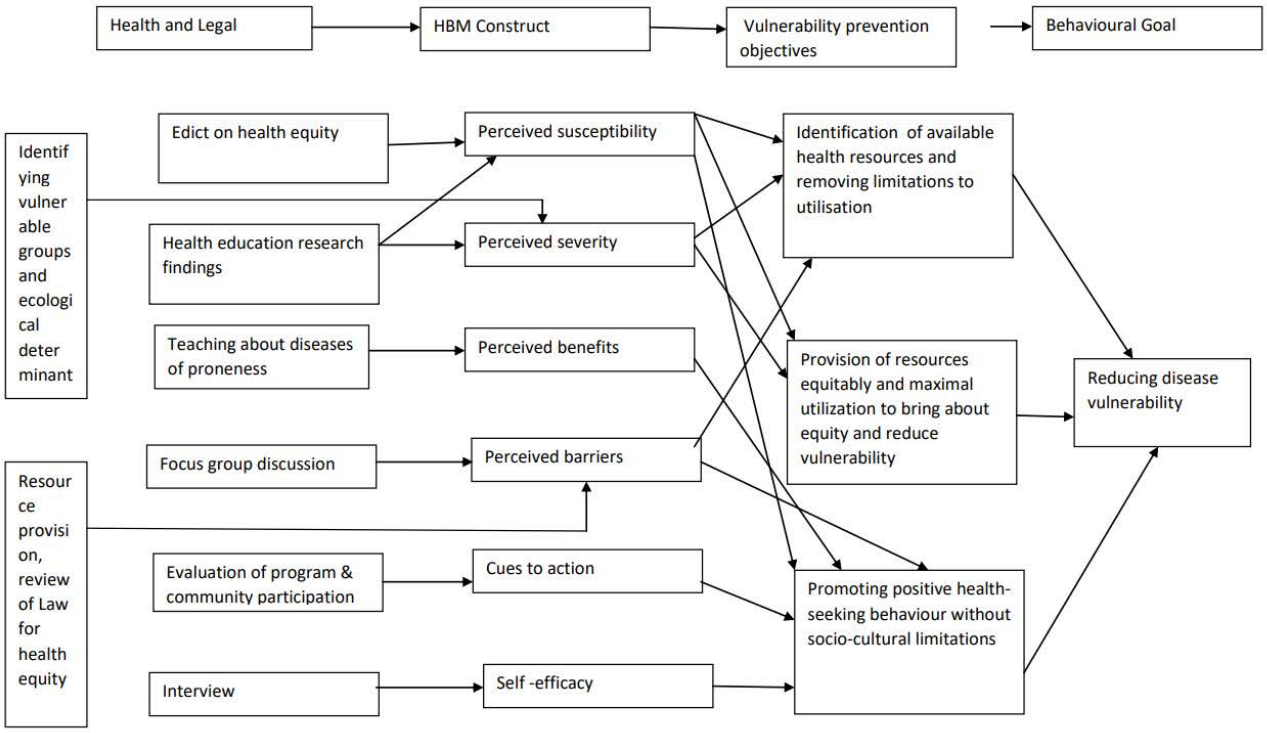

Figure 1: Application of Health Belief Model (HBM) Construct to reduce Disease Vulnerability among Rural Populace

Health Belief Model construct, in this study's involvement commenced with restructuring the first independent variable of *perceived susceptibility,* which was done by explaining disease vulnerability through video of people that are prone to diseases due to their demographic and environmental variables and those death resulting from both communicable and non- communicable diseases which was as a result of their vulnerability especially from countries where health care facilities were inadequate with marked state of health inequity, the video provided explicit information on how people could contact various forms of diseases as a result of their existing sociocultural and demographic characteristics and show those reasons that makes people more vulnerable to the various diseases. Presenting data on the mortality and morbidity rate of diseases which people are prone to because of their vulnerability such as the rural agrarian farmers that are prone to malaria fever and diarrhea diseases among others which are prevalent among the group due to their geographical location that enhances their susceptibility but can be prevented if all required resources are made available and utilised equitably.

Perceived severity which will underscore the serious negative effects and consequences of failure to utilize the available resources or not having access to enough health facilities which enhances vulnerability and severity of diseases and cause several complication and make rehabilitation difficult or delayed. To influence the *perceived benefits*, information on the use of available resources for optimal benefit such as

the use of treated mosquito net, environmental health management through the application of environmental health laws by the health officers at the local government level, adopting health education information such as using available nourishing food resources available in the rural community. For *perceived barrier*, participants were involved in focused group discussion on public health laws for equity to identify those areas, where the laws protect the vulnerable group on the utilization of the available resources and for advocacy on request for more health facilities in their locality to reduce vulnerability and promote health equity. To influence *cues to action*, the participants were presented with evaluation questions to serve as reminder to help improve on the positive health behaviour of developing good health-seeking behaviour geared towards the utilization of available resources and demanding for improved resources that can reduce their level of vulnerability and promote health equity as stated in the law. *self-efficacy,* demonstration by a community leader in a small, dramatized form to show example and shows the importance of community participation geared towards improving access to health resources.

The World Health Organisation (WHO) conference held at Alma Ata in 1978 set the philosophical foundation for the global idea of health development on the basis of social justice (Lucas and Gilles, 2003). The historical declaration at the conference established the various health goals till date including the sustainable development goal 3 (SDG3). This firmly established that health care is the responsibility of government to make sure that all the citizens has equal right to highest health care in consonance with the available resources. Preferably, the health care services of every nation should include: fairness in resource allocation taking into cognizance the individual and group needs, selecting and managing resources carefully and efficiently by adopting cost-effective intervention models and identifying the felt needs of the people and responding to them most transparently, prudently and accountably (Hajat et al, 2015; Hufe et al. 2015; Rani, 2017; Roth and Johannes, 2018).

The inequality of the state of health between the rural poor and the elitist city dwellers can no longer be tolerated. Hence, the existing political, social and community variables that tend to allow this inequity must be addressed because it is of great concern to public health and legal practitioners. Equity in health care means justice and fairness which has three varied meanings: health status of families and groups, resource allocation, access to resources and utilization of available resources (Lucas and Gills, 2003, Goldmann and Lakdawalla, 2005., Boutayeb, 2006., Boutayeb and Helmert, 2011).

Health equity can be promoted through the following important issues: political commitment, which is the responsibility of government to promote health equity. Health equity entails a commitment to reduce and finally to eliminate disparities in health in its social and other determinants (Braveman, 2014, Braveman and Gruskin 2003). It means pursuing 'highest possible standard of health for all people and giving special attention to the needs of those at greater risk of poor health, based on social conditions' (Braveman, 2014).

This translates that government must ensure that everyone has the chance to be as healthy as possible. It is difficult in Nigeria because the political stance is dominated by free market idea and it is capitalistic in nature, it is important to note that political commitment is required to correct the inequities that results from discrimination on the basis of gender, ethnic, race, and other demographic variables and also policies that marginalize disadvantaged groups like the rural agrarian dwellers and when the law fails to take cognizance of these variables, the level of vulnerability of the disadvantaged group members will be high which can be reduced through good legal framework and legislation (Piketty, 2018).

Policy formulation within the health sector should be critically scrutinized on its effect on health equity to reduce the incidence of high vulnerability by the rural poor and this can be achieved by legal input for peace and justice (Kanbur and Adam, 2014., Hughes et al, 2019). On resource allocation, the government should allocate financial resources fairly evenly to the whole population irrespective of geopolitical variability but should be based on the needs of the people especially the most vulnerable groups. Intersectoral action, this can best be utilized for equity by enacting in the health policy the various integrative policies that will promote health equity within all related health sectors., community involvement is an integral part of the process of health policy formulation that will promote equity, the needs of every individual community members should be put into consideration before anything and if this is not considered, the administrators/implementer of policies may be working at variance with the need of the people which will further complicate issues of vulnerability (Donatti et al, 2018., Diffenbaugh and Marshall, 2019). And also, to monitor equity, for good evaluation of all health activities, it is meant to identify the area of strength and weaknesses in order to move in line with various emerging issues from time-to-time. To make equity possible and effective, there should be a well-defined framework through which the health policy implementation can be monitored.

Objectives of the study

i. To identify diseases that the rural community members are susceptible to
ii. To compare the perception of public health practitioners with the legal practitioners on reducing disease vulnerability for sustainable health development through health equity
iii. To identify the place of health equity in reducing vulnerability among rural community inhabitants
iv. To identify factors that make the rural community members more vulnerable to diseases

Research Questions

I. Why are the rural community members more Vulnerable to diseases?

II. What are the diseases that the rural community members are more vulnerable to?

Hypotheses

1. There is no significant interaction effect of treatment on participants vulnerability to diseases
2. There is no significant main effect of gender on the participants vulnerability to diseases
3. There is no significant difference in the perception of the health practitioners and legal practitioners on preventing vulnerability using health equity
4. Political commitment will not significantly promote equity to reduce disease vulnerability

2. Methods

The study adopted mixed method of quasi experimental and survey research designs to collect data for the study. The experimental design was used to train the vulnerable groups on how to use the available health resources maximally and develop positive health behaviour to reduce disease vulnerability using Health Belief Model construct while survey research design was used to collect data using validated instrument from the participants that are both professionals (Law and Public health practitioners) and the vulnerable groups in the local communities. One thousand three hundred and twenty (n=1320) participants were gleaned for the study when One thousand two hundred (n=1200) were the selected among the professional group members (Law and Public health practitioners) they were purposely selected among teachers of Law with bias in health law and National health policy from randomly selected Universities in Nigeria, Instrument was administered through online filling of questionnaire. One hundred and twenty (n=120) were vulnerable public populace selected from rural areas in Ogun State southwest Nigeria, one rural local government was selected from each of the existing senatorial district of the state and the data collection process involved the training of six research assistants that collected primary data from the participants to determine their entry knowledge on diseases that are most prevalent which are predicated upon some given socio-demographic and environment variables and after this, the researchers and the trained assistants were involved in the intervention process with the use of the HBM adapted intervention package after twelve weeks, the post test was conducted to collect data which was used to make comparism.

The intervention process involved the church, the mosque and the community health centres where the participants were assembled and trained with some motivation. Health Inequity and Health Equity Questionnaire (HIHEQ) (r=0.92) Disease Vulnerability in Relation to Equity Questionnaire (DVREQ)

(r=0.78) and Checklist on Ill-Health conditions that rural people are most vulnerable (r=0.822) were used to glean data from the two groups of the participants to answer the research questions and tested the various formulated hypotheses and adapted health belief model construct was used to train and educate the vulnerable's pre and post results were compared to determine its effects on reducing disease vulnerability. The data collected were analysed using mean, standard deviation, t-test, and analysis of covariance (ANCOVA).

3. Results and Discussion

Data analysis and Interpretation Research Questions

One: Why are the rural community members more Vulnerable to diseases?

Table 1: Descriptive statistics showing reasons why rural community members are vulnerable to diseases as perceived by legal and public health professionals

	N	Mean		Std. Deviation
Statements	Statistic	Statistic	Std. Error	Statistic
Financial inaccessibility promotes disease vulnerability due to inequity	1177	3.8037	.01712	.58733
Financial accessibility reduces disease vulnerability due to equity	1177	2.2710	.03325	1.14082
Geographical Inaccessibility promotes disease vulnerability due to inequity	1177	3.5607	.01919	.65848
Geographical accessibility promotes disease vulnerability due to equity	1177	1.7850	.02491	.85447
Cultural inaccessibility promotes disease vulnerability due to inequity	1177	3.0000	.02614	.89690
Cultural accessibility promotes disease vulnerability due to equity	1177	2.2150	.03165	1.08586
Gender predicts disease vulnerability	1177	2.3738	.03050	1.04634

Gender do not determine disease Vulnerability	1177	3.8037	.01288	.44192
Age determine disease vulnerability	1177	3.6168	.01473	.50523
Age do not predict disease vulnerability	1177	2.1682	.02970	1.01882
Valid N (list wise)	1177			
	Average Mean = 2.86,		**Criteria Mean = 2.50**	

Table 1 present the descriptive statistics showing the practitioners (Health and Legal) perceived reasons why rural community members are vulnerable to diseases. In the analysis presented above, it can be deduced that item with mean value greater than the criteria mean of 2.50, indicated as reason why rural community members are vulnerable to diseases. In a nutshell, rural community members are vulnerable to diseases based on the followings: Financial inaccessibility promotes disease vulnerability due to inequity (Mean = 3.80), Geographical Inaccessibility promotes disease vulnerability due to inequity (Mean = 3.56), Cultural inaccessibility promotes disease vulnerability due to inequity (Mean = 3.00) and age (Mean = 3.61). The findings revealed that the perception of both the legal and public health practitioners are the same on the causes of vulnerability among rural communities which is predicated upon health inaccessibility which are financial inaccessibility to procure medical consumables, distance from medical facilities makes health geographically inaccessible to health care services. If legal framework is well fashioned out and enough health information is provided, the rural community members will be more accessible to modern health care and level of disease vulnerability will be reduced with active poverty reduction through equity maintenance (WHO, 2008; World Bank Group, 2018; UNICEF, 2010; De Villiers, 2021)

Two: What are the diseases that the rural community members are more vulnerable to?

Table 2: Descriptive statistics showing diseases that the rural community members are more vulnerable to

	N	Mean		Std. Deviation
Diseases	Statistic	Statistic	Std. Error	Statistic
Malaria Disease	120	3.0167	.08775	.96130
Cholera	120	2.0667	.08675	.95031
Diarrhoea Disease	120	3.0333	.08851	.96956
Arthritis	120	2.6333	.09754	1.06852
Antenatal Health maters	120	2.9833	.08112	.88861
Prostate Enlargement	120	2.3000	.09213	1.00920
Cancer	120	2.0667	.07074	.77496
Malnutrition	120	2.8000	.09730	1.06590
Visual issues	120	2.1167	.07502	.82180
Hearing defects	120	2.3167	.08934	.97862
Dental health	120	2.8833	.08549	.93650
Hypertension	120	2.4000	.09197	1.00753
Diabetes mellitus	120	2.1500	.08505	.93170
Liver Disease	120	1.9000	.08318	.91118
Asthma	120	2.0000	.07485	.81992
Valid N (list wise)	120			
	Average Mean = 2.44,		**Criteria Mean = 2.50**	

Table 2 present the descriptive statistics showing diseases that the rural community members are more vulnerable to. Findings above indicates that they are more vulnerable to Malaria Disease (Mean = 3.02), Diarrhoea Disease (Mean =3.03), Arthritis (Mean = 2.63), Antenatal Health (Mean = 2.98), Malnutrition (Mean =2.80), and Dental health (Mean = 2.88). From the findings here, the rural community members can be made less vulnerable to most of these diseases if there are enough measures put in place to prevent these diseases such as access to good medical care with enough health education on how to prevent these diseases such as good environmental hygiene, good housing facilities, health insurance and rural hospitals where early diagnosis can be done and prompt treatment can be commenced.

Hypotheses

One: There is no significant interaction effect of treatment using HBM strategy on participants' vulnerability to diseases

Table 3: ANCOVA showing interaction effect of treatment on participants' vulnerability to diseases

Tests of Between-Subjects Effects

Dependent Variable: Participant Vulnerability

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1009.200[a]	1	1009.200	154.764	.000
Intercept	161333.333	1	161333.333	24740.946	.000
Treatment effect	1009.200	1	1009.200	154.764	.000
Error	769.467	118	6.521		
Total	163112.000	120			
Corrected Total	1778.667	119			

a. R Squared = .567 (Adjusted R Squared = .564)

Table 3 above present an ANCOVA (Analysis of Covariance) showing interaction effect of treatment on participants' vulnerability to diseases. The result above indicates a significant outcome (F= 154.764; p = 0.000). This outcome implies that there is a significant interaction effect of treatment on participant's vulnerability to diseases. By the above therefore, the hypothesis of no significant interactive effect of treatment on participant's vulnerability to diseases is hereby rejected. The finding revealed that good health information when provided can promote health behaviour that can reduce disease vulnerability using Health Belief model. Health belief model has been used functionally to promote healthy living and reduce disease vulnerability(Luquis and Kensinger, 2019; Azadi et al, 2021)

Two: There is no significant main effect of gender on the participant's vulnerability to diseases

Table 4: Interactive effect of gender on participants' vulnerability to diseases

Tests of Between-Subjects Effects

Dependent Variable: Participant Vulnerability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8.555[a]	1	8.555	.570	.452
Intercept	160812.688	1	160812.688	10720.168	.000
Gender	8.555	1	8.555	.570	.452
Error	1770.112	118	15.001		
Total	163112.000	120			
Corrected Total	1778.667	119			

a. R Squared = .005 (Adjusted R Squared = -.004)

Table 4 present an ANCOVA (Analysis of Covariance) showing effect of gender on the participants' vulnerability to diseases. The result above indicates a non-significant outcome (F= 0.570; p = 0.425). This outcome implies that there is no significant main effect of gender on the participants' vulnerability to diseases. By the above therefore, the hypothesis of no significant interactive effect of gender on participants' vulnerability to diseases is hereby retained. In effect, and statistically, there is no significant main effect of gender on the participants' vulnerability to diseases. The finding revealed that there is no difference in the vulnerability of disease if resources are equitably distributed and rural community members are given equal access to health care services in ever ramification. It is a known fact that gender is an important variable in determining some given diseases vulnerability but in this case, there is no difference recorded in disease vulnerability as a result of equity issue.

Three: There is no significant difference in the perception of the health practitioners and legal practitioners on preventing vulnerability using health equity.

Table 5: Differences in the perception of practitioners on preventing vulnerability using health

equity construct.

Group Statistics

Practitioners	N	Mean	Std. Deviation	Std. Error Mean	T-Cal	Remarks
Health Practitioners	586	50.2901	3.27870	.13544	0.834	Not Significant
Legal Practitioners	591	50.3638	3.30454	.13593		

Table 5 above present an independents sample t-test showing significant difference in the perception of the health practitioners and legal practitioners on preventing vulnerability using health equity. The result of the descriptive analysis presented above showed that the mean score for health practitioners towards preventing vulnerability using health equity is 50.29 while that of legal practitioners is 50.36 with standard deviation of 3.28 and 3.30 respectively. The mean differences were not significant at 0.05 level of significance. Thus, there is no significant difference in the perception of the health practitioners and legal practitioners on preventing vulnerability using health equity. The t-value of 0.834 whose probability close to one percent shows statistically that at 0.05 level there is no significant difference in the perception of the health practitioners and legal practitioners on preventing vulnerability using health equity. The finding revealed that the practitioners-legal and public health both agrees that disease vulnerability can be reduced if resources are geared towards achieving health equity whereby ever citizens are given equal opportunity to access health care without any limitation(s) (Neter and Esther, 2012; Meng and Ke, 2014; Rispel, 2018; Weiss et al, 2018; UN, 2020)

Four: Political commitment will not significantly promote equity to reduce disease vulnerability

Table 6: Chi-square showing the effect of political commitment in promoting equity to reduce disease vulnerability

Parameters	Observed N	Expected N	O-E	$(O-E)^2$	Chi-Square	Remarks
Strongly Disagree	33	294.3	-261.3		2424.83	significant
Disagree	11	294.3	-283.3			
Agree	110	294.3	-184.3			
Strongly agree	1023	294.3	728.8			
Total	1177					

Table 6 above present a non-parametric chi-square showing whether political commitment will not significantly promote equity to reduce disease vulnerability or not. The result above shows a significant outcome (Chi-square = 2424.83, p ¸0.05). This outcome implies that political commitment will significantly promote equity to reduce disease vulnerability. Hence, the null hypothesis is hereby rejected. Political commitment have been identified to reduce inequity in health which implies that the political elites should be encouraged to be more committed towards promoting equity through improved health policy reform which will enhance proper distribution of resources especially fund (Van der Weude and Branko, 2018, Roth and Johannes, 2018; Rani, 2017)

4. Conclusions

It is concluded in the study that HBM intervention strategy can help to reduce disease vulnerability among rural community dwellers by providing enough education relating to the understanding of the uses of available resources and making advocacy for health resources provision through community commitment in promoting health equity for health sustainability. It is also discovered that several preventable diseases like malaria, diarrhea and other highlighted diseases are those that rural populace are vulnerable to and these can be prevented with health equity promoted through political commitment among other variables.

It can be concluded that legal structures through health policy review can be adopted to reduce disease vulnerability among rural community members and health education can also promote health equity to reduce disease vulnerability among the rural community members. Lastly, it is revealed that both legal framework and health promotion and health education practitioners should collaborate to promote health equity for the purpose of reducing disease vulnerability for health sustainable development to achieve Sustainable development goal 3. It is therefore important that the public health and legal practitioners should put up an effort geared towards improving health policy that will promote health equity to enhance disease vulnerability prevention. The health Educators should conduct more research intervention that will apply HBM to reduce disease vulnerability among the rural populace.

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The Evolution of Women's Agency Related Perceptions and Practice among the Gaddi Women of Himachal Pradesh in India

Kritishnu Sanyal[1], Shyamasree Dasgupta[2]

[1] Doctoral research scholar, School of Humanities and Social Sciences, Indian Institute of Technology Mandi, Himachal Pradesh, India.
Email: d18065@students.iitmandi.ac.in

[2] Associate Professor, School of Humanities and Social Sciences, Indian Institute of Technology Mandi, Himachal Pradesh, India.
Email: shyamasree@iitmandi.ac.in

Abstract

Globally, the tribal societies living in the margin are often hailed as less patriarchal than the main stream ones. The same notion is popular for Indian context also. However, inferring about the state of women based on such blanket conjecture can be grossly erroneous. Our study shows that women face severe discrimination in such societies too.

This paper explores the state of women's agency and the awareness about the same in the Gaddi community of six remote, forest neighbouring villages of Chamba district in Himachal Pradesh in India.

Quantitative and qualitative data have been collected through interviews of 100 randomly selected households with a semi-structured questionnaire and informal discussions with 171 villagers. In-depth qualitative and statistical analysis reveals the following.

While discrimination against women both at communal and familial spheres were common, its recognition was very much gender dependent. The society was not willing to listen to a single or soft-spoken woman. And women united or loud enough to be listened were criticized. Their lack of agency was non-existent to their male counterparts who "already listen to the womenfolk more than needed". Their hard work and subtle mastery in indoor and outdoor were not emulated in the authority they had. The continued lack of agency, a repeated denial of rights made the situation so obvious that the women in general were incapable of thinking of a system change. The sad reluctancy ran so deep that most of the respondents even questioned the purpose of discussing discrimination.

These findings conclude that the frequent 'obviousness' of gender discrimination made the lack of agency a standard event for the women to accept. However, the women were very much aware of the absurdity of

the claim of male superiority or female incapability. They accepted their situation not because of its righteousness but because of their own waylessness. The advent of female literacy and the increasingly increasing exposure to the outer world brought some cultural change. The young generation started questioning the customs. They were strong enough to protest. When needed, they started being vocal or united overcoming their foremothers' unease of being judged. Though the Gaddi women were yet to start their long walk towards equality, our study shows that the first seedlings had already spread their roots under the ground.

Understanding a community's perceptions and reactions of gender discriminations is important for paving the road to end this discrimination. This study thus, directly helps the policy makers to design better strategies to combat gender discrimination and find better avenues for the state to act as an enabler in this regard.

Keywords: Women, Agency, Perception, Gaddi, India

1. Introduction

The idea of women's agency is not new. Much t before the birth of modern feminism, the idea about women's view point originated in the western world (Bennet, 1989). This idea can be traced back even further in the western history to the time of ancient Greek civilization (Schultz, 2021). However, the idea of women' agency or specifically lack of it started to gain attention in socio-political theater only after the rise of second wave of feminism in the 1960s (Rampton, 2015). Since then, this issue started making its inroad both in academia and in common social platforms or more specifically in social sciences since the beginning of twentieth century.

Women's agency in the developing world was always an issue of interest (Hanmer and Klugman, 2016). And it was found that there is no universality in the social status held by women in the developing world (Chant, 1997). There is a much-debated myth of greater women empowerment among the tribal societies. Globally, the tribal societies living in the margin are often hailed as less patriarchal than the main stream ones. The same notion is popular for Indian context also. A huge literature suggests a greater agency of women among the tribal societies (Mishra and Tripathi, 2011) while a significant portion of the literature identifies the women in such societies as marginalized among the marginalized (Ghosh and Choudhuri, 2011).

However, inferring about the state of women based on such blanket conjecture can be grossly erroneous. To understand the ground reality in this regard in a particular locality, we have to start with field survey. When, we had the response *"Nobody listened to us and nobody will ever listen to us"*[1] by our 65 years old

female respondent with a bitter smile in her lips it was easily understood that there exists a huge personal and social history of gender discrimination behind the line.

Based on our ground level survey in the Gaddi community of eleven remote, forest neighbouring villages of Chamba district in Himachal Pradesh in India, our study shows that women face severe discrimination in such societies too.

This study intended to explore how the agency[2] of the Gaddi women has evolved over time. Also, the study explored how the perception of the Gaddi women about their own agency has been changed over time. We found that significant discrimination against women both at communal and familial spheres were common. What is important that its recognition was very much gender dependent. All the women agreed to the existence of significant gender discrimination that most of their male peers either failed or denied to understand. This gender division in recognition is also not an umbrella observation as in case of both the genders, we found the difference in recognizing and addressing the issue in different age groups. We also find that the society was not willing to listen to a single or soft-spoken woman. And women united or loud enough to be listened were criticized. Their lack of agency was non-existent to their male counterparts who "already listen to the womenfolk more than needed". Women's hard work and subtle mastery in indoor and outdoor was not enough to achieve them the proportionate authority. The continued lack of agency, a repeated denial of rights made the situation so obvious that the women in general were incapable of thinking of a system change. The sad reluctancy ran so deep that most of the respondents even questioned the purpose of discussing discrimination. Though, as mentioned the treatment was different at different age Gropius among the studied women.

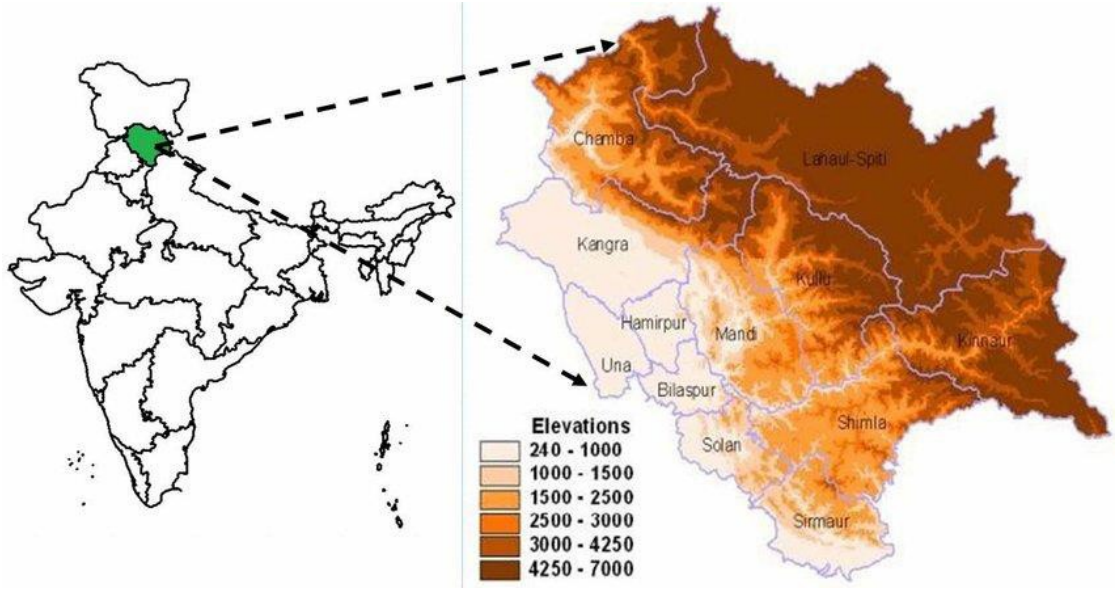
[1] Exact quote: —Hume koi nahi suna aur koi sunega bhi nahi. Respondent: a 65 year old farmer-cum-contractual labourer (woman); date: 26 August 2019; time: 17:08 IST; location: study village 5; interviewer: Author 1.

[2] We are defining agency as "the ability to identify goals or make choices and then act upon them" (Kabeer, 1999).

2. Study Area

We conducted our study in eleven forest neighbouring villages in Bharmour block of Chamba district in Himachal Pradesh. Chamba has high forest cover (77.1%) (Forest Department, Himachal Pradesh, 2014). In Himachal Pradesh, Bharmour block has a high scheduled tribe population (26.1%) (Department of Economics and Statistics, Himachal Pradesh, 2019). The villages were so remote that other than a few research scholars, seasonal tourists and forest product merchants no outsider visited those villages. All three villages were entirely populated with Gaddi community. The Gaddis are a scheduled tribe living in Himachal Pradesh. They are also found in Parts of Uttarakhand, Punjab and Jammu and Kashmir. Their main occupations are agriculture and animal husbandry. The remoteness, lack of connectivity and open access forests within 2 Kms of those villages made the residents highly dependent on forest resources. Also, the very long history of forest management made the villagers emotionally well connected to the forest.

Figure 1: Topographic map of Himachal Pradesh and its location in India



(**Source:** Jasawal et al., 2015)

Figure 2: The 'Tehsil' division of Chamba district and Bharmaur block

(**Source:** www.chambaonline.in)

Legally all forests in Himachal Pradesh are categorized into 4 types – 'reserved forest', where any damage or alteration to the forest area is strictly prohibited; 'demarcated and un-demarcated[3] protected forests' where alteration or change in forest cover by central or state government is permissible only for public interest driven

[3]For demarcated protected forests, the limits of the forest are specified by a formal notification. For, un-demarcated protected forests, the limits of the forest are not specified by a formal notification.

project. The fourth category of forest is termed as 'unclassed forest'. This type of forest is not protected by any government or civil body and it is freely available to use for all (Forest Department, Himachal Pradesh 2014). Our study villages were surrounded by protected forests. One of the three villages had a nearby sanctuary which was a reserved forest. However, the villagers did not report venturing into this sanctuary for foraging.

The community had a practice of winter migration. Jassur (in Kangra district) and Joginder Nagar (in Mandi district) in Himachal Pradesh were their main migration destinations. Pathankot district in Punjab and Chandigarh (joint capital of Punjab and Haryana) were two minor destinations. Very few migrated to Delhi. Wealthier ones migrated to rural areas like (Joginder Nagar or Pathankot). In most of the cases they had lands there. Some local farmer managed and cultivated those lands in summer months against yielded crop or generated cash revenue shared with the respondents. In winter they themselves cultivated those lands. Poorer ones went to cities and got employed in temporary agricultural and non-agricultural jobs. Most households had livestock. They did not migrate with their livestock. Few households were rotationally chosen to stay in the village and look after the migrated family's livestock in winter. However, the advent of liquified petroleum gas and electricity in past couple of decades largely reduced the need for winter migration. A brief statistical representation of our surveyed community is offered here:

Table 1: Summary statistics of the sample space for structured interview

Major socio-economic parameters of the surveyed households	**Figures**
Total number of observations considered	100
Average age of household head (years)	45.42
SD of average age of household head (years)	17.1
% Male headed households	78
% Female headed household	22
% Hindu households	100
% Muslim household	0
% Other religion	0
% SC household	1
%ST household	98
% General household	1
Average monthly PCI (in INR)	2004.69
SD of monthly PCI (in INR)	82.95
Average monthly PCE (in INR)	1447.29
SD of monthly PCE (in INR)	31.72
Average family size	7.2
Average no. of adults in a family	3.9
Average no. of kids in a family	2.8
Average years of schooling	7.8

3. Methodology

We interviewed the 100 randomly selected households with a semi-structured questionnaire. It consisted both quantitative and qualitative questions. We also gathered the views of 171 individuals from non-surveyed households personally and in uninterrupted group discussions. We duly explained the purpose of the study and sought interviewee's consent before interviewing. To better connect with the respondents, we hired locals as explainers. The surveys were carried out in different phases between August, 2019 to May, 2021.

For extensively used descriptive statistics to understand the major trends visible on surface. To analyze the qualitative aspects like understanding the respondents' views or behavioural pattern and practices, we looked through the standard theoretical framework followed in the related literature.

Based upon the differences in responses we divided the entire study group in three different groups – Grandmothers, Mothers and Youngers[4]. The following table will elaborate the ideological justification of this group division based on certain parameters.

The following tables gives an understanding of the basic difference in terms of some major socio-economic parameters across the groups and the ideological differences caused by them.

Table 2: Difference among three groups of women in the studied area

Terms used in the paper		**Grandmothers**	**Mothers**	**Youngers**
Who falls under this category		Whose children were all settled and their major identity in the family was of an 'elderly' grandmother.	All their kids were not yet settled. They might have grand kid(s) but still their role as a mother was important in the family.	They were either unmarried or even if they were married their kids were below 5 years
Observed age limit		**Above 60 years**	**30 -60 years**	**Less than 30 years**
General trend in the major parameters	**1. Education**	Many of them were uneducated. A few had a couple of years of primary schooling.	Many of them were educated. But almost nobody earns with skills taught in schools.	All of of them were educated. Many were in to colleges. A few were into professions or professional courses.

[4] This classification is inspired by the study published by Aassve et al. in 2012.

	2. Exposure	The area was much more remote in her days. So, they really had much less idea about alternative ways of life.	They experienced many changes in their lifetime: from metal roads to modern technologies. They were aware of different ways of life but could not aspire for that.	Modern technologies and access to education broadened their mind. They were well aware of the alternative ways of life practiced by people elsewhere
	3. Family situation	Their partner was not the alpha male in the house anymore. Their in- laws are also mostly dead. They did not face direct personal discrimination any more. By following the customs, they willingly or unwillingly helped in discriminating against the women of next generations in her house.	Their partner was the alpha male in the house. they faced oppressed by both husband and in-laws in the house. Also, they practiced discrimination against their daughters and daughter in laws if any.	If married they had greater agency than their foremothers. Married ones could not protest against the discrimination caused by their in-laws, but they protested against the discrimination they faced in home comparing to their male siblings.
	4. Perceptions about discrimination against women	Discrimination against women was a 'natural' phenomenon. As a young kid they used to feel bad about it. But their vast experience taught her that it will always be the practice.	Discrimination against women was 'wrong' and 'unfair'. This issue needed to be addressed. Probably it required fighting. They were not ready to fight.	Discrimination against women was 'wrong' and 'unfair'. This issue needed to be addressed. It required fighting. They were ready to fight.
	5. Attitude towards life	Their job was to wait for her natural end.	They had expectations from life and hoped to fulfil some. However, they well knew the distance between cup and lips.	They were quite optimistic about life. They thought a hard fight could turn something dreamt into achieved.

In light with the ideological difference expressed by our respondents, we discuss how over the generations the idea of women's agency and right have evolved in the studied region. We also will show how that shaped the behaviour of the women in the region.

4. Results and discussion

In the field we found numerous evidences of strong gender discrimination. Also, we observed how the situation was changing with advent of time and education. All the following observations will clearly portray the same.

4.1 Women's hesitancy to talk:

It was our common experience that the 'grandmothers' and 'mothers' were initially reluctant to talk to us. In many houses they actually asked us to wait so that they can ask some male members to come and talk to us. They were very shameful of their lack of knowledge and inability to meet the need of an external researcher. They themselves considered them unable to carry put a conversation with us. On the contrary, none of the male respondents felt shy to communicate. The situation was different for the 'youngers'. They were confident of their views. They were happy that someone was interested in listening them. They were vocal.

4.2 Women were well aware of their discrimination:

All the women irrespective of in which category they belonged to were very much aware of the ever-happening gender discrimination practiced against them. There is a tendency in the literature to portray that the recognition of gender discrimination takes some training (Nogueira et al. 2018; Heilman and Caleo 2018). What we found from the study that now always an external awareness generation is needed. The 'youngers' had a greater exposure to the outer world through their education and modern technologies. The 'grandmothers' lacked both. But the hardships and deprivations of their entire life was enough for them to understand discrimination.

4.3 Chronological evolution of perception about gender discrimination:

We found that there was a significant change of thought process and actions in regard to gender discrimination across the three categories of women in the study area.

4.3.1 Gender discrimination is a 'natural' norm:

In general, the majority response of the 'grandmothers' were without any optimism. They knew that the problem of gender discrimination existed since the beginning. On probing they opened to us, how they felt bad about it when they were young and how they even wanted to change the system. But over the years they made a forced comptonization. Gender discrimination as a system is too powerful to end. The only advice they had to offer to others and to the younger girls in and out of their community is to adjust.

4.3.2 Gender discrimination is the norm which needs to be changed:

'Mothers' too had seen the world. They knew the burdens of discrimination. Because of their average higher educational qualifications and more exposures to the outside world they were more open to the issue of gender discrimination. They knew that the system needs to be changed as it will lead to a better future for both individual women and the household.[5]. However, they were unsure about how to bring in the change.

4.3.3 Fight against gender discrimination is a must

The 'youngers' knew the absurdity of the core logic of gender discrimination: the men are superior than the women (Jayachandran 2015; Tost et al. 2021). They identified the gender discrimination as historical injustice that needed to be stopped immediately. The society's inability to understand their view made them angry and sorry. But unlike the 'grandmothers' they did not pursue the view that probably what is running for so long is too powerful to remove[6].

4.4 Chronological evolution of perception about women's' agency:

We found that every woman univocally agreed to the fact that the women have a much-restricted agency than their male peers. However, there was a significant difference in perceiving women's agency across the three categories of women in the study area.

4.4.1 Gender discrimination is a 'natural' norm:

The 'grandmothers' were habituated of their limited agency. This limited agency became something so natural to them that they sometimes fail to notice it. However, on probing they revealed how the limited agency made them unhappy in the past. They admitted that limited agency is a real problem. Women should grant equal agency as men.

4.4.2 Discrimination is the norm which needs to be changed:

They believed the justness of gender irrespective equal agency. They had their own painful stories of limited agency. Each individual women respondent lamented because they were not offered more agency by the

social customs. They also knew that to achieve more agency fighting the status-quo is needed. Only they were unsure how to fight.

4.4.3 Limited agency is halting making the society suffer:

The 'youngers' reported several stories of their limited agency in the society. They were unhappy of their personal sufferings of the same. Also, they were both aware and confident of the potential contribution of a woman to the society. They wanted the society to understand how a society with equal right for both the genders can grow more evenly and at a faster pace. It will also result more social welfare[7]. They were certain that changing the status-quo will not be easy. But they were up for it.

4.5 Fighting for greater women's' agency:

We found that there was a stark difference in the views expressed by women of different generations about how to fight for women's right or agency. Also, the view about the possibility and the fruitfulness for fighting in this regard varied significantly across the generations.

[5] The community members agree on the point that, women manage the household more efficiently than men, the greater agency she can practice in taking household related decisions, the more prosperous and efficient the household will be.
[6] This optimism found among the 'youngers' clearly shows the importance of greater exposure as an educational medium. Also, it points the possible scope for the state to bring social change by acting as anenabler.
[7] Of course, they said these without taking technical nomenclatures of development economics.

4.5.1 Fighting is needed but we don't want to fight anymore:

The 'grandmothers' knew how required it was to fight gender discrimination But, they did not want to take any more trouble to fight. However, they were open enough to supporting gtheir younger generations in fighting for the same.

4.5.2 We want to fight but don't know how to fight[8]:

The 'mothers' knew pretty well that without fighting for their own rights achieving the rights they aspire for would remain a distant dream only. They were also certain of the righteousness of the fight. Only they did not know how to fight. They were ready to help a girl of the next generation in her fight. But, they feared to break the status quo on their own.

4.5.3 Ready to fight:

The 'youngers' were certain that they need to fight to change the status-quo. They already have started fighting inside and outside their houses. Some cases of their battles ance few success stories were reported to us. They were also not very sure how to fight or whether the way they were fighting, was enough or efficient. But they were ready to learn through errors. Also, they were confident enough to succeed at the end.

4.6 The changed perceptions about the image of a fighter woman:

As reported by a woman of 72 *"a women must need to raise her voice, otherwise nobody listens to her"*[9]. But for very long almost all societies across the globe were patriarchal. With respect to the men, limited agency and restricted rights for the women were the standard norm. Hence, their existed a very dominant social taboo about the women who expresses her voice publicly asking for an equal right to practice. Firstly, it was 'unnatural' for a woman to have equal right as men. Secondly, it was 'improper for a woman to raise her voice publicly. A woman who forces the society to listen to her considered to be a 'bad girl' (Hamilton 2003). The story was not different in our studied community. Individuals care for their social images

8 Exact quote: ―Hum bhi to ladna chahti hai, lekin kyayse lade? a 47 year old farmer (woman); date: 22 April 2021; time: 12:14 IST; location: study village 9; interviewer: Author 1.

9 Exact quote: ―Agar koi ladki ucha na bole to koi uski suntan nahi. Respondent: a 72 year old farmer (woman); date: 03 March 2021; time: 19:30 IST; location: study village 6; interviewer: Author 1.

(Lacetera and Macis. 2010). The more cohesive a society is, the extent an individual will be concerned

about her/his image is likely to be increased (Schiefer and Van der Noll. 2017). They studied community is a tribal society situated at a remote location lacking most features and notions of modernity. Naturally for any individual, the perceived importance her/his own image to others of the same community is likely to be much higher for the same in any modern society. Our study found that the imagery of the 'bad girl' had significantly different effect upon the working mechanisms of the women of the three categories in our studied area.

4.6.1 The idea of 'bad girl' is questionable:

The 'grandmothers' could recall how they were always afraid of getting the 'bad girl' tag just for expressing their logical and just views. They were aware of instances when a woman received this tag for no reason. They became skeptical of society's ability to judge a girl in this regard. However, due to age and due to lack of direction, they could not fight against it.

4.6.2 That illogical term had control over minds:

The 'mothers' also felt that the social practice of tagging a girl 'bad girl' was illogical. They wanted to fight it. But they did not gather the courage to fight. They too were afraid of this 'bad girl' tag. In spite of knowing the voidness of such a social judgement they could not overcome it.

4.6.3 It is okay to be a 'bad girls':

The 'youngers' were pretty aware how the society would judge them for standing against traditional social customs to attain their just agencies. Of course, it was painful for them. Other than a single instance[10], we did not come across any girl who is happy to be identified as a 'bad girl'. But unlike the 'mothers' they were not afraid of the social tag. They were ready to accept it for the greater good. At times they feel upset about it but overcoming the same they wanted to fight their own battle[11].

[10] This girl studied in college. She belonged to an affluent family. Primarily due to her upbringing she had enough exposure to the different cultures granting more right to the women.

[11] Exact quote: —Agar humare liye hum nahi lade bhaiya, to jindegi ka kam keya? Respondent: a 18 year old student (woman); date: 18 March 2020; time: 13:36 IST; location: study village 1; interviewer: Author 1.

4.7 The other side of the coin: how the men perceived the issue of gender right and women's agency in the studied community:

Women and men both form the two pillars of any society. Thus, any study related to any of the issue with women at the centre is incomplete without the men's side of the story. Following observations depict how the Gaddi men perceived the issue of women's right in the studied region.

4.7.1 Belief about male supremacy:

On the surface level most men were in full support of equal rights for the women. However, a little probing disclosed that across all ages there was a wide and strong belief that women are not as smart and efficient as the men. The belief usually was stronger among the older ones. Interestingly enough, the oldest ones (equivalent to the 'grandmothers' among women) were less critical of the idea of women's right[12]. The middle-aged ones (equivalent to the 'mothers' among women) were most vocal against women's right. Also, they were generous enough to provide sour comments like: "the less (the girls) say the better"[13].

4.7.2 Recognizing gender discrimination:

While all women were certain about gender discrimination, the male were mostly blind about it. There were two types of very common responses among all the male respondents we talked to. Somebody thought discrimination happened in the past. Now a days it does not happen anymore. And some of them even reported that due to greater women's agency, now a days the possibility of gender discrimination is nil. They loved to report that there is no practice of gender discrimination in the studied area. Only after probing

[12] They were also facing discrimination with respect to agency at home. So, they had a realization how depriving someone from agency can hurt the person. That is how we have interpreted their relatively softer stand towards the issue than their immediate next generation.

[13] Exact quote: — jitna kam bolegi utnahi mangal. Respondent: a 35 year old government employee (man); date: 11 March 2021; time: 09:15 IST; location: study village 4; interviewer: Author 1.

they realized its existence and recognized it. Here also, because of their higher education and greater exposure to alternative cultures, the younger ones were more ready to identify the problem.

4.7.3 Perceiving women's agency:

The following table shows how the gender difference resulted significantly varied opinions about women's agency.

Table 3: How gender plays a role in developing gender related perceptions

The questions asked		Gender of the respondent	
		Male (78)	Female (22)
Participation in forest management	Women should have more participation	78	22
	Women should have more authority	71	14
Participation in broader and other platforms	Women should have more participation	31	22
	Women should have more authority	16	22

We see that when it comes to forest management the men are okay with women participation. In fact, they quoted a quite a few traditional provers to tell that as women manages the household so efficiently, naturally given a chance they can manage anything outside of the house with similar efficiency, be it the forest or something else. However, immediately after when we asked them their opinions about women's participation in broader social activities beyond forest management, we noticed a sudden change of tone. The willingness to see women with a greater role plummeted very deep. As usual The middle-aged men (equivalent to the 'mothers' among women) were ready with their sour comments like: "I don't want to get harassed by them (the women)"[14] or "(the girls) will start quarreling among themslevs (when they try to manage something together)"[15].

We found that education and exposure in general helped to understand and support the idea of women's right. The younger ones were more apprehensive of the idea of women's participation beyond forest management.

[14] Exact quote: — jutte to nahi khana hai unse. Respondent: a 47 year old farmer cum shopkeeper (man); date: 19 March 2020; time: 12:55 IST; location: study village 2; interviewer: Author 1.

[15] Exact quote: — apne milke behes karne lag jaygi. Respondent: a 52 year old farmer (man); date: 21 April 2021; time: 15:10 IST; location: study village 7; interviewer: Author 1.

5. Conclusion

Our analysis reveals that the perception of the very existence of gender discrimination itself is gender sensitive. Men were much less aware about the issues like gender discrimination or women's right. On the other hand, the women naturally were very much aware of the absurdity of the claim of male superiority or female incapability. They accepted their situation not because of its righteousness but because of their own waylessness. Each of them recognized the problem of gender discrimination and limited women's agency from every possible angle.

The advent of female literacy and the increasingly increasing exposure to the outer world brought major changes in the psyche of an average individual woman in the studied community. The young women started questioning the customs. They were strong enough to protest. When needed, they started being vocal or united overcoming their foremothers' unease of being judged. Though the Gaddi women were yet to start their long walk towards equality, our study shows that the first seedlings had already spread their roots quite deep under the ground.

As education proved to be an important tool in make people recognize gender discrimination and lack of agency, it is advisable that the government should focus on spreading education. Also, exposure to different cultures is important for an individual to understand the drawbacks of the culture of the community s/he belongs to (Castro et al., 2004). A change in the curriculum offering more exposure to different kind of cultures (cultures positively indicating to the desired direction) may be a stepping stone to start with.

The recognition of our findings will help the policy-makers to understand the very heavy weight of the burden of which our study is just the tip of the sunken iceberg. A recognition of the gender related issue will enable the policy makers to come up with a better plan in the form of targeted developmental strategies which is recognized as the best way to achieve developmental goals in a limited time with a limited resource (Benerjee and Duflo. 2007)

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8. Social foundations of sustainability

8b. Communication for sustainability

Abstracts

Developing Sustainability Strategy for Community Disaster Risk Management

Mr. Polin Kumar Saha, Mr. Syed Tanim Ahmed, Ms. Ishrat Jahanara, Ms. Jannatul Bakia Sweety

Global Research and Marketing, Dhaka, Bangladesh

Abstract

For the sustainable strategy, there are some important issues focused on developing mechanisms of future coordination of various stakeholder groups. In this regard, some considerable factors are like supportive institutional environments, commitment and ownership, institutional capacities, economic & financial aspects, and genuine and effective participation importantly.

This paper has developed a sustainable strategy and its process considering a Community Disaster Risk Management project accomplished in one of the most vulnerable and disaster-prone areas at Bhola district in Bangladesh. This project titled ICDRM (Inclusive Community Disaster Risk Management) provides a lot of support and cooperation to make people aware, to increase knowledge level, and to develop coordination among disaster management committees. These issues help community people a lot. However, after the ending of the project or any other project like this, it is essential to ensure the sustainability of the project outcome continues. Therefore, sustainability strategy development has become an important agenda to keep a project sustainable through different ongoing activities of a community.

In the mainstreaming of sustainability in the ICDRM project, there are lots of discussions about policy gap analysis in project driven disaster management activities, project interventions, an achievement for disaster risk reduction, implementation approach for COVID-19, inclusion issues and aspects, capacity building training, disaster forecast management, access to cyclone shelter, inequality and stakeholders' analysis. Also, there are issues regarding committees' mechanism to reach out to the community or their major intervention areas/major activities as well as the most common barriers of disaster response.

In the process of sustainability strategy development, the study team visit the project location and collect relevant primary data to conduct the situational analysis, gap analysis, and draw recommendations for the sufficient accomplishment of different sustainability model. During the study, the research team used different tricks and tried not to give any benefit or gift (e.g. FGD snacks after ending the meeting) to the respondents, and this helps the study team to understand better how they react when the people will not receive any financial gain in the expense of their time. Also, secondary documents review helps the study team to understand better the situation and future sustainability strategy.

This sustainability strategy is for better partnership with different stakeholders (e.g., DRM committees, implementing partner organization, local administration, concern departments, NGO, community etc.) so that the disaster preparedness and risk reduction activities can be continued by the DRM committees addressing the inclusion issues after the project phase-out.

Finally, this sustainability strategy will also be helpful for the DRM committees and stakeholders to ensure the inclusion and situation like COVID 19. This sustainability strategy might help the organization adapt and evolve by planning ahead; building resilience, controlling risks, protecting oneself and the community, and, most importantly, seizing any potential opportunities that occur. But the primary motivation for establishing this sustainability strategy is to ensure community sustainability in aspects of the community disaster risk reduction process as well as the outcome is maintained after any of the projects has been phased out in the community.

Track

Track 8b Communication and sustainable development

Leveraging United Nation's International Day for Yoga (IDY) to Promote Sustainable Lifestyles and Wellbeing: Setting a research agenda

Professor Neha Purushottam

University of South Africa, Johannesburg, South Africa

Abstract

Communication is a social process and providing importance to social institutions, cultural and social practices and settings affects acceptability of sustainability practices in daily life. Literature indicates that the scope of contribution of an event in raising awareness, in changing attitudes and behaviours is still an under researched area especially in the area of promoting SDGs. This is even more true when the event is of the scale of 'IDY'. The purpose of this paper is to explore the potential of events like United nation's International Day for Yoga (IDY) to promote sustainability lifestyles. The paper notes that often in communications on sustainability, role of international event like UN international day, engagement of social institutions, social settings and cultural practices are ignored. The papers examines the literature on communications for sustainability in order to improve their effectiveness and reach especially to masses. The paper is literature review based concept paper.

Yoga is an ancient practice and remained part of many Indian households; spirituality and health practitioners and enthusiasts; group of like LOHAS, elderly and spiritual tourists etc. However, the acceptance of 'IDY' at UN and its international celebration has contributed towards bringing attention of the world to the lifestyle issues and its importance in the area of health and wellness. Therefore, it can be proposed that:

Proposition 1: IDY promotes sustainability oriented lifestyles.

Considering yoga as eastern concept or a religious concept often creates pseudo boundaries which restricts its acceptability among masses. Yoga is not religious but a cultural asset of India and celebrating it as one of the UN day will help in propagating the thought. Therefore, it can be proposed that:

Proposition 2: Celebrating 'IDY' contributes in establishing (a) authenticity of sustainable lifestyles (b) secular nature of practice and (c) in promoting it across continents.

The yoga (in uncommercialized form) is approachable so everyone can relate to it and adapt it for mental, physical, emotional and spiritual wellbeing. Simplicity of 'IDY' celebrations and its sharing on social media is promoting preventative health across classes. Therefore, it can be proposed that:

Proposition 3: Celebrating 'IDY' promotes preventative health attitudes and overall wellbeing .

India has always been considered birth place of Yoga. However, practice of 'Yoga' within India remain limited (10-13% of population). Literature suggests that the communication for sustainability benefits from the authenticity, trust and standardization. It is noted that yoga education market can benefit from regulations and standardization. Therefore, it can be proposed that:

Proposition 4: Impact of celebration of 'IDY' by Indian government can benefit from regulations and standardization of yoga education.

Proposed Contribution : Health and wellness are directly related to the third SDG (Ensure healthy lives and promote well-being for all at all ages) and indirectly to other SDGs like issues of sustainable consumption covered under SDG 12. This paper intends to contribute to sustainability communications in general and to 'IDY' in specifics.

Track

Track 8b Communication for sustainability

Full papers

Sustainable Development in the Portuguese Press

A content analysis for 2019 and 2020

Vítor Bessa[1], João Simão[1,2]

[1]Universidade Aberta, vitorbessa@gmail.com
[2]CAPP- Centro de Administração e Políticas Públicas, ISCSP-UL, joao.simao@uab.pt

Abstract

Sustainability and sustainable development are increasingly common concepts in the public and political spheres. The press has a fundamental role in defining these terms, making them accessible to the lay audience and setting up the political agenda. Understanding how SD is being reported, the dominant narrative and which ideological vision it is based on may help to predict the evolution of policies for sustainability in a given. We examine three major national newspapers in Portugal, *Jornal de Notícias* (a popular daily), *Público* (a quality daily) and *Expresso* (a quality weekly) for the years of 2019 and 2020, aiming to understand how sustainability is reported and who defines it. Our findings show that sustainability is a common theme on the Portuguese press, but rarely discussed in depth. Promotion of technocratic solutions, corporate social responsibility and "sustainable consumerism" are the predominant frames used across all three titles, often in sponsored or advertorial pieces. Calls for equity or emphasizing threats were more commonly found on the two daily papers, although generally presented as solvable problems and rarely focusing on the blame. Skepticism is extremely rare and comes mostly from academic voices. Business people and government agents are the leading viewpoint from which sustainable development is presented, with a significant presence of NGOs on the daily papers as well. We also discuss how the covid-19 pandemic impacted this coverage. Although the pandemic is often referred to in articles from 2020, this has not led to a substantial change on the predominant definitions and narratives used. Despite the fact that most Portuguese newspapers, including the three selected ones, never assume a political alignment and praise themselves on being plural, our findings coincide with past studies that noticed certain political tendencies

Keywords: Sustainable development, Sustainability, Press, Information, Portugal

1. Introduction

Since the publication of the Brundtland report in 1987, sustainable development (SD) has become an increasingly current topic in public discourse and debate. The environmental and climate crisis made it an ever-more present topic and thus a new field of investigation emerged, the analysis of the treatment given by the media to this topic. Analysing the written press is particularly important, as it is not just a mirror of public debate (Bonfadelli, 2010), but actively contributes to filtering what is or is not debated and how, simplifying complex scientific concepts for the general public. The number of studies analysing the role of the press in different countries has been increasing, with more qualitative articles focused on specific countries, for example Bonfadelli (2010) for the Swiss press, Yacoumis (2018) for the Australian one, or Fischer et al. (2017) for the German press, and articles with a more quantitative approach, making use of data mining tools, which sometimes make comparisons between different geographies, as Czvetkó et al. (2021). This article seeks to analyse how SD is treated by the Portuguese press, an analysis that has not yet been done.

The existing literature has focused especially on countries in the global North, with a few rare exceptions like Adelekan, I. (2009) for the Nigerian press. Portugal is a country in the North, but less developed than its peers and industrialized far later than them. It is therefore relevant to understand how the concepts of SD and sustainability are used in the Portuguese public discussion, what kind of significance they receive and how the situation compares with other countries. For this analysis, we selected the years 2019 and 2020, to have a recent portrait and simultaneously understand if the covid19 pandemic had any impact on the way SD is reported and discussed in the Portuguese press.

2. Methods

To develop this analysis, we chose three of the main titles in the Portuguese press, *Expresso*, the most influential weekly newspaper in the country, *Público*, considered the reference daily and *Jornal de Notícias* (*JN*), a popular daily, especially influential in the North and Center regions, being the only one based outside the capital, in the city of Porto, and also the leader in online audience. For all of them, we considered only the online editions. Previously we also considered including the *Correio da Manhã* tabloid, but we ended up excluding it from the analysis given the very little content it published on this topic.

Initially we filtered all articles published between January 1st, 2019 and December 31st, 2020 that contained the terms “sustainable development” or “sustainability”, using either the search tool of the websites themselves or the Google search engine. We only considered articles published under the internet domain of each newspaper (expresso.pt, publico.pt and jn.pt), thus excluding content from supplements with their own domain such as *Dinheiro Vivo* (an economic supplement of *JN* shared with *Diário de*

Notícias, a quality daily paper from Lisbon, and which has its own website, dinheirovivo.pt)

We then made a qualitative selection, selecting articles relevant enough to be classified as how they presented SD in order to obtain a sufficiently representative sample for each analysed newspaper. Most of the articles were thus disregarded, the terms sustainability and sustainable are increasingly part of current language and used to describe the financial health of companies ("Super Bock Group fires 10% of workers (…) to defend and protect sustainability" of the group" in JN, 6/16/2020) or even the growth of sports ("debate of an agenda with a view to the sustainability and growth of Portuguese football" in JN, 11/29/2019) and even dance ("This new non-profit association was born with the mission of contributing to the sustainable development of dance" in JN, 9/1/2019). Even among the selected articles, several can be considered superficial, although relevant enough to indicate a dominant narrative.

We chose to use the frames defined by Diprose et al. (2018) for the British press, as they seemed appropriate for the selected contents of the Portuguese press and thus allow an easier comparison with these results. We only excluded the categories of "intergovernmental events" as they were not relevant in the years under analysis.

- Primary Sustainability Frames
    - Economic: sustainability can be achieved through existing market mechanisms.
        - Applied Technology: faith in business, financial and scientific innovations.
        - Consumerism: promotion of aspirational green lifestyles and products.
        - CSR: relating business' efforts to harmonize profitability and sustainability.
        - Growth: equating economic growth with sustainability.
    - Environment: inclusive of biodiversity, climate change, nature and nonhumans.
    - Society: sustainability must include a social basis of cooperation.
        - Crisis: dramatization of perceived threats to social harmony.
        - Equity: appeals to human rights and reducing poverty and/or inequality.
    - Skepticism: a disbelief in the necessity or viability of sustainability.

- Moral Claims
    - Culpability: identifies and blames particular actors for unsustainable practice.
    - Entitlement: identifies and supports particular actors' claims to rights or goods.
    - Responsibility: identifies actors who are responsible for sustainable practice.

In addition to this categorization, we also classified the articles by type (news, opinion, interview etc), the dominant tone as positive or negative and the dominant voice or viewpoint. This qualitative analysis necessarily has a significant degree of subjectivity, with several articles that could fit into more than one category. But it does provide an overview of the dominant narratives and facilitates comparison between

the three concerned newspapers and with the press of other countries.

3. Results and Discussion

Table 1. *Number of Google entries per year, website and key-words found on March 6th 2022.*

Key-Words	Sustainability		Sustainable Development	
Years	2019	2020	2019	2020
Expresso	370	567	69 (37)	147 (27)
Jornal de Notícias	96	104	19 (8)	15 (3)
Público	449	789	197 (76)	163 (74)

On table 1 we see the number of results obtained in the Google engine for the period under analysis, for each site and keyword ("sustentabilidade" and "desenvolvimento sustentável" in Portuguese, respectably), in parentheses is indicated the number of entries for the search of "sustainable development" as an expression, thus excluding articles where the words "development" and "sustainable" are present separately. It is important to bear in mind that these values do not necessarily correspond to the number of articles published, but to the number of entries indexed by Google for each site, keywords and search period. Some of these entries correspond to documents attached to an article (such as photo galleries), or indexes of the site itself (such as author pages). Despite these limitations, these values can be seen as an estimate of the amount of content published by each site. The use of Google guarantees an equivalent analysis for the 3 sites, with their own search systems being much more limited and in the case of *JN*, Google is also used on their site itself.

It is clear that in all three newspapers there are many more entries for "sustainability" than for "SD". These figures confirm the idea that "sustainability" has become a common word and is often used with a meaning far from the intended by the Brundtland report. The reference newspapers (*Expresso* and *Público*) have many more entries than the more popular *JN*, the slight difference between them can be explained by the fact that one is a weekly and the other a daily newspaper.

Note also that the SD table includes the total results of entries with the words "development" and "sustainable" and in parentheses only the number of entries with the expression "sustainable development". Many of the articles where the words appear only separately have no particular relevance,

but there are in fact some articles that even though do not use the expression “sustainable development” end up revealing a valid SD narrative, as do the many articles that use only the word "sustainability". On the other hand, not all articles with the expression “sustainable development” are guaranteed to be relevant, as they sometimes only refer to some initiative, without it being the main theme of the article.

Finally, there was a slight increase in results between 2019 and 2020, especially in the search for “sustainability”, which seems to be related to the media coverage of the pandemic (see Table 2), which in 2020 often associated the need for a return to a more sustainable normality, since the very trigger of the pandemic is suspected to be associated with unsustainable practices of exploitation of natural resources.

Table 2. *Google entries from 2020 mentioning sustainability and the pandemic*

Expresso	288
Jornal de Notícias	39
Público	650

From these raw results we selected a sample of 50 articles, for each newspaper, with the most significant articles where it was possible to find a narrative about the SD. All types of articles were considered, from news, to opinion columns, interviews, sponsored articles (advertorials) and feature articles (longer than a news story). While with *Público* and *Expresso* there was no difficulty in finding enough articles for this sample, in the case of *JN* some were included despite being quite short and superficial, otherwise the sample would not have much meaning.

Table 3. *Number of articles by type*

	News	Opinion	Interview	Advertorial	Feature
Expresso	22	6	8	13	3
Jornal de Notícias	42	3	-	5	-
Público	26	20	1	2	1

From this it can already be concluded that sponsored content has a very significant weight in the coverage of the SD on the Portuguese press and that opinion articles have a higher weight on *Público*.

The first categorization made was about the tone of the article (Table 4), whether positive or negative. Considering positive articles the ones that even if focused on problems, also present solutions considered viable. This metric, although simplistic, allows us to assess whether, in general, SD coverage presents it as something attainable or not.

Table 4. *Dominant tone of selected articles*

Tone	Positive	Negative
Expresso	43	7
Jornal de Notícias	37	13
Público	44	6

From this sample is possible to conclude that the Portuguese press tends to present SD as something realistic and achievable, despite how problematic the situation may be. An extreme example of this is the opinion piece published by *Público*, "Can a tobacco company be sustainable?" (21/05/2019), the conclusion and answer to the title is a clear yes. This optimism of this article is probably not oblivious to the fact that it was written by the CEO of a tobacco company.

It is therefore essential to understand which are the dominant voices and view points behind the articles. For opinion articles and interviews, the profession of the author or interviewee was used to determine this, in the remaining articles, the source of the news or the predominant angle was considered its voice.

Table 5. *Dominant voices and viewpoints*

	Local gov.	National gov.	Foreign gov./EU	UN	Academia / Scientist	Business	NGO	Other
Expresso	-	7	2	1	8	23	9	-
JN	10	6	6	6	7	6	7	2
Público	7	3	4	5	8	6	11	6

Expresso is by far the title that gives the most attention to the business world, which corresponds to the profile of a weekly reference paper for the upper middle class (its founder was also the founder of the largest center-right party, the PSD, making this the newspaper with a stronger political connotation, even if not admitted by itself). *JN* is the one that gives more space to local news, which corresponds to its regional and popular profile. Finally, *Público* is the one that offers the greatest variety of voices and the most attention to NGOs.

Table 6. *Dominant sustainability frames*

	Expresso	*JN*	*Público*
Economy (total)	**35**	**20**	**13**
Applied Tech	10	7	5
Consumerism	8	3	7
CSR	5	1	1
Growth	12	9	-
Environment	**-**	**13**	**7**
Society (total)	**15**	**17**	**28**
Crisis	7	7	16
Equity	8	10	12

Skepticism	**-**	**-**	**2**

This table highlights the weight of economy frames in *Expresso*'s coverage and social ones in *Público*'s, in addition *Público* is the only title that presents articles with a sceptical frame; "the visions of university students and the pitfalls of the ecological agenda. Despite the benign intention, the new buzzwords like "sustainable development", "blue economy"; "circular economy", "sustainability", "recycling", among others, run the risk of being nothing more than buzzwords" (4/8/2020) and "What if Africa rejected the Sustainable Development Goals?" (1/8/2019) and no articles equating economic growth with sustainability as the main frame. *Expresso* is the only one not to present articles with a frame dominated by the environment. Our sample seems once again to indicate a greater diversity in *Público*'s coverage, with a greater focus on the crisis and also presenting sceptical views and a greater economy emphasis on *Expresso,* with *JN* being somewhere between the two.

***Table 6**. Moral Claims*

	Culpability	**Entitlement**	**Responsability**
Expresso	4	31	15
JN	12	20	18
Público	6	8	36

JN emerges as the one where more articles point out guilt, and this was also the paper with more articles with a negative tone. This culpability goes in different directions, from the global North to the South, "Developing countries 'risk a lost decade', warns IMF" (27/8/2020), from the opposition to the government, "Greens say that the Recovery and Resilience Plan may be a "missed opportunity"" (21/9/2020), or from local activists to mining projects, "Portuguese and Galicians will protest against lithium on the Cerveira bridge" (15/9/2020). However, the most common moral claim is entitlement, which is especially prevalent in *Expresso*, "Internet: a luxury or a human right?" (3/12/2020). Finally, *Público* is the only one where responsibility is the most frequent moral claim, "Platform brings together 40 municipalities for people, for the planet, for peace" (11/10/2020).

Despite the fact that almost all 2020 articles make references to the pandemic, it was not possible to

identify a narrative shift trend for this reason. Some articles mentioned the need for a more sustainable post-pandemic recovery, "Manifesto for a fair and sustainable economic recovery in Portugal" (20/4/2020) or "Resumption must be "healthier, greener, fairer": WHO launches post-covid manifesto" (28/5/2020) both in *Público*, but no change in the sustainability vision was identified because of the pandemic, just a sense of greater urgency.

4. Conclusions

The Portuguese press does not traditionally assume a political alignment, unlike other countries, frequently denying it when accused of doing so, papers prefer to be seen as neutral/impartial. Only recently some new titles, exclusively digital, seem to be more keen on admitting an ideological alignment, but these are still relatively discreet websites with the exception of *Observador*, an online newspaper that takes a right-wing editorial line and is often quoted in other media. However, our analysis reveals three newspapers with very different profiles, *Expresso* being the one where it is easier to identify an alignment of SD narratives with those used by companies and right-wing parties, where technological solutions and consumption options appear to be sufficient to achieve sustainability and economic growth is seen as perfectly compatible with this objective. The lack of sceptical articles in this newspaper shows how sustainability is an expression already fully appropriated by the business world, and an anti-sustainability narrative does not seem to have any added value here, after all, it is also in *Expresso* that we find more sponsored content about SD.

It is precisely in *Público* that we find the only two articles where scepticism is the dominant narrative and which are therefore the most disruptive of our entire collection. This is not a scepticism that denies the need for SD, but rather doubts its viability in its current terms. Elísio Macamo, a Mozambican professor at the University of Basel, defends the African rejection of the SDGs: "We are committed to a world view based on the idea that the pursuit of wealth is a *sine qua non* condition for eliminating poverty. By instead defining wealth as a problem, we might even go so far as to suggest that those who have more should be more restrained in their wealth or that they should share. […] They define ends that wither the political space, preventing a discussion about the means. Today, poverty is actively produced by the dominant way of managing the world." (8/1/2019). In the other article, three professors from the Faculty of Sciences of Porto defend the need for a new anthropocentrism, which they see absent from SD: "Despite the benign intention, the new buzzwords such as "sustainable development", "blue economy"; "circular economy", "sustainability", "recycling", among others, run the risk of being nothing more than clichés, precisely because they do not enshrine Man as the first and only responsible among the living for the state of the environment: the only one whose choices decide the future. We therefore resume the fair model of anthropocentrism, with Man having the duty to take care of Nature, while simultaneously participating in

it, caring for and creating." (4/8/2020). These two articles have special merit for deeply questioning the definition of SD and for proposing another vision, it is not by chance that they both originate from the academia.

Despite *Público* having revealed the most diverse coverage, confirming its reputation (Pinto et al., 2020), and being the one with the most opinion articles, for each article capable of questioning the essence of SD, we found several that propose consumption options to get there, "After all, it is more sustainable to reuse animal skin or look for alternatives vegetables and recycled?" (6/12/2019).

Finally, *JN* proved to be the title with the smallest coverage and a great focus on short news about local initiatives, which corresponds to its profile as the most popular newspaper, read mainly in the North and Center of the country. Even so, this makes it clear that SD is also part of the current debate at the local and regional level.

When we compare our analysis with the press in other European countries, the biggest surprise seems to be the absence of a narrative clearly against the SD, in the sense that it can be an impediment to economic growth. This can be explained by the fact that Portugal is a country that on one hand arrived late to the industrialization, but on the other hand has been a pioneer in the large-scale adoption of renewable energies (whose promotion was also always eased by the lack of fossil fuels in the country). There is thus a strong discourse in favour of green energy and sustainability, also promoted by entrepreneurs and companies, already since some decades, and there is no traditional heavy industry that could oppose this narrative. Since joining the EU in 1986, the country has seen stricter environmental standards as a sign of progress and its position in international rankings is closely followed ("Portugal ranked 22nd among 180 countries in the healthy development of children", *JN*, 19/2/2020). The business world has adopted this language and a significant part of the articles found are even sponsored, which also reveals the financial fragility of the Portuguese press. This circumstance also facilitates articles that present sustainable consumption options, but that rarely simply suggest a reduction in consumption instead.

The fact that Portugal is a country with strong connections to the other Portuguese-speaking countries, all of them in the global South, opens space for the geographical perspectives not to be exclusively European and Northern and that is why we find articles such as the one by the aforementioned Mozambican professor, or the response of the Brazilian environment minister to Leonardo di Caprio's criticisms in the *JN*: "I think Leonardo DiCaprio should take care of things in his country, his class, including the artistic people, who have a lot of resources, but invest too little in protecting the environment. (...) Anyone who wants to give tips should to put their hand in their pocket, free tips, we won't even care to answer" (19/8/2020), despite unpolished tone that characterizes the current Brazilian government, this answer touches on an essential point of the economic relationship between North and South.

The pandemic, on the other hand, does not seem to have had a significant impact on the way the SD is reported in Portugal, except for an increase in references to a "more sustainable economic recovery", which did not challenge the idea of economic growth as something not only compatible, but also fundamental to SD, or the "green growth"/"ecological modernization" paradigm (Atasanova, 2019).

As the professors from the Porto Faculty of Sciences wrote in *Público*: "By enabling citizens to give their opinion and make informed decisions, media takes on a particularly relevant role today, also because it can favour the construction of a new vision of the environment and of the place and the responsibility of Man within what is, in short, also his, although shared, home." (4/8/2020), but given the rarity of in-depth discussion articles about SD and sustainability, it seems more that the press may be helping to dilute their meaning, making them into buzzwords that businessmen and market-friendly politicians embrace without any hesitation.

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8. Social foundations of sustainability

8c. Just transitions

Abstracts

A Hidden Dimension of Energy Poverty in Brazil Revealed by Covid 19: Access to education

MSc Raiana Schirmer Soares

University of São Paulo, São Paulo, Brazil

Abstract

Energy poverty has been conceptualised and measured in different ways, one of them being through the verification of access to energy services. With Covid-19 pandemic, the issue of energy poverty has gained much notoriety, as people's level of access to public services, as well as their level of comfort at their homes, have come to define their lives, the continuity of their work in many cases, and their education. Particularly in what comes to the effects in people's education, Brazil has been the country with higher number of instruction days schools were fully closed in 2020. In view of this unprecedented crisis in the national education system arising from the need for social distancing and, therefore, the need to implement distance learning strategies in the basic education system, the present study aimed to address the relationship between energy poverty and access to education. More specifically, through an exploratory analysis carried out with a methodological triangulation, this study aimed to address what the relationship between energy poverty and the lack of access to internet and equipment, such as tablets and computers, is. The triangulation consisted of a systematic review of the literature, coupled with a case study that verified the level of access to equipment in Brazil before and during the pandemic. The literature review used Scopus platform and the case study used the National Household Sample Survey (PNAD) (2018) and the School Census (2020) results. The present study demonstrates that the educational dimension of access to energy is still, if not hidden, much overshadowed by the discussion of energy poverty, and shows, employing Brazil as an example, that the lack of access to these services was determinant to the emerged (and to be continued) educational crisis in the country. The study showed that there is a significant territorial and social gap in access to this energy service and that the actions adopted by schools served to minimise the damage but were insufficient to ensure the continuity of remote classes, violating a Brazilian constitutional principle regarding equal conditions for access and permanence in school. The present research highlights the interconnectedness between SDG 7 (Affordable and Clean Energy) and SDG 1 (No Poverty), given that it focuses on the energy poverty debate but, also, it emphasises that there is an important relationship not to be forgotten between SDG 7 and SDG 4 (Quality Education). Most studies assess this latter relationship by highlighting the impact knowledge on energy efficient strategies has over household consumption and the environment; however, the present paper focuses on presenting education not as a determinant to energy consumption, but, instead, energy access as a determinant for people to have adequate access to education. Such a perspective allows us to better understand the cycle of impoverishment of families and its relationship with access to energy amid crisis, highlighting the relevance of the study to the conference, given that eradication of poverty is a core value of Agenda 2030.

Track
Track 8c Just transitions

Are Hard-to-reach Energy Users being Left out of a Just Transition? Exploring the hard-to-reach concept through an energy justice lens

Mr Miguel Macias Sequeira, Dr. João Pedro Gouveia

CENSE FCT-NOVA – Center for Environmental and Sustainability Research, NOVA School of Science and Technology, NOVA University Lisbon, Lisbon, Portugal

Abstract

Climate change and inequality are high on the agenda worldwide. The transition to a post-carbon society involves cultural aspects, equity and morality that are seldom explicit in policies. While growing momentum surrounds the recognition of a right to energy, energy poverty remains a widespread challenge. In this work, we first review the concepts of energy justice and hard-to-reach energy users before blending both streams-of-thought. Even if thematically connected, these concepts have not been combined before; this work addresses this gap and derives policy insights.

Sovacool and Dworkin (2015) define energy justice and introduce three tenets: distributional, recognition and procedural. Although not consensual, this work follows this approach and looks at the consumption-side in developed nations. The hard-to-reach terminology has only recently been applied to energy, e.g. Rotmann et al. (2021), representing audiences that, due to their vulnerabilities, circumstances and/or characteristics, have so far been detached from energy transitions. Five profiles: vulnerable households, high-income households, renters/landlords, commercial sub-sectors, and small and medium enterprises.

First, distributional justice recognizes the unequal allocation of energy-related benefits and ills. We argue that vulnerable households bear the brunt of energy poverty, exacerbated by intersectional vulnerabilities as socio-economic, cultural, gender and ethnic inequalities, while high-income households overconsume. Meanwhile, smaller enterprises are often susceptible to stricter energy burdens, compared to larger companies, while lacking the means to improve their performance. Second, recognition justice states that all individuals must be fairly represented, identifying forms of cultural domination, non-recognition, and disrespect. Through this perspective, a hard-to-reach profile can be seen as a lack of recognition of different needs of specific groups and disrespect for their wellbeing. Third, procedural justice relates to decision-making processes, manifesting as non-discriminatory participation. The perspectives of less powerful hard-to-reach groups may often be underrepresented. Insufficient access to information and decider bias can further contribute to unfair policy outcomes that, e.g., exacerbate energy poverty. In contrast, high-income households are better represented in governance circles while being more capable of challenging outcomes.

We suggest that involving the hard-to-reach is key to a just transition, implying multi-scalar policies ensuring that vulnerable households, tenants and smaller businesses benefit from solutions as energy efficiency, building renovation and decentralized renewable energy, and that high-consuming households contribute their fair share. The merger of hard-to-reach and just transition frameworks can serve as a decision-making tool that evaluates the effects of policies on different audiences while providing an ethical/moral compass. Facing a “triple climate injustice”, we contribute to the literature by framing the inclusion of hard-to-reach users as a matter of energy justice. Simultaneously we build on criticism of the hard-to-reach concept, namely for blaming individuals, by putting the emphasis on policymakers. Future work will explore how to engage with the hard-to-reach while integrating emerging justice tenets.

This work linksto SDG1+Target:1.4, SDG7+Target:7.1, SDG10+Targets:10.2&10.3, SDG13+Target:13.2. Following the proposition of affordable energy services as a human right, it assesses

how energy justice can be deployed to improve policy inclusiveness towards the hard-to-reach for a just transition that addresses climate change and energy poverty.

Track
Track 8c Just transitions

Beyond Coal - progress towards a sustainable future in Poland in the light of Just Transition and post pandemic reconstruction

Adv Magdalena Stryja[1], Dr Alexandra Harrington[2]

[1]University of Silesia, Katowice, Poland. [2]Lancaster University, Lancaster, United Kingdom

Abstract

With a longstanding reliance on coal for domestic heating and electricity generation, Poland continues to experience some of the worst air pollution in the EU as well as high carbon emissions. At the same time, Silesia, the country's industrial and mining heartland, is facing marked pressures and transformation challenges as it progresses towards a greener future. As was demonstrated by the eagerness with which many in Silesia embraced UNFCCC CoP24 in 2018 when it was held in Katowice, there is significant potential for transforming the region into a force for sustainable and climate-friendly efforts. The transition required in the Silesian context reflects the need for a wide-ranging and just transition, as provided for in the Paris Agreement, including insights from Polish academia, private sector and society at large. This presentation will address the ways in which hosting CoP24 and accompanying events led to a realisation of the urgency of action and opportunities that can accompany just transitions in Silesia and the ways in which laws and practices have been implemented to accomplish these goals. The structural transition will involve infrastructure regeneration, legal revisions, worker re-employment and changing public attitudes. As the paper will highlight, legal changes in Poland in recent years have already contributed to green technology development, which is striking when considering that it has been a leader in coal for so long and demonstrates the ability to shift from dirty to green technology through the lens of Just Transitions.

This paper will construct potential future legal consequences of the application of Just Transition, which, after all, takes on even greater significance when confronted with the effects of the pandemic. It will argue that a Just Transformation in research and technology, and that in Poland, especially in Silesia, scientific research and its development and higher education may become a future branch of business, allowing for the creation of new industries and decent jobs into the future. The paper will address these issues through the framework of the SDGs broadly, and particularly SDG 7 broadly, 8.1, 8.2, 8.3, 8.4, 8.5, 9.1, 12.2.

Track
Track 8c Just transitions

Full papers

Articulating Voices of the Young: How to bring youth into contemporary planning and governance?

Tomas Kjellqvist[1], Romina Rodela [2], Ann Mutvei [3]

[1] *Södertörn University, School of Natural Sciences, Technology and Environment, tomas.kjellqvist@sh.se*

[2] *romina.rodela@sh.se*

[3] *ann.mutvei@sh.se*

Abstract

The youth movement "Fridays for Future" has spurred new interest from the research community about the way in which young people engage in politics and governance of social and physical environment. The recent wave of youth activism originated from school strikes concerning the failure of the adults to take any serious measures against climate change. Over the past two years, there is a growing research interest to study how youth articulate their concerns about the present and the future, and how adults pay attention to these, and act on these demands in practical terms e.g., if, and how these translate into current social and political affairs. Youth research trending in the last decades has investigated why youth political organizations fail to attract young people. Researchers have investigated the ways in which young people engage politically e.g. via social media, rather than being loyal to traditional political parties. Much of this literature is research done ***on*** the young, but more recently a new strand of research has been emerging where researchers work ***with*** the young, in order to gain a better understanding of how social and political engagement can be articulated.

Keywords: Youth, Participation, Planning, Citizen Science

1. Introduction

In the view of increasing interest for the role of young people in politics and in the governance of the social and physical environment, it is important to consider what are the ways that can best allow them to be engaged (Rodela and Norss, 2022; Severcan, 2015). In fact, there are multiple ways how this can occur and researchers at Södertörn University are active in studying the different ways that youth can be engaged in contemporary social and environmental challenges. In this essay submitted to the ISDRS 2022 conference we take stock of work done on two large research projects that are each focused on municipalities in the South of the Stockholm Region and focus on the methods used to engage representative groups of young in the transdisciplinary research in the context of spatial planning and local politics. The two projects are:

Project 1: *YouCount*, is an EU-funded project that engages Young Citizen Social Scientists (YCSS) (14-22 years) to explore issues that may mobilize latent engagement and participation to improve conditions for young people in their municipality.

Project 2: *Planning with Youth* is a project funded by FORMAS where we seek to test and compare alternative participatory tools for the engagement of young people (13-18 years) in sustainable spatial planning with the aim to develop an intergenerational framework for planning.

The two projects focus on current issues related to how, and to what degree, the social and physical environments are accessible to the young. Both projects also take into consideration the institutional context by acknowledging already existing methods for dialogue and participation in planning processes and have an interest for young people's concerns for the future, and the eagerness of the participating youngsters to learn how they can influence and explore the pathways to sustainability. Both projects are now in their half-time period which allows us to consider preliminary findings and to compare and contrast the types of problems identified by the young people engaged on these, in relation to their living environments /neighbourhoods.

In this essay we are particularly looking at the following Sustainable Development Goals, SDGs, and targets; 16.7, 11.3, 12.8, and 10.2. We contribute to the track 8c on Just transition by demonstrating methods that show promise to facilitate "a fair and equitable process of moving towards a post-carbon society" and to design processes for "Inclusive and citizen-centric governance".

2. Methods

In this section we briefly summarize the two projects and give information about the research methods that each one has used and what young people are engaged in. A core methodological aspect that we emphasis here in this essay that guides the two projects is the role given to young people as these are given a more central place to the research inquiry. This includes youth having a say on the specific questions to be addressed during the research process, and youth having a role in data collection.

YouCount

The overarching objective of YouCount is to generate new knowledge and innovations to increase the social inclusion of youth at risk of exclusion across Europe through co-creative youth citizen social science (Butkevičienė et al., 2021). Overall, YouCount targets two strands of inquiry: 1) knowledge about social inclusion and how to create social change through the involvement of young citizen scientists and 2)

contributing to the scientific knowledge base for Young Citizen Social scientists for scaling-up interventions. The program focusses on three main domains of social inclusion: a) social participation (e.g., work, education, and social life); b) connectedness and social belonging; and c) citizenship and rights.

YouCount adopts a broad understanding of Citizen Science, CS, based on the definition from Holdren (2015), where CS is understood as the public voluntarily participation in the scientific process, addressing real-world problems from formulating research questions to collecting and analysing data, interpreting results, developing technologies and applications, and solving complex problems.

Each case will establish local living labs (LLs) with multiple stakeholders in the wider community, which will use the data provided by the participating young citizen scientists to cocreate policymaking and innovations in terms of new ideas, products, or methods to create social change.

In the Swedish case, Södertörn University (BYC), where young citizens between 13–22 years, can partake in local policymaking to influence social, political, and environmental decisions affecting the community of young people. The members of BYC are elected by their peers in schools, sports clubs, associations, and at youth centres. As elected, they represent their peers towards the municipality and other organizers of youth activities. With 20 years of experience, BYC sees civil-society engagement as a crucial factor for social inclusion among young Botkyrka citizens. At the same time, they are aware that many young people experience challenges against such engagement.

In Botkyrka, the young, elected members of the BYC voluntarily participate in the research team throughout the whole research process. This core group of citizen scientists (R-YCS) are the main dialogue partners and given space to design the research process with methodological support from the Södertörn researchers. One of the main research questions defined by the citizen scientists is to investigate how engagement in BYC can lead to other forms of social inclusion, such as work, education, social life. To find out, focus group interviews will be organized with former members of the BYC to discuss issues and questions formulated by the current members. The core group citizen scientist has been trained to identify themes of inclusion and engagement through exercises where they imagined their own possible futures and which pathways that could take them to desirable positions in society. In one of the exercise they were also reflecting on what and how their current engagement in BYC would contribute to their selection of pathways and opportunities to enter. Based on this exercise they formulated themes and questions to ask within the focus group dialogue. (The focus group interview will be conducted in fall 2022)

For the BYC, the most important research question is how more young people in Botkyrka can engage with activities organized by the BYC? To find answers, a larger group of youths will serve as community citizen scientists (C-YCS) by contributing data from their daily experiences on an online platform and

identifying targeted solutions through participating in local dialogue forums. The respondents or community citizen scientists will be recruited when the BYC members do their outreach activities to schools, sports clubs and youth centres.

To prepare the on-line survey, the core group of citizen scientists have engaged in exercises together with the researchers to explore the issues and questions to ask for on the on-line platform. The first steps of these exercises were conducted in video-meetings during the pandemic, which partly limited the scope of the discussions. Using "Jamboard", the core citizen scientists were divided into smaller groups to brainstorm on the questions they wanted to ask. In a plenary session, they then discussed how recipients might react or respond to the questions, thereby filtering out questions that were too vague, intrusive or offensive. The researchers contributed with perspectives on integrity, relevance and validity. When a set of questions were agreed upon, the citizen scientist got the task to interview at least two friends each in a pilot study. One set of the questions related to the respondent´s personal data such as age and gender. Another set concerned the knowledge about the BYC, and the third category were questions related to perceived needs for change in Botkyrka and the opportunities to perform change activities.

The results of the pilot study were first compiled on a jamboard during an on-line session and then discussed and analysed in the first physical meeting at Södertörn University. The analysis was done by printing the jamboard notes (post-it) and turn them into a card game. The core group worked by sorting cards in themes, thereby getting a view on topics that were of concern to their peers. Topics raised were sorted into broad categories related to the situation in school, leisure time activities, meeting places, transport and mobility, and security.

In the analysis, the core group also identified responses relating to disillusionment about the possibilities to influence. There were three types of answers, either the respondents did not think they had the ability and knowledge to influence, some did not think they would be listened to, and others yet were disappointed by previous experiences were much had been said and little done. These observations could then be connected to a discussion about theories on youth engagement, were previous studies (Amnå et al 2016) have shown that although some young are disappointed, some are indifferent, the bulk of the young do have a latent interest to become engaged if the issues are relevant to them. The BYC coordinator could then contribute with examples where the youth council had been able to raise such latent engagement. In coming workshops, emphasis will be put on formulating more precise questions to integrate in the on-line app that may pin-point issues that could raise latent engagement.

The results of the studies will be presented in Dialogue Forums with adults engaged in youth matters through the municipal organization, sports clubs and other associations and employers of young people. We are anticipating that the responses we get through the discussions with the BYC and through app will show

gaps in activities currently organised by the stakeholders mentioned. Based on the dialogue, Living Lab activities will be organized to try out some possible gap fillers (Karlsen, J., & Larrea, M. (2016).

Planning for Youth

The overarching objective of *Planning with Youth* is to study when and how different participatory tools (serious gaming, participatory mapping, workshopping creative methods, etc.) enables meaningful activities for young people on questions related to spatial planning. Over the course of four years, we are testing a series of different methods across different age groups with the intent to gather in depth inside about the tools being tested, but also about youth experiences. The project focusses on: a) how are the different methods/tools allowing youth voice to emerge, or maybe not; b) if and when are the different methods/tools allowing for a meaningful participatory experience, and c) how that plays out across different age groups. The aim is to extract insight to advance academic inquiry as well as to inform current policy and practice.

The empirical element of this project is done in close collaboration with local associations and municipalities with whom we collaborated closely. For instance, in collaboration with the Office of Youth Affairs of the Huddinge municipality we have collaborated with two groups of youth who joined our team to study three different tools/methods. A first group of nine youth aged about 15 years helped us over a period of three months in testing two methods i) participatory mapping and ii) photovoice, while a second group of youth aged about 19 years helped us in testing iii) computer games used to discuss aspects of urban governance.

This activity was drafted so that youth joined the project in a role as "researchers" in the processes of testing the methods in close collaboration with the project team. All youth joined to this initiative on the basis of an open call announced by the municipality which took the form of an internship which had also elements of reciprocity – this in terms of offering them and opportunity to learn about project management and about the tools. The internships also foresaw a monetary compensation subsidized by the municipality.

For both groups we have worked in stages over the course of three months. During the first period we sought to build a relationship and have listened closely to what their interests and expectation from this collaboration where. We have offered dedicated training of the method to be tested and other aspect of interests and in this have paid attention to the different needs these youth had. In the second stage we began working on tasks seeing their feedback at dedicated times. In the last stage we brought the work done together and hold discussions to gather feedback on the process and on their engagement as well.

At present we continue with our work on testing different participatory methods and tools for use in

planning and urban governance and aim to develop tick descriptions as to how when and how these can support practitioners and planners in their engagement with young people on questions of planning and urban governance.

3. Results and Discussion

In this section we bring together preliminary insight from these projects and discuss that with attention to the context, but also with attention to transferability of the insight. Namely, while our work is located in Sweden, a country that embraces high standards in terms of democratic values and institutional structures meant to put these into practice (e.g. Act on youth engagement in planning), we also take note of the on-going international trends leading to the consolidation of youth growing a political voice (e.g. y 2022 marks as the European year of the youth). In the view of this growing wave, it becomes very important to reflect on ways researchers can engage with youth that are not extractive, but rather allow for youth agency and meaningful participation. Both projects are ongoing, and the research processes are in the stages of preparations for coming activities. The young people who are participating are stepping in as researchers and as such both projects foster mutual learning processes. In the following we summarize core lessons learned to this point across the two projects:

Diversity of Youth and why it Matters

Youth studies researchers have long been discussing the need to acknowledge that youth is not a homogeneous social category, rather it is a diverse group of individuals and this diversity needs to be understood and acted upon in concrete ways (Özlemnur et al, 2019). Both projects took this assumption on board and worked in ways to allow these differences to be acknowledged and accommodated. In the recruitment of participants, we have allowed for a certain representativity, at least by allowing young people with different backgrounds into the project. In the training activities we have been aware of the different ways voices can be expressed and what they express. Despite the diversity, through patience, we made our way towards consensus or formulations that all participants could accept.

One facet of this diversity is gender and for instance lack of meaningful leisure activities along gender lines has been brought up in the YouCount project. One traditional remedy from the adult world is to start youth centers, but when brought up by the researchers there was a unison response from the girls participating to YouCount that youth centers were only for the boys. When asked to clarify, they said that boys constantly comment on girls' appearance and for the girls this meant that they had to spend hours preparing the right apparel before visiting the youth center. To further explore the gender aspect on leisure time activities to spur engagement is one of the challenges brought up by diversity. It also relates to the desires of the young to define their own ways of meeting and relating to each other.

Another aspect of diversity relates to the socio-cultural background of youth which in Sweden often takes the form of urban segregation in both the municipalities. There is a clear distinction between urban areas as it comes to socio-economy class and ethnical belonging, which in turn form their lived experiences. For some, criminality and drugs are an obvious part of their surroundings while others in the BYC rarely meet such phenomena in their neighborhoods. This was expressed in the discussions about the most important questions to ask their peers through the app, where some thought it to be necessary to ask about criminality as a phenomenon, while others were reluctant.

However, we also see diversity as an asset. For the young participants to our projects, coming from different backgrounds and with different experiences, the opportunity to meet with others and formulate a common agenda is an opportunity to learn about other perspectives. It is also important to see that the young participants come with experiences that can be harnessed within the research project. They have gained experience from school, from associations, and from informal, colloquial gatherings with peers. It has been obvious that such experiences have contributed not only to the discussions and selection of topics, but also to the formation of the research methods.

The Place of Youth in Society and Decision-Making

Activities of this type are demanding and best done in close collaboration with local organizations who know local conditions well and can help in shaping up processes that are context sensitive. Working with the relevant offices within the municipal organizations has proved to be fruitful. We can see opportunities for impact in that we can add a third learning process which is the learning done by the municipal officers engaged in the project. In YouCount we can clearly see that working with the youth council means that the participants already have a joint task, despite their different backgrounds, and they have been exposed to a culture of collaboration within the BYC activities.

Also, from the work done for the project Planning with Youth we can report on the important role that the institutional framework with guidelines as to what role participatory processes shall have has an important role. It allows building alliances across different organizations who are supporting municipalities in delivering participatory activities centered on youth engagement. For instance, close collaboration with municipality offices also allowed the project Planning with Youth to better understand local needs and conditions where youth is situated which was information we used to inform our project activities

Youth participatory research benefits when the way youth contribute is acknowledged within and outside the group involved. Within, as the work in progress was totally dependent on the participants discussions and questions about ways forward, and where they learned to listen to and appreciate different arguments. Outside the group, the YouCount participants have understood that their contributions are not only for

other young people in Botkyrka, but also for youth all over Europe.

One difficulty found in the YouCount project is that the BYC is a moving target, where people leave the organization and others enter on an annual basis. The young participate in YouCount as representatives of the organization, not in their personal capacity. This has led to a core group of persistent participants, while others have shown up occasionally at the meetings. For each meeting the researchers and the BYC coordinator have had to reiterate the progress made in previous workshops which makes the progress slower than with a consistent group. To mitigate this problem, the participants suggested making a short video presenting the project and its objectives so that new members can come to workshops with a good idea of what they are about to experience. In a similar vein, each workshop will be concluded by a short video recording presenting the progress made.

Youth Participatory Research and How we Work with it in our Projects

We can deduce some preliminary responses from the ways that the projects are organized and from the lessons learned. In both cases, the close link with the municipal offices paves the way for young voices to be represented in the administration. To what extent this leads forward into the planning processes is a matter of how well the municipal officers can make their voices heard in relation to other departments within the municipality. In the case of BYC in Botkyrka there is a formalized route that provides opportunities, although there are no guarantees that the suggestions from the young will be taken into consideration.

The research methods can make a difference in various respects. As ideas expressed by the young have been formulated in co-development with researchers could give them a greater weight in the administrative considerations within the municipality. In Planning for Youth this is further emphasized using professional visual and gaming tools to express the perspectives and ideas of the young. In YouCount and in Planning for Youth, the activities conducted have similarities to what the young participants do in their leisure time. They get opportunities to talk about their experiences and concerns to researchers that listen with curiosity and respect, and who can respond by questioning and with constructive critique from a non-defensive position. Further, the researchers can provide tools to validate positions and perspectives and to articulate viable formulations.

In both cases, we will expose the findings and makings of the young to the decision makers. This latter group is to a large extent responsible for the environment in which the young find themselves situated. Such meetings will need both preparation and moderation to set the tone for mutual respect between the generations. Through the various workshops conducted with the young we have heard the young articulate their perspectives in a trustworthy way. One challenge is to what extent it will be possible to

conduct workshops or dialogues with decision makers in a similar trustful climate that we built between the researchers and the young collaborators. If we can induce an atmosphere of collaboration between the parties, there would be possibilities for a constructive dialogue.

4. Conclusions

The outcomes of the work reported above suggest that undertaking research with close involvement of young people has value, but it is not a straightforward process. Working together within the mode of co-development is challenging to us as researchers, it is constantly bringing in unforeseen features to the scene. Researchers get insight into the lived experience of young people, how they see different ways of knowing, and opportunities for themselves. This allows us to develop in-depth understanding of the circumstances that shape youth access to planning and governance and ways in which we could make these more inclusive and meaningful for young people. As Sweden puts its ambitions for more inclusive and participatory spatial planning and governance into law, asking local administration to include young people in planning, there are questions as to which tools and methods are best suited to the task (Cele and van der Burgt 2015; Rodela and Norss 2021). In recognizing that youth is a diverse group this is then a question we shall collectively explore by continued collaboration with young people which shall also help us to sharpen and expand our knowledge about participatory planning and governance.

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Justice in the Shadows – Land, Labour and Migration in India's Clean Energy Transition

The case of the Pavagada solar park

Vishwajeet Poojary[1], Uttara Narayan[2], Ashwini Hingne[3]

[1]World Resources Institute India, Vishwajeet.Poojary@wri.org 0000-0003-0599-9303 [2] School of Geography & Environment, University of Oxford, Uttara.Narayan@ouce.ox.ac.uk 0000-0003-1029-0868

[3] World Resources Institute India, Ashwini.Hingne@wri.org

Abstract

The Silesia declaration at the COP24 (2018) in Katowice catapulted 'Just Transition' to significance within climate and energy policy discussions. This was built on decades of conversations and struggle by labour unions, especially in the US, on the future and livelihoods of industrial workers and communities. Katowice heralded a new context for just transitions — especially for coal workers, post the phase-out of coal. We situate key principles of Just Transitions in the sites of cleaner technologies that are expected to replace coal in the Indian context. We use the case of the Pavagada Solar Park in India, one of the largest solar parks in the world in terms of installed capacity and land area, as the country makes rapid strides in its contributions to Agenda 2030 through ambitious Renewable Energy generation targets. The scale of these installations requires huge tracts of land which in turn could have tremendous implications on the people dependent on land-based livelihoods. A focus on making this transition to Renewable Energy (RE) just and people-centred is indeed essential. Our research demonstrated a disconnect between what is theorized in the planning of goals and targets, and what is experienced at the local level during and post their implementation. The dominant narrative is that clean energy technologies are fundamentally benign. Therefore, there is limited understanding and acknowledgement of the socio-economic consequences of the installation of large renewable energy systems. These include the loss of traditional livelihoods, changes in intra-household dynamics due to changes in employment and income generation. The lack of security in blue collar green jobs at the solar park, and the lack of an agency to demand decent working conditions specially affects social groups which are already at the margins (including but not limited to landless labourers, *Dalits*, women). While these impacts are more tangible, communities' cultural relationship with these lands are often discounted. In this paper, we try to focus on a few socio-cultural dimensions of the impacts of the Solar Park. Firstly, we look at the change in the relation between land and those who are dependent on it for their livelihoods but do not have any formal land titles. Secondly, we look at the state of migration in the village and whether the advent of the solar park has influenced it in

anyway. Finally, we also briefly touch upon the precarity of labour by looking at the nature of jobs generated at the solar park. An understanding of impacts as observed and experienced by the local communities can help inform the articulation of a just transition. Additionally, the study argues that there is a need for an expansion in the interpretation of Just Transition to include the socio-cultural impacts of renewable power installations on communities, in the Indian context. While this work cuts across multiple SDGs, our focus on livelihoods, differentiated impacts and inclusion makes it most relevant to the goals with the following specific targets: SDG5.5, SDG7.2, SDG8.5, SDG8.8, SDG10.2 and SDG10.3. By providing a critique of mainstream clean energy project development, we hope that an updated just transitions framework will resonate with the nuances and contexts that are presented in countries like India, thus also accommodating the rights of workers and local communities at the other end of the transition.

Keywords: Just Transition, Energy Transitions, Energy Justice, Solar Park, Utility-scale solar

1. Introduction

India's low-carbon transition is driven by its ambitious targets for renewable power installations in this decade. It's Nationally Determined Contributions (NDCs) included a commitment to ensure that 40% of its total installed electricity capacity is generated from non-fossil fuel sources by 2030. In 2021, the Government of India's Ministry of New and Renewable Energy announced that it had achieved this target way ahead of its promised timeline (MNRE, India achieves target of 40 % installed electricity capacity from non- fossil fuel sources, 2021). Indeed, it currently has an installed capacity of 156.83 GW from non-fossil fuel sources, constituting 40.1% of its total capacity. At CoP26, the country further improved on its previous targets with an announcement that it will aim to achieve 500 GW of installed capacity from non-fossil fuel sources by 2030. The country had also set specific targets to accelerate its uptake of renewable power. It aimed to install 175 GW of renewable power by 2022 (India, 2015). This included a revision of the targets for 2022 originally laid down in the National Solar Mission (2010), which was increased by 5-times from 20 GW of solar power installations to 100 GW (60GW utility- scale and 40GW rooftop solar) (Government of India, 2015). In 2021, this target was further revised upwards to 300 GW by 2030 (Economic Times, 2021). These ambitions are in line with SDG7.2 which seeks to "substantially increase the share of renewable energy in the global energy mix by 2030." The Government of India through its relevant ministries has been promoting the growth of renewable power through various fiscal and promotional incentives (Kumar & Majid, 2020). One of the major instruments of achieving these massive targets has been the development of utility-scale projects. As per the (U.S. Dept. of Energy, n.d.), utility-scale projects typically refer to powerplants with an installed capacity of 10 MW or more.

The Ministry of New and Renewable Energy (MNRE) in India announced a scheme to promote the

development of "Solar Parks and Ultra-Mega Solar Power Projects" in 2014. The scheme aimed to develop more than 50 solar parks with a minimum capacity of 500 MW each (MNRE, Scheme for development of Solar Park and Ultra Mega Solar Power Projects, 2014). As of December 2021, 77% of India's solar installed capacity came from grid-connected utility-scale solar projects (JMK Research & Analytics and IEEFA, 2022). The southern Indian state of Karnataka had the second largest utility- scale solar installed capacity in India with approximately 7.5 GW installed by the end of 2021 (Joshi, 2021). The cumulative installed capacity in India was 41.5 GW as per the same report. Another 15.8 GW of utility-scale solar capacity is estimated to be added in 2022. Rooftop solar, on the other hand, has contributed a smaller share to India's transition to solar power so far, with India estimated to have a capacity of roughly 11 GW as of 2021 (JMK Research & Analytics and IEEFA, 2022).

The emphasis on justice in sustainable transitions is significant not simply because how transitions which don't benefit everyone will not be sustainable but also because the urgency of achieving these targets could discount the risks of perpetuating injustices against the already vulnerable sections of the population. This is especially true for a developing country like India as it strives to find the best pathways to an accelerated transition that balances its developmental needs and its mitigation targets. The overwhelming share of utility scale solar installations is indicative of India's approach towards clean energy deployment. The need to adopt renewable power at scale and to do so quickly is well- established (Gielen, et al., 2019) (Kumar & Majid, 2020). The commitments to such goals and their implementation in the past decade have been instrumental in India's ambitions to develop sustainably within the constraints defined by climate change. These goals, however, are sometimes defined at the macro level in numerical terms with technological references, especially in the context of the clean energy transition. There is a need to examine how they translate to sustainable development at the local level, to understand whether they do so at all, and to explore how local and national priorities could potentially inform each other. Furthermore, at the macro level, cleaner technological alternatives to fossil fuel sources seem to be assumed to be almost benign. There is lesser attention to the socio- economic and cultural implications of large-scale renewable power projects.

In this study, we look at the case of the Pavagada Solar Park in Karnataka. The Park, also known as "*Shakti Sthala*", was conceptualised in 2015, and the construction began in 2016. When it became fully operational towards the end of 2019, the 2,050 MW solar park was the biggest such installation in the world (Bhushan, 2019). It is spread over 13,000 acres of land across 5 villages in the semi-arid region of Pavagada. The Karnataka State Power Development Corporation Limited (KSPDCL) was responsible for the development of the Solar Park. This project adopted a unique land leasing model and around 3,000 farmers leased land to KSPDCL for a period of 28 years, in return for an annual rent of INR 21,000 ($313) per acre

per year (starting in 2016) (Government of Karnataka, n.d.). The rental amount would be increased by 5% every two years. Such an arrangement was projected to be beneficial in that the landholders continue to retain ownership while gaining a fixed income from the lease agreement. Landholders, however, do not constitute the entire population in region. With this study, we attempt to gather evidence on how the impacts are distributed across some of the different social groups.

Firstly, we look at the change in the relation between land and those who are dependent on it for their livelihoods but without any formal land titles. Secondly, we look at the state of migration in the village and whether the advent of the solar park has influenced it in anyway. Finally, we also briefly touch upon the precarity of labour looking at the nature of jobs generated at the solar park. An understanding of impacts as observed and experienced by the local communities can help inform the articulation of a just transition, especially in the context of such transitions in India. Moreover, it encourages an exploration of justice in transitions from the perspective of impacts felt at the sites of low-carbon interventions. The three tenets framework (McCauley et al, 2013) and the eight-principle framework (Sovacool & Dworkin, 2015) are major reference frameworks in energy justice. The three tenets try to address issues of justice pertaining to both energy systems and energy policies through the dimensions of distributional, procedural and recognition justice. The framework proposed by Sovacool and Dworkin (2015) suggests that decisions relating to energy be made based on eight basic principles: 'availability, affordability, due process, good governance, sustainability, intergenerational equity, intragenerational equity, responsibility'. Their notion of justice builds on the idea that procedural and distributional justice are interconnected and hence, require a synthetic framework to be incorporated adequately. The paper uses observations from the local communities and examines them through the lenses of procedural and distributional justice.

2. Methods

This is part of a broader research study conducted by World Resources Institute India to create an empirical evidence-base of the local impacts of utility-scale solar deployment in the country specifically focusing on the case of the Pavagada Solar Park. Following a review of literature on just transitions frameworks, and past articles and studies on solar projects in India, we identified the research questions for this paper. First, we tried to understand the socio-cultural implications of the Pavagada Solar Park on the landless communities in the villages. Second, we explored whether the solar park had any impact on the migration situation in the villages. Finally, we tried to examine work at the solar park for its accessibility to villagers, and the working conditions therein. Consultations with researchers and activists working in similar areas of research helped narrow down our approach to the primary data collection stage of the study. For the primary data collection, we collaborated with a team from a local NGO, *Thamate*[1], who were based out of

Pavagada. Their knowledge and familiarity with the local context and the local community helped us build trust with our respondents and identify key sources of information in the process. The Pavagada Solar Park is spread over 5 villages – Thirumani, Volluru, Rayacherlu, Kyathaganacherlu and Balasamudra. 3 (Thirumani, Volluru, Rayacherlu) of these 5 villages were examined for this study.

This selection was based on the size of the villages - the 3 villages with the most households were chosen to allow for a greater sample collection. Using data for number of households at a village level available from the Census of India (2011), the sample size was estimated for the selected villages with a confidence level of 95% and a margin of error of 6%. We planned to use stratified sampling to ensure that the distinct caste characteristic of the region was captured in the sample.

The evidence collection was completed in three modes. Firstly, a standardised structured questionnaire was administered to more than 175 households to gather information about the members at the household level in all the 3 villages combined. Data from the surveys was gathered using a mobile application designed specifically for the research in collaboration with *Dhwani RIS*. Secondly, thematic Focus Group Discussions were conducted using semi-structured questionnaires to guide the discussions amongst different groups of participants including landless labourers, marginalized caste groups, workers at the solar park, etc. Finally, key informant interviews were conducted to gather detailed insights from different stakeholders varying from community representatives and *Dalit* leaders to local journalists. These interviews were again guided by semi-structured questionnaires.

Methods of analysis: Primary data from household surveys was analysed using MS-Excel and R. Qualitative data collected from key informant interviews was analysed using narrative analysis, and data from Focus Group Discussions were analysed using the emerging themes as a reference.

[1] *Thamate* (thamate.org) is a community-based organization working since 2006 on human rights with the most marginalized groups to help them break free from the discriminatory practice of caste-based occupations and to facilitate the comprehensive development of communities.

Limitations

There were a few limitations to the methods employed for the study. Firstly, the language of research is different from the language in which the information was gathered. This results in a potential for losses in translation. The researcher and the data gathering team's familiarity with at least one of the two languages (Kannada, Telugu) in which information was collected mitigates the scope of errors in contextualising to an extent, but the researchers acknowledge the limitation posed by multiple levels of translation in some places – from Telugu to Kannada to English. Secondly, a lack of robust datasets for certain parameters, especially those pertaining to migration is a limitation to our attempts to capture a longitudinal image of changes in the region. Finally, the study was conducted amidst COVID19- and though we have tried to clearly segregate our inquiries, its implications on responses can be difficult to completely sieve out.

3. Results and Discussion

1) Land relations and Caste

Approximately 26% of the households in the surveyed villages do not have any land titles. A breakdown of this into the caste identities of these families reflects the traditional social hierarchy in these villages. 88% of the so-called "upper" caste households have some land ownership whereas close to 41% of the *Dalit* families or the most backward communities in the villages do not have any land ownership. The direct benefits from the solar park accrue to those who have leased land to the solar park. Therefore, the benefits may be disbursed equally on a numerical basis (fixed amount per acre per year), but do not percolate to different social groups equitably since the privileged castes tend to own larger quantities of land while small landholders and landless labourers tend to hail from marginalised caste groups.

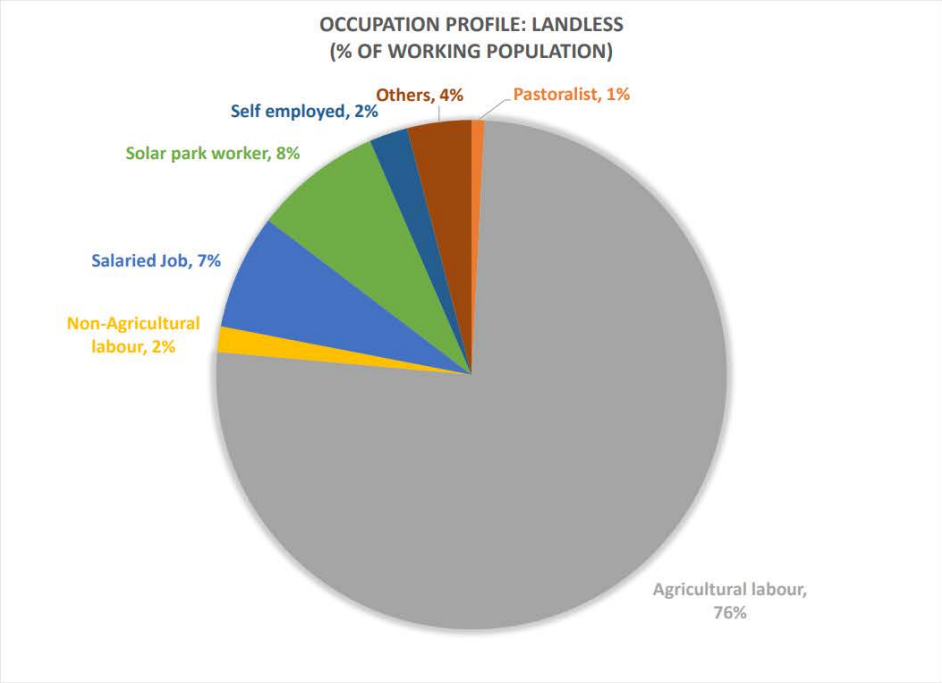

Figure 1. *Occupation profile of landless individuals*

Approximately 76% of landless workers were engaged in agricultural labour. Of these, 71% belonged to the Scheduled Caste (35.5%) and Scheduled Tribe (35.5%) communities[2]. Agriculture in Pavagada is rainfed, and workers from these families depended on this seasonally available agricultural labour. Several families of workers had been working on the same stretches of land for years and had relations with the landholding cultivators. Based on this relationship of trust, they could negotiate access to informal credit or advance payments which the landless families could use to meet their urgent needs in difficult times. A significant area of land which was previously under agriculture is now being used to host the solar park. In our sample, there was an 88% reduction in the amount of land under agriculture in the surveyed villages since 2015. This reduction has affected the lives of the landless workers in three ways:

No monetary or material compensation: No land titles has meant that they have had no share in the direct benefits from the land lease mechanism.

i) Lost opportunities to work as agricultural labourers in the same villages: Landless labourers in the villages where the solar park has been installed have to compete amongst each other for the drastically reduced labour available in the village. They must now travel to other villages in search of work.

[2] Scheduled Caste (SC) and Scheduled Tribe (ST) are groups officially recognized by the Constitution of India as among the most disadvantaged socio-economic groups in the country.

ii) Breakdown in relations with the land-owning cultivators, which has resulted in a loss of access to informal streams of financial assistance.

All three factors leave the landless families without direct access to their traditional sources of income and worsens their financial vulnerability. Their financial security is further weakened as they are unable to seek advance payments or credit from the landowning families with whom they do not have a working relationship to leverage anymore. With no other major alternatives available locally, the landless labourers have no choice but to look for opportunities elsewhere – either in the neighbouring villages or in towns and cities.

2) Migration

Pavagada has been declared drought affected 54 times in the last 60 years (Rao, 2019). Reducing rainfall in the last three decades has seen a fall in the agricultural productivity of the region, and a corresponding reduction in the number of families practicing agriculture as it has become less viable over time. The region was categorised as one of the "most backward" in Karnataka by the Dr. Nanjundappa Committee set up by the State Government (Nanjundappa et al., 2002). One of the outcomes of the extreme weather conditions and low economic growth has been an increasing trend of migration away from Pavagada (The News Minute, 2018).

Typically, families were involved in agriculture and allied activities in the monsoons and cultivation ended in the months of November and December. In the non-agricultural seasons, the labourers would migrate to neighbouring towns and cities in search of temporary jobs. Children, elderly family members and caretakers would be left behind. Seasonal migration was common in families which could rely on agriculture to generate income for parts of the year. Permanent migration, on the other hand, involved entire families moving out to settle in another place permanently. They would leave behind their houses in their villages to work and live in other towns and cities.

In an in-depth interview with a local social worker, G, who has been actively working for more than 2 decades, they claimed that a minimum of 25 to 30 families in every village have migrated. Most of the migrating families belong to the Scheduled Caste (SC) community and a few to the Scheduled Tribe (ST) community. Roughly 40% of SC families and 30% of ST families in our sample did not have any land titles. We have seen above that 3 in 4 landless workers relied on agricultural labour. With land now under the solar park, there is a reduction in availability of such labour in the agricultural season. Seasonal migrants are now increasingly getting converted to permanent migrants. With fewer alternatives available, workers from these marginalised communities migrate to seek subsistence.

From more interviews with key informants, limited land and asset ownership, absence of access to capital, absence of safety nets from the government or benefits from existing schemes, and fewer options for non-agricultural employment emerged as some of the reasons for the migration. An inquiry into the kinds of opportunities sought by the migrating workers led us to the finding they ended up doing one or more of the following jobs, all of which are unskilled or semi-skilled labour activities:

i. Daily wage construction labour/ masonry – which they also referred to as 'cement' work/ 'builder' work
ii. Painting
iii. Plumbing
iv. Garment factory – which mostly employ women
v. Restaurants/ canteens – as waiters, helpers
vi. Security personnel

None of the jobs listed above provided the workers with any security or guaranteed them an income which was enough to gather monthly savings. Daily wage labourers were stuck in a vicious cycle where they would survive on weekly payments with no scope to break free from the cycle by saving enough to do something different. Those with a relatively better education such as diploma or industrial training holders would work in factories and industries, but they too were employed on a contractual basis, and they did not have any guarantee that they would be employed throughout the year. Most of the migrants go to one or more of the following places to find work:

i. Bangalore
ii. Tumkuru
iii. Ramanagara (Bangalore)
iv. Mysuru
v. Doddaballapura
vi. Chikkaballapura
vii. Hindupur (state of Andhra Pradesh) factory – 50 kms from Pavagada
viii. Coffee estates in Coorg, Chikkamagaluru, and as far as the neighbouring state of Kerala

As mentioned earlier, with the installation of the solar park, the amount of land under cultivation and the number of households employing agricultural labour has come down. This has meant that those who possess little or no land, who relied on agricultural labour for income have now lost access to an immediate source of income. These labourers now must either look for agricultural labour in other villages in the taluka during these months or migrate elsewhere for alternative opportunities altogether.

Indeed, the advent of the solar park has seen families gradually convert from seasonal migrants to

permanent migrants. The number of jobs generated at the solar park is currently not equivalent to the number of people left without a livelihood. Besides, there was an agreement in principle to give a preference in solar jobs to those who have leased land to the solar park at the initial stages of the project development (KSPDCL, 2018). This further keeps the landless labourers at the margins. Reliance on unskilled labour and on informal contractual agreements means that they are perennially at risk. Apart from minor changes in skillsets adapted to suit their specific jobs, there is no mechanism for systematic skill development in place that could help them secure a stable livelihood.

Women labourers face specific new challenges as they address changes in livelihood opportunities introduced post the installation of the solar park. Unlike their male counterparts, they had limited options to migrate to farther distances for agricultural or other labour. They were expected to fulfil their socially defined role of caretaking and be available to tend for children and elderly family members. This entailed a reduction in income generating work opportunities for such women. There were women who still travelled as a group on daily basis to surrounding villages for agricultural labour, whenever it was available which was just a few months a year. Female agricultural labourers were paid roughly 60% less wages than male agricultural labourers. In the surveyed sample, the average wages for a female labourer were INR 250 per day and the corresponding figure for a male labourer was INR 400 per day. From interviews with a female social activist and a teacher in the village, it was gathered that there was a general lack of agency for women in the village to participate in discussions and contribute to decisions. It reaffirms the need for measures to drive SDG 5.5 which aims to "ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life."

3) Precarity of labour

The solar park has created new jobs too. These include workers working as engineers, technicians, security personnel, grass-cutters and panel cleaners, among others. The average level of education in the surveyed villages is 5th to 6th Grade. Only around 7% of the population have an undergraduate degree or higher. A low level of educational qualification in general means that most of the villagers are not eligible for skilled positions or "white-collar" jobs. Indeed, the solar park workers that we met during the household surveys were mostly employed as security guards or involved in grass cutting and solar panel cleaning work. These positions were contractual in nature, and the contracts themselves were not formally designed. Large landowners competed amongst each other for Operations & Maintenance contracts granted by private solar park developers. Once they had the contract, the contractors could hire workers from anywhere to get the work done. This left the workers at the mercy of the landholders. It was common for workers to need what they called influential "References" or "Recommendations" to land a job at the solar park. More than 80% of the workers at the solar park in our survey belonged to households which had some land ownership.

Work wasn't always available for wage labourers; they would only be occupied for a few days a month. Additionally, it was learned from interviews with solar park workers that delays in payments were common. Grass cutting workers mentioned the lack of safety equipment and regulations given the risks of snakebite in the early hours of the morning or the evening when they typically went about their work. No grievance redressal mechanisms or platforms to voice their concerns, and no associations and very little bargaining power to stake their claims for better working conditions sums up their precarious situation.

This component speaks broadly to the motives of SDG 8 which seek to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". More specifically, they throw more light on matters relevant to SDG 8.5 which advocates for "decent work for all" and SDG 8.8 which promotes "safe and secure working conditions for all workers, specifically for those in precarious employment".

4. Conclusions

The evidence presented in this paper challenges the notion that clean energy is fundamentally benign, especially when propagated through the medium of utility-scale projects. Specific inquiries into the Pavagada Solar Park in this study shed some light onto the experiences of the most marginalized groups in the project villages. It was observed that the landless workers in the villages were at a disadvantage. The compensation mechanisms which were directly linked to land ownership discounted the dependence of the landless families on land-based livelihoods. A reduction in the livelihood opportunities in the villages and a breakdown of long-standing relationships between workers and cultivators further added to their vulnerability. Migration had been common in the past few decades in Pavagada due to a decline in agricultural productivity and low economic growth. The Solar Park aimed to create new jobs and develop economic opportunities in the region. Yet, as per several in-depth interviews, migration of landless families has increased in the years after the installation of the solar park as more and more workers moved away in search of livelihood opportunities. Again, this was most common among the most marginalized sections of the population who had little or no access to financial, social or human capital. Furthermore, these workers mostly ended up working in insecure, contractual jobs or as daily wage labourers on unsustainable incomes. Women in the surveyed villages had limited options for migration as they were expected to remain available at home to fulfil domestic care responsibilities. Finally, the lack of suitable qualifications and skills in the local working population has meant that their employment at the solar park is limited to roles such as grass cutters, solar panel cleaners and security personnel. All the solar park workers considered in this study's sample were hired as contractual labour (by contractors who operated as intermediaries between

the Solar Park Developers and the workers) thus keeping them out of the purview of employment benefits and safety nets, occupational health and safety regulations or any bargaining power to demand for decent working conditions.

These findings highlight the risk of exacerbating the plight of vulnerable and marginalized communities in the absence of methods to recognize, understand and account for their differentiated needs and vulnerabilities in the path to a low-carbon future. It is essential that the local power relations are understood on a case-to-case basis, especially between classes of landowners and those without land, between different caste groups and between genders, at the planning stage of such projects. These efforts must also recognise and respect the agency and knowledge of the local communities in contributing to these at a project-level, as well as the broader low carbon vision. Further research should work towards understanding approaches of how the institutionalised decision-makers can work in collaboration with the local communities. Such an approach would be appreciative of participatory and democratic processes to ensure that the differences in interests of each of these social groups are understood and negotiated. Achieving justice in this context, necessitates attention to historical injustices propagated by existing social and institutional structures. Policy and legal instruments may enable addressing structural concerns, at a multi-scalar level, that such technology-centric approaches to the clean energy transition demand.

Each social group had unique experiences. This case study emphasizes the impacts on the landless labourers (who typically belonged to underprivileged caste groups), women and workers at the solar park. Some of the impacts of the Pavagada Solar Park have forced a few workers to reorganize their livelihood strategies. Its role in inadvertently accelerating the migration of people from the underprivileged communities, out of Pavagada, needs to be examined further. Research to understand the range and intensity of impacts on different social groups in the project villages must be conducted after the installation of the solar park. Such research must engage with the local communities to find ways to redistribute the costs and benefits in an equitable manner and limit the perpetuation of inequalities and vulnerabilities. Villagers working at the solar park as contractual workers could benefit from accountability mechanisms for employers to uphold workers' rights to safe and fair working conditions. Interventions aimed at strengthening the villagers' capabilities and ability to negotiate with the project developers for their rights as workers also need to be developed.

Caste plays a significant role in social and land relations in India. Understanding caste dynamics, and the subsequent power relations it perpetuates is a prerequisite to envision an equitable sharing of the consequences of large-scale green infrastructure such as the Pavagada Solar Park. The most underprivileged intersection of caste (*Dalits*) and class (landless households) bear a disproportionate share of risks and disadvantages in Pavagada. It was also seen that women at this intersection were further

marginalised owing to their reduced access to livelihood options, domestic care responsibilities, and their lack of freedom to choose alternatives. These dimensions must guide our understanding of vulnerabilities in greater detail and inform approaches to understand how the consequences of low- carbon interventions are distributed between the various stakeholders.

Finally, we propose that we build on this case to expand the conceptualization of Just Transitions within the electricity sector to include those affected by the installation of cleaner alternatives, especially large- scale green infrastructure. Including the socio-cultural implications of the Solar Park by factoring in the interests of farmers, workers and other local communities whose lives and livelihoods have been altered would be a vital addition to the existing scope of the Just Transitions discourse.

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9. Governance, power and institutions and weakness of SDGs

9a. Peace and sustainable development

Abstracts

Carbonomics, H2Onomy, and the Age of Disruption: A thought experiment for the decade humanity reoriented, reimagined, and (perhaps) renewed itself

Dr Sebastian Thomas

Curtin University, Perth, Australia. Blue Praxis, Melbourne, Australia

Abstract

The future is uncertain. Environmental changes including global warming, ocean acidification, and biodiversity losses have unknown consequences for human societies. Political tensions resulting from the conflicting strategic priorities of nation-states and other actors also represent potential threats to stability. In combination with increasing resource pressures, population growth, and forced migration, these trends mean that human civilisation may look very different by mid-century, if indeed the international order survives at all.

The convergence of digital, mechanical, and biological technologies provides extraordinary new opportunities for innovation in business, governance, warfare, and welfare. Robotics, advanced computing, internet connectivity, bio- and nanotechnology, machine learning, and decentralization are among the 21st Century tools that are changing how we live, work, learn, trade, compete, and collaborate. The Fourth Industrial Revolution – or Industry 4.0 – is a period of rapid and significant change across sectors including manufacturing, energy, finance, transport, textiles, healthcare, real estate, and security. Yet this revolution has implications that go far beyond commerce.

This paper explains the concepts, challenges, and opportunities of the Fourth Industrial Revolution, and applies these to a thought experiment that considers how institutional stakeholders and communities might respond to continually increasing pressures of climate change and resource constraints, speculating on the nature of governance in a climate disrupted future. The analysis takes an interdisciplinary sustainability science approach that encompasses social, technical, political, economic, and historical perspectives. The paper considers uncomfortable but not unrealistic scenarios of coming decades, in which global climate policies will be increasingly focused on rapid mitigation of carbon emissions, and local trading dominated by the need for water. These future dynamics are characterised as global 'carbonomics' and a local water economy, or 'H2Onomy.' The paper explores the drivers, characteristics, and implications of these scenarios.

Track
Track 9a Peace and sustainable development

Ethnicity, Inequalities, and Collective Grievances: The changing the contours of democracy and political community in India

Dr Mansi Awasthi
Tata Institute of Social Sciences, Mumbai, India

Abstract

Expanding interest in social institutions, and centering of attention on State as an institution that is essentially cultural, a major interest in ethnicity studies is on the process of State-ethnic group interface in the State-building process. An important condition that underlies this casual interface is perceived inequalities, often expressed as collective grievances. Drawing on information from the Ethnic Power Relations datasets, the paper highlights the effects of ethnicity in conjunction with politically induced collective grievances. Although such grievances can arise in many scenarios, we focus on a specific ethnic group who are separated from their co-ethnics in the different nation-state. In this article, we contribute to the current literature by stressing the avenues of exhibiting ethnopolitical grievances among excluded ethnic group. These contestations are seen in the micro-politics, that characterize the democracy seen in the country.

Track
Track 9a Peace and sustainable development

Interactive Governance of Smart Cities: Collaborative participation of the citizen o to sustainable development in the metropolitan region of Baixada Santista

Doctor Mateus Catalani Pirani, Master Camila Marques Gilberto, Doctor Adriana Machado da Silva, Doctor Josieni dos Santos Pereira

Unisantos, Santos, Brazil

Abstract

The consolidation of sustainability as a dominant paradigm should be built from multiple dimensions, especially with the Technological Dimension of Sustainability. Cities are the stage where social, economic and environmental dimension converge more intensely. Faced with numerous challenges, the conceptions of cities suffer a lot of influence from technologies, especially smart cities and sustainable cities. With the present study, it is possible to glimpse how the technological dimension impacts social relations, allowing not only to propose efficient policy models, but to ensure that they are tools of digital empowerment and thereby develop, in the Metropolitan Region of Baixada Santista, crucial concepts of SmartCity based on sustainability by design. The Smart City concept plays a significant role in terms of sustainability, enabling the management of the efficiency of operations and functions, natural resources, intelligent management of infrastructure and facilities, improving the quality of life and well-being of citizens and improving mobility and accessibility. With this, it seeks to achieve the social function of the city. It is impossible to conceive the concept of smartcity without discussing and implementing interactive governance system, because the restructuring of urban centers is essential to achieve the Sustainable Development Goals (SDGs). Some of these SDGs are directly related, such as SDGs 9 (industry, innovation, and infrastructure) and SDGs 11 (sustainable cities and communities). Indirectly, the concept is also linked to all other SDS. In practice, it is essential that the citizen (city user) is able to play a leading role in this governance process, especially due to the constant demands of community movements to ensure the right to decent housing, access to natural and economic resources, among others. All these actions are skilled in coping with numerous socio-environmental conflicts. This article proposes the examination of transformative mediation as a strategy of durable social pacification in community environments, within the scope of SmartCities, through constructive dialogue and the recognition and valorization of the actors involved. Community transformative mediation allows all actors involved in the conflict to feel part of a human project, with sustainability based on shared responsibility. The method adopted in this article consists of dialectical critical theory, with inductive bias, aiming at examining the dynamism of social relations involving community actors, inserted in a historical-social reality in constant transition process.

Track
Track 9a Peace and sustainable development

9. Governance, power and institutions and weakness of SDGs

9b. Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Abstracts

A Variety of University Initiatives Aiming at Promoting Collaboration for Sustainable Development. Reflections on strategies and collaboration practices as Södertörn University.

Associate professor Malin Gawell, Dr. Erik Falk, Dr. Johanna Tollbäck, Professor Peter Dobers

Södertörn University, Stockholm, Sweden

Abstract

According to the Swedish University Act (1992:1434), higher education institutions must include the task of collaboration with surrounding society for mutual exchange and working to ensure that the knowledge and competences that exists in the higher education institutions benefit society. For some universities, e.g. technical universities, forms for collaboration have emerged over decades, while others are trying out suitable forms.

Södertörn University, with a strong emphasis on social sciences and humanities, opened its doors to 1.200 students in 1996; in 2021 it was more than 13.300 students. The location in southerner Stockholm's suburban region was chosen as a counterweight to the northern location of established higher education institutions. The aim to reach out to potential students from non-academic families and contribute to the economically less developed region was explicit.

While the university's core tenets of multidisciplinarity, multiculturality and liberal education have underwritten and continue to inform much collaboration in educational programmes and research programmes, the institution's collaboration can be historically and organizationally divided into three phases.

During the early years (1996-2010), collaboration was primarily based on initiatives from individual teachers and researchers, first and foremost on an ad hoc bases and with relatively little learning between individuals or initiatives. Then centres such as Centre for Studies in Practical Knowledge, The Academy of Public Administration, and later on in 2017 Reinvent – Centre for City Dynamics were established as platforms for collaboration among other tasks.

Södertörn University has a collaboration strategy (since 2015), a strategic collaboration council since 2017 and a strengthened support unit. During these years a number of initiatives have been launched to increase collaboration and partnership capacity of the university, and to support the development of collaboration with the aim to contribute to sustainable development and to have more students, teachers and researchers engaged in collaboration activities. As a result, the university has now created two strategic partnerships with neighboring suburban municipalities as one of eight so called regional cores to be intensively developed until 2050. Södertörn University has a strategic vision to become the most relevant university for those regional cores that have been identified as necessary to lessen the pressure on the capacity of the central core while avoiding urban sprawl and increased car use.

The aim of this paper is to elaborate on some of the challenges and success factors of recent and current initiatives and to set these insights in a multi level transdisciplinary framework as a way to understand different types of initiatives contributing to the promotion of collaboration for sustainable development.

Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Collaboration Capacity as an Institutionalized Practice for Sustainable Travel

Professor Margareta Friman[1], Professor Lars Olsson[1], Deputy Transport Director Lena Thorin[2]

[1]Karlstad university, Karlstad, Sweden. [2]Region Värmland, Karlstad, Sweden

Abstract

The transport domain is on the agenda in the climate and sustainable development discussion as it is facing a major challenge when it comes to transforming from a fossil-based car fleets to sustainable mobility, such as carpooling, public transport or active travel. In the UN Sustainable Development goals it is an important component of goal 11 (Sustainable cities and communities) and target 11.2 (By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons). This presentation focuses on collaboration capacity between academia and practice as a prerequisite for sustainable travel.

Collaboration between different stakeholders is argued to increase the efficiency and quality of the transition to sustainable mobility. At the same time, collaboration act as a mean towards a professionalization of all parties – academia as well as practice. Although collaboration is a recognized priority, current practices do not fully support this goal. A barrier is that stakeholders sometimes differ in their understandings of what "collaboration" means. This presentation develops a set of criteria for enhancing the collaboration capacity between academia and practice based on experiences from a (more than) ten-year research program named SAMOT (Service and Market Oriented Transport Research Group). The SAMOT research program has a clear vision to develop a public transport that succeeds in combining the individual's requirements for simple, effective, and flexible transportation with society's goals regarding the long-term, sustainable development of cities and regions. In order to reach such goal, collaboration is performed between academia (university), public (e.g., regional authority) and private (e.g., transport operators) actors. SAMOT's mission is to actively contribute in developing the transport sector in accordance with SAMOT vision, by co-producing and disseminating scientifically-grounded knowledge of public transport and its conditions; knowledge which both stimulates continued development and inspires critical reflection as regards public transport's service and market orientation.

In this presentation, we clarify different forms of knowledge development and collaboration between academia and practice within SAMOT, as well as how these are experienced and viewed. Second, we present three cases illustrating a collaboration capacity that has outlined knowledge development and a general professionalization among collaborating parties. Based on our findings, we invite scholars to further develop and promote a general collaboration capacity and to participate in establishing collaborative capacity as an institutionalized practice within the transport domain; an initiative that requires both courage and trust between different stakeholders.

Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Community-based Innovators and their Innovations Emerging in the Developing World as an Enabler of Co-creation of Collective Actions toward Sustainable Futures: Emergence of legitimate leadership, trust-based network, and partnerships with scientists

Professor Tetsu Sato[1,2], Mr John Matewere[3], Mr Brighten Ndawala[4]

[1]Ehime University, Matsuyama, Japan. [2]Research Institute for Humanity and Nature, Kyoto, Japan.
[3]Sustainable Cape Maclear, Chembe, Mangochi, Malawi. [4]Sinthana Project, Chembe, Mangochi, Malawi

Abstract

People and local communities in rural areas of developing countries face various difficulties and barriers in mobilizing collective actions in collaboration with diverse actors, both in the community and from broader areas and contexts, to mobilize societal transformations toward sustainable futures. Through transdisciplinary research in two consecutive research projects; TD-VULS project funded by Research Institute of Science and Technology for Society at Japan Science and Technology Agency (2017–2019); and IntNRMS project funded by Japan Science and Technology Agency and Japan International Cooperation Agency (2020–2025), we have identified many examples of creative practices emerging among community members to improve sustainability of natural resources and human well-being (community-based innovations) in Malawi, which would produce broader impacts on multiple targets of SDGs.

We have conducted transdisciplinary dialogues and deliberations with innovators leading these practices, including two coauthors of this paper from a riparian community in Lake Malawi National Park, to co-create narratives on the processes and mechanisms of emergence of collective actions collaborating with diverse actors. Among the coauthors, John Banana Matewere is the founding member of the tour guide association with his fellow tour guides to mobilize close collaboration with tourist lodges, resulting in promoting clean-up activities of the village with broader members of the community. In collaboration with external scientists including Tetsu Sato, he has expanded his networks with fishers and coastal residents to co-create an artificial fishing reef, which has improved sustainability of fisheries and well-being of people. Brighten Ndawala is the founder and director of the Sinthana Project, which has established the first preschool education facility in the community in collaboration with international donors for children to prepare for formal education. To improve nutritional conditions of the children, it has developed organic agriculture systems to provide healthy foods for children. They successfully established supply chains of organic agriculture products in the village to secure funding bases for their project, benefiting other collaborating farmers and buyers at the same time.

Transdisciplinary dialogues among coauthors indicated important factors of community-based innovations as enablers of collaborations among diverse actors to transform the community toward sustainable and equitable futures through co-creation of knowledge and actions. Based on the co-created narratives on these innovations, we will discuss three fundamental enablers of successful collaborations to co-produce broader impacts beyond the communities; (1) securing legitimacy in their leadership by interacting with other actors in the formal and informal decision-making systems, (2) expanding trust-based networks of actors involved in the actions, and (3) co-creation of broader and more general values of community-based innovations with external scientists.

This research is deeply related to SDGs 12, 2, 1, 14 and 15 (in order of relevance). The community-based innovations in this paper are embedded in local cultural contexts with inertia and obstacles of transformation. The innovators introduced in this paper have demonstrated their leadership to break

through these barriers by co-creation of knowledge and collective actions through trust-based collaboration with other actors including scientists.

Track
Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Dynamic Laboratories for Local Sustainability: Insights of the ODSlocal project (Portugal)

Madalena Duque dos Santos[1], Filipa Ferreira[2], Paulo Miguel Madeira[1], João Guerra[1], Lia Vasconcelos[2], Luísa Schmidt[1]

[1]University of Lisbon - Institute of Social Sciences, Lisbon, Portugal. [2]NOVA School of Science and Technology, FCT NOVA, Lisbon, Portugal

Abstract

In 2015, the United Nations established the 2030 Agenda and defined 17 Sustainable Development Goals (SDGs). Recognizing the challenges of their implementation, given the global scope of the SDGs, their achievement will depend on our ability to materialize them in the local and regional context. The 'localization' of the SDGs has been presented as the best approach to promote SDGs in a mobilizing, inclusive and systemic way.

Based on their proximity to citizens and local problems, municipalities, and their technical staff represent key strategic actors in the process of localizing SDGs, since they mediate between civil society, the private sector, and central government. In this context, the ODSlocal - Municipal Sustainable Development Goals monitoring platform (www.odslocal.pt) main objective is to foster a continuous process of localizing the SDGs and the integration of sustainability imperatives in the municipal planning tools.

ODSlocal intends to contribute to: definition of local goals; identification of priorities and their integration into local policies, plans, and strategies; implementation of collaborative approaches to generate joint solutions built by local communities; coordination between the different levels of governance, ensuring a coherent policy and working directly with the municipalities, allowing different local actors to work together for a better adaptation to local needs and expectations.

One of the main aspects of this project are the Dynamic Laboratories for Local Sustainability, whose objective is to mobilize municipalities and citizens for the 2030 Agenda and the SDGs, whilst taking advantage of the systematization of data and knowledge that the ODSlocal platform adds.

This paper will seek to focus on the first phase of the Dynamic Laboratories for Local Sustainability, namely on the cycle of training sessions for municipalities to promote the 2030 Agenda at a local scale, organized in eleven geographic areas of the country. These sessions, which took place throughout 2021, involved three hundred municipal technicians representing 116 municipalities (almost 40% of the total). They enabled the discussion of the SDGs application at the local level, the sharing of good practices, the impacts of the pandemic and collaborative processes for the strategic co-construction of the local 2030 Agendas, promoting the sharing of different local realities in the context of the SDGs. The outputs of these sessions resulted in important contributions to the identification of the main challenges and opportunities for the achievement of the SDGs at the local scale. They also allowed participants to identify priority strategic lines for their territories in the short and medium term. This proposed abstract relates to all SDGs but most directly with SDG 11 – Make cities and human settlements inclusive, safe, resilient and sustainable, by engaging local authorities to reach the society at large at the local level, through a comprehensive and intense mobilization of decision-makers, municipal technicians, and local agents, promoting local sustainability cultures.

Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Evaluation Synthesis on Private Sector Engagement in International Development

Valerie Habbel[1], Magdalena Orth[1], Johanna Richter[2], Steffen Schimko[1]

[1]DEval, Bonn, Germany. [2]KfW, Frankfurt, Germany

Abstract

Cooperation between international development actors and the private sector is becoming increasingly important. Public donors expect it to mobilise additional resources to achieve the Sustainable Development Goals (SDGs) and the private sector to act as a driver of economic growth, entrepreneurial creativity and innovation. However, whether private sector engagement actually achieves these goals has so far only been explored in evaluations and studies of individual projects and instruments.

This evaluation synthesis attempts to close this gap by systematically analysing existing evidence (evaluations and academic studies) from national and international development cooperation on private sector engagement. It differentiates between three types of cooperation: the financing *with* companies (for the mobilisation of resources), the financing *of* companies (to encourage investments) and the preparation of financing, e.g. through matchmaking activities.

The synthesis followed the procedure of systematic reviews, including the development of inclusion criteria and the formulation of an explicit search strategy. The relevance of evaluations and studies was then determined both manually and using text mining. A quality assessment of the sources ensured that only reliable evidence was included in the evaluation synthesis. Lastly, the data was analysed using framework synthesis and qualitative content analysis.

Overall, the evaluations and studies included in the synthesis report mainly positive effects on investors and donors, intermediaries, partner countries, and target groups, such as the mobilisation of private funds, knowledge and skills transfer in the partner countries and the creation of new/better jobs. However, various analyses, including on the quality of the evaluations, point to a positive bias in the results. The evaluation synthesis makes recommendations regarding the definition of indicators, the measurement and evaluation of impacts and additionality, knowledge management, and the consideration of transaction costs in the cooperation with private actors.

Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Mismatches in Practice Centered Research Processes on the Challenges of Youth in Swedish Suburbs

Dr. Truls Neubeck[1,2], Associate professor Lisa Kings[3]

[1]Save the Children, Stockholm, Sweden. [2]Department of social sciences, Business and administration, Stockholm, Sweden. [3]Department of social sciences, Social work, Stockholm, Sweden

Abstract

Based on an ongoing experiment of practice centered knowledge creation aiming for civil society to achieve sustainable impact this paper reveals three distinct mismatches in contemporary research practice and general preconditions. The current project involves a collaboration between academia and street level bureaucrats in Save the Children Sweden four units working directly with youth in marginalized neighborhoods; On Equal Terms (PLV) in Stockholm, Gothenburg and Malmö and the youth recreation centers in Järvafältet, Stockholm.

The experiment at hand is developed in relation to the premises that children and activities directly will benefit from the participation in knowledge creation, to attract academic competence by offering a creative work environment for researchers, to be able to fund innovative practice and to improve the management of practice with research projects.

The test consists of parallel development processes with both practice and research in three distinct phases. In order to ensure both ownership and value for the practice the first phase consisted of qualitative ground-up discussions on what challenges, unanswered questions and prior experiences of knowledge processes existed. Based on this, phase two consisted of out-reach activities to engage and match interested, interesting and locally active researchers that would be willing to engage in an unknown knowledge process on equal terms with practice. Phase one revealed a need for practice in critical reflection, systematic data collection and analysis as well as an increased availability to known research results. In phase two, an interactive process for engagement between practice and research on the terms of practice while maintaining high academic standards, critical perspective and theoretical rigor has been developed. During the spring of 2022, the third phase will involve individually designed interaction between practice and researchers to create value for both practice and academia based on the results of phase one and two.

I addition to a tried and tested process for practice centered research the findings from the experiment reveal some important mismatches in practice centered research processes. First, existing initiatives and arenas for co-creating research initiatives or disseminating of research results are not directed for the street level bureaucrats at the core of practice. Second, although several different research approaches such as action-oriented, interactive, activist, and participatory exists they seldom specify the challenges and opportunities when it comes to the participation and value for practice. Third, and finally, there is a distinct mismatch between funding for the innovative practices aiming to meet new and urgent needs of children and youth and the much-needed research processes that could help improve, evaluate, and critically reflect over this practice.

With these findings we hope to stimulate new and engaging discussions, tests, and studies so that mismatches in practice centered research can be overcome and knowledge be available for sustainable social efforts.

Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

The CareLab for People and Planet: Collaboration and co-creation under the lens of care for enhancing inner and outer sustainability

Dr. Antje Disterheft, Prof. Dr. Tomás Ramos

CENSE - Center for Environmental and Sustainability Research, NOVA School of Science and Technology, NOVA University Lisbon, Caparica, Portugal

Abstract

"What do I do to take care of myself? And what helps me to take of the planet?" These two questions were asked in Summer 2021 within a photovoice project to diverse academic and non-academic members of a Portuguese faculty to start the dialogue about inner and outer sustainability under the lens of ethics of care (Ives et al. 2020, Moriggi et al. 2020). The initiative was embedded in the creation of a new space of collaboration, co-creation and transformative learning: the CareLab for People and Planet at NOVA School of Science and Technology, NOVA University Lisbon (https://the-care-lab.org/). Following a transformative approach within sustainability-oriented labs (McCrory et al. 2020), with a specific focus on aspects of care and the interlinkages between personal and collective sustainability, first, a conceptual framework was developed during 2021, preparing the kick-off of the activities starting at the beginning 2022. The agenda of activities for this year's spring term includes e.g. nature-based learning activities, a mindfulness course, webinars with international scholars of related research, and a co-creation process to design an outreach event at the faculty under the topic "The care-full sustainability campus". This work aims to present the accompanying qualitative assessment of the initiatives within the CareLab, using Theory of Change (ToC) as the guiding evaluating framework (Ahmad et al, 2018). ToC was chosen for its adequacy (i) to guide and evaluate reflective and participatory research practices; (ii) to identify ongoing sources of evidence that can help verifying whether the link between purpose, design and outcomes is apparent, and (iii) assess the impact of initiatives and interventions. This research relates in particular to SDG4, target 4.7, as it aims to foster the acquisition of knowledge and skills relevant for holistic sustainability practices, that include emotions, affection and embodied knowledge, in order to thereby promote a new culture of awareness and collaboration at higher education institutions. Since such transformation requires courage to act against the current competitive-oriented paradigm, this work can contribute to the conference theme by providing insights toward the cultural shift strongly needed for more just and sustainable societies.

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Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Universities as Enablers of Collaborative Learning in Communities of practice: The case of the Sustainable Enterprise Network in Colombia

MSc Carlos Polo-Barceló[1], Dr Sjors Witjes[1], Dr Bernhardus Van Hoof[2]

[1]Institute for Management Research, Radboud University, Nijmegen, Netherlands. [2]Universidad de los Andes School of Management, Bogotá, Colombia

Abstract

Firms play an important role in responding to sustainability challenges and contributing to the sustainable development goals by collaborating with different societal actors. Isolated efforts, deficiency of capacity, individualisation of leadership and lack of trust are barriers for achieving ambitious sustainable development goals. This research investigates the role of universities as enablers of collaborative learning for the dissemination of sustainability practices among networks of companies. The theoretical perspective of communities of practice (CoP), an approach based on situated learning theory, is used as framework to analyse the social interactions leading to collaborative learning among different actors. The Sustainable Enterprise Network Program (RedES for its acronym in Spanish), a relevant environmental sustainability dissemination program in Colombia, provided an empirical setting for analysis. This consisted of several groups of firms in an anchor-supplier group configuration (i.e. a medium or large enterprise and its suppliers), the regional environmental authority and Colombian universities. Research data includes a longitudinal dataset covering the period 2013-2019, outlining process indicators and outcomes from +500 participating firms; interviews with stakeholder representatives from firms, public sector and universities involved; and secondary sources (books, reports and articles on the program). Additionally, one of the authors was involved in the program from inception as its co-founder and director. Our findings explain the role of universities in the articulation of several, interconnected communities of practice within the RedES network. The role of universities as enablers of collaborative learning in communities of practice highlight: (i) transparency building through research and publication of outcomes and collaboration processes; (ii) capacity building for innovation in sustainability practices through collaborative learning in firms; (iii) advocating conflicting interests as independent third-party moderator; and (iv) positioning collective leadership by connecting individual interest to aggregated collective goals. Our paper contributes to literature on inter-organisational learning and collaboration by exploring the role of universities in social dynamics at the CoP level. Through collaborative learning, firms can better cope with the demands of sustainability and, collectively, find ways to integrate these challenges in their operations. In addition, we propose a model on collective learning for sustainability-oriented CoPs, by which policymakers, academic or industry actors can nurture such communities as pathway to stimulate sustainability across networks of firms. At the same time, we highlight their transformational potential at the individual, organisational and network levels.

Our paper relates to SDG 9, target 9.4. "Upgrade all industries and infrastructures for sustainability"; SDG 12, target 12.6. "Encourage companies to adopt sustainable practices and sustainability reporting"; and SDG 17, targets 17.16. "Enhance the global partnership for sustainable development" and 17.17. "Encourage effective partnerships". Lastly, our paper relates to conference topic by presenting empirical data on known theoretical concepts as collaborative learning in communities of practice from an alternative context as is Latin America, especially Colombia. The specific social and environmental challenges in Colombia present specific cultural issues when analysing the collaborative learning between companies. Moreover, taking the lead as corporates in complying with international agreements as are the SDGs in these challenging contexts also needs courage.

Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Quadruple Helix in Eliminating Poverty: The case study of *Asnafprenuer* program in Malaysia

Professor Dr Suhaimi Ab Rahman[1], Associate Professor Dr Rasyikah Khalid[2]

[1]Universiti Putra Malaysia, Selangor, Malaysia. [2]Universiti Kebangsaan Malaysia, Selangor, Malaysia

Abstract

Poverty is one of the major problems faced by developing countries around the world. In Malaysia, a Muslim majority country, eliminating poverty has been the main agenda of the government through the zakat institution. Zakat functions as one of the mechanisms to eradicate poverty as it fulfils the needs of the poor either in the form of monthly financial assistance or capital allocation to enable them to live independently. However, many of the zakat recipients, or Asnaf, take zakat as of their right and fails to upgrade their standard of living. This study investigates the process of which quadruple helix can help poverty elimination by engaging the poor section of the society with the zakat institution, the industry, and the academia. The case study of Asnaf entrepreneur by the Zakat institution, the QSR Brands and the Universiti Putra Malaysia is presented and analysed. The study found that the zakat institutions in Malaysia provide various financial assistance in the form of monetary support, skills courses, and others. As a result, the aim to produce "asnafpreneurs" can be realised. However, supports from industry is pertinent to ensure the program continuity, while a new module developed by the academia provides the knowledge and enhances the Asnaf knowledge in entrepreneurship. This contradicts the traditional zakat system where industries pay their zakat while the zakat institution distributes the zakat to the poor. This quadruple helix model incorporated in the asnafpreneur program has promoted bottom-up collaborative processes in innovating new ways of eliminating powerty and challenge the traditional top-down policymaking process in this regard. Through the program, poverty is eliminated (SDG 1) improve their access to quality food (SDG 2), health (SDG 3) and education (SDG 4).

Track

Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Posters

Collaboration and co-creation for local sustainable development: Contributions of social innovation in the light of Portuguese experience

Maria João Ruela, João Simão and Filipe Almeida

Collaboration and Co-Creation for Local Sustainable Development: contributions of social innovation in the light of Portuguese experience

Theoretical Framework

Social Innovation
- Intersectorial Collaboration
- Participation
- Change (to more Sustainable Community)
- Process and Result

Sustainable Development
- Intergenerational Justice
- Economic Development
- Social Cohesion
- Environmental Sustainability
- Governance and Participation

Portuguese Experience
- Public Policy
- Impact on Municipalities
- Public and Civil Society Partnerships
- Impact on Local Sustainable Development

Question

How came social innovation in Portugal to constitute a collaborative and co-creation model for sustainability ?

Baker (2006); Hubert (2011); Maduro *et al.* (2018); Murray *et al.* (2010); Voorberg *et al.* (2015); Westley & Antadze (2010);

SI Projects

Characterization

Entrepreneur Idea

Public Investment (70%)

Social Investment (30%)
- Municipalites 50%
- Private 30%
- Social Economy 12%

Regional Distribution

Intervenction Area Distribution

Objectives

Idea / Investment → Social Innovation Project → Impacts on local sustainable development; Impacts on governance

Stages of the Project

1. Sample selection
2. Data Collection: . Interviews . Documental analysis . Observation
3. Content Analysis

Social Innovation → Sustainability

Sustainable development goals attained (Eichler & Schwarz, 2019)

More resilient communities (Olsson *et al.*, 2017)

Intergenerational dimension (Vasconcellos Oliveira, 2021)

New forms of collaborative governance (Baker & Mehmood, 2015; Parra, 2013)

Context conditions (Agostini *et al.*, 2017)

New local social innovation market players (Maduro *et al.*, 2018)

Next steps

Empirical study:
10 projects sellected
10 Municipalities: Vila Nova de Gaia, Porto, Fundão, Leiria, Sintra, Cascais, Beja, Odemira, Albufeira e Loulé
12 entrepreneurs

Maria João Ruela, Universidade Aberta, Lisbon, Portugal; João Simão Universidade Aberta, Lisbon, Portugal; Filipe Almeida, Universidade de Coimbra, Portugal. Track 9b Collaboration and co-creation for sustainability, SDG initiatives and scale of governance.

5/26/22

9. Governance, power and institutions and weakness of SDGs

9c. Public participation and the role of stakeholders

Abstracts

Curating Participation: Understanding micro-democracy in grassroots movements

PhD student Anton Poikolainen Rosén[1], PhD Karin Hansson[1], PhD Maria Normark[2]

[1]Södertörn University, Huddinge, Sweden. [2]Södertörn University, Stockholm, Sweden

Abstract

Participatory techniques are increasingly used as a central element of different levels in society. In this "participatory turn", the rhetorical performance of democratization often seems to receive more attention than the actual methods. When designing ICT with participation in mind, the dynamics and conflicts in the participatory situation often go unrecognized. The socio-technical infrastructures of the participation therefore require urgent examination, in order to improve approaches and tool support. While digital technology has made it easier to participate in grassroots movements, the organizational structure in these contexts is more loosely coupled as people tend to have a fragmented engagement in such communities.This poses a particular set of challenges for maintaining engagement, responsibility and democracy within such communities. There is thus a need to understand how technology can strengthen more long-term local activism and support a strong civil society based on decentralized structures.

In the ethnographic study, we take a look closer at an urban farming community in Stockholm that has made an attempt to develop methods that address this problem by organizing around sociocratic principles. Sociocracy is a system of governance using each individual's consent/objection rather than majority voting in decision-making. It is distinguished by organic, small and loosely coupled groups, with clearly stated mandates. The approach hence requires transparent processes and information distribution. Our analysis is primarily focused on coordinative digital tools across various commonly used platforms such as Facebook and Instagram which the urban farming community use to organize their group.

The results show the tension between individuals' active participation and contribution on one hand and their need to curate their digital participation in order to manage the amount of information on the other. Another tension is between the scale of the local participation and the scale of possible global reach enabled by the technology. In the analysis we discuss the democratic consequences of such information and participation curation and outline a set of principles for managing democratic transparency in these contexts. With these research insights we aim to contribute to the research and development of more robust and democratic communication tools.

Track
Track 9c Public participation and the role of stakeholders

How can Nature Participate as a Real Stakeholder in Public Policy-making and Decision-processes?

Professor Tineke Lambooy[1], Master in arts alex putzer[2], professor ronald jeurissen[3], dr. bart jansen[3]

[1]nyenrode business universiteit, amsterdam, Netherlands. [2]santa anna school of advanced studiesresearch institute, pisa, Italy. [3]nyenrode business universiteit, breukelen, Netherlands

Abstract

All around the world, new forms of governance of nature area's are being developed and have been put in place. Where Nature traditionally could never participate as a stakeholder in public policy-making and decision processes, nor in private sector decisions, these new forms of governance place certain entities of Nature in the spotlight as stakeholders that can participate in the legal system with an own voice.

Commonly referred to as 'Rights of Nature' or 'Earth Jurisprudence', rights have been granted or acknowledged to rivers, seas, mountains, animal and plant species and to nature 'indistinctively'. In Ecuador, rights of nature have been included in the Constitution. In Colombia, the Supreme Court as acknowledged rights of nature of several rivers and the Colombian part of the Amazon. In the USA, Canada, Latin America, Australia, New Zealand, India, Bangladesh, and various European countries, many entities of nature have been granted rights or their rights have been endorsed.

The authors have established a data base of all Rights of Nature initiatives in the world, currently more than 400. In this paper, they analyse on the basis of text analysis and content analysis all legal documents pertinent to each of those initiatives. They answer several questions: (i) In which way can the entity of Nature that possesses a Right of Nature publicly participate in regard of questions that affects that entity of Nature? and (ii) Have the initiatives been motivated from an anthropocentric or ecocentric perspective?

The results show for each individual initiative why it was started and which goal was formulated in the legal documents. Also, the analysis demonstrates for each initiative in which way the representation of the entity of Nature takes place (stakeholder participation). Lastly, the research results reveal on the basis of word choices employed in each initiative to what extent the Rights of Nature were formulated in an anthropocentric perspective or an ecocentric perspective. The authors use a scale here and visualise all the initiatives in one diagram.

This paper adds a new perspective to the innovative policy and academic subject of Rights of Nature and also provides ample research ideas for further research.

Track
Track 9c Public participation and the role of stakeholders

Sustainable Cities: How stakeholder engagement in SEA advances sustainability

Maria da Luz Fernandes[1], Sara Moreno Pires[1], Alexandra Polido[2]

[1]Govcopp, DCSPT Universidade de Aveiro, Aveiro, Portugal. [2]GOVCOPP, DCSPT, Universitiy of Aveiro, Aveiro, Portugal

Abstract

The environmental and social challenges the world is nowadays facing is urging the need to protect ecosystems and build inclusive societies towards sustainability. This paradigm shift is particularly important for urban systems, and it implies the need to better understand the challenges as well as the decision-making processes and governance issues to tackle them. Environmental Assessment (EA) is an environmental policy integration tool that promotes and integrates sustainability into decision-making processes. It analyses the decision-making effects on the environment and on the communities and it is a systematic, strategic, and participated approach. This study analyses a form of EA commonly known as Strategic Environmental Assessment (SEA) which deals with the *ex-ante* evaluation of policies, plans and programmes (PPP). Previous work shows that SEA has the potential to deliver a shift towards sustainability, through governance and community empowerment. Even though the dominant SEA scholarship focuses on rationality and process effectiveness to achieve sustainability, the empirical reality shows that SEA processes have a strong political, institutional, and cultural dimension which are affected by diverse stakeholders. This research aims to understand how different stakeholders intervene in SEA towards sustainability through the analysis of public participation processes.

The study focuses on the Portuguese context and analyses 4 Urban Master Plans SEA (Aveiro, Matosinhos, Porto and Sintra). Each SEA is analysed through qualitative content analysis targeting environmental, social, and cultural issues within the public participation. Specifically, it focuses on the number of participants, typology of actors, type, theme, and outcome of contribution. Preliminary results show that public participation is still developed through tokenism and mostly made by individuals on site specific issues. The analysis of the themes shows that the major concerns are housing and road infrastructure. Nevertheless, there is also a substantial contribution on sustainability issues, such as soft mobility, green and blue spaces. The analysis of the outcomes of the urban plans public participation shows that it is necessary to improve the mechanisms to strengthen cooperation between stakeholders and empowerment of practitioners and local stakeholders. Overall, this research gives insights of the gaps and potentials of public participation processes in SEA and how to improve the cooperation between practitioners and local stakeholders.

This research is closely aligned with the Agenda 2030, and may help achieve SDG 11.a (Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning), SDG 11.3 (By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries), SDG 16.6 (Develop effective, accountable and transparent institutions at all levels) and SGD 16.7 (Ensure responsive, inclusive, participatory and representative decision-making at all levels).

Track

Track 9c Public participation and the role of stakeholders

Sustainability in Sporting Mega-Events: The case study of the Birmingham 2022 Commonwealth Games

Miss Emma Baker, Dr Shushu Chen

University of Birmingham, Birmingham, United Kingdom

Abstract

Sustainability has become a popular term over recent years and holds a prominent position within the world of sporting mega-events. This progress in sustainability is largely attributed to the United Nations and their Sustainable Development Goals as well as the Paris Agreement, which were both announced in 2015, kickstarting a sustainability campaign worldwide. A myriad of sporting organisation, such as the International Olympic Committee, FIFA, the FIA, Commonwealth Games Federation, highlight sustainability as being at the forefront of their aims and goals. Existing literature on the topic of sustainability in sporting mega-events focuses on events, such as the Olympic Games, with some research developing around the FIFA World Cup. There is still a significant lack of research into understanding what sustainability strategies have been implemented by different major sporting events and how to create sustainable legacies. This research project aims to address these gaps, specifically focusing on the case of the Birmingham 2022 Commonwealth Games and their sustainability efforts regarding long-term impacts on the economy, environment and society. It also provides reflections on past mega-events hosted by a variety of organisations, to identify how sustainability is growing within the field of major sporting events. Drawing upon semi-structured interviews with key stakeholders as well as document analysis of sustainability reports published by stakeholder organisations, this research reveals the perceptions of creating a successful sustainable event alongside the challenges this new regime faces. The results further revealed that stakeholders believed that their organisations were taking steps in the right direction but understood that progress was gradual. Interviewees highlighted that the biggest challenges faced were financial and trying to change the opinions of other key stakeholders on issues surrounding sustainability to implement sustainable policies into all aspects of the events. The paper provides a detailed insight into the practices concerning integrating sustainability commitments into event hosting and legacy management.

Track
Track 9c Public participation and the role of stakeholders

Full papers

Participatory System of Local Indicators of Sustainable Agriculture: the case of Minas Gerais, Brazil

Cecileny Cecília Silva[1], Sandra Sofia Ferreira da Silva Caeiro[2], Marcelo Abreu Lanza[3], Djalma Ferreira Pelegrini[4]

[1]Universidade Aberta, Lisboa, Portugal, 1700047@estudante.uab.pt
[2] CENSE & CHANGE – NOVA School of Science and Technology, Universidade NOVA de Lisboa and Centro de Estudos Globais, Universidade Aberta, Lisboa, Portugal, caeiro@uab.pt
[3]Empresa de Pesquisa Agropecuária de Minas Gerais, Prudente de Morais, Brazil, mlanza@epamig.br
[4]Empresa de Pesquisa Agropecuária de Minas Gerais, Uberaba, Brazil, djalma@epamig.br

Abstract

Agricultural systems are critical to food production, as they ensure the vital needs of people in the world more than any other segments. According to the United Nations, by the year 2050, 68% of the world's population will live in urban areas, and this will include the expansion of cities, population growth, increased *per capita* consumption, restrictions on land use and human needs for food. Thus, for Sustainable Development (SD), there is an urgent need for public policies integrated with infrastructure, social services and environmental links. Brazil is a good example of a large country, where agriculture plays an important role in the national economy. However, for this potential, it is inevitable that sustainable agriculture is addressed in depth and frequently. Public policies are being applied locally, but to be successful, it is important to engage farmers in the process. The main objective of this paper is to analyze family farmers' perceptions of sustainable agriculture and the current Agroecosystem Sustainability Indicators (ISA) system of the Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG) based on their knowledge and experiences. The research is based on an initial study in urban and rural farming units with farmers in the Metropolitan Region of Belo Horizonte (RMBH). The methodology was described in the combination of deductive and inductive actions for the specific objectives: i). Analyze farmers' perception of the existing sustainability indicators system used in public policies in Minas Gerais - Brazil; ii). Identify, in the local context, indicators proposed by farmers for voluntary assessment and monitoring of sustainable agricultural practices. The results obtained and discussed enabled contributions to support the formulation of public policies, as well as non-formal indicators considered by stakeholders, appropriate for sustainable agriculture, according to the local reality.

Keywords: Agroecology, Agroecosystem, Family Farming, Participatory Knowledge, Sustainable Perceptions.

1. Introduction

Brazil in the last 50 years, has undergone processes of productive reorganization as subsistence agriculture or regional monocultures were transformed or replaced, according to their potential for food production (abundant and fertile land, public investments, pricing policy, and institutional reforms). According to Martine (1991), research and scientific knowledge have contributed both to the benefits of modernization and to the social and environmental impacts.

However, according to NGM (2022), in the contemporary context, studies have gradually re-examined resolutions to replace the agricultural development model suggested mainly by the Green Revolution (regarding the use of agrochemicals, transgenics and mechanization).

This premise induces reflection on sustainability in agriculture and correlations for agricultural activities (production, processing, distribution and consumption) in "causing little or no damage to the environment" (Cambridge, 2022:1), and, at the same time, meet the social and economic needs of those who integrate the production chain (producer, supplier, industry, trade and consumer) with consequent food security.

According to Faiden (2005) the agroecosystem consists of the changes made by human action to an ecosystem to produce goods necessary for subsistence. In the conceptions of sustainable agriculture, agroecology prioritizes the "conscious management of natural systems in favour of food production with healthy soils and adapted varieties" (Primavesi, 2001:30).

Based on this verification, either to measure or evaluate existing land crops, or to define goals or guidelines, indicators have been researched, in data set or unique, in different agricultural production systems, which necessarily lead part of the modern sustainable vision.

Indicators can be understood as resources that "allow measuring the changes in the characteristics of a system – and that allow assessing the sustainability of different systems" (Deponti, Eckert & Azambuja, 2002:44).

Governmental actions have acted in the development of appropriate technologies to the environmental legislation in force. But, as a challenge, the current system of existing indicators prioritizes the use in rural areas.

In this way, other areas still present themselves as unknown or information not contemplated for measurement and, therefore, without access or inserted in public policies, given the growing agricultural practices in urban and peri-urban spaces in the State. Thus, it is revealed that the participation of citizenship in discussions on an environmental dimension incites a rethinking of rights and responsibilities, and compulsorily, the deepening of investigations into sustainable agricultural development.

This article had the objective of analyzing family farmers' perception of sustainable agriculture and of the current Agroecosystem Sustainability Indicators (ISA) system, based on their knowledges and experiences. The research is based on an initial study in urban and rural farming units with farmers, in the Metropolitan Region of Belo Horizonte (RMBH), in the state of Minas Gerais, Brazil.

2. Methods

The analysis method combined deductive and inductive actions in linked approaches on sustainability in agriculture in a non-probabilistic sample population (convenience sample), being considered a selection factor, 20 farmers accessible through technological tools (smartphones or computers and internet) in the period from September to November of the year 2020. The aims and corresponding method are presented in Table 1.

The selection of a list of indicators for sustainability analysis had as a theoretical reference, who called the Indicators of Sustainability in Agroecosystems (ISA) developed by Ferreira *et al.* (2012).

Organized into 21 indicators, they follow the criteria: (a) perform an economic, social and environmental diagnosis of the agricultural establishment; (b) point out critical points/risks and positive points/opportunities in sustainable practices; (c) generate useful information in the development and management of public policies, considering local specificities in the interpretations and contextualizations referenced. The proposed methodology was based on the following two sections:

Table 1. *Methods used and results obtained in each specific objective.*

Specific goals	**Methods**	**Selection**
i) Analyzing the farmers' perception of the ISA system.	Presentation of explanatory videos about the ISA system; 2. Survey with farmers in the region; Focus group with farmers and a public manager in the capital Belo Horizonte.	Analyzed 21 formal indicators and identified 13 variables in 16 indicators for expansion opportunities.
ii) Identify indicators proposed by farmers for voluntary assessment and monitoring of sustainable agriculture practices.	. Triangulation of the data obtained by the previous methods; 5. Surveys with farmers in the region.	Propose 7 variables, of which 3 parameters were selected by the stakeholders for monitoring as non-formal indicators.

i) To analyze the perception of farmers in relation to the ISA system, the verifications of the formal

indicators, had three phases: (1) beginning, with the presentation of 5 short explanatory videos about indicators and the ISA system (one video per day); (2) questionnaire survey to analyze the current indicator system as to habituality of application or measurement of the finalistic aspects of evaluation (Table 2); and, (iii) focus group lasting 1h and 30 min for dialogues with farmers and a public manager from the Belo Horizonte municipality, during the week of September 27 to October 1, 2020.

ii) Regarding the identification of indicators proposed by farmers for voluntary evaluation and monitoring of sustainable agriculture practices, the methods adopted were synchronized in two ways: In the survey of non-formal indicators supported by participatory approaches and in the context of the agricultural property to evaluate the sustainability, bringing the Sustainability Indicators in Agroecosystems (ISA) closer to the holistic aspects of agroecology as a proposal for improvements.

The surveys were carried out using *Google Forms* resources, with an estimated time of 10 minutes for answers, and, concomitantly, the survey of indicators equated to the perspectives of the SDGs listed in Table 4. This process took place from October to November/2020.

The responses from the interviews were treated based on descriptive statistics (occurrence analysis) in relative percentage frequency *(fi% = Fi/ ∑*100%)* where *Fi* = Frequency of the number of answers, and *fi%* the percent result of the number of answers by the total number of participants.

3. Results and Discussion

3.1 Analysis of farmers' perceptions of the ISA system

In this step, 10 farmers pondered ISA for their productions by watching the videos (recorded in the *aTube Catcher* program) of 5 minutes duration, and then responding to the opinion surveys (using the *SurveyHeart* application) of average duration of 5 minutes.

Using the non-statistical criteria ‘agree’, ‘do not agree’ or ‘partially agree’ as responses, the following results described in Table 2 were obtained:

Table 2. *Results of the survey by questionnaires about the ISA system (formal indicators).*

Indicator	**Description and Measurement Units**	**Agree (*fi%*)**	**Do not agree (*fi%*)**	**Partially agree (*fi%*)**
1 - Productivity and sale price (Economic Dimension)	Checks the total income from all activities on the farm, as well as the most important products, and compares production and average sales in the region. This indicator is measured in: value/hectare/year.	80%	-	20%
Indicator	**Description and Measurement Units**	**Agree (*fi%*)**	**Do not agree (*fi%*)**	**Partially agree (*fi%*)**
2 – Diversity of income (Economic Dimension)	Checks the direct relationship with production activities, including the proportion of income (agricultural, livestock, and forestry) and other sources of income (on and off the farm). This indicator is measured in: gross income per activity/year.	50%	30%	20%
3 - Asset evolution (Economic Dimension)	Estimates the value of the property and analyzes the evolution or regression of property over time (value of the property, equipment, improvements, livestock). This indicator is measured in: average value of movable, immovable, and animals/year.	50%	-	50%
4 - Degree of indebtedness (Economic Dimension)	Evaluates the proportion of the amount of borrowing (agricultural costing, livestock, investments, financing, among others) in relation to the estimated asset value. This indicator is measured in: total debts payable/year.	50%	-	50%
5 - Basic services available for property/food Security (Economic Dimension)	Checks the access to some basic services and food security around the households and own food production. This indicator is measured as a weighted average for each available service/year and for each available food production/year.	100 %	-	-
6 - Education/courses related to farming, forestal and pastoral activities (Social Dimension)	Checks the information regarding schooling (adults and children) and training (hired and members) directed to the farm activities of the farm. This indicator is measured as: weighted average for each member by level of schooling or apprenticeship courses attended/year.	70%	-	30%
7 - Quality of the occupation nd employment generated (Social Dimension)	Verifies compliance with labor laws for those who employ people in the production systems (permanent and temporary contract workers). This indicator is measured in: weighted average per employee/year and compliance with labor law items/year.	70%	-	30%

8 - Enterprise management (Social Dimension)	Evaluates the management capacity related to administration, cost control, accounting, access to credit and technical assistance, compliance with environmental legislation, and the degree of organization of the region's producers. This indicator is measured in: weighted average at each access, control, and access in business guidelines items/year.	100 %	-	-
Indicator	**Description and Measurement Units**	**Agree *(fi%)***	**Do not agree *(fi%)***	**Partially agree *(fi%)***
9 - Commercialization and information (Social Dimension)	Verifies if the producer seeks market information for marketing and/or if he accesses markets that add value (certified products or markets that pay a differential in quality) or institutional markets (government programs with direct marketing from producer to consumer, supply program for school meals in the municipality, among others). It verifies the use of management tools directed to the critical factors identified in the main activities, focusing on the adoption of innovative techniques, environmentally appropriate, and on the innovation capacity of the rural producer. This indicator is measured as: weighted average in items of entrepreneurship guidelines/year.	100 %	-	-
10 - Waste and effluents management (Environmental Dimension)	It verifies the collection rate and the adequate disposal of garbage (recyclable and non-recyclable) produced on the rural property; the adequate disposal of domestic sewage; the reuse rate of organic solid waste generated on the rural property (composting, organic fertilizer, animal feed, etc.); and, the treatment rate and adequate disposal of liquid and gaseous effluents, when these are generated on the property. This indicator is measured as: weighted average in waste management items/year.	100 %	-	-
11 - Work safety and management of the use of pesticides and veterinary products (Environmental Dimension)	It verifies if agrotoxics are used in the property, and surveys how many people handle or are exposed to these products, if they use personal protection equipment, and observe the storage and proper disposal of the packaging of these products (it is suggested to do the same procedure for veterinary products, especially products used for parasite control and vaccines). This indicator is measured as: weighted average in items of exposure/handling of pesticides/year.	100 %	-	-
12 - Soil Fertility (Environmental Dimension)	Evaluates the capacity of the soil in the production system to provide the minimum resources necessary for the maintenance of crops and pastures, ensuring a stable production, with economic return for the producer. Ten parameters related to the chemical and physical properties of the soil are evaluated. This indicator is measured in: soil quality items/acre/year.	100 %	-	-
13 – Water quality assessment (Environmental Dimension)	Evaluates aquatic ecosystems from two segments of a watercourse, when present on the rural property, upstream and downstream, using a rapid assessment protocol of aquatic ecosystems. Complementary	100 %	-	-

Indicator	Description and Measurement Units	Agree (*fi%*)	Do not agree (*fi%*)	Partially agree (*fi%*)
	analyzes can be carried out using pH, nitrate and coliform analysis tapes, and turbidity analysis equipment. This indicator is measured in: water quality assessment items/ milliliter/year.			
14 - Risk of water contamination from agrochemicals (Environmental Dimension)	Estimating the risk of contamination of water bodies by the use of pesticides on the farm, considering parameters related to the persistence of the active ingredient in the environment, its mobility in the soil profile and the toxicity of the formulation. All pesticides eventually used on the rural property are considered, as well as the volume applied and the vulnerability of each plot, considering the granulometry of the soil, the proximity of water bodies and the type of soil management (related to the preparation for planting and the management of the between rows of perennial and forest crops). This indicator is measured in: water volume/amount of toxics/year and risk of contamination/area/year.	90%	-	10%
15 - Evaluation of areas with degraded soil (Environmental Dimension)	It verifies the presence of soils in degradation stage, dimension the area, the intensity of the process (scale and impact potential) and evaluate the behavior trend of the degradation process (intensification, stabilization or decrease). This indicator is measured in: weighted average in items of intensity and behavior/soil volume/year.	90%	-	10%
16 - Degree of adoption of conservationist practices (Environmental Dimension)	Evaluates the degree of adoption of a series of measures for soil and water conservation in all production systems on the rural property. The verification is done in all the plots of crops and pastures. It is also verified with the producer or person in charge of the enterprise what strategies are being adopted for coping with drought or water stress and for the conservation and preservation of water on the rural property. This indicator is measured as: weighted average of practices and strategies per existing area/year.	100 %	-	-
17 - State of conservation of the roads that cut through or border the rural property (Social Dimension)	It verifies the presence of structures for drainage and runoff of rainwater (runoff) from roads located on the rural property or that tangent to the rural property, noting the presence of bulges or transversal declivity of the roads, the presence of humps for runoff detour, when necessary, the presence of infiltration basins or boxes to capture water from road runoff, when necessary, and the conservation status of the roads, noting the presence of holes and erosion gullies.	70%	-	30%
Indicator	**Description and Measurement Units**	**Agree (*fi%*)**	**Do not agree (*fi%*)**	**Partially agree (*fi%*)**
	This indicator is measured in: percentage of critical points / length of roads/ year.			

18 - Native vegetation - phytophysiognomies and conservation status (Environmental Dimension)	It assesses the state of preservation of the remnants of native vegetation and the level of fragmentation of these habitats on the rural property. It also verifies if these fragments of native vegetation are linked to other fragments on neighboring rural properties, forming ecological corridors. This indicator is measured in: area (hectare)/year.	70%	-	30%
19 - Adequacy of the permanent preservation areas (APP) (Environmental Dimension)	Checks if the use and occupation of the soil in the APPs is in compliance with the New Forestry Code, and verifies the conservation status of the APPs around springs and water bodies (waterways, dams, ponds, etc.). This indicator is measured in: area (hectare)/year.	70%	10%	20%
20 - Legal reserve adequacy (Environmental Dimension)	Assesses compliance with the Legal Reserve (RL) requirement on the rural property, according to the New Forestry Code. It also verifies whether the rural property has an area with native vegetation exceeding the RL requirement (considered as an environmental asset). This indicator is measured in: area (hectare)/year.	100 %	-	-
21- Diversification of the agricultural landscape (Environmental Dimension)	Checks the diversification of the landscape at the scale of crops and plots, and at the scale of the rural property and its surroundings. This indicator is measured as: weighted average in (agro)biodiversity items per area/year.	100 %	-	-
Total of respondents (∑) = **10**		100%		

Within the sample universe, when checking the 5 economic indicators of the system, 80% considered in 'total/partial disagreement', because in general aspects, they perceived improvements for sustainability practices, suggesting mainly as technological innovation, the segmentation or comparison of income and expenses per activity between conventional agriculture and agroecology.

On the other hand, when analyzing the 5 social indicators, 60% observed that issues related to the generation and appreciation of employment and education encouraged sustainable agricultural practices to combat the reduction of poverty levels, food security and social vulnerability, are challenges interrelated with the dimensions of sustainability.

Of the 11 environmental indicators, 45% stated that sustainable agricultural practices must be inserted with other environmental processes, policies, and decisions (entities, governments, and citizens), with the adoption of production and consumption patterns that protect the regenerative capacities of the environment.

The formal indicators considered in wholly/partially agreement and/or disagreement, according to the perspectives of use and monitoring by the participants, were selected and discussed in the focus group. This was done by videoconference (using the *Zoom Colibri* tool) interconnected with the *Jamboard Google* interactive whiteboard for multiplatform online collaboration, illustrated in Figure 1. Four farmers and one representative from the Municipality of Belo Horizonte participated in the focus group:

Figure 1. *Focus group on-line in multiplatform Google Jamboard and Zoom Colibri.*

In this research phase, it was observed in the ISA System, as monitoring and evaluation in public policies, favorable alternatives for improving governance and possibilities to stimulate the farmers for the participative construction of sustainable development.

When agroecology is emphasized as one of the priorities in the search for necessary solutions, it contributes not only to the functions and strengthening of public policies, but also to technologies that can be built locally through dialogue and a set of integrated efforts among farmers, consumers, the production chain, and environment.

It was understood as opportune to reconcile the scientific support of an existing monitoring methodology by indicators with the perceptive knowledge on sustainable development for agricultural productions. According to statements that "agroecology and the application of ecological concepts and principles design and manage sustainable agroecosystems" (Gliessman, 2000:13), complement this set of efforts, agroecological practices in the composition of integrative strategies, either in aggregating other sciences, or in adding knowledge and popular experiences of agricultural communities to the ISA system.

As a result of the research process with the focus group (see chapter 2 Methods), Table 3 shows the issues discussed and developed. These contributions, based on concepts of sustainability, and the understanding of agroecosystems under an agroecology approach, favorable to family and community agriculture

(agricultural producers who combine subsistence production and production destined for the market), a concept outlined by Federal Law No. 11,326 of July 24, 2006 shows how the members of the focus group were contributing to the ISA system.

Table 3. *Focus groups: Participants' dialogic contributions to the ISA system.*

Contributions for improvement and/or suggestions for implementation proposed by the focus group	
Economic dimensions	**A. Gross Agroecological Production:** Evaluates correlation of products in natura and subsequent destinations (industrialization, direct sale, internal consumption, discarded, donated, reused and others). Units of measurement for bags/hectare; units/square meter; liter/milk/day with details for the final destination. Annual periodicity.
	B. Agroecological management: Checks parameters for comparison between agro-ecological production with other productive styles on the farm (conventional production or other sustainable production styles). Units of measurement: production per area/unit or revenue generated in comparison with the other production style. Annual periodicity.
	C. Agroecological assets estimate: Verifies the evolution or regression of the assets of movable and immovable property directly related to agroecological practices. Units of measurement by estimating the value of goods, equipment, area used, renovations and improvements for agroecological production. Annual periodicity.
	D. Indebtedness and agroecological costs: Verifies the financing, loans, debts, access to credits and expenses/costs ratio destined for agro-ecological production. Units of measurement in scaling in descending order of value (highest value and repayment term) and establish proportion to production for the same period. Annual periodicity.
	E. Basic services available to the property: Checks the access of some basic services. Measurement scales (sufficient, partial sufficient or insufficient) for: Access to water (quantity and quality); electric power; regular
Contributions for improvement and/or suggestions for implementation proposed by the focus group	
	access for production runoff and receipt of inputs; health service; school transportation; field safety; telecommunications; waste collection and management. Annual periodicity.
	F. Agroecological self-sufficiency: Verifies the exclusive productive capacity to sustain the agro-ecologist without dependence on other sources of consumption or external suppliers as well as food security. Use as a parameter the minimum nutritional value recommended by the Ministry of Health (2020) or references from the ISA system (EPAMIG, 2022). Annual periodicity.
Social Dimensions	**G. Agroecological Innovation & Education:** Verifies implementations of agro-ecological perspective through teaching, research and extension institutions in the region. Examples of measurement unit: Number of participations in training, qualification and education actions. Annual periodicity.
	H. Agroecological social participation and valorization: Verify formats of social inclusion (associations, memberships, social connections, among others) in promoting or enhancing agroecological social movements. Examples of measurement unit: Survey of farmers on how marketing, market information gathering (certification and niches) and participation in innovation capacity or leadership in the community is developed. Annual periodicity.

	I. Local governmental and non-governmental agroecological interventions: Verifies the efficiency and effectiveness of public and collective policies related to agroecology. Examples of measurement unit: Cataloging of processes and activities carried out through public policies, local community mobilization and private partnerships. Annual periodicity.
Environmental Dimensions	**J. Estimate of indicator, repellent and companion species on site:** Check the ecosystem balance, soil conditions and effects of climate change, anthropic actions on agroecological production. Use as a measurement unit in the most representative area of production, identify the main species (area/ quantity). Annual periodicity.
	K. Agroecological combination with other modes of environmental conservation: Verifies the behavior of agroecological production and transition with other sustainable modes of production. Recommended as unit of measurement the enumeration of productive styles on the farm/production. Annual periodicity.
	L. Wild species outside of agroecological production: Verifies the favoring of tree and shrub species of the biome around agroecological production. Measurement through stage assessment (sufficient, insufficient, critical situation) of the presence of the biome according to ISA system criteria (2021). Annual periodicity.
	M. Native species within agro-ecological production: Verifies the importance of planting native species in local production and adopting practices that help in agro-biodiversity and occurrence of a high proportion. Unit of measurement: quantities of species/ area on the property. Annual periodicity.

In studies such as those of Weißhuhn *et al.* (2017) similar diagnoses regarding environmental and sustainability implications were revealed. There was a presumption, in view of the consensus among the participants, regarding the criteria for evaluating the provisions to environmental legislation, but visible apprehensions due to disasters and environmental impacts in the regions of the state in recent years. This fact suggests an intensity, mainly on the part of public policies, of optimization and rigor with the main governmental instruments (frameworks, plans, goals, publicity and resolution of diagnosed problems, among others), being extensive at a national level.

The method was significant in fostering knowledge of opinions and experiences for previously generalized topics. The discussion brought rich contributions to describe issues missing or incomplete in the previous steps of the research process. In this context, authors Nyumba *et al.* (2018) report that focus group discussion is often applied as a qualitative approach to gain in-depth understandings of social issues.

From another perspective, although the purpose of the focus group was for opinions to be externalized to the ISA system, farmers arbitrated by contextualizing their agroecological practices. According to Wezel *et al.* (2009), there is an emphasis for the agroecological movement and practice in Brazil, notwithstanding advances as the scientific discipline.

Some weaknesses noted by the participants were: reconciling time for meeting participants and difficulty in accessing technological tools (internet connection/remote access, use of communication applications, collaborative software, and viewing of presentations), requiring extensive planning (scheduling, sizing of

time, survey of teaching tools, and preparation of work plan) for this phase of the research. Another limitation on the occasion of sanitary protocols, during the epidemiological crisis in the research period, was the lack of in loco application of the ISA system, in the practical investigation of the properties, making the observations based on bibliographic bases and theoretical functionalities.

It was highlighted in the focus group as a strength, in addition to the selection in front of formal indicators, the evaluation of agroecology in its state of sustainability in an agroecosystem, which is reiterated in the studies of Nyumba *et al.* (2018), in addition to the collaborative approach as a strategy to link scientific research and local knowledge. Adversarial or complementary viewpoints enliven popular wisdom and experience that, for now, in individualized contexts, the apprehension of reality differs from a universalized, socially constructed approach.

3.2 Identification of non-formal indicators proposed by farmers

It is understood that non-formal indicators are related in the farmer's observation and practical experience to measurable or verifiable events, based on the given monitoring frequency, which they favor:

· the recognition of the dimensions of sustainability of an agricultural production;
· are perceptible, over time, for interpretation, testing and scientific definition;
· and/or may show new trends to a system of defined indicators (formal indicators) and, so far, no methodology or official standard (national or international) for data production has been established.

From the selection, discussion and analysis of the results achieved in the previous method, 7 variables were identified conducted by farmers, how they interpret the importance for measurement (monitoring and evaluation) in their agroecological practices, production strategies best suited to the existing reality.

The validation counted on responses from 19 farmers for joint selection by means of surveys with an impersonal measuring scale. The non-formal indicators were triangulated to the SDGs, as shown in Table 4:

Table 4. *Characterization of non-formal indicators and percentage of selection considered relevant for voluntary monitoring with farmers.*

Characterization of non-formal indicators of sustainability in agroecological practices considering the SDGs			
Non-formal indicator		**SDG relevance**	**Percentage for voluntary monitoring *(fi%)***
Economic Dimension	**Sheet 1. Agroecological Geographical Indication:** Checks the available natural factors (vegetal, animal and mineral) that enhance agro- ecological practices and help preserve local traditions and the sustainability of the production process. Indication of source (IP); denomination of origin (DO). Examples of measurement unit: Coffee from the Cerrado Mineiro, Canastra Cheese, Cachaça Artesanal de Salinas, São Tiago Cookies, among others. Recommended annual periodicity.	Conservation and sustainable use of territory; generation of opportunities and businesses with the possibility of establishing fair and direct supply and demand relationships; expanding the importance and representativeness of local agroecological traditions; SDG 1 (Poverty Eradication); SDG 2 (Zero Hunger and Sustainable Agriculture); and SDG 15 (Earth Life) Themes: (1.a), (2.b), (2.c) and (15.6)	52%
Characterization of non-formal indicators of sustainability in agroecological practices considering the SDGs			
Non-formal indicator		**SDG relevance**	**Percentage for voluntary monitoring *(fi%)***
Economic Dimension	**Sheet 2. Products of agroecological sociobiodiversity:** Checks socio-biodiversity products (goods and services) generated in agro-ecological production, aimed at forming production chains and valuing farmers' practices and knowledge. Examples of measurement unit: Quantity of types of cultivars per square meter; number of activities as described in the National Classification of Economic Activities (CNAE). Recommended annual periodicity.	Valuing natural and cultural heritage, strengthening social and productive organization, structuring markets for sociobiodiversity products; SDG 12 (Responsible consumption and production); and SDG 2 (Zero hunger and sustainable agriculture). Themes: (2.4), (12.2) and (12.7)	52%

Social Dimension	**Sheet 3. Native species germplasm bank:** Verifies the farmer's access to genetic material (pollens and seeds) and other traditional genetic heritage directly associated with natural and agroecological factors in the region. Examples of measurement unit: Mass (gram and milligram) or Units in case of seedlings and animals. The most biodiverse is idealized per square meter. Recommended annual periodicity.	Collective scope of actions such as meetings, courses and cultivation practices and other methods of interactions with communities, including institutional involvement (Universities, municipalities, NGOs...), SDG 13 (Action against global climate change); SDG 2 (Zero hunger and sustainable agriculture); and, SDG 15 (Earth life) Themes: (2.5), (2.a), (13.1) and (15.5)	63%
Social Dimension	**Sheet 4. Agroecological participatory grade:** Checks the involvement, retention or evasion of people in agroecological practices on the farm/production. Examples of measurement unit: number of hirings and firings of workers; census survey of agroecologists, ecovillages, communities or specific groups (ethnic, gender, social classes…) involved, migration of people engaged partly or exclusively in sustainable agriculture. Recommended annual periodicity.	Consolidating conservation units within an agroecological strategy; improving labor market mechanisms and valuing labor; SDG 2 (Zero Hunger and sustainable agriculture); SDG 8 (Decent work and economic growth); and, SDG 11 (Sustainable cities and communities). Themes: (2.3), (8.3), (11.a) and (11.c)	52%
Characterization of non-formal indicators of sustainability in agroecological practices considering the SDGs			
Non-formal indicator		**SDG relevance**	**Percentage for voluntary monitoring *(fi%)***
Social Dimension	**Sheet 5. Planning of agroecological public spaces:** Verifies territorial planning (regional, municipal and local) of agro-ecological areas. Examples of measurement unit: Area (square meters) destined for collective use of agro-ecological gardens or open markets; access to phytotherapeutic programs by the Single Health System (SUS); survey of traditional medicinal practices in the community. Recommended annual periodicity.	Improved planning and revitalization of idle urban spaces; direct marketing and distribution of agroecological products; integration with health clinics, social promotion and citizenship in sustainable processes in agriculture; SDG 2 (Zero Hunger and sustainable agriculture); SDG 3 (Health and well-being); and, SDG 10 (Reducing inequalities). Themes: (2.1); (2.2); (3.9) e (10.2)	79%
Social Dimension	**Sheet 6. Non-partisan governmental interactions:** Checks citizen participation through governance processes and public policies in the development of agroecology and sustainable production in the region. Examples of measurement unit: Number of participations of agroecologist in legally established devices and conventions per year (local Agenda 21, (inter)municipal protocol of intentions, propositions, regulations, municipal laws...). Recommended annual periodicity.	Incorporation of democratic shared issues of populations regarding ecological well-being and social welfare in agriculture; SDG 10 (Reducing inequalities); and, SDG 17 (Partnerships and means of implementation). Themes: (10.3) and (17.14)	63%

Environmental Dimension	**Sheet 7. Agroecology for future generations:** Checks agroecologist's motivations to remain, change or extinguish sustainable practices. Measurement scales (decreased, indifferent, increased or not applicable) to the 17 SDGs that may be related to agroecology in the context of their farms or production. Recommended annual periodicity.	Combination of present data with similar studies that serve as tools considering the existing interfaces between environmental, social and economic factors considered to be emerging, and SDG 16 (Peace, justice and effective institutions). Themes: (16.b)	58%
Total of respondents (∑) = **19**			100%

For the selection of non-formal indicators, it was listed above 60% of the sample population, whose opinion perspectives were considered of 'Very High Importance' (Sheets 3, 5 and 6), for the use of farmers.

Attention was paid to the selection of collaborative indicators for voluntary monitoring, implications of social impacts. Overall, the collaborative analysis denoted a trend toward quantitative metrics for social impacts, qualitative metrics for economic impacts, and maintained conceptual definitions regarding environmental implications, more rigorous existing environmental legislation as well as intensified performance evaluations in research.

Baccar *et al.* (2020) report a lack of studies that explore perceptions of either the sustainability of their farms or of farmers' values holistically related to sustainability issues. They emphasize the importance of sensitizing farmers to these issues, even those who express different representations regarding sustainable practices, relating to their properties, their interests/priorities, and their value systems, in addition to the resistance strategies in their plantations, which are forceful.

Although the process of selecting non-formal indicators sought to verbalize stakeholder perspectives on sustainable agricultural development, one needs to extend understandings to "the way in which a particular set of shared values comes into interaction with the particular experiences common to a community of experts" so that "most of the group comes to regard one set of arguments as more decisive than the other" (Kuhn, 1998:246).

In this sense, it is important to mention Herbelê, Dias & Udry (2018), regarding the need for organizational and behavioral innovations to be pondered, in addition to technological solutions. Under these strata, it is complemented to the predisposed results, suggestions as collective local potentialities of agricultural sustainability to structural situations:

i) *expand the assessment of sustainability in urban areas as well as the target audience for action*: facing UN projections (2018), by the year 2050, 68% of the world population will live in urban areas, and including the expansion of cities, population growth, increasing per capita consumption, restrictions on land use and human needs for food, the intensification of debates on sustainable urbanization is pressing

for integrated public policies between urban and rural areas based on infrastructure, social services and environmental ties;

ii) *incorporate agroecology as an adaptive technology and innovation, adopted in a rational and environmentally responsible way*: by researching the conceptions about agroecology, especially about agroecosystemic diversity, it is a sustainable agriculture that best adapts to the realities and specific local conditions of family, traditional and community organization in moderation of the monitoring, evaluation and control activities of productive processes, as well as in food and nutritional security; conservation of agrobiodiversity; and, socio-territorial development. In a state with significant agricultural production, the significant contributions in crops and livestock come from these social bases for Sustainable Development (SD);

iii) *governmental engagement and active collective to the goals of sustainable development*: according to Martin *et al.* (2017), contemporary sustainable agriculture has priority relevance, especially in the goals of the Sustainable Development Goals (SDGs). It was envisioned as contributions, share necessary information from the perspective of the citizen for politically neutral resource management, forming and making decisions, supported by the functional aspects of agroecology, for better understanding of the forms of planting, relating them to goals ordered in indicators that can advance the Agenda for sustainable development by the year 2030.

Implementing multi-stakeholder consultation structures to improve agricultural systems, the "ways in which farmers perceive and transform their context of action to achieve sustainable development must be better understood and analyzed" (Baccar, 2020:2). In this sense, it surrounds environmental sustainability because it involves broader levels of organization and, consequently, mobilization, encouragement, and resource management.

In a way, the joint vision enabled the awareness to consolidate a better decision making to the sustainability questions. However, studies by Weißhuhn *et al.* (2017), explain about the few generally accepted methods to link research results to sustainability impacts, especially regarding a broader scope and obtaining long-term metadata.

4. Conclusions

The methodological procedures used provided qualitative and quantitative data, with a focus on agroecology for sustainable development.

The combination of scientific knowledge and popular wisdom pointed out opportunities in an existing evaluation system and improvements for actions in public policies. The application of mixed methods,

based on farmers' perceptions, had positive effects because it verified innovations in the current form of monitoring, and brought new themes for indicator studies at the local level.

However, we understand that the results obtained have an interpretative character on conceptual bases and restricted to the functional aspects of an existing indicator system, rather than results from the study focusing on responses or operational experiences.

The research was important to: (i) identify integrated experiences within sustainable agriculture practices; (ii) social and institutional construction to jointly analyze solutions to current challenges that are the intensification of production and the diminishing of ecosystems; and, (iii) obtain indicators with a view to (eco)development.

We also describe, as opportunities for other potential variables: (a) studies of the Brazilian labour and social security legislation to encourage agroecological production; (b) strengthening entrepreneurship in order to implement products and services, considering that sustainable agriculture in precarious areas;
(c) forms expansion and transfer of technologies, for coming generations and alternative to improve food;
(d) strengthen cultural (including artistic, aesthetic, touristic), landscape and historical aspects of local traditional knowledge and environmental protection models for other regions of the country.

Public institutions and organizations of agricultural research have an important role in the hybridization of sciences and knowledge. Agroecology as a research priority can strengthen public policies and offer technologies that can be built locally, through dialogue, and integrated efforts among farmers, consumers, the production chain, and the environment.

After the final research process, a synthesis of the results with the proposed indicators was sent to the Municipality of Belo Horizonte, to support the goals plan 2021 - 2024, according to the prerogatives of the article 108-A of the Municipal Organic Law (Law 0 of 3/21/1990). And, also registered as an implementable project of good participatory practices between citizens and public policies with specific purposes for future research, in the computerized system of the government of Minas Gerais.

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Reflections on Sustainable Development Planning and Implementation:

Proposals for a stakeholder-oriented framework

Jerry Kolo[1], Sandra Schrouder[2], Ragad A. Almashour[3]

[1]American University of Sharjah, Sharjah, UAE, jkolo@aus.edu
[2]Barry University, Miami Shores, FL, USA, sschrouder@barry.edu
[3]American University of Sharjah, Sharjah, UAE, g00074611@alumni.aus.edu

Abstract

Since the world adopted sustainable development (SD) as a development philosophy in 1992, SD implementation concepts and strategies have featured in scholarly, policy and development circles. The various creative approaches to SD implementation attest to the diversity of the global context in which implementation occurs. This diversity informed the United Nations' prescription, exemplified by Local Agenda 21 of 1992, to localize SD implementation. One contention in this paper is that the marginal achievements of the world on numerous SD protocols, e.g., the Millennium Development Goals (2000-2015), SD Goals (2015-2030, etc., is attributable to various reasons, one of which is the lack or vagueness of the principles of how protocols engage stakeholders in policies, programs and projects. SD initiatives focus on projects which most stakeholders, especially in the grassroots sector, are grossly unaware of and unengaged with. This paper argues that the Brundtland framework is silent, in respect to local context, on the practical Interface between the 3-E pillars and stakeholders in implementation processes. The 3-E pillars are environment, economy and equity, known in business circles as the triple-bottom line (TBL or 3BL), which are people/social, profit/economy, planet/environment. This paper postulates that the interface can be achieved by two additional pillars, which are engagement and enlightenment. This results in a 5-E SD planning and implementation framework dubbed the SD pentagon. The authors of this paper deciphered and vetted the SD pentagon from practical exercises in implementing SD initiatives in grassroots communities in parts of the world, and in teaching SD courses in graduate schools. Using the evidence-based and gedankenexperimental social research methods, this paper found and concluded that, one, the SD pentagon provides a refreshing option to, and builds on, not transplant, the Bruntland framework. Two, the pentagon is explicit on how to achieve the intent of SDG 17. The 17 targets for this SDG were clustered into five categories. One category targeted capacity-building among stakeholders in the SD implementation process. This paper found that inadequate capacity is a formidable challenge in SD implementation worldwide. Three, the SD pentagon provides a universally applicable framework that institutionalizes and normalizes enlightenment and engagement without violating the intent of localization.

In this sense, the pentagon respects and is anchored on local culture. From concepts and diction to strategies and dividends, local stakeholders are proprietors of SD planning. Finally, the pentagon facilitates the achievement of several SDGs, specifically goals 3, 5, 6, 7, 12 and 17. It is a powerful SD implementation tool that improves and strengthens a healthier relationship between the environment (life-support systems) and all anthropogenic activities.

Keywords: Brundtland sustainable development framework, Sustainable development pentagon, Life-support systems, Engagement, Enlightenment

2. Introduction

There is ample evidence that the relationship between humans and the natural environment is strained, due primarily to human, also known as anthropogenic activities. The environment is the sustainer of human and all life forms, and the source of energy for all the activities of humans and all other living things. It is in the context of the critical role of the environment in sustaining all life forms and their activities that the uncompromisable credibility of sustainable development lies as a development philosophy and framework or model.

Mounting and solid evidence of the threats of human activities and stochastic events (force majeure) to the environment led the world community to gather in Rio, Brazil in 1992 for the first earth summit, where SD was formally adopted as the de facto development philosophy and framework for the world. The concept and meaning or definition of SD were framed by the ground breaking 1987 Brundtland Report. In the report, SD is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987:8).

Since the Rio summit, a litany of international, regional, national and local initiatives have been taken to implement the spirit and letter of SD. In that line-up of initiatives is Global Agenda 2030, which delineated 17 sustainable development goals (SDGs) and were endorsed by 193 countries to be achieved by 2030. Since 1992, a perpetual part of SD discourse is the challenges of cost-effective implementation of SD in general, and the SDGs in particular. This paper reflects on these challenges with the aim of proposing a multi stakeholder-oriented enlightenment and engagement implementation framework as an alternative, and complementary to the extant political-economic and government-oriented framework. The rationale for the focus of this paper rests on four basic contentions. One, laudable and critically essential as SD is as a development philosophy, goal and model, cost-effective implementation has proven to be the Achilles heel in achieving SD initiatives all around the world. Two, there is evidence that the critical mass of the world's population is not actively and meaningfully involved in governments' strategic SD initiatives. Three, inadequate, very limited or total lack of knowledge or awareness about SD as a policy and development agenda of governments is hampering cost-

effective implementation of SD initiatives. Four, the more aware and involved people across all strata of society are of and in SD initiatives, the better the chances of implementing the initiatives cost-effectively. It is on the basis of these contentions that this paper proposed an alternative implementation framework for SD.

In this paper, one major argument is that the top-down strategy (TDS) of SD planning and implementation is fraught with challenges that make overall global efforts ineffective, thus prompting an urgent need for alternative approaches that may complement and/or supplant the TDS. The questions answered in the paper are, one, what are some of the challenges obstructing effective implementation of SD in general and, specifically the SDGs of Agenda 2030? Two, what alternative strategy is proposed to facilitate effective implementation of SD and what evidence-based justification can be provided for the prospect of an alternative strategy? As its main objective, this paper proposes a bottom-up strategy (BUS), along with justifications for its prospects. The BUS is based on a conceptual framework for which the neologism SD pentagon (SDP) is coined. The SDP is shown in Figure 2, followed by its elaboration.

The vast body of literature on SD in general and the SDGs in particular spans practically all fields of research and practice, reaffirming the pervasive influence of the SD philosophy. The concept and framework of SD in the Brundtland report is anchored on three pillars, viz, environment, economy and social equity. Depictions of this framework proliferate the SD literature, such as the example in Figure 1 by Sharma, 2008.

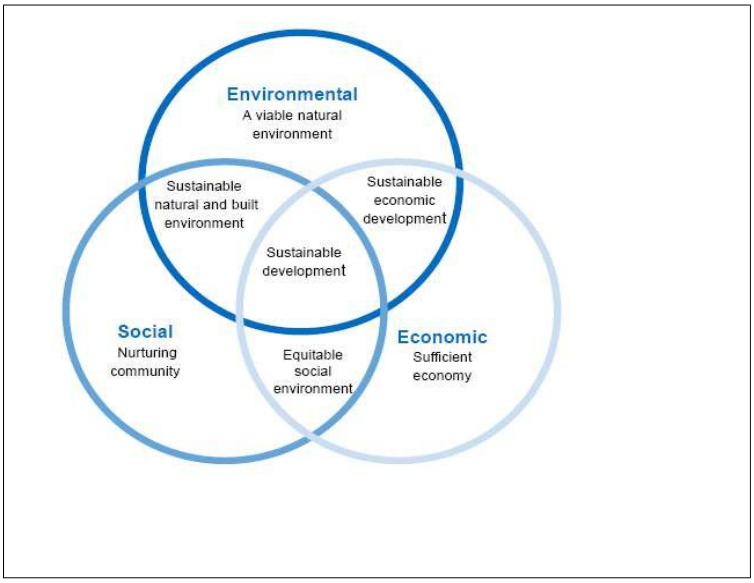


Figure 1. A graphic depiction of Brundtland's 3-E SD framework Source: Sharma (2008)

SD can be rightly dubbed the zeitgeist of development policy, practice and discourse since the first earth summit held in Rio, Brazil in 1992 (Pinderhughes, 2004; Gunder, 2006; Stefanovic, 2000). SD was adopted

by world leaders as the world's premier development policy and planning quaquaversal. Since then, as Bressers and Rosenbaum (2003:5) noted, "sustainable development has rapidly acquired such global salience that it is now a strategic concept at virtually every level of international and national government where public policy is discussed." In spite of the prominence of SD, Bressers and Rosenbaum (ibid.) noted that, "what sustainable development implies about the appropriate means to this end or about what is to be specifically achieved, is a matter of continuing debate." Interestingly, scholars such as Gunder (2006) view this debate positively, noting that "… it is this lack of clarity that allows this concept to be a 'real' or 'good thing' for all those who embrace it, regardless of the particularity of their individual understandings, dreams, and desires about this sublime subject."

In the quest to achieve the intent and goal of the SD philosophy since 1992, various initiatives have been, and continue to be designed for implementation at all levels of government. Most prominent examples of such initiatives at the global level are the Local Agenda 21 of 1992; Kyoto Protocol of 1997 aimed at mitigating greenhouse gas emissions; the Millennium Development Goals of 2000; the Paris Agreement of 2015; the SDGs of 2015 – the focus in this paper; the New Urban Agenda of 2016 (Habitat III); and several others.

The verdict of this paper on all the SD initiatives since 1992 is that the intent and rhetoric of the global community to improve the human-environment relationship have not been matched by substantive and desired outcomes. Of the various reasons that can be adduced for this mismatch between intent and outcomes, one that is examined in this paper is the ineffective top-down implementation process of SD and the SDGs. Since the 'birth' of the SD framework in 1992, the issue of implementation has been a perpetual part of SD discourse. The SDGs face the same question of implementation. Time and again, the issue of implementation has been raised by SD scholars, professionals, advocates and policy makers. For example, Miller (2016) posed an emphatic question with particular reference to the implementation of the SDGs. "But how do we actually implement sustainable policies and practices in order to meet the SDGs?" In her view, "for this answer we must turn to cities, where more than half of the world's population now lives," a percentage that is rising rapidly as more and more people worldwide move to cities. More chilling was the question by Nicolai (2016), when she asked "how can we reach an SDG target when we're moving in the wrong direction?" In yet another reference to the herculean implementation issue, in discussions about progress on the SDGs in 2018, Kharas (2018) made a revealing and poignant observation that:

Almost three years have passed since the Sustainable Development Goals and Agenda 2030 were adopted by 193 countries at the United Nations General Assembly. Since then, focus has switched to implementation. Here the news is not good. Indicators of 14 out of 16 targets directly related to individuals

(like poverty, education, or child mortality) are unlikely to get more than half way to their agreed 2030 endpoint.

Kharas (ibid) cautioned that "there is an urgency to SDG implementation. Time is running out. If the estimated trends do not change, many lives will be lost or damaged, and, in the longer- run, development trajectories for the next few decades will be adversely affected. A narrow window of opportunity that exists today is closing." The view in this paper is that the narrow opportunity window has been, and will continue to be significantly shrunk by critical global events, both stochastic and anthropogenic, such as covid-19, active wars in different parts of the world; global economic recessions; globalization fragmentation; etc. This is part of the justification for a more pragmatic framework, as is proposed in this paper, for the implementation of SD initiatives. As Clark and Kavanagh (2019) suggested from their review of Ireland's progress on the SDGs, "the world needs a new model based on a broader understanding of what it means to be human and how humans relate to one another and to their common home."

2. Methods

This is a qualitative interpretive research that used the evidence-based and gedankenexperimental social research methods to collect and analyze the information collected from several sources. The specific techniques used are described in Table 1. These are in addition to the desktop method used to review the literature on SD, and for information to construct the analytical frameworks for aggregating some of the conceptual data, for example, in Tables 2, 3 and 4. The authors deciphered and vetted the SD pentagon from practical exercises in simulating and actually implementing SD initiatives in various group settings in different parts of the world.

Research Process	Research Informant Groups

	Community Empowerment Group	Master's Degree Classes	Executive Master's Education Module	SDG Pavilion Visitors at EXPO 2020
Techniques	• Monthly thematic expert panels • Community town hall meetings	• Course research assignments • Seminar presentations • Critical discourse	• Focus group • Critical discourse	• Conversational interview
Estimated group size	50 – 100	200	20	10
Observation timeframe	10 years	20 years	14 days	2 days

Table 1. Information collection techniques from informants

Results and Discussion

The results of this research are organized as follows. First is a summary in Table 2 of the challenges gleaned from the literature on implementing SD initiatives in general, and the SDGs in particular, in various parts of the world. Second is the summary in Table 3 of interpretations of the responses of the informant groups to the points of inquiry posed in this research. Third is the SDP in Figure 2, which was formulated as an alternative SD implementation framework, based on the aggregation of the information and insights garnered in this research. Some strengths and advantages of the framework are presented in Table 4.

Societal Goal Clusters	Examples of challenges of SD

Governance	• Intra- and inter-jurisdictional policy incoherence and contradictions (Fischer, 2020; Wahlen, 2019; ECA, 2018) • Ineffective, inept and corrupt governance structures (Wahlen, 2019; Patterson et al., 2015) • Elitist, one-way, top-down approach to SD policy making and programming (Miller, 2016; Kolo, 2009) • Making difficulty trade-offs (Patterson et al., 2015) • Competing interests (Patterson et al., 2015) • Little or lack of input or participation in SD processes by the masses at the grassroots (Miller, 2016; Kolo, 2010) • Shrinking space for civil society organizations (Fischer, 2020)
	• Environmental injustice via policy, regulatory and structural deficiencies • Illegal and criminal environmental activities • Anti-environment movements (e.g., dominion theorists) • Intra- and inter-jurisdictional conflicts over LSS • Political extremism (e.g., populism, ethnic nationalism, xenophobia, etc.) • Spillover impacts of outright political conflicts, violence and wars
Economy	• Lack of funds for government plans (Fischer, 2020; IMFBlog, 2019; Patterson et al., 2015) • Greed and reluctance of big business (anti-environment business lobbies) (Salingaros, 2019) • Unemployment hazards and risks • Over-commodification of planetary resources (Salingaros, 2019) • Leisure, entertainment and marketing businesses (cruise ships, hospitourism*, air shows, etc.) • Unaffordability of modern, environmentally-friendly innovations (cost of sustainable practices)
Psychosocial	• Consumerism (lifestyle choices, e.g., the rich and famous) (Howes, 2022) • Citizen apathy, unawareness • Lack of, or weak capacity, expertise (Fischer, 2020) • Illiteracy and grinding poverty • Population increases and shifts (Dugarova & Gülasan, 2017) • Cultural, religious, traditional and primordial practices and vestiges • 'Alien' SD concepts, diction and models/paradigms (Pipa, 2018; Miller, 2016) • Free-rider syndrome or phenomenon (abuse and theft of commonwealth)
Built environment	• Lack of, inadequate, obsolete legacy (historic) and smart (next-gen) infrastructure • Environmentally unfriendly infrastructure (hazardous, polluting infrastructure)

Natural environment	• Extinction of species and planetary resources due to over-exploitation and abuse (Dugarova & Gülasan, 2017) • Pollution and contamination of LSS due to anthropogenic activities and stochastic events (Dugarova & Gülasan, 2017)

Talking Points with Informants	Summary of Findings from Research Informant Groups			
	Community Empowerment Group	Master's Degree Classes	Executive Master's Education Module	SDG Pavilion Visitors at EXPO 2020
Talking point 1	• Not much. Just general	• Not much. Just general	• Not much. Just general	• Not much. Just general

Table 2. Examples of challenges of SD planning and implementation by societal goal clusters
Source: Compiled by authors, 2022
Note: Hospitourism is a neologism coined in other research by one of the authors for two inextricably intertwined activities, viz, hospitality and tourism.*

Depth of knowledge about SD or sustainability	information about doing whatever we can to save the environment	information about doing whatever we can to save the environment	information about doing whatever we can to save the environment	information about doing whatever we can to save the environment
Talking point 2 Precise description of knowledge of SD and source(s) of information	• Nothing in particular, just to take care of the environment • Local information about recycling, energy and water conservation programs	• Nothing in particular • Some green building codes • Local information about recycling, energy and water conservation programs	• Nothing in particular, just to take care of the environment	• Nothing in particular, just to take care of the environment
Talking point 3 Depth of knowledge about the SDGs	• Practically nothing	• Practically nothing	• Practically nothing	• Practically nothing
Talking Point 4 Individual actions taken to help save the environment	• Recycling • Control water and electricity use • Volunteer for community clean ups	• Recycling • Control water and electricity use	• Recycling • Control water and electricity use	• Recycling • Control water and electricity use
Talking point 5 Level of optimism that 'we' can all succeed in protecting the environment	• Yes, if we all work together • Yes, if government has the political will • No, not with the power of big business • No, there is too much environmental injustice	• Not sure • Yes, if government has the political will • Yes, if we all work together	• Not sure • Yes, if government has the political will • Yes, if we all work together	• Not sure • Yes, if government has the political will • Yes, if we all work together

Table 3. Summary of interpretations of information from informant groups Source: Compiled by authors, 2022

The following five observations were extracted by the authors from their interpretations of the information summarized in Table 3.

One, the informant groups admitted knowing little to nothing about the SDGs in particular, and that their knowledge of SD as a development policy, goal and model was equally low and vague.

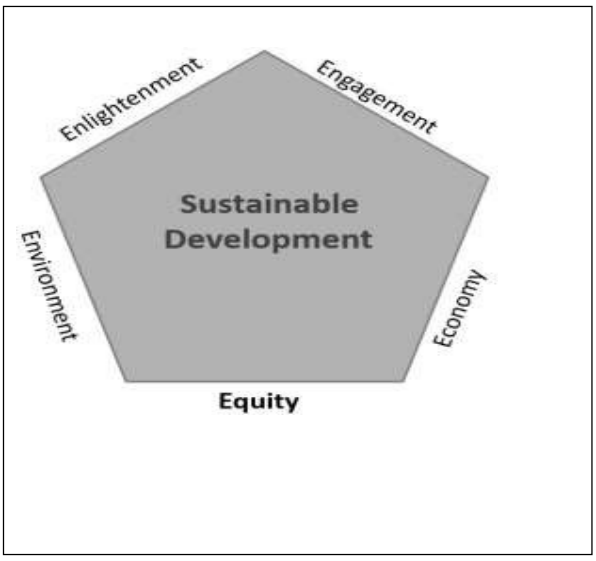
Two, the community empowerment group was more focused on, and critical of environmental injustice in American cities. This was not surprising since over 90 percent of the group members were Black Americans, all of them educated and professionals. Most had experienced one form of environmental injustice or another, and were aware of landmark environmental justice legal cases. Most were very critical

of ‘big business’ as a major cause of environmental injustice and unethical environmental practices, such as environmental greenwashing.

Three, the master’s graduate students were very young, freshly out of school, professionally inexperienced and very uninterested in political-economic affairs. There was clear evidence of their ‘naivety’ about strategic political-economic and environmental challenges around the world. The level of unawareness of the SDGs in particular was dismally low. Interestingly, their curiosity and interest about such challenges and the SDGs picked up rapidly as they were enlightened and engaged through assigned course research, seminar discussions and presentations and other course activities about SD.

Four, the executive master’s group was surprisingly similar to the master’s graduate students. However, the former had more professional or work experience, were more aware of political, economic and environmental challenges at the national and global levels. The shock for these authors was the level of unawareness about the SDGs in particular, more so as the group of 20 trainees consisted of 13 nationalities from all regions of the world.

Five, the informants at the EXPO 2020 Sustainability Pavilion in Dubai, United Arab Emirates were a mix of different nationalities from both the developed and developing countries. They admitted visiting the pavilion as part of the adventure of being at a global event such as the EXPO 2020; in an effort to get value for their money, which was to attend as many pavilions as possible; and based on recommendations from others who had previously visited the pavilion. What was striking about this group, quite similar to the executive master’s group, was that SD was seen as a UN initiative, program or activity. That created or reinforced that impression that SD is about big government and big business, with philanthropies tagging along for consultancy opportunities. The grassroots were hardly factored into the SD implementation equation, as is emphasized in the SDP proposed in this paper and depicted in Figure 2 below.



The rationale for both the enlightenment and engagement pillars are discussed in greater detail elsewhere by this author (Kolo, 2010). Suffice it to say that, SD implementation must go beyond the classical Brundtland 3-E pillars in Figure 1 to include the additional pillars prescribed in the SDP in Figure 2. Table 4 is a summary of some of the key potentials, strengths and advantages of the additional SDP pillars. These attributes are assured to add great value to SD implementation at the local level, especially in the developing world.

Enlightenment/Awareness	Engagement/Participation
1. Knowledge or awareness about the environment, its uniqueness and relationship to all life forms and their activities 2. Sense of responsibility toward the environment 3. Accountability for one's actions to self and to society 4. Conviction and excitement about choices 5. Sense of empowerment (the truism that knowledge or information is power) 6. Knowledge or awareness of options, choices and implications of one's choices/actions (creating a 'mutual' relationship between humans and the life-support systems) 7. Interest in, and awareness of, sustainability issues and practices elsewhere 8. Awareness of participation channels on SD initiatives 9. Keen sense and motivation to participate in SD initiatives locally and beyond	1. Citizen buy-in into the SD policy, planning and implementation processes 2. Partnership and coalition building in the SD network 3. Sharing and learning about best practices in SD implementation 4. Collective sense of responsibility 5. Confidence in, and respect for, SD processes, institutions and policy makers 6. Infusion of experiential (culturally contextual) knowledge into SD processes 7. Incremental and pragmatic implementation of SD initiatives (healthy balance or mixture of indigenous and foreign SD practices) 8. Designation of roles and responsibilities based on competency, capacity and interests 9. Collaborative approach to sharing SD benefits and absorbing liabilities (mutualism)

Table 4: Additional advantages of the enlightenment and engagement pillars of the SDP
Source: Adapted from Kolo (2010)

4. Conclusions

The urgency of mitigating the strained relationship between the LSS and all life forms and their activities is echoed clearly and loudly around the world by leading expert authorities such as the International Panel on Climate Change, the World Economic Forum, etc. One of the suggestions for addressing the strained relationship is the need for new approaches to implement SD initiatives. Among the various observations made in this paper to buttress the need for more dynamic SD implementation frameworks are the following. One, laudable and critically essential as SD is as a development philosophy, goal and model,

governments are implementing SD initiatives such as the SDGs using an elitist, top-down, centre-periphery approach. This approach marginalizes most of the public citizens, especially those at the grassroots. Two, because people are unaware or uniformed about governments' SD initiatives, there is less than adequate enthusiasm and involvement or participation in such initiatives. Apathy in many cases is not deliberate, but a result of exclusionary public processes for implementing SD initiatives. Three, at the personal or individual level, people generally practice, voluntarily or in compliance with government regulations, activities that help to safeguard the natural environment, such as recycling, energy and water conservation, etc. Scaling up on such activities to achieve the critical mass for effective results is what this paper suggests for SD scholars, professionals and policy makers to focus on. Four, across all the stakeholder sectors of society, viz, the public, corporate, philanthropic and grassroots sectors, policy, project and program initiatives emphasize and focus on the environment pillar of Brundtland's three-pillar SD framework, leaving the economic and social equity pillars needing serious and urgent attention. The pillars complement and reinforce each other, and ignoring any of them undermines all efforts to achieve the goal of SD.

With the SDP proposed in this paper, the 3-E Brundtland framework becomes more implementable and effective by embedding two additional 'Es' of the pentagon. Porter (2000:2) noted quite tersely that "translating the lofty ideals of sustainability into the rough-and-tumble world of everyday development can be a daunting task." A foremost implication of this task is for all societal stakeholders to work collaboratively in all aspects and facets of SD planning and implementation. The top-down, elitist approach alluded to in this paper has not been effective in securing the buy-in and shared responsibility required of all community stakeholders. The types of collaborative approaches required to implement SD initiatives cost- effectively already exist in most communities. What policy makers need is to foster and institutionalize more dynamic and pragmatic SD governance frameworks, such as the SDP proposed in this paper. For the SDGs in particular, the SDP addresses goal 17 directly, especially the cluster of targets that aims to build capacity among stakeholders in the SD implementation process. The SDP also facilitates the achievement of several SDGs, specifically goals 3, 5, 6, 7 and 12. Finally, the SDP is a universally applicable framework that institutionalizes and normalizes enlightenment and engagement without violating the intent of localization. In this sense, the SDP respects and is anchored on local culture. From concepts and diction to strategies and dividends, local stakeholders are proprietors of SD planning.

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9. Governance, power and institutions and weakness of SDGs

9d. Legal aspects of sustainable development

Abstracts

Building Coherent Social Protection Systems: A comparative legal analysis of mechanisms in Sub Saharan Africa

Ms. Irene Among, Prof. Dr. Markus Kaltenborn

Ruhr Universität, Bochum, Germany

Abstract

The multidimensional nature of poverty and vulnerability requires coherent social protection systems reaching beyond their sub-policy instruments to other social policies. Social protection objectives are efficiently achieved when social protection policies and programmes enhance synergies and minimise contradictions with each other (internal coherence) and with neighbouring policies (external coherence). This article draws on a qualitative content analysis of policies, laws, reports and articles and is embedded in the functional comparative legal research method. The key research questions it addresses are, what is the nature of incoherence of the social protection system in South Africa and Uganda, and how are countries addressing the problem? The study found that the two countries have a fair mix of legal and extra-legal policy coordination and integration mechanisms, some of which have led to the internal coherence of some social protection schemes. However, external coherence is more challenging due to the broader policy coordination conundrum governments generally face. The findings suggest that solutions lie in designing and implementing goal-oriented social protection policies and laws, strong leadership, and functioning institutions. Further research is nevertheless required to understand why incoherence and fragmentation persist despite the mechanisms and why some mechanisms may be more successful than others.

Track
Track 9d Legal aspects of sustainable development

Business towards Sustainability Transformation: The example of the transitional economy states

Tamara Horbachevska

Wageningen University & Research, Wageningen, Netherlands

Abstract

Introduction

The SDGs envisage a key role for the private sector in ensuring implementation and are intertwined with the BHR agenda as SDGs should be "at the heart" of business strategies on human rights (Shift, 2016). UN member states differ in their development levels, strategies to achieve the goals, and the potential role of the private sector. At present, little attention was paid to this role in post-soviet states (former Union of Soviet Socialist Republics), and how it relates to law and business practice there (Sanchenko, 2019).

Methods

The project combines desk-based research of legislation, state, and corporate policies along with the doctrinal analysis.

Findings

The region of the research characterized with low self-regulation, weak engagement of non-state actors in BHR and SDGs agenda is also in the luck of the coherent state regulation, so-called "state controls gaps" (The UNDP in Ukraine, 2022) that is a challenge for business actors to achieve the stage of compliance with state law regulation, i.e. weak sustainability (Landrum, 2018).

In the region, it is specified as being a part of transitional economy states, Ukraine can be characterized as "wild capitalism" with a high level of bureaucracy, the concentration of achieving the maximum profit, and weak attention to human rights (Scoping study, 2021).

Additionally to the compliance with state law regulating the Concept on implementation of state policy in the field of promoting the development of socially responsible business in Ukraine until 2030 aims to strengthen the impact role of business in solving societal issues but refer to the notion of "socially responsible business" as a voluntary framework which can be chosen by the business (Cabinet of Ministers of Ukraine, 2020).

For example, only two companies in Ukraine (from 100 biggest business companies researched) contain Sustainable Development Policies as approved documents, and the companies of the survey lack substantive reports on the implementation process of their policies (Company Transparency Index 2019 – Ukraine, 2019).

Discussion

Therefore, the question arises whether voluntary commitments to sustainability can be effectively implemented at a practical level and contribute to overcoming the stage of weak sustainability i.e. the stage of compliance to the law regulations by providing instead with a holistic approach to successful regional transition to sustainability by using non-state mechanisms such as soft law, voluntary commitments, and self-regulation of business actors.

Conclusion

The research aims to contribute to the discussion on how business actors can engage in SDG's achieving by providing a specific regional example of Eastern European Countries which were members of the former Soviet Union and now experiencing a transformation of their laws as well as policies of business actors located under their jurisdiction towards global agenda on sustainable business.

The abstract addresses SDG 16 "Peace, justice and strong institutions" + SDG 16 Target 6 "Develop effective, accountable and transparent institutions at all levels" (16.6).

The proposed abstract relates to the Conference topic track 9d. Legal Aspects of Sustainable Development, specifically, a sub-track question on the analysis of regional integration to the sustainability from the legal perspective.

Track
Track 9d Legal aspects of sustainable development

Could Human Rights be 'Environmentally Friendly'? Bridging environmental degradation and right to life in the jurisprudence of the human rights committee

Doctor Jingjing Wu[1], Mr. Piergiuseppe Pusceddu[2]

[1]University of Southern Denmark, Odense, Denmark. [2]University of Tilburg, Tilburg, Netherlands

Abstract

In 2018, the Human Rights Committee (HRC), a United Nation Body, adopted the 'General comment No. 36 (GC 36) on article 6 of the International Covenant on Civil and Political Rights (ICCPR), on the right to life'. In its paragraphs 26 and 62, GC 36 attempts at creating a legal connection between environmental degradation and impingement on the right to life. This relation is, however, far from straightforward, as human rights protection and environmental law lay on different theoretical constructions, and arguably pursue different aims. Against this backdrop, the starting point of this paper is a recent decision issued by the HRC in the case Teitiota v New Zealand (2019). The decision adds up to the body of case law on Article 6 of the ICCPR (right to life) and made reference to the newly enacted GC 36. While this decision is a milestone in the elaboration of the content of the right to life and its relation to environmental degradation, possibly advancing the debate on climate refugees, we contend that the decision fails to articulate properly how, and to what extent, environmental degradation affects the right to life. Without this linkage, one can never know for sure to which point environmental degradation is considered sufficient to trigger human rights protection under article 6, which leaves this seemingly progressive legal approach in vain. Therefore, in this paper, we focus on filling the gap left by the HRC by examining (a) the right to life and its possible violation in the context of article 6, (b) the drawbacks of the Teitiota decision, when contextualised within the type of harm caused by environmental degradation, and (c) the possible reconciliation between the gradual nature of environmental degradation and human rights protection that requires an imminent threat. In its underpinning, this paper attempts at reconciling human rights and environmental law, in light of giving meaning to GC 36.

Track
Track 9d Legal aspects of sustainable development

Creating a System for Biodiversity Offsetting in Finland: The case of land use planning

Senior Researcher Minna Pappila

Finnish Environment Institute, Helsinki, Finland

Abstract

In biodiversity offsetting (ecological compensation), biodiversity losses due to ecologically harmful human activity are compensated by producing equal gains elsewhere. Generally, the target is set to No Net Loss or Net Positive Impact of biodiversity. The topic of this presentation - biodiversity offsetting - is closely related to the SDG 15 and especieally to target 15.5: "Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species " As development projects will keep increasing all over the world, biodiversity offsetting is one necessary means to halt biodiversity loss. In addition to offsetting, of course, large areas of nature conservation are needed, too.

Biodiversity crisis calls for a paradigm shift in law: the No Net Loss of Biodiversity principle and biodiversity offsetting has to be operationalized into our legal systems to prevent further biodiversity loss. There are already several countries with mandatory biodiversity offsetting policies for at least some infrastructure sectors or habitat types, and much more countries that recommend or enable voluntary offsets. The ongoing reform of the Finnish Nature Conservation Act is aiming at establishing a system of biodiversity offsetting. The draft includes rules on both obligatory and voluntary offsetting. Offsetting would be obligatory when authorities grant a derogation from certain NCA regulations on the protection of species and habitats and nature conservation areas. In addition to the law reform there are ongoing research projects, private development projects (e.g. internet trading centres) and municipal initiatives on biodiversity offsetting.

The aim of this presentation is to highlight certain questions that are important when considering integrating the mitigation hierarchy and biodiversity offsetting into land use planning in Finland. Some of the questions that have been identified are the rights of private land owners, the need of new instruments in land use planning and the need to create compensation pools. These specific topics will be disussed in the presentation that is based on the recently started work within a research constortium Biodiversity offsetting as an operational tool for a just sustainability transition towards no net loss of ecosystems and biodiversity – BOOST.

Track
Track 9d Legal aspects of sustainable development

Governance Mechanisms for Sustainable Development

Dr. Alexandra Harrington

Lancaster University Law School, Lancaster, United Kingdom

Abstract

When the Sustainable Development Goals (SDGs) were designed, a critical element was the creation and operationalization of the High Level Political Forum (HLPF) to serve as an annual review, oversight and information sharing mechanism. Indeed, the HLPF's existence can be seen as a governance innovation stemming from the Millennium Development Goals (MDGs) which, among other identified gaps, failed to include an oversight system. Since its inception, the HLPF has been an important tool in reviewing the Voluntary National Reviews, hearing commentary and generating innovations in implementation of the SDGs, and convening civil society actors engaged in implementing the SDGs. However, even within the context of governance implementation, the SDGs are and will continue to be significantly impacted by the governance mechanisms used by other international and regional treaty regimes. This was partially alluded to in the footnote to SDG 13, "Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change."

This paper will examine the ways in which other treaty regimes' governance mechanisms have functioned to impact the achievement of sustainable development and, relatedly, the SDGs as well as the ways in which newly operationalized governance mechanisms can potentially impact the implementation of the SDGs and advancement of sustainable development. It will pay particular attention to the functioning of the newly operational Paris Agreement Committee on Compliance and the Compliance Committee for the Convention on Biological Diversity's Nagoya Protocol, as well as the Aarhus Convention Compliance Committee and the framework for the new Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (Escazu Agreement)'s Compliance Committee. These regimes have been selected for analysis because they address core elements of the SDGs, notably SDGs 13, 14, 15 and 16.3; 16.6; 16.7; 16.8; 16.10. Ultimately, the paper will address the gaps and challenges generated in these governance mechanisms and how they can be incorporated into the governance structure for the SDGs. These insights will allow a broader sense of how mechanisms for governance, including those which relate to environmental and human rights regimes, can be linked to and used to further the achievement of sustainable development

Track

Track 9d Legal aspects of sustainable development

How Should Trees Have Standing? Rights of nature and indigenous cosmovision

Doctor Jingjing WU

University of Southern Denmark, Odense, Denmark

Abstract

In this paper, I ask whether and how we can weigh and balance indigenous cosmovision—the reasoning used as the main source of legitimacy in some rights of nature legislation—within a secular legal system. I examine two barriers that rights of nature and their corollary spiritual reasoning are likely to encounter if they are invoked in secular courts, namely spiritual reasoning is non-defeasible, and the current concept of human rights as a categorical legal norm is based on a circular logic. In order to overcome both barriers, I draw inspiration from Dworkin's 'rights as trumps' thesis and the proportionality principle, and propose that for rights of nature and their spiritual connotation to be operatable in a secular court, we need to create an exception—a meta rule for these legal concepts—and subject them to the proportionality principle, instead of going through the weighing and balancing process.

Track
Track 9d Legal aspects of sustainable development

Interface of policy and institutional framework for Co-management of Marine and Coastal Resources and Challenges to Effective Implementation

Mr. Masanori Kobayashi

Ocean Policy Research Institute of the Sasakawa Peace Foundation, Tokyo, Japan

Abstract

Fishery communities particularly in the developing countries depend on fishery resources for their food and income that are vital for their sustainable living. However, there are cases where foreign distant fishing vessels are engaged in illegal, unreported and unregulated (IUU) fishing or poaching that often result in the exploitation and depletion of fishery resources. There are cases reported, for instance, in Gambia, Africa, where foreign distance fishing vessels exploited local fish called bonga fish (Ethmalosa fimbriata or a type of herring fish). The lack of national coast guard capacity was a part of the reasons. The communal collective fishery resource management covers only the nearshore areas. Besides, the communal system is not sufficient to avert foreign distant fishing vessels.

The consequence of deficient capacity in fending off foreign IUU fishing vessels and the depletion of fisher resources caused the food shortage and the loss of income in the local community. The damages caused by the fish resource depletion forced the local community to opt out for alternative food sources. It was reported that there was sudden increase in the import of the frozen chicken meat from overseas. The Government of Gambia halted the rapid import of frozen chicken on the ground to sustain the national food supply system. The Ministry of Fisheries and Water Resources of the Gambian Government has developed a fishery co-management plan in 2012 and support local fishermen to organize themselves to conserve and sustainably use fish stocks. However, such a management plan doesn't necessarily include the measures to respond to the entry and operation of foreign IUU fishing vessels.

There is a regional fishery management organization that is supposed to function to promote regional cooperation and international partnership to eliminate IUU fishing and to promote sustainable fisheries. However, the regional organization is not necessarily equipped with measures to eliminate IUU fishing in a timely manner. To promote regional cooperation in West Africa, there is a call for the creation of a regional fisheries management organization to conserve and sustainably manage key fish stocks in West Africa that can include, for instance, Morocco, Mauritania, Senegal, Gambia and Guinea Bissau.

The European Union extends partnership with West African countries through multilateral and bilateral channels to support the capacity development for the conservation and sustainable management of fishery resources. To effectively respond to the issues of IUU fishing in West Africa, marine surveillance and the application of satellite data are essential and such operations require external technical, financial and operation assistance.

The case study reveals the need for multi-faceted approach to promote sustainable natura resource management including both marine, coastal and terrestrial areas and to promote a sustainable management of a nature-food-livelihood cycle. The linkage of national policy, legal and institutional systems with communal co-management systems is also vital. It is also important to develop a regional policy and institutional framework to build upon the common interests and to respond to greater impending challenges that emerge from the inter-regional and global scales.

Track

Track 9d Legal aspects of sustainable development

Legal Measures to Overcome Green vs Green Conflicts Related to Renewables in Japan

Professor Noriko Okubo

Osaka University, Toyonaka, Japan

Abstract

Japan's NDC under the Paris Agreement is to reduce GHGs by more than 46% compared to 2013 by 2030 and to reduce emissions to zero by 2050. There is still a big gap between the current situation and the target to be achieved. In order to achieve this target, the widespread use of renewable energy is essential. However, renewable energy projects have caused various environmental problems in many places, and lawsuits have been filed against them. The main causes of these disputes are inadequate land use zoning and ineffective and insufficient public participation. In addition, there is strong dissatisfaction among local residents that development projects, especially those by large outside developers, do not bring benefits to the community. In order to solve these problems and to promote sustainable development, it is necessary to take measures to promote renewables that will also lead to social and economic revitalization of the communities.

This presentation discusses legal measures to overcome green vs green conflicts related to renewables, especially analyzing the new positive zoning and approval system based on the Law Concerning the Promotion of the Measures to Cope with Global Warming, which was revised in 2021. A new approval system for project plans has been established to encourage consensus building in each region and to promote decarbonization of the region. Positive zoning refers to the pre-designation of areas for the promotion of renewable energy. The approval system for projects within the designated zones represents a kind of deregulation, providing a one-stop service for project operators. The various relevant permits under the National Parks Act, Forestry Act, etc. will be integrated into one approval. Project operators will not need to apply for each of these permits. Furthermore, a simplified EIA procedure will be applied to such projects. In order to promote local consensus, the Council for Local Action Plan will be established by prefecture and/or municipality.

However, questions remain as to whether proper positive zoning is possible and whether the new system for consensus building is sufficient. From the viewpoint of SDG 16.7, it is essential to introduce SEA into the positive zoning of the municipality, and to strengthen the functioning of Regional Action Plan Councils by providing with adequate resources.

Track
Track 9d Legal aspects of sustainable development

Measures of Continued Ecological Functioning do not release from Species Derogation Procedures? An analysis of EU-nature conservation judgements

Professor Volker Mauerhofer

Mid Sweden University - Department of Ecotechnology and Sustainable Building Engineering, Östersund, Sweden. Vienna University - Department of Botany and Biodiversity Research, Vienna, Austria. Meiji University - Enviromental Law Centre, Tokyo, Japan

Abstract

Measures of Continued Ecological Functioning (short CEF-measures) have been introduced by the Commission of the European Union (EU) in its Guidance Document 2007 for the application on one species conservation norm of the EU-Habitats Directive. According to this Commission opinion, CEF-Measures with a certain effect are capable to exclude ahead the application of this species conservation prohibition (and in the following the procedure of issuing an derogation permit from this prohibition).

The presentation will analyse in how far the jurisdiction of the Court of Justice of the EU (CJEU) since 2014 on compensatory measures especially related to Habitat Conservation (Natura 2000) but also to Species Protection in Natura 2000 areas challenges the legitimacy of CEF-measures.

The methods applied on CJEU-Case law are legal database research, in-depth literature review, and analysis by means of different legal interpretation approaches. Material identified includes CJEU-judgements as well as the related Opinion of the Attorney Generals. Eight cases starting with the Case Briels et al. from 2014 have been identified to be of relevance and will be assessed with a particular focus on the Case Skydda Skogen from 2021. Latter case has concerned species and habitat conservation issues related to both Directives (HD and BD) and has been even rendered by the Grand Chamber of the CJEU.

The results

1. show how and which arguments the jurisdiction of the Court of Justice since 2014 developed that substantially challenge the extension of this CEF-concept by member states as well as even the original concept of the EU-Commission,
2. indicate that the EU-Commission itself in 2018 seems to have even refrained from following the CEF-Concept originally support in 2007, and
3. present how the Court in the 2021 judgement Skydda Skogen apparently requests that a planned application of CEF-measures does not release from the prior application of derogation procedures. Such a request would also provide the precondition for the public participation in the sense of the Århus Convention in such procedures.

The results are in particular relevant for all Member States which already apply or tend to apply the original CEF-measures concept of the EU-Commission or an extended version therefrom. They indicated an increased duty to implements formal derogation procedures from the prohibitions of the species protection norms of both Directives (HD and BD) instead of excluding ahead the application of species conservation prohibitions based on any CEF-measures.

The presentation has its focus on SDG 16 as it particular guides SDG 16.3. “16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all” as well as 15.5 “Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species”. It relates to the conference topic

through its call for a systematic change in absolute terms of the human culture of excluding – by reference to CEF-measures - formal derogation procedures and thereby excluding public participation.

Track
Track 9d Legal aspects of sustainable development

Optimizing SDGs 13 and 15 in the Democratic Republic of Congo: Updating the existing legal and policy framework and promoting the courage of actors of change

Professor Blaise-Pascal Ntirumenyerwa Mihigo

University of Kinshasa, Kinshasa, Congo, the Democratic Republic of the. Université du Québec à Montréal, Montréal, Canada

Abstract

The Democratic Republic of Congo (DRC) is home to the largest part of the Congo Basin forests, i.e. 60%. These forests play an essential role in regulating the climate, providing environmental services and for the millions of people who depend on them. With 152 million hectares, the DRC is the most forested African country, in the heart of environmental issues and an environmental power for its potential and its role for the planet.

The DRC is committed to the implementation of the SDGs and has ratified several international environmental conventions related to SDGs 13 and 15. Regarding the SDG13, the DRC is a party to the UNFCCC, to the 1997 Kyoto Protocol and to the 2015 Paris Agreement. Two international mechanisms on SDG 13, the CDM and the REDD+, are implemented in the DRC. On the SDG 15, the DRC has ratified several international conventions, including the 1992 Convention on Biological Diversity and others. At the domestic level, the DRC has adopted laws on the conservation of nature, the protection of the environment, policies on the conservation biodiversity and REDD+ regulations.

Despite all this commitment, SDGs 13 and 15 are struggling to be implemented. Deforestation, poaching, oil exploitation in protected areas, loopholes of REDD+ projects (insignificant participation of local communities, injustices in benefit sharing, failure to achieve environmental objectives, failing institutional coordination), plastic pollution, the lack of regulation and policy on related sectors to the exploitation of ecosystems (agriculture, wood energy, etc.) are all challenges facing the DRC. War in eastern DRC, institutional and political instabilities, mining extraction; illegal loggings are additional areas with negative impacts on SDGs 13 and 15.

The participation of stakeholders is key to the enforcement of the Agenda 2030. National agencies, Donors, Private Sector, Universities and Civil Society are the main stakeholders. Among them, Civil Society is leading the change with several actions undertaken to stop oil exploitation in the Virunga Park, the violation of the moratorium on the forestry concessions, the infringement of the IPLC rights and REDD+ safeguards. However, the participation of Civil Society is not optimally efficient due to mainly financial and capacity aspects. This paper analyses the lack of this participation and promotes the courage of Civil Society.

This paper provides an analysis of the legal and policy framework on the SDGs 13 and 15 in DRC to improve efficient and equitable enforcement of these SDGs. The paper focuses on actions of actors who promote positive changes and raises strategies to straighten their participation for an effective and equitable enforcement of SDGs 13 and 15.

Track
Track 9d Legal aspects of sustainable development

Protection of the Environmental Human Rights Defenders for Achieving the Sustainable Development Goals

Assistant Professor Elif Oral

TOBB University of Economics and Technology, Faculty of Law, Ankara, Turkey

Abstract

Human rights defenders play a key role in the realisation of all human rights. A rights-based approach to planetary boundaries for ensuring a safe and just space for civilisation and humanity requires environmental actions not only from within and across the United Nations system but also from the civil society engaging in the democratic decision-making processes (António Guterres, The Highest Aspiration: A Call to Action for Human Rights, 2020). According to the Declaration on Human Rights Defenders, it is the responsibility of every individual to promote human rights, to safeguard democracy and its institutions. However, exclusion and power imbalances between States, companies, and human rights defenders cause the deterioration of the environmental rule of law, particularly infringing the rights to freedom of peaceful assembly, freedom of association, freedom of expression, and the right to access to justice and effective remedy (A/71/281 Report of the Special Rapporteur on the situation of human rights defenders, 3 August 2016).

States have a duty to protect and empower human rights defenders, while businesses, financial institutions, and social media companies also have responsibilities to respect human rights. However, currently, the protection afforded to the environmental human rights defenders is far from being effective. For example, in 2020, the killings of human rights defenders were reported to be increased by 18% from 2019. Furthermore, laws and/or practices regarding the rights of human rights defenders vary among cultures, leading to incoherent judgements by courts. On the other hand, the legal developments, such as the establishment of a new legally binding mechanism to protect environmental defenders, especially those fighting for climate justice, in the context of the Aarhus Convention, can be regarded as encouraging.

In this contribution, the author firstly presents the legal framework regarding the protection of human rights defenders under international treaties and soft law documents. Then, from a selective comparative perspective, she elaborates on the national laws and practices, which have been subject to international scrutiny of the judicial and quasi-judicial human rights monitoring mechanisms. Finally, the corporate obligation to respect the rights of rights defenders is discussed in light of this theoretical framework. It is argued that laws and policies that empower civil society and encourage broad participation in the decision-making processes both within the States and the businesses ensure accountable, transparent, and good governance.

Relevant SDGs:

16.1 Significantly reduce all forms of violence and related death rates everywhere

16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all

16.6 Develop effective, accountable and transparent institutions at all levels

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

Relevance to the conference:

The activities of human rights defenders contribute to the realisation of the Sustainable Development Goals. However, it requires courage to challenge the existing political, economic, social, and legal imbalances and structures, particularly in the ‘developing’ countries of the Global South. Thus, effective universal protection for the rights of the human rights defenders is an urgent need.

Track
Track 9d Legal aspects of sustainable development

Restoration & Liability Duties for Environmental Damages "from the past"? The interplay of EU's environmental liability, habitat & birds directives and Swedish fiber banks

Senior Lecturer Dr. Henrik Haller[1], Professor Volker Mauerhofer[1,2,3]

[1]Mid Sweden University - Department of Ecotechnology and Sustainable Building Engineering, Östersund, Sweden. [2]Vienna University - Department of Botany and Biodiversity Research, Vienna, Austria. [3]EMeiji University - Enviromental Law Centre, Tokyo, Japan

Abstract

The contribution concerns Directives of the European Union related to environmental liability and the restoration of environmental damages caused by Fiber Banks in Swedish coastal waters. Fiberbanks and fiber-rich sediments are legacies of the previously unregulated wastewater discharge from the pulp and paper industry. Large quantities of this toxic waste material have accumulated in the Baltic Sea floor and on the bottom of rivers and lakes. The Environmental Liability Directive, the Habitats Directive and the Birds Directive of the EU addresses the liability against and restoration of damages of soil, water and biological diversity. The contribution aims to identify – based on the first results of an ongoing project - the potential to establish a liability for restoration measures also for cases of ongoing damages even if the discharges have been lawfully emitted prior to the release of these Directives. An in-depth literature review is applied as well as hermeneutic methods, such as comparative legal analyses and different types of text interpretation (e.g. historic, wording, rational).

The results show the kind of scientific evidence that exists for negative causal effects by Fiber Banks on soil, water and biological diversity respectively. Furthermore, the legal framework as well as the related judgement at EU-level will be presented which are relevant to establish the duty to restore and the liability of particular stakeholders to do so. Finally, first answers to questions about the level of evidence required to establish causality of negative effects by Fiber Banks as well as to questions about the burden of proof in such procedures will be presented.

The first results on this ongoing project show based on Swedish costal Fiber Banks the high potential of the interplay among the three Directives to effectively mitigate even past and ongoing environmental damages that have their origin in a time prior to the entering into force of these Directives. Such an institutional interplay can provide a blueprint for other restoration activities beyond the case study presented, in wider EU and globally. The presentation has its focus on SDG 16 as it particular guides SDG 16.3. "16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all" as well as 15.5 "Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species". It relates to the conference topic through its call for liability for and restoration of environmental damages that have been caused by past human culture of ignoring nature.

Track
Track 9d Legal aspects of sustainable development

Righting the Green Transition for Indigenous Peoples: Lessons from the Fosen Norwegian Supreme Court Decision

Assistant Professor Dorothee Cambou

University of Helsinki, Helsinki, Finland

Abstract

On October 11, 2021, the Norwegian Supreme court issued an historic decision for Sámi indigenous peoples and the just transition movement. The court, in the form of its grand chamber, ruled unanimously that the decisions for license of development of two wind farms were invalid because the projects violate the rights of two Sámi reindeer herding communities which practice reindeer husbandry in the projects' vicinity. After several years of court proceedings, the supreme court found that the development is in violation of Article 27 of the International Covenant on Civil and Political Rights. Article 27 protects the right to culture of person belonging to minorities, including the Sámi indigenous people and their right to reindeer husbandry and is part of Norwegian Law.

Considering the Sustainable Development Goals (SDG) 7, which focuses on access to Affordable and Clean Energy and SDG 16 which targets Peace and Justice, the Fosen decision illustrates the increasing fact that our governance system is failing to conciliate ecological priorities with the safeguard of human rights, including the culture of indigenous peoples. Drawing on the Fosen decision, the objectives of this contribution are to describe the conflict that opposes the development of wind energy to the rights of the indigenous Sámi people and to examine what the Fosen decision means for the responsibility to promote sustainable development.

Several lessons can be learnt from the cases. The first relates to the failure of the state to ensure that wind energy development does not violate the cultural right of the Sámi people to reindeer husbandry. The second relates to the responsibility of companies to ensure that their project respect the rights of indigenous peoples. The present contribution focuses on the latter lessons. It argues that companies must be required to conduct human rights due diligence considering the rights of indigenous peoples to ensure that future renewable energy projects conciliate ecological priories with human rights. However, because the current legal system is largely failing to conciliate those priorities, companies must follow new standards. This contribution will look for what standards should be promoted in the light of the Fosen decision and human rights law.

Track
Track 9d Legal aspects of sustainable development

Study on the Adequacy of Laws for Climate Change Mitigation and Adaptation in Malaysia and Indonesia

Associate Professor Dr Rasyikah Khalid[1], Associate Professor Dr Mada Zuhir Apriandi[2]

[1]Universiti Kebangsaan Malaysia, Selangor, Malaysia. [2]Sriwijaya University, Palembang, Indonesia

Abstract

There have been clear impacts of climate change in Malaysia and Indonesia. Although flood can be seen as a normal phenomenon in monsoon climate countries, changes in climate has led to more flash flood in the region and more funds have been allocated both for relief and repair. Last year, major flood occurred in several parts of Malaysia which have not been inundated before. Lost and damage were estimated at amounted to more than USD1.5 billion and killed 50 trapped victims. More allocation is needed if actions are not taken to adapt and mitigate climate change impacts on water in the country. The absence of an effective law to mitigate and adapt the impact of climate change will reduce the resiliency of the public in both countries towards flood. This study aims to analyse relevant laws on flood in Malaysia and Indonesia, and whether they are sufficient to mitigate and adapt to the impact of climate change on water. This study employs doctrinal analysis of existing laws, policies, official documents, reports, books, and article journals. The researchers will also conduct in-depth interviews with relevant agencies to understand the gap between policy and implementation. The study found that although relevant policies on climate change existed in both countries, there is still lack of specific laws on climate change mitigation and adaptation. This has derailed the objective of most climate change policy, that is to mainstream climate change consideration in decision making at all levels of governments. In Malaysia, problems become apparent since many sectors that must be reported under the Paris Agreement like forestry and land use planning are under the state government jurisdictions. Thus, the existing legal and policy framework are not responding well to climate change mitigation and adaptation, and more and more people are suffering from the climate change as a result. Specific laws on climate change will guide policy makers on what is needed to mainstream climate action (SDG 7). Furthermore, in monsoon climate region, effective mitigation and adaptation will reduce impacts on the water sector (SDG 6), life under water (SDG 14) and life on land (SDG 15).

Track
Track 9d Legal aspects of sustainable development

The implementation of EU marine biodiversity protection in Finland

Senior researcher Minna Pappila[1], Doctoral researcher Suvi-Tuuli Puharinen[2]

[1]Finnish Environment Institue SYKE, Helsinki, Finland. [2]University of Eastern Finland, Joensuu, Finland

Abstract

Marine nature is known better than before and thus there are better possibilities to protect it. At the same time there are numerous old and new pressures on marine environment. EU is enhancing marine nature protection by e.g. Marine Strategy Framework Directive (MSFD), Water Framework directive (WFD), Habitats Directive and Birds Directive and the Biodiversity Strategy.

The goals of the Marine Strategy Framework Directive are to achieve good environmental Status (GES) of the EU's marine waters (originally already by 2020) and to protect the resource base upon which marine-related economic and social activities depend. The Water Framework Directive aims at achieving good ecological status of the inland and coastal waters leaving the choice of concrete means to member states.

Both directives, MSFD and WFD, have good environmental status (GES) as the main goal and both apply an ecosystem-based approach to management of inland waters and marine environment. This is realized by various approaches: the directives concern all activities affecting waters, take many aspects of ecosystems into account, includes integrative planning of management, and management area boundaries are – at least partly – based on natural ecosystem areas (e.g. whole river basins, common sea areas of several states urging interstate cooperation) instead of administrative or state boundaries.

In our presentation we analyze how the aims and responsibilities of these directives concerning biodiversity have been implemented in Finland and what are the main shortcomings in implementing the directives and gaining the good environemntal status. For the analysis, we have scrutinized both EU and national legislation and Finnish marine strategy documents, read research literature and interviewed some marine environment experts.

We conclude that the legal weight of the MSFD's and WFD's objectives is too vague in Finnish legislation. All in all, the effects of the main marine directive, MSFD is not yet largely visible in Finland. For example, the protection of marine areas is not effective, and only about one fourth of the most valuable marine habitats have been protected at all. Also, there are deficiencies in environmental permitting processes that do not sufficiently take biodiversity values or cumulative effects into account.

The theme of the article is tightly bound to the Goal 14 to Conserve and sustainably use the oceans, seas and marine resources for sustainable development, and more specifically to target 14.2: By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

There is no direct link to the topic of the Conference, SUSTAINABLE DEVELOPMENT AND COURAGE: CULTURE, ART AND HUMAN RIGHTS, but clearly the right to clean and biologically diverse marine environment is a human right and a right of future generations, too!

Track
Track 9d Legal aspects of sustainable development

The new legal system of urban gardens

Alexandra Ribeiro

CETRAD, Vila Real, Portugal

Abstract

The new generation of urban gardens are drivers of sustainability, as such it is fundamental to study them with an interdisciplinary approach in order to achieve the necessary holistic solutions that allow urban gardens to thrive. In the area of Law, we found that the potential of the existing legal instruments is underused due to a lack of concrete data and coherent and aggregated information on urban gardens and their specificities on the side of public entities, comprising ownership, possession and use, implementation, rights and duties of use, prospects for proliferation, treatment of contamination, production monitoring, among other.

This paper aims to present a proposal for the creation of a new legal system of urban gardens, in Portugal. Towards this end, at first, a systematic review of worldwide solutions was conducted, relating it with the urban policies and legislative gaps to create opportunities to enhance urban gardens as a legal system. Reference will also be made in the recent years emerged worldwide local initiatives that show that urban gardens can indeed contribute to sustainability by mobilizing collective action that can be enhanced by best-fitted legal frameworks. Secondly, our purpose is, considering that our research was done at a local level and local governments' responsibilities were recently added by the transference of competencies, they will be able to propose solutions of intervention at local level.

The paper and the proposed legal system will also address issues such as: a) The recently approved housing law provides for the creation of green spaces in social housing so that local production of food be possible; b) Existing private urban gardens and existing local markets that could potentially support the dynamic of frame urban gardens and their existing flaws of implementation and proliferation in cities; c) Mechanisms such as the program of transformation of the landscape as, for example, the village condominium, recently approved by legal diploma and some multi-criteria systems that the law allows for the promotion of ecosystems that advocate urban gardens: to treat them and organize them so that they can help in the operationalization of the growth of urban gardens in cities.

Conclusions indicate that this could be aligned with Responsible Research Investigation indicators that aim to engage publics and responsible actors in the science and innovation field to produce ethically acceptable, sustainable, and socially desirable research and innovation outcomes. This investigation contributes to sustainable development and its goals, namely zero hunger, sustainable cities and communities and responsible consumption and production (SDG´s 2, 11 e 12), and contribute to the achievement of the activities and actions set by the United Nations for each one of the goals.

Track
Track 9d Legal aspects of sustainable development

The role of law in the making of deforestation in the Peruvian Amazon

Mr Pablo Peña

Centre for Socio-Legal Studies, University of Oxford, Oxford, United Kingdom. Pontificia Universidad Católica del Perú, Lima, Peru

Abstract

Law is deeply embedded in deforestation in the Peruvian Amazon, particularly as it relates to its most important direct cause: small-scale agriculture. Underlying factors drive this process: demographic, economic, political, and institutional, but also legal. This research examines the latter as it interacts with the other factors in the 'making' of deforestation. It untangles the various legal features of official laws and regulations that affect how it gets implemented and navigated in the agricultural frontiers by public officials and farmers, in particular, and how this ultimately impacts the forests. An interesting example is the constitutional protection of forestland as a natural resource, not subject to the land property regime. In line with this legal doctrine, the government is unable to give land rights to thousands of farmers encroaching and expanding the agricultural frontier in the Amazon, leaving them in a legal limbo that likely has an impact in their connexion to the forest but also on other dimensions, such as democratic representation or access to public services. This and other laws and regulations are an expression and extension of past policies to 'develop' the Amazon, seen as an empty space in need of colonization, but also of the inherited legal tradition and concepts of Peruvian law that can be traced back to the colonial period. They are now being slowly changed to accommodate environmental concerns such as climate change and biodiversity loss. This research expands the conservation literature putting a spotlight on migrant farmers who are central to environmental policy.

Track
Track 9d Legal aspects of sustainable development

The Sustainability Challenges for Agri-food Value Chains

Professor Liliana Lizarazo Rodriguez[1,2], Professor Marijke D'haese[3]

[1]Brussels School of Governance (Vrije Universiteit Brussel), Brussels, Belgium. [2]University of Antwerp, Antwerp, Belgium. [3]Ghent University, Ghent, Belgium

Abstract

This article accounts for increasing awareness on the sustainability challenges of agri-food value chains, which are complex because their legal and economic frameworks operate in formal and informal ecosystems, interact with other economic sectors and their particularities depend on the regions where they operate. This interdisciplinary analysis of the agri-food value chains, aims at conceptualising the scope and reach of these chains from a legal and economic perspective, to identify the man challenges they encounter to meet the goals and targets of the Agenda 2030. The article assesses how agri-food chains have increased their reach worldwide thanks to technology transfer, innovation and trade liberalisation, but still many gaps in term of sustainability persist. This articles is structured as follows Part 1 introduces the context and challenges, part 2 assesses the emergence of agri-food as GVCs. Part 3 addresses the main legal challenges for agri-food value chains. Part 4 flags that notably - or paradoxically – the agricultural sector and its key components, farm resources (including natural resources), farmers, and farmworkers, are disadvantaged. It addresses the challenges of inclusive agri-food value chains, following an adapted version of the five pillars of inclusive business benchmark inclusiveness, formulated in the framework LEGEND[1] (German et al. 2018). Part 5 addresses the environmental challenges for agri-food value chains. Part 6 concludes. This paper connects with panel 9d. Legal Aspects of Sustainable Development as it unveils how value chain analysis is a complex exercise that requires a detailed legal and economic assessment before starting with the assessment of sustainability. Agri-food value chains do not function in a sequential and linear manner, but they are interlinked with other economic sectors that go beyond state boundaries. Many SDG targets are a priority for the sector, in particular to SDGs 1, 2, 5, 6, 8, 9, 10, 12, 15 and 17. It is also relevant for other SDG targets such as SDG 4, targets 4.4 until 4.7, or SDG 13, targets 13.1 until 13.3.

[1] LEGEND: Land: Enhancing Governance for Economic Development. This is an initiative released by the Overseas Development Institute.

Track
Track 9d Legal aspects of sustainable development

The UN Post 2020 Biodiversity Framework and the EU Habitats Directive: United we stand for Net Gains

Professor Volker Mauerhofer

Mid Sweden University - Department of Ecotechnology and Sustainable Building Engineering, Östersund, Sweden. Vienna University - Department of Botany and Biodiversity Research, Vienna, Austria. Meiji University - Enviromental Law Centre, Tokyo, Japan

Abstract

Biodiversity is continuing to decrease widely and manifold echoed calls for reversing this trend need support from more effectively formulated and implemented rules-of-law. The UN Post 2020 Biodiversity Framework to be concluded in May 2022 contains in the past and current drafts an overall vision for global net improvements till 2050 and already some goals and targets for concrete net gains. The overall goal of this contribution is to show how the EU Habitats Directive already in its current version contributes and can further contribute to such biodiversity net gains, besides the actions outlined in the 2020 EU Biodiversity Strategy also referring to the Net Gain Principle. Hermeneutic methods are applied such as comparative legal analyses and different types of text interpretation (e.g. historic, wording, rational). The findings identify three major parts of the EU-Habitats Directives where the implementation of the objective to achieve net gains can be legally based upon, namely the maintenance, the restoration and the compensation.

1. For the maintenance of habitat types which are already in a Favourable Conservation Status (FSC) the Habitat Directive defines a natural habitat also as 'favourable' when its natural range and areas it covers within that range is increasing (beside being stable).

2. Within the restoration of habitat types and wild species in unfavourable FSC, the Habitat Directive practically requires net gains (while the implementation and enforcement of this requirement could in the last overall assessment of the status of those habitat types and wild species not be established).

3. In the area of conservation, the implementation Habitat Directive already provides practical examples where an over-compensation towards net gains could be shown (while this does not seem to be a realistic option for all habitat types and wild species).

The results show the already current potential of the Habitats Directive to contribute through an implementation of EU's Net Gain Principle to the overall global vision toward net improvements of the UN Post 2020 Biodiversity Framework. This can be considered as a starting point for steering the regional and global implementation of this new international policy objective enabling a sustainable development also on the EU level. The presentation has its focus on SDG 16 as it particular guides SDG 16.3. "16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all" as well as 15.5 "Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species". It relates to the conference topic through its call for a systematic change in absolute terms of the human culture of decreasing biodiversity.

Track
Track 9d Legal aspects of sustainable development

Urban law, climate change and sustainable development

Associate Prof. Raquel Carvalho

Universidade Católica Portuguesa - Law Faculty and Catolica Research Center for the Future of Law, Porto, Portugal

Abstract

Nature-Based Solutions (NBS) and Urban Green and Blue Infrastructures (UGBI) are an important tool in the use of urban building and planning Law to combat climate change, particularly in what respects the improvement of building energy-efficiency standards and the reduction of the urban heat effect. We will present scientific data on NBS and UGBI, as well as Portuguese administrative regulations that already foresee these types of solution. Solutions such as the UGBI are already being applied, while others still need some development and/or wider implementation. We will also address the way in which the Law foresees its use – either as a recommendation or as a mandatory requirement – and present some practical examples of NBS and UGBI solutions.

NBS are considered an umbrella concept and seen as "living solutions", inspired by and making use of nature (vegetation and water solutions). There are over 130 examples of different NBS actions we could address. Still, we intend to focus specifically on NBS related to urban building, such as green roofs and green wall solutions, both of which are affected by the structure and the type of building and enhance the effect of other urban solutions such as UGBI.

As for UGBI, they play a strategic role in urban planning and in spatial organisation and management. Although rooted in sprawl control and stormwater management, they can also contribute to improve energy-related issues. By using vegetation (Green) and water (Blue), UGBI convey spatial solutions such as urban parks, street arborisation and water surfaces. The best solutions include both dimensions due the seasonality of urban vegetation, which is why it is crucial to choose trees wisely, weighting the leaf organisation – whether they are evergreen or deciduous trees – while adapting the choice to autochthonous trees.

Both NBS and UGBI are highly beneficial in urban areas, namely by reducing temperature and improving buildings' energy efficiency, thereby helping to mitigate the rising temperatures in cities – also known as the "urban heat island effect".

This paper directly addresses the UNEP SDG 13 – Climate Action –, particularly SDG-target 13.2: "integrate climate change measures into national policies, strategies and planning", and SDG 11: to "make cities and human settlements inclusive, safe, resilient and sustainable", particularly SDG-target 11.3 – to "enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries". As such, the subject matter is closely related to the ISDRS 2022 Conference topic.

Track
Track 9d Legal aspects of sustainable development

Water as a Human Right: a comparative analysis between Brazil and the US

Dr Stella Emery Santana[1,2], Dr. Janaina Macke[3]

[1]Centro Universitario FAESA, Vitoria, Brazil. [2]ProfAGUA UFES, Vitoria, Brazil. [3]Universidade Caxias do Sul, Caxias do Sul, Brazil

Abstract

The main goal of this research is to demonstrate the legal aspects of water as a human right in the 2030 Agenda by comparing Brazil and the U.S. contexts to understand water as a human right. This paper demonstrated that in order to have good water quality for all, SDGs 6 and 14 must be achieved. Because the scarcity of drinking water on the planet is evolving rapidly and the distribution of water is unequal around the globe, the 2030 Agenda would be a way to sustain life on the planet so that no one would be left without this essential resource for our survival. The language of SDG 6, well known as the "water goal," used language that directly reminds us of human rights that are internationally recognized. Therefore, the social approach of this SDG combined with a more social approach of SDG 14 should focus on satisfying the water needs of present and future generations. Comparing Brazil and the U.S., even though Brazil does not have legislation guaranteeing water as a human right, its courts have granted several decisions in the country applying this concept.

Nevertheless, it does not predict nationally water as a human right. On the other hand, three U.S. states have declared this right legally: California, Pennsylvania, and Massachusetts. Moreover, the tool developed by California will be an important model to be followed not only nationwide but worldwide as well. When referring to how Brazil is achieving SDG 6 and 14 and the U.S., even though the latter one has a better overall ranking in the SDGs (32/165) while Brazil is 61/165, the two compared goals show that both countries have a long way to go to achieve a sustainable present and future.

Moreover, to be more specific, SDG 14 is so far behind all other SDGs that it seems like we ignore the fact that there is more ocean water on our planet than freshwater. Due to freshwater scarcity, desalination plants are a reality in 150 countries in more than 19,372 facilities. When controlled and with proper technique, the desalination process may support SDG 6. Finally, to grant environmental justice in the countries analyzed, both SDGs need to be a part of local governments and communities, with the necessary innovative tools to enable information sharing, transparency, and participation. We must bring innovative technology to help governments better manage these SDGs and citizens follow up on how their leaders comply. Citizens should be able to access the development of each indicator and at the same time participate in the process to become more responsible with the outcomes.

For all researchers out there, academia must come together to develop ways on how our legal systems can achieve better sustainable results for society, in a way that we cannot leave anyone behind, no matter if it is a developed, developing, or non-developed nation.

Track
Track 9d Legal aspects of sustainable development

Full papers

A proposal to develop a "Culture of sustainability" in the legal framework of agriculture

Opportunities for ecosystem restoration through the adoption of the concept of ecosystem services in the legal framework of agriculture in Brazil and Europe Union.

Alexandre Altmann[1], Alexandra Langlais[2]

[1] Professor of Environmental Law (Post-Graduate in Law Program, University of Caxias do Sul). Doctor in Law (University of Coimbra). Post-doctorate researcher at (IODE) Institute of West: Law and Europe /University of Rennes1. E-mail: aaltamann@ucs.br

[2] Research Director CNRS (National scientific research center). (IODE) Institute of West: Law and Europe. Faculty of Law and Political Science, France. E-mail: alexandra.langlais@univ-rennes1.fr

Abstract

This paper analyzes the opportunities that the adoption of the concept of ecosystem services by the legal framework of agriculture can provide for the achievement of target 15 of the SDGs. Land use change - from natural ecosystems to agricultural areas - represents the main impediment to achieving of target 15 of the Sustainable Development Goals. Therefore, reconciling land use for agriculture and restoration of terrestrial ecosystems is the key challenge to sustainability nowadays. The concept of ecosystem services has received increasing scientific and institutional attention since the Millennium Ecosystem Assessment, issued in 2005. This concept presents a great potential to complement and enhance the concept of sustainable development by establishing a connection between the economic, social, and environmental dimensions. Consequently, the inclusion of the concept of ecosystem services in the legal framework can contribute to the achievement of the SDGs. Indeed, in order to protect, restore and promote the sustainable use of terrestrial ecosystems (SDG 15), it will be crucial to adopt the concept of ecosystem services in the legal framework of agriculture. The agriculture currently, despite being highly dependent on ecosystem services (e.g. pollination, water, nutrient cycling), does not take these services into account in the decision making process. Thus, there is enormous potential for restoring terrestrial ecosystems with the help of agriculture - an essential sector that covers a large area of land. Harnessing this potential for ecosystem restoration involves, first and foremost, the introduction of a culture of sustainability into the legal framework of agriculture, so that ecosystem services are understood as essential to agricultural production and thus embedded into the norms that regulate the sector. An example of this potential could be the adoption of the concept of ecosystem services by the European Union's Common Agricultural Policy with the aim of enhancing the value of Europe's natural capital. Another example of the potential for ecosystem

restoration based on the concept of ecosystem services is the use of the Payment for Environmental Services (PES) system for small family farms in Brazil. To scale the potential of the concept of ecosystem services in the legal framework of agriculture, the agricultural policies of France, largely framed by the CAP, and Brazil are studied, analyzing the challenges and opportunities for ecosystem restoration. We emphasize that this is an empirical and theoretical study that seeks to highlight the opportunities and challenges for the adoption of the concept of ecosystem services in the three dimensions of sustainability (ecological, social and economic) linked to agriculture

Keywords: Ecosystem restoration; Ecosystem services; agriculture; culture of sustainability; SDG 15.

1. Introduction

Agriculture relies heavily on ecosystem services. However, the agriculture practiced in Brazil, and to a large extent in Europe, impacts many ecosystems and the biodiversity that provides these services. In clear terms, agriculture as currently practiced is far from sustainable. Even though agriculture has great potential to contribute to the achievement of SDG 15 - conservation and restoration of terrestrial ecosystems - there is no consistent movement in this direction. On the contrary, even though several studies point to the social, economic, and environmental advantages that can be gauged with a more sustainable agriculture, predatory agriculture rapidly advances over ecosystems and biodiversity, observing only the logic of maximizing immediate profit. The present study examines an aspect little addressed in the literature: the adoption of a culture of sustainability in the legal framework of agriculture. We believe that the ecosystem services approach can contribute greatly to introducing a culture of sustainability in the legal framework of agriculture by recognizing, valuing and internalizing the value of ecosystems and biodiversity in this sector of the economy. Agriculture itself generates provisioning ecosystem services when it produces food. But it also depends heavily on supporting and regulating services such as the hydrological cycle, pollination, and nutrient cycling. This dependence notwithstanding, the legal framework of agriculture currently does not recognize ecosystem services and consequently does not consider them in the decision-making process. An example of this is land use and land conversion for agriculture in Brazil, where ecosystems and biodiversity are severely affected. In Europe, ecosystem services are not really considered in agricultural practices, as a reflection of the Common Agricultural Policy (CAP), which has relegated these services to the background. In both cases, there is no culture of sustainability in the current legal framework of agriculture. But there is a great potential to transform the legal framework of agriculture with the adoption of the concept of ecosystem services, which is why they were chosen as a study cutout. The adoption of the concept of ecosystem services in the legal framework of agriculture can lead to the valuation of the natural capital of these countries, highlight new production chains, create new markets, and attract new investors

that strive for sustainable enterprises (such as ESG funds). In addition, the concept of ecosystem services can support the creation and implementation of new policies, such as systems of Payment for Ecosystem Services (PES), traceability in production chains, certification and labeling, incentives for sustainable agricultural practices, among other measures with the potential to make agriculture more sustainable.

2. Legal framework of agriculture in Brazil: challenges and opportunities for sustainability

Historically, agriculture in Brazil has been characterized by the unequal distribution of land and the advance of the agricultural frontier over ecosystems and native peoples. In recent years, degradation has increased, largely caused by the advance of the agricultural frontier into all six Brazilian biomes. Brazil has not succeeded in stopping deforestation and there are no prospects for a broad restoration of ecosystems. Therefore, any intention to change the legal framework of agriculture to a more sustainable model requires a review of the land use and occupation model (agrarian model) and the form of production (agricultural model). Below we will analyze the legal framework of agriculture in Brazil, addressing the challenges and opportunities for changing the agrarian model to a more sustainable agricultural model, based on the preservation and restoration of ecosystems.

2.1 Brief historical note on the agrarian and agricultural issue in Brazil

State policies and actions directed towards agriculture had several phases in Brazil. At the beginning of the 20th century Brazil was marked by economic liberalism and, therefore, there was no clear state policy for the agricultural sector. Only some sectors (notably coffee and sugar) were benefited by state actions, such as the construction of railroads and ports, labor attraction policies (European immigration), subsidies and financing. In the 1930s, the so-called Estado Novo (New State) of President Getúlio Vargas, with an interventionist character, started a minimum price policy for coffee as a response to the 1929 crisis. Vargas also perceived the agricultural sector as strategic for national development and, particularly, as an important input for the incipient Brazilian industry. Vargas' political heir, João Gulart, came to power in 1961 promising a major agrarian reform, with the purpose of distributing land to peasants. The agrarian problem, that is, the concentration of land in the hands of large landowners, had been dragging on since the colonization of Brazil and had not been solved with the independence of the country (1824), nor during the Empire (1824-1889), nor in the first years of the Republic (1889). On the contrary, the presence of large rural landowners in politics never allowed their interests to be reached by public policies of land redistribution. Although Brazil became an urban country in the process of industrialization, large landowners were always present in Brazilian politics. The land reform promised by João Gulart

government never happened and is even pointed out as one of the causes of the military coup of March 29, 1964.

The Military Regime (1964-1985) then promulgates a norm that represents a response to the land issue, with the purpose of calming conflicts in the countryside and bringing greater legal security to rural producers: the Land Statute - Law 4.504 of November 30, 1964. More than a production issue, this phase of agricultural policy is characterized by the agrarian issue. In fact, Art. 1 states that Law 4.504/1964 "regulates the rights and obligations concerning rural real estate, for the purposes of implementing Agrarian Reform and promoting Agricultural Policy." According to Art. 1, §1, Agrarian Reform is "the set of measures aimed at promoting better distribution of land, through modifications in the regime of its possession and use, in order to meet the principles of social justice and increased productivity." It is clear in the concept of agrarian reform brought by the Land Statute that the state should take care, initially, of the agrarian issue (possession and ownership of land) to, only later, deal with production and productivity (agricultural policy). Nevertheless, agrarian reform moved slowly during the Military Regime and the agricultural policy was characterized by the conversion of more natural areas into arable land with a view to "national development at any cost," even with vast public funding. At that time, the environmental issue and the protection of native peoples were not a priority, on the contrary. In this context, the occupation of the Amazon for agricultural uses began, with great impetus in the 1970s.

2.2 Legal framework of agriculture in Brazil after the re-democratization and the 1988 Federal Constitution

The Constitution of the Federative Republic of Brazil promulgated in 1988 determines that all federated entities, that is, the Union, the States and the Municipalities, have the competence to legislate on the environment. However, the Union has exclusive competence to legislate on agrarian law. Administratively, all the federated entities have competence for the execution of environmental policies, as well as for the promotion of agricultural production. In summary: all the federated entities are competent to legislate and execute environmental policies, but only the Union is competent to legislate on agrarian law and the other entities (States and Municipalities) participate in the execution of agricultural policies.

When organizing the national economic order in its Title VII, the Federal Constitution adopts the preservation of the environment as one of the general principles of the Brazilian economy, together with free competition, private property and the social function of property. Within this same Title VII, the Brazilian Constitution dedicated Chapter III to agricultural and land policy and agrarian reform. In effect, Article 187 states that "agricultural policy will be planned and executed as established by law, with the

effective participation of the production sector, involving producers and rural workers, as well as the commercialization, storage and transport sectors (...)". Agricultural policy planning includes agro-industrial, farming, fishing and forestry activities (Art. 187, §1). According to Art. 187, §2, agricultural policy and agrarian reform actions must be made compatible. Agrarian reform is foreseen in Art. 182, being the competence of the Union and falling upon unproductive properties, that is, rural properties that do not fulfill their social function.

The constitution deals with the environment in Title VIII, which deals with social order. Art. 225 states that "everyone has the right to an ecologically balanced environment, an good of common use for the people and essential to a healthy quality of life, and it is the duty of the government and the community to defend and preserve it for present and future generations." As a result of this Article and of the international conventions to which the country is a signatory, the right to the environment is understood as a fundamental human right in Brazil. To ensure the effectiveness of this right, the constitution provides a series of duties to the Public Power, among which is to "preserve and restore the essential ecological processes and provide for the ecological management of species and ecosystems." (Art. 225, §1, item I). In relation to the large Brazilian biomes, Art. 225, §4, states that "the Brazilian Amazon Forest, the Atlantic Forest, the Serra do Mar, the Pantanal Mato-Grossense and the Coastal Zone are national heritage, and their use will be done, in the manner of the law, within conditions that ensure the preservation of the environment, including the use of natural resources." From the constitutional treatment of the matter, it is clear that agricultural policy in Brazil should take into consideration the protection of the environment.

2.3 The Brazilian Agricultural Policy (Law 8.171/1991)

Law 8.171/1991 regulates the Constitution with respect to agricultural policy in Brazil. According to its Article 1, "this law establishes the foundations, defines the objectives and institutional competencies, provides the resources, and establishes the actions and instruments of agricultural policy, with respect to agricultural, agroindustrial, and fishing and forestry planning activities." This law, therefore, structures the agricultural policy in the country and disciplines the main aspects related to rural productive activity.

The legal concept of agricultural activity is in Article 1, sole paragraph, of Law 8.171/97: "agricultural activity is understood as the production, processing and marketing of products, byproducts and derivatives, services and agricultural, livestock, fishing and forestry inputs." Article 2, item I complements the concept by establishing, as an assumption of this policy, that "agricultural activity includes physical, chemical and biological processes, where the natural resources involved must be used and managed, subordinating to the rules and principles of public interest, so that the social and economic function of the property is fulfilled." It is fundamental to emphasize that the physical, chemical and biological processes related to ecosystems

and biodiversity - among these, ecosystem services - are directly related to agricultural activity. The agricultural sector is composed of the following sectors: production, inputs, agro-industry, commerce, supply, and the like, which respond differently to public policies and market forces. (art. 2, clause II)

Agriculture in Brazil is heterogeneous because the climate and soil vary enormously. For example, the South region receives a lot of rainfall and has soils suitable for various crops (corn, wheat, rice, beans, soybeans, etc.), while the Northeast region has a semi-arid climate with low rainfall, thus requiring investments in irrigation. In relation to infrastructure, in the same way, there are important asymmetries, such as in the Southeast region, which has ports, railroads and roads, silos, and distribution of inputs. The northern region, on the other hand, has difficult access to roads, for example. Access to technology is achieved by the public power through two main structures: EMBRAPA[1] and the rural extension and technical assistance entities present in the states. This structure of research and development, performed by EMBRAPA, and rural assistance performed by the state rural extension agencies, allows up-to-date technology and knowledge to reach the rural producer.

The agricultural policy has a chapter on environmental protection and conservation of natural resources. Art. 19 states that the Federal, State and Municipal governments are responsible for the preservation of the environment when planning and executing agricultural policy. To this end, the government must "discipline and supervise the rational use of the soil, water, fauna and flora" (Art. 19, clause II); "carry out agro-ecological zoning that will permit the establishment of criteria for the discipline and ordering of spatial occupation by the various productive activities (…)" (III); "promote and/or stimulate the recuperation of areas in the desertification process" (IV); develop environmental education programs (V); "foment the production of native essence seeds and seedlings" (VI); as well as "coordinate programs to stimulate and

[1] The Brazilian Agricultural Research Company (EMBRAPA) is a public company of "technological innovation focused on the generation of knowledge and technology for Brazilian agriculture and cattle ranching" and is linked to the Ministry of Agriculture, Livestock and Supply (Mapa). Since its creation in 1973 it has developed "a genuinely Brazilian tropical agriculture and livestock model, overcoming the barriers that limited the production of food, fiber and energy in our country." Embrapa was instrumental in transforming Brazilian agriculture and cattle ranching, taking Brazil from "the condition of importer of basic food to the condition of one of the world's largest producers and exporters." (EMBRAPA,2022)

encourage the preservation of water course springs and the environment, as well as the use of animal waste for conversion into fertilizers. (VII). These are not just simple repetitions of other laws that deal with environmental protection: they are the rules that should guide the planning and execution of the agricultural policy. Another very significant provision is Article 22, which states that the "provision of services and

application of resources by the government in agricultural activities must have as a basic premise the technically indicated use, the rational management of natural resources and the preservation of the environment. In clear terms: financing and public services directed at agriculture cannot promote the degradation of the environment.

2.4 The issue of illegal occupation of public lands in the Amazon

The Indigenous Lands, the Conservation Units and the non-allocated public areas form a true buffer zone against the advance of the agricultural frontier in the southern and southeastern Amazon region known as the "arc of deforestation", as can be seen in the map below:

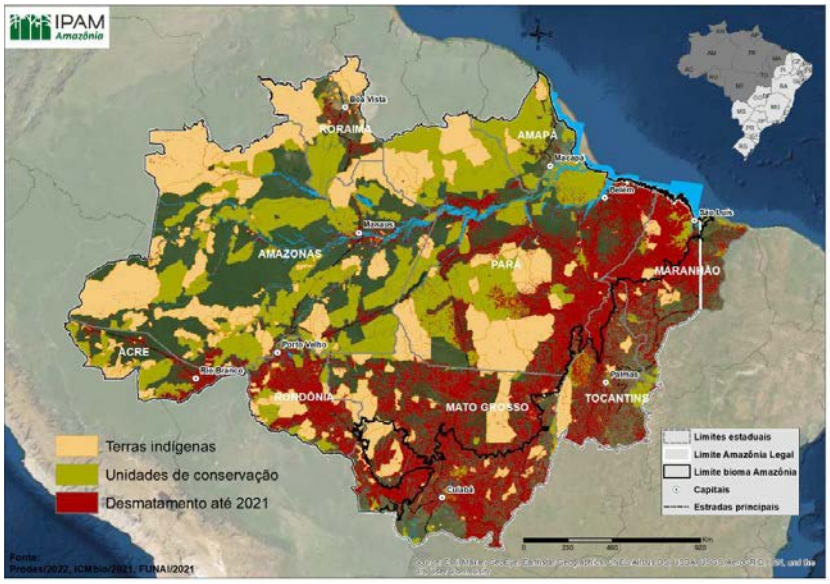

Figure 01: Deforestation until 2021 and the public lands. (IMAZON, 2022)

Besides forming a "buffer zone", the Indigenous Lands and Conservation Units can contribute greatly to the restoration of the biome, since many of the degraded areas are located adjacent to them. These areas are, therefore, strategic to avoid a tipping point in the Amazon biome. Nobre and Lovejoy (2020) warn that the tipping point in the Amazon forest may occur when the biome loses more than 20% of its area, which, according to the authors, is close to occurring:

Current deforestation is substantial and frightening: 17% in the entire Amazon basin and about 20% in the Brazilian Amazon. There are already ominous signs in nature. Dry seasons in Amazon regions are already warmer and longer. Mortality rates of wet-climate species are increasing, while dry-climate species are showing resilience. The increasing frequency of unprecedented droughts in 2005, 2010 and 2015/16 is

signaling that the tipping point is near.

These public areas are therefore strategic to contain the advance of the agricultural frontier into the forest and prevent the tipping point of the Amazon, which would have catastrophic regional impacts (in relation to the hydrological cycle) and global consequences (because of climate).

Even though the 1988 Federal Constitution represents a paradigm shift in relation to property rights and environment protection, Brazil has not been able to change a reality of centuries of appropriation and destructive use of the environment. Land distribution in the country is extremely unequal. On the large properties, the use of the soil is mainly directed to the production of commodities and cattle. Many of these large properties do not respect the environment and the rights of native peoples and traditional communities are systematically violated - all for the sake of private profit. This profit, therefore, is generated from a great collective damage. And it is obtained from two sources that are linked to exports: the production of commodities and the "production" of land for the production of agricultural commodities.

There is a significant portion of landowners who are seeking a less environmentally degrading production through the use of advanced technology and preservation of sensitive ecosystems, thereby achieving productivity gains in increasingly smaller areas. In fact, the invasion of public lands, with the consequent slash and burn of the forest for the expansion of the agricultural frontier, is a persistent reality - reproducing the modus operandi of land use and occupation carried out in Brazil for 500 years. A significant part of the occupied areas are public areas (indigenous lands; protected environmental areas; public forests). The acquisition of property rights over these invaded areas through fraudulent documents is a recurrent practice, known as "grilagem". Thousands of square kilometers are illegally appropriated and deforested every year. The native peoples who live in these areas are forcibly expelled. The "grileiros" deforest these areas and prepare them to be sold to investors, rural producers who run ranches of thousands of hectares of soy, cattle, palm oil, and other export products.

The historic concentration of land ownership not only persists today but has increased exponentially in recent years. The growing value of agricultural commodities, animal protein and minerals has urged recent governments and private enterprise to expand production to meet international demand. In light of this, there is a constant and growing expansion of the agricultural frontier over all six Brazilian biomes, with the Amazon and the Cerrado being the most rapidly converted. Land fraud (grilagem) and the consequent deforestation and expulsion of traditional communities is a frequent practice. Anyone wishing to "invest" in cattle or soy farms in the Amazon will easily find advertisements of areas for sale with thousands of hectares "ready to produce". According to data from the National Institute of Colonization and Agrarian Reform (apud Westin, 2020):

(...) currently, only 0.7% of the properties are larger than 2 thousand hectares (20 km2), but together they occupy almost 50% of the Brazilian rural area. On the other hand, 60% of the properties do not reach 25 hectares (0.25 km2) and, even so numerous, cover only 5% of the rural territory.

Despite the repeated practice of land fraud (grilagem), Brazilian legislation allows the regularization of non-titled occupations. In the state of Pará, for example, reference values for regularization vary from 55 euros to 193 euros per hectare, depending on the location of the property. (Instituto de Terras do Pará, 2021) The illegal appropriation of land is strongly related to deforestation because, according to Instituto Socioambiental (2021), the invaders deforest and fence in order to show that the area "belongs to them". After deforesting, they allege to the land agency that they have occupied the area for a long time and request regularization, paying the State lower values than those practiced in the real estate market.

With the property title, the “grileiros” sell the "legalized" area for a market price. In this way, the real estate market for agricultural land represents a risk for the forest - long before the sale to soy and cattle producers. The ease that grileiros have to legalize invaded public areas "meets a speculative market for terras griladas [fraud lands], now heated by the dismantling of policies to inspect and combat deforestation." (Oviedo et al., 2021) That is, "those who deforest end up owning the land " in the Amazon, as Oviedo et al. (2021) explain:

The connection between the invasion of public lands and deforestation reveals the sad reality, where those who deforest end up owning the land, and are benefited by public policies with rules to legitimize and proliferate latifundia. However, the retaking of these public lands is never discussed. Thus, deforestation and grilagem in the region are not combated by the agencies that have the legal responsibility to do so.

Oviedo et al. (2021) show that between 2018 and 2020, the invasion of public lands that could not be occupied (such as indigenous lands, quilombola territories, and conservation units) grew 56%, representing an area of 297,000 km², an area seven times larger than Switzerland. In these areas, deforestation grew 63% between 2018 and 2020, in all states of the Brazilian Amazon - the data were obtained from

PRODES/INPE[2] and the Brazilian Forest Service, ImaFlora, IPAM and RAISG. The opening of highways, railroads, or electricity supply further valorizes the irregularly occupied areas, fomenting illegal occupation. With the opening of roads in forest areas, the deforestation known as "fishbone" occurs (image below). The simple announcement of the paving of highways, such as BR-319, heats up the land market, encouraging more invasions.

Figure 02: Junction of the Transamazônica Highway (BR-230) with the BR-163 highway near Santarem (PA), Pará, and its numerous fishbone branches. (Mongabay, 2020)

As well as the announcement by the Public Authorities of new infrastructure works, the mere processing of Bill No. 510/2021 and Bill No. 2633/2020 - known as the "PLs of grilagem" – are encouraging the

[2] "The PRODES project conducts satellite monitoring of clearcut deforestation in the Legal Amazon and has produced, since 1988, annual deforestation rates in the region, which are used by the Brazilian government to establish public policies. The annual rates are estimated from the deforestation increments identified in each satellite image covering the Legal Amazon." Available http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes

invasion of public lands even before the law has been approved.[3] The numbers from PRODES demonstrate this: between 2018 and 2019, 225,856 hectares were deforested in undesignated public forests (federal and state), which represents a 420% increase compared to the previous period (2017 - 2018). The proposition of this bill is representative of the moment of retrocession of environmental and social policies in Brazil, where "geographical pressures and dynamics that have been exerted, especially in the Amazon and Cerrado biomes, and result in the reduction of the limits of protected areas, increased deforestation, invasion of public lands, and land conflicts." (Oviedo et al., 2021) All this goes against the Paris Agreement and the COP-26 in Glasgow. The current federal government is committed to the approval of Bills PL no. 510/2021 and PL no. 2633/2020 - known as the "Bill of Grilagem", which will "legalize" the invasions that occurred until 2018. Even before it comes into effect, the Bill of Grilagem is already causing record deforestation, by encouraging the grileiros who hope to have ownership of the land they are deforesting today. The situation is likely to get even worse with the approval of these bills.

3. The European Union's Common Agricultural Policy: challenges and opportunities for sustainable agriculture in Europe

Since the beginning of European integration in the 1950s, agriculture has been a strategic and priority sector, receiving significant financial resources. More recently, after 1993, and in particular with the entry into force of the Maastricht Treaty, the environment became part of the European Union's most diverse public policies. Since this policy impacts most of Europe's territory, there is a great potential for biodiversity protection and ecosystem restoration. Currently the CAP occupies an important place in the European arena - in terms of strategic positioning (occupies Title 2 of the Treaty[4]) and budget - almost 70% of the budget at the outset.

3.1 The Environment in the CAP

The post-war period brought a major concern with food production, supply and self-sufficiency in Europe.

[3] "The federal government's proposal to change the legal frameworks of land tenure regularization was presented by the edition of MP 910, December 10, 2019. PL 2633/2020, which replaced MP 910/2019 and amends articles of Law 11952/2009, promotes a radical change in the legal framework for the occupation of federal public lands. Among these changes, we highlight three especially significant ones: (i) the extension of the time frame for land regularization, (ii) the expansion of the simplified regularization procedure by self-declaration, and (iii) the favoring of medium and large rural producers to the detriment of family farmers, indigenous peoples, and traditional communities." (Oviedo et al., 2021) It is curious to note the similarities that the PL of Grilagem has with what happened in practice with the promulgation of the Land Law of 1850: it recognized the immense sesmarias of the colonial period, giving amnesty to the grileiros of public lands and allowing only the large landowners to "regularize" their possessions. All in favor of the producers of commodities for export.

[4] Article 7: "The Union shall ensure consistency between its policies and activities, taking all of its objectives into account and in accordance with the principle of conferral of powers."

In this context, in 1962 the Common Agricultural Policy (CAP) was created with the aim of stimulating production and ensuring the supply of foodstuffs. With this, the CAP created a single market, which authorizes the free marketing of agricultural products in member countries. In this context, it can be said that this policy is an aggregating element of the European Union. Moyano-Estrada and Ortega (2014) recall that "analysts are almost unanimous in pointing out that the CAP, created in 1962, represented one of the pillars of support for European construction, because, after all, agriculture was the only sector to receive high priority from all member states." Aerni (2016) points out that the CAP was guided by three main principles: "single market; Community preference and; financial solidarity - all directly or indirectly structured to ensure support for farmers aimed at increasing agricultural production in Europe." This initial conformation of the policy followed a preference in France for strong state intervention in the agricultural sector.[5]

Since its origin, the CAP has undergone several reforms. Each of its reforms corresponds to a new period of budgetary arbitration. Several criticisms, such as those of GATT, introduced changes in the structure of financing and support. The environmental issue is introduced in 1992, but the policy only changes, according to Aerni (2016), to a multifunctional agriculture from the CAP Agenda 2000 "when several rural development measures and agri-environmental schemes were introduced in the member states." It is in the 1990s that the environment starts to receive greater attention within the CAP. In the face of concerns expressed at the UN Conference on Environment and Development (Rio-92), the MacSharry Reform (1992-1999) approves the first CAP Agri-Environmental Programme. In 1992, therefore, the CAP moves from "market support to producer support" as Price support is phased out and replaced by direct aid payments to farmers. They are encouraged to be more environmentally friendly. This reform coincides with the Earth Summit in Rio de Janeiro in 1992, which launches the principle of sustainable development. (European Commission, 2012)

For the first pilar of CAP, in the stage from 1999 to 2003, in view of Agenda 2000, eco- conditionalities are introduced in agricultural aid. In 1999 the Agri-Environmental Program became part of the Second Pillar of the CAP, created to coordinate rural-agricultural development. In the 2003 Fichler Reform, cross-compliance is maintained and emphasized as agri- environmental measures. These agri-environmental measures are maintained in the 2013 Ciolos Reform, in view of their territorial management capacity and potential for environmental protection.

[5] France is one of the EU Member States that are strong supporters of the CAP, particularly because of the importance of the agricultural sector.

3.2 Agri-environmental measures in the CAP

In the 2014-2020 CAP period, agri-environmental measures consisted of tax exemptions or granting bonuses with the aim of supporting sustainable agriculture and environmental preservation. These measures, which represent about 30% of the CAP budget for Pillar 2, are justified by the extent of the area under this policy and the direct and indirect effects on the population of the European Union, particularly in urban areas. The explanatory memorandum of Regulation (EC) 1698/2005 described agri-environmental measures as a "response to society's growing demand for environmental services."

Colle (2017) recalls that "the productivist agriculture that developed under the initial CAP was criticized early on by environmentalists." But with the 1992 reform, agri-environmental measures "became mandatory [for member states], and the agri-environmental mechanism became an important aspect for the new CAP, such that its unformulated but real goal was to contribute to the reduction of production." (Colle, 2017) In fact, to apply an agro-environmental measure, farmers sign a contract with the state, receiving the financial counterparts. This counterpart is related to the loss of revenue per hectare or animal that the farmer stops earning as a result of the practices adopted.

Various pressures, internal and external to the European Union, mean that the budget and the scope of agro-environmental measures fall short of what is needed for the restoration and preservation of ecosystems and biodiversity. Among the internal criticisms is the difficulty of justifying the high cost of the CAP. Countries that have a smaller rural population and a small agricultural GDP, such as Germany, no longer see any sense in maintaining the CAP as it was in the 2005-2013 period. Externally, the high subsidies to European agriculture are criticized in multilateral trade organizations. These factors, added to the economic crisis in the Eurozone, led to the changes introduced by the 2013 Ciolos Reform, among which the following should be highlighted: reduction of the total CAP budget; coexistence between sectoral-agricultural and land-use planning purposes; and urban-rural integration. According to Aerni (2016), since 2013 the CAP seeks to "reconcile the global need for food security with the challenge of ensuring the sustainable management of environmental services." In other terms, the CAP has become a multifunctional policy, focused also on the management of the territory of the environment.

The budget allocated for the CAP for the period 2014-2020 was about 400 billion Euros, which is about 40% of the total EU budget. Despite the fact that agriculture is a strategic sector, it accounts for only 1.5% of EU GDP and employs only 5% of the total workforce. In 2020, for example, the CAP budget was 58 billion euros, which is 34.5% of the total EU budget. This large amount of resources for a specific sector of the European economy has generated strong criticism about the maintenance of the CAP in its current form. These criticisms suggest that only a redirection of the CAP's objectives could justify the continuity of this

large volume of spending.[6]

The CAP in the period 2023-2027, therefore, shift from an agricultural and agrarian policy to a policy focused on public goods, in line with the objectives of the UN Sustainable Development Goals, the Convention on Biological Diversity, the Climate Convention, and the European Green Deal. In this sense, the CAP 2023-2027 gives priority to – in addition to food security – issues such as the environment, the fight against climate change, the maintenance of biodiversity and provision of ecosystem services.[7] In 2013, when the CAP was reviewed for the 2014-2020 period, several criticisms were raised about the (minor) role of ecosystem services in the reform approved at the time. The need for the CAP to pay more attention to ecosystem services is a major issue, already highlighted by the European Commission in Communication COM(2017)713 - "The future of Food and Agriculture".

Within the new CAP structure, agri-environmental and climate measures have enormous potential for ecosystem restoration, biodiversity preservation, and mitigating the effects of climate change, in line with the EU Green Deal and the biodiversity strategy. In France, for example, the biodiversity law is very focused on services (both ecosystem services and environmental services), thus adopting the principle of complementarity between agriculture and environment. But the legislator did not go all the way because there was no creation of PES, nor did it adopt a definition of ecosystem or environmental services.

4. A culture of sustainability in agricultural legal framework: integrating ecosystem services

The legal framework of agriculture in Brazil nowadays considers the environmental issue only tangentially. But in Europe, the latest version of the European Union's CAP for the period 2023- 2027 has undoubtedly become greener, as "the new legislation, which is due to begin in 2023, paves the way for a fairer, greener and more performance-based CAP." (European Comission, 2022). In Brazil, despite robust environmental regulations, their implementation is insufficient, especially with regard to agriculture.

[6] "€387 billion in funding has been allocated to the CAP for the 2021-27 period. This will come from two different funds: the European agricultural guarantee fund (EAGF), which has been set at €291.1 billion (in current prices); and the European agricultural fund for rural development (EAFRD), which will amount to €95.5 billion." (European Commission, 2022)

[7] According European Commission (2022), "agriculture and rural areas are central to the European Green Deal, and the new CAP will be a key tool in reaching the ambitions of the Farm to Fork and biodiversity strategies."

Besides the issue of the effectiveness of environmental regulations, the country is currently facing a dismantling of its institutions, a process called "cupinização"[8], which represents a retreat from the advances achieved in recent years. This process occurs throughout the country, but is more acute in the Amazon, where the advance of the agricultural frontier, mining, and illegal mining are leading the degradation of the biome to a tipping point. Paradoxically, Brazilian agriculture needs ecosystem services, but continues to ignore ecosystems and biodiversity in decision-making processes. The question is: how to change the legal framework of agriculture in Brazil - which today is not very environmentally oriented (and even refractory) - to a legal framework based on sustainable development? Part of the answer to this question may lie in the concept of ecosystem services.

Ecosystem services, according to the Millennium Ecosystem Assessment (2005), are the benefits that people obtain directly or indirectly from ecosystems. They are fundamental to well-being and the economy. They are classified into provisioning, supporting, regulating, and cultic services. Note that all of these classes are linked to agriculture, as shown in the figure below:

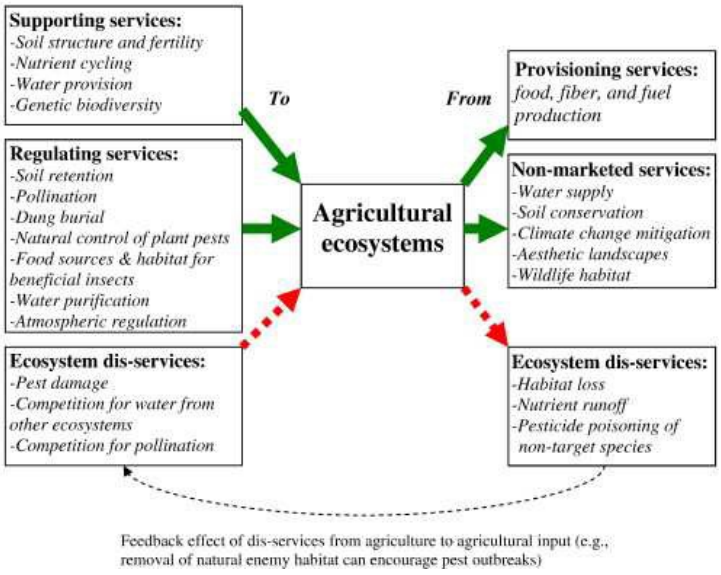

Figure 03: *Ecosystem services and dis-services related to agriculture (adapted from Zhang et al., 2007).*

[8] In reference to the gradual destruction caused by the termite insect in wood. This expression was used by the Minister Carmen Lúcia, of the Brazilian Supreme Court in the trial of the case ADPF No. 760 to designate the dismantling of environmental protection norms and institutions, in the following terms: "(…) normative pruning that is done without noise, an almost normative "cupinização" whose effects are noticed only with a general look at the picture, especially with the results demonstrated when the bureaucratic-normative obstruction has already prevented the fulfillment of the purpose of preserving forests and springs, reserves, protection of forests, guaranteeing the rights of all to a dignified and healthy existence." (STF, 2020)

Notwithstanding the importance of ecosystem services for agriculture, the disturbances it causes to ecosystems - such as loss of habitats for biodiversity, erosion of soil nutrients, poisoning of species with pesticides - can trigger so-called ecosystem disservices, i.e. the harm that comes from degraded ecosystems - such as pest damage, water shortages, reduction of pollinators, etc. Therefore, it is of utmost importance that the legal framework of agriculture considers ecosystem services in the decision making process.

Indeed, to bring ecosystem services into the legal framework of agriculture, the first step is to recognize their importance for the sector. For this, the science of ecosystem services is essential. Several studies demonstrate the importance of these services to agriculture[9] (MEA, 2005; IPBES, 2016; INRAE, 2017; IPBES, 2018; EMBRAPA, 2019). The role of agricultural research agencies, such as INRAE in France and EMBRAPA in Brazil, is essential to highlight the importance of ecosystem services to agriculture. With the help of these agricultural research institutions, it will be possible to communicate the relevance of ecosystem services to decision makers and bring them into the legal framework of the sector.

The second step is the valorization of ecosystem services by the legal framework of agriculture. The valorization does not necessarily pass through the valuation, understood here as the tool that allows the assignment of a monetary value to ecosystem services. While valuation in monetary terms is extremely useful in many cases, valorization is a previous step. The valorization of ecosystem services signals that these services are important and should be considered in decision- making processes. In law we can mention the legal value assigned to the human dignity: a person's dignity has no monetary value, but is protected by legal norms to the highest degree. If violated, it can be subject to monetary valuation, for example, in order to establish compensation. Therefore, ecosystem services must be valued as a legal good deserving of a high level of protection.

Once they have been recognized and valued, ecosystem services should become part of the decision making process in the legal framework of agriculture. At this point, the concept of ecosystem services becomes the praxis of legal framework by guiding norms, administrative decisions, corporate and business decisions, the courts, development and funding agencies, investors, etc. Only then will it be possible to put this concept into practice and achieve real sustainability effects in the legal framework of agriculture.

[9] According INRAE (2017): "Over the course of an agricultural production cycle (the cropping cycle), a certain number of ES have an impact on yield production by affecting the level of expression of factors that can limit or reduce yield, including water scarcity, nutrient deficiencies, insufficient pollination, and pest damage. Regulating ES that support crop production may thus be considered as factors of production, rather like external inputs (irrigation water, synthetic fertilizers, crop protection products, etc.). As managers of agricultural ecosystems, farmers are direct beneficiaries of these ES, referred to here as "input ES". By substituting for the use of synthetic inputs, some input ES can contribute to the reduction of environmental pollution, creating an indirect benefit for society as a whole."

By adopting the concept of ecosystem services, it will be possible to introduce a new culture in the legal framework of agriculture, as it recognizes, values and integrates the contributions of nature. It is therefore necessary to create a culture of sustainability among decision makers and the institutions that govern agriculture. Ecosystem services may hold the key to creating such a culture.

The adoption of the notion of Ecosystem Services by the CAP 2023-2027 brought a response to the demand for stronger environmental results. The alignment with the European strategy for biodiversity and the EU Green Deal brought more "green" to the CAP that presents a real potential for restoration and preservation of ecosystems to meet target 15 of the SDGs.

In Brazil, the integration of agricultural policy with environmental policy is going through a moment of extreme tension. The process of "cupinização" of environmental agencies, retreat of environmental norms, lack of inspection, etc., is allowing the advance of the agricultural frontier over natural ecosystems, especially through the "grilagem" of public lands. There is currently no broad initiative to restore ecosystems.

4.1 Prospects for ecosystem restoration from a culture of sustainability in the legal framework of agriculture: the ecosystem services approach

The adoption of the ecosystem services approach opens a new perspective for the restoration of ecosystems and biodiversity. And this new perspective can be extended to the legal framework of agriculture. In the European Union, the CAP adopted the concept of ecosystem services to promote public goods and therefore ecosystem restoration. In this sense, the CAP become a policy focused on land and environment improvement, rather than just an agricultural policy - which would help justify its huge budget. In Brazil, the National Policy for Payment for Environmental Services recently enacted with Law 14.119/2021, structured a new environmental policy instrument based on the concept of ecosystem services. There is an expectation that this new policy will promote the restoration of ecosystems that provide ecosystem services. This logic of promoting the provision of ecosystem services (which legitimizes the PES) has a strong link to agricultural policy. In addition, there is an opportunity in ESG-oriented company actions, as well as opportunities for new restoration ventures. In Brazil, payment for ecosystem services to small family farmers, indigenous peoples, and traditional communities can stimulate ecosystem restoration. In the European Union, planning through the concept of ecosystem services can boost farms, as, for example, with the implementation of the European Green Infrastructure Strategy.

5. Conclusion

To achieve real sustainability, agriculture needs a cultural change in decision making bodies and institutions. And law can play an important role in this transition to a culture of sustainability. The legal framework of agriculture still takes little account of ecosystems and biodiversity in the decision-making process, even though it is deeply dependent on ecosystem services. Adoption of the concept of ecosystem services by institutions, norms, and decision makers governing agriculture could represent a shift in understanding of what nature, biodiversity and ecosystem services means to the sector. From this, new restoration opportunities may emerge, enhancing the ecological and economic sustainability of agriculture. In Brazil, for example, there is great anticipation with the implementation of the National Policy of Payment for Environmental Services, through which farmers are remunerated for restoring and preserving ecosystems that provide ecosystem services. In Europe, the CAP has great potential to promote public goods, particularly the provision of ecosystem services. Notwithstanding this potential of agriculture to promote restoration, a cultural change must take place. And the adoption of the concept of sustainability is key to promoting a culture of sustainability in the legal framework of agriculture.

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Benefit-sharing in International Law

Post-2020 Global Biodiversity Framework and reciprocity

Dr Aysegül Sirakaya[1]

[1]*Lund University, Department of Law, Sweden, aysegul.sirakaya@jur.lu.se*

Abstract

Benefit-sharing is a twofold concept that appears both in the realm of human rights law and environmental law. This is because the achievement of many human rights objectives such as those listed under the UN Sustainable Development Goals inherently depends on the maintenance of a healthy environment (A/HRC/19/34, A/RES/70/1). The lack of achievement related to environmental objectives can therefore jeopardize the achievement of human rights objectives. The Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy, and sustainable environment states that the "enormous problem is that [biodiversity agreements] have often not been effectively implemented and their goals have not been met." (A/HRC/31/52) Consequently, the provenance and prevalence of benefit-sharing in international law need analysis from both the human rights and the environmental law perspectives as they are interdependent. This paper initiates a holistic study on benefit-sharing in international law by exploring its application in the Global Biodiversity Framework through interconnected human rights and environmental principles of theory of change, rights-based-approach, and intergenerational equity.

Keywords: Benefit-sharing, international law, Global Biodiversity Framework, Convention on Biological Diversity, human rights-based approach

1. Introduction

Does the international law consider fairness and equity of achieving prosperity within science, conservation, rights, and resources? If so, to what extent? What type of systemic structures do we have in place when it comes to the idea of returning benefits to those who enable the benefits to be generated in the first place? This paper is developed through asking these initial questions which explore the reciprocity in international law. More concretely, this paper stems from the thought process of discussing the depths of the principle of benefit-sharing in international law as a holistic concept. The holistic approach derives from the reasoning that benefit-sharing appears both under human rights and environmental law. This is in line with the fact that the achievement of many human rights objectives such as those listed under the UN Sustainable Development Goals inherently depends on the

maintenance of a healthy environment (A/HRC/19/34, A/RES/70/1). This paper is designed to serve as a prelude a broader holistic study on benefit-sharing in international law. Due to the topicality of its negotiations, the paper takes the reader through the interconnected realm of benefit-sharing in international law via exploring the benefit-sharing within the Post-2020 Global Biodiversity Framework (GBF). The paper begins by explaining why benefit-sharing constitutes a holistic system by providing examples from international environmental and human rights law. It then moves on to discussing the holistic approach of benefit-sharing under the Global Biodiversity Framework. The section thereafter examines the benefit-sharing-related goals and targets under the draft GBF to review to what extent the wording thereof is fit for purpose of theory of change, conservation as well as the rights-based-approach and intergenerational equity.

2. Benefit-sharing as a Holistic System

This article utilises the systems thinking approach to draw a holistic and inclusive map of benefit- sharing in international law. The systems thinking definition and context employed by the present paper is that of Meadows who defines a system as "an interconnected set of elements that is coherently organised in a way that achieves something" (Meadows and Wright, 2009). Benefit-sharing, be it within the access and benefit-sharing realm, or in a broader human rights or environmental law setting, is a purposeful arrangement of international law with interconnected elements. Notwithstanding whether this interconnectedness has been a conscious design by the lawmaker or not, there exists an inseparable dependence between the achievement of human rights objectives and environmental objectives. Therefore, benefit-sharing in human rights law constitutes a system which fits the definition of Meadows, even if this system is spread around different branches of international law such as human rights law and environmental law.

At the high level, this interconnectedness has been initially reaffirmed by Report of the United Nations High Commissioner for Human Rights in 2011 (A/HRC/19/34) and benefit-sharing is not an exception to this interconnectedness. This is because, benefit-sharing appears both in international human rights and international environmental law contexts and therefore inherently requires an analysis that encapsulates a critical reflection on the historical, social, and institutional systems tied to its creation Additionally, benefit-sharing system, be it in its human rights or environmental context, or both, is ought to be producing outcomes, i.e. benefits (Pierson-Brown, 2020) which are then either channelled into conservation or incentivising conservation, or are made available to the beneficiaries who are either those historically, socially or institutionally made the transaction possible which generated the benefits, such as the countries of the Global South or indigenous people and local communities.

International law provides mechanisms for conservation and restoration of biodiversity resulting from utilising nature. One of these is fair and equitable sharing of benefits arising from genetic resources (Convention on Biological Diversity 1992). The system of access and benefit-sharing (ABS) aims to

fairly distribute benefits between the providers (such as biodiversity-rich countries) and users of genetic resources (such as biotechnology or pharmaceutical companies, universities, collections such as botanical gardens or gene banks) deriving from research and development on genetic resources. The ABS system prescribes to the Parties to the Convention on Biological Diversity to implement national legislation on providing fair access to users of genetic resources while receiving fair and equitable monetary benefits (such as access fees, royalties, licence fees) as well as non-monetary benefits (such as technology transfer, participation in research, recognition of country of origin or capacity building). These benefits should then be channelled into biodiversity restoration and conservation (Nagoya Protocol on Access to Genetic Resources and Fair and Equitable Sharing of Benefits Arising from their Utilisation 2010).

Under human rights law, the concept of benefit-sharing has been mentioned in relation to the right to self-determination, right to participate in decision-making the right to development, the right to enjoy the benefits of scientific progress and technology, and the rights of indigenous peoples and local communities in participating decision-making as well as participation in benefits from the use, management and conservation of natural resources (UNGA Res. 217A (III) UN Doc. A/810 (1948); UNGA Res. 3384 (XXX); UN Doc. A/10034; UNGA Res. 41/128; International Labour Organisation Indigenous and Tribal Peoples Convention Articles 6 and 15). The most elaborate exposé on the issue of benefit-sharing from scientific research can be found in Article 27.1. of the Universal Declaration of Human Rights which is further complemented with Article 15(1)(b) of the International Covenant on Economic, Social and Cultural Rights (ICESCR) describing the right to participate in the benefits of scientific advancement. Recently, the concerns about research on biological material and human rights have been incorporated in the Universal Declaration on Bioethics and Human Rights, with specific attention to benefit-sharing under Article 15. Benefit-sharing under human rights law has often been coupled to the right to health as well as mechanisms such as technology transfer, capacity building and participation in research (International Bioethics Committee, 2015).

Benefit-sharing in environmental and human rights law thus have common modalities of implementation. For instance, it is common to both realms to foresee benefit-sharing mechanisms such as technology transfer, capacity building and participation in research as well as taking part in decision- making regarding the use and conservation of biodiversity (SHS/YES/IBC-22/15/3). It should therefore not come as a surprise that the Preamble of Nagoya Protocol clearly sees this interconnection as its Preamble explicitly refers to the United Nations Declaration on Indigenous Peoples.

Even though the human rights treaties have pioneered the concept of benefit-sharing derived from scientific research, the normative context has been further detailed in relation to genetic resources under the CBD, the International Treaty on Plant Genetic Resources for Food and Agriculture, the Pandemic

Influenza Preparedness Framework and the Nagoya Protocol regarding the obligation to share benefits derived from the utilization of genetic resources. Furthermore, its relation to marine genetic resources beyond the scope of national jurisdiction is currently being discussed under the UN Convention on the Law of the Sea which will be implemented as a separate benefit-sharing treaty for marine genetic resources (UNGA Resolution A/RES/59/24). The common objective of these instruments is fair and equitable sharing of benefits arising from the research and development activities in the realm of genetic resources with the overarching aim of biodiversity conservation by means of benefit-sharing.

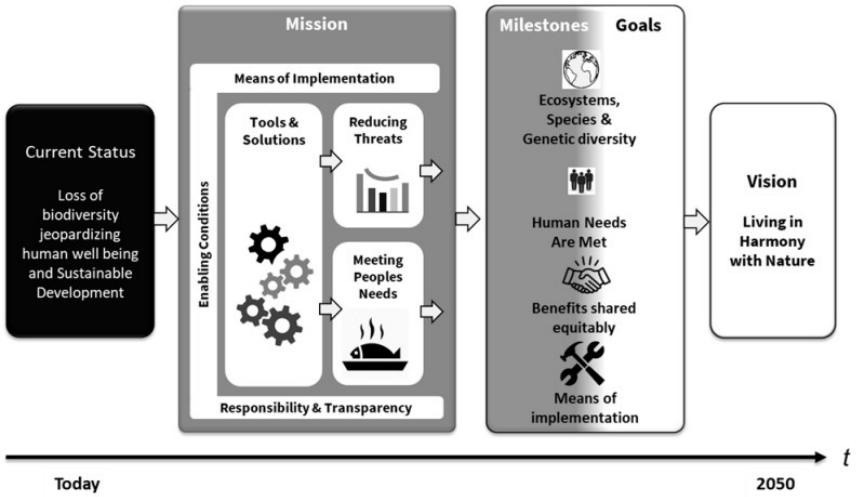
Despite the existing framework on biodiversity conservation, the global community continues to fail meeting its conservation targets. Benefit-sharing under international law aims to be a tool to generate means for conservation in return for the utilisation of genetic resources, however, the implementation has proven to be insufficient as there is a lack of benefits channelled into conservation. With the current trajectories, we cannot meet global targets such as the Sustainable Development Goals 3, 13, 14 and 15 (IPBES 2019). Additionally, achievement of many human rights objectives such as those listed under the UN Sustainable Development Goals inherently depends on the maintenance of a healthy environment (A/HRC/19/34, A/RES/70/1). The lack of achievement related to environmental objectives can therefore jeopardize the achievement of human rights objectives. The Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment states that the 'enormous problem is that [biodiversity agreements] have often not been effectively implemented and their goals have not been met.' (A/HRC/31/52) Consequently, the provenance and prevalence of benefit-sharing in international law needs the analysis from both the human rights and the environmental law perspectives as these are interdependent. Therefore, on top of the gap in literature related to the definition and achievement of objectives, the concept of also lacks the full-fledged legal analysis combining the two angles.

This paper serves as a prelude to the broader, holistic study of benefit-sharing in international environmental law and human rights law, or as the author would like to call it; *the notion of reciprocity in international law.* Due to its topicality, and due to the fact that it is the only mechanism at the international level which places accountability to benefit-sharing and what it is ought to achieve, this paper will initiate this broader study's holistic thought process through the current negotiations of the Global Biodiversity Framework (GBF). At the time of drafting this paper (May 2022), there currently is no final decision on the text and parameters of the GBF. Nonetheless, the paper aims to utilise the latest draft and discussions related to benefit-sharing to demonstrate the importance attached to the holistic thinking regarding the benefit-sharing system in *the* international discussions hoping to place accountability of its legal frameworks on conservation.

3. Principles of GBF and Benefit-sharing

The first draft of the GBF bases its methodology around *the theory of change*. The *theory of change* is expressed as the need to strive for a holistic paradigm shift in global policy action as well as the economic, social and financial models related to the conservation of biological diversity. This approach is considerably welcome, as this is the first time we recognise that our current system based around the appropriation and conservation of biological diversity is not suitable to achieve our conservation goals.

Figure 1. Theory of change of the framework



The outcomes of the inability to achieve our global conservation targets were documented by the Secretariat to the Convention on Biological Diversity in its 5th Global Biodiversity Outlook (GBO-5), in which we had to face the grim reality that we have failed every single one of our goals and subsequent targets (Secretariat of the Convention on Biological Diversity, 2020) It is worth appraising the GBF's theory of change for acknowledging that operating under the status quo or business-as-usual attitude of our current economic, social and financial models, we will not get the job done. This, in itself, is a significant matter to be considered not only for achieving benefit-sharing goals and targets at the national level but also for the effective national implementation of the GBF as a whole. If we drop it down to the sole issue of benefit-sharing, it is noticeable that the goals and targets relevant for benefit- sharing as such relate to those of benefit-sharing deriving from genetic resources. The present paper will discuss these goals and targets more in detail in the following section. Nevertheless, it is worth noting the discrepancy between how benefit-sharing is incorporated into the theory of change as a broader, holistic concept, yet has only been discussed as an action coupled with genetic resources.

The ability of the Nagoya Protocol as well as the Access and Benefit-sharing (ABS) Framework as a whole to result in a significant amount of benefits has long been under scrutiny. This argument is not only based on the GBO-5, but also on the academic literature which has been criticising the ineffectiveness of the ABS framework in achieving its goals (Heinrich et al., 2020; Laird et al., 2020; Sirakaya, 2020; Bagley, 2018; Ruiz Muller, 2018; Pauchard, 2017; Pagiola, 2004). The academic literature has been debating whether ABS, an international legal framework aiming at building trust- based relationships under the principles of fairness and equity between the Global North and the Global South, is currently achieving more than the bureaucratisation of obtaining the prior informed consent of the holders of sovereign rights over genetic resources. The implementation of the GBF is the ultimate space to discuss the inability of the Nagoya Protocol as well as the ABS Framework as a whole in achieving its objectives. This is firstly because GBF assumes that benefit-sharing is solely related to that of ABS. Secondly, the actors of the ABS system currently *assume* that ABS and the Nagoya Protocol contribute to biodiversity conservation, yet, is the Nagoya Protocol actually designed to conserve biodiversity? In a recent study which subjects the text of the Protocol to a legal review and analyses all of the negotiations that led to the adoption of the Nagoya Protocol, we came to the conclusion that there are no legally binding obligations under the Nagoya Protocol that obliges Parties to channel benefits into biodiversity conservation, except for Article 10 on Global Multilateral Benefit- sharing Mechanism (GMBSM). Since the modalities of GMBSM is still under the consideration of the Parties, and it is thus yet to be activated, the benefit-sharing as such foreseen under the GBF is therefore that related to bilateral benefit-sharing (Sirakaya, 2022)

The aforementioned study furthermore sheds light on how the benefit-sharing was conceptualised during the negotiations for the Nagoya Protocol. As such, benefit-sharing was foreseen in a twofold manner. While some negotiators conceptualised benefit-sharing as a generator of economic incentives, some emphasised the role of certain actors in conserving biodiversity and therefore perceived those actors to be the main beneficiaries of benefits due to their role in conservation. The former argument of benefit-sharing as an economic incentive generator, stipulated that the providers of genetic resources would automatically be incentivised to conserve biodiversity if those genetic resources have a price tag on them. This meant that the more a user accesses a specific genetic resource, the more benefits that genetic resource would bring and therefore more conservation would happen. Therefore, these negotiators emphasised that supporting the exploitation of genetic resources and therefore supporting the market of genetic resources would automatically support the conservation (UNEP/CBD/WG- ABS/5/INF/1, 2007; UNEP/CBD/WG-ABS/6/INF/3/Add.3, 2008). The second argument, prioritising the actors involved in conservation as the primary beneficiaries, discussed that the indigenous people and local communities (IPLCs) were the actors who lived in harmony with nature, and thus those who de facto contributed to the conservation of biodiversity with their inherently ecocentric livelihoods (UNEP/CBD/WG-ABS/7/4, 2009;

UNEP/CBD/WG-ABS/8/4, 2009; UNEP/CBD/WG-ABS/8/5,
2009). The final text of the Nagoya Protocol, even though it contains reference to both these approaches, fails to effectively establish a language that legally binds Parties to channel benefits into conservation. The initial point to take on the paradoxical aspect of the Nagoya Protocol is that the implementation of the GBF takes note of the assumption versus lived experiences related to the conservation of biodiversity in order not to base targets on *assumptions* or *voluntary goodwill* of actors of ABS to channel benefits into conservation of biodiversity.

4. Benefit-sharing, Intergenerational Equity, and Rights-based Approach

The *theory of change* under the GBF presents itself as an inclusive one, in the sense that it acknowledges the need for appropriate recognition of gender equality, women's empowerment, youth, gender- responsive approaches and the full and effective participation of indigenous peoples and local communities in the implementation of this framework. It refrains from specifying the synergies between conservation and human rights but does mention that the implementation will take a rights-based approach and will recognise the principle of intergenerational equity.

Problems related to intergenerational equity demonstrates itself in three areas identified by Brown- Weiss (1989) relevant for the interaction between humankind and the rest of ecosystems: depletion of resources for future generations; degradation in the quality of resources; and discriminatory access to use and benefit from resources received from past generations (Fitzmaurice, 2017) Following this approach, we need to hold the Post-2020 Framework accountable for ensuring that it possesses the accurate parameters to enable a rights-based approach in sufficing the regeneration of resources for the future generations, maintenance of healthy ecosystems and equitable distribution of resources previously accumulated from the past generations. Therefore, there exists a need to analyse what intergenerational equity combined with rights-based approach mean for the goals and targets relevant for benefit-sharing in Post-2020 Framework. The present paper does so below by examining the wording of the benefit-sharing-related goals and targets and their considerations over rights-based- approach and intergenerational equity.

4.1 Goals

Goal C of the GBF currently (as of its latest version deriving from the negotiations which dates to 29 March 2022) consists of three alternatives relevant for benefit-sharing of genetic resources (CBD/WG2020/3/L., 2022).

Alternative 1 Reads as follows:

" [Alt 1. The benefits arising from the sustainable use of biodiversity, including biological and genetic resources, [and its derivatives,] digital sequence information and associated traditional knowledge are

shared fairly and equitably, [in particular with indigenous peoples and local communities] with a substantial increase in monetary and non-monetary benefits shared, thereby contributing to the conservation and sustainable use of biodiversity and alternative international ABS instruments." The wording of the Alt. 1 is very much a reminder of Article 1 of the Nagoya Protocol on the objective of the Protocol, with possible additions attached to it such as the nuance on the separation between genetic and biological resources, possible inclusion of the digital sequence information as well as the emphasis of traditional knowledge and indigenous people and local communities. In addition, Alternative 1 mentions the *substantial* increase in monetary and non-monetary benefits shared, which points to today's reality of not having had enough benefits deriving from the enactment of the international ABS Framework under the Convention on Biological Diversity and its Nagoya Protocol. This alternative presupposes that the substantial increase of these benefits arising from sustainable use of biodiversity will *thereby* contribute to the conservation and sustainable use of biodiversity and alternative international ABS instruments. Therefore, under this Alternative, there persists the *assumption* identified in Sirakaya (2022) as well as Section 3 of this paper, that benefit-sharing under the Nagoya Protocol automatically contributes to conservation and sustainable use.

The second alternative specifies the following:

"Alt 2. Monetary and non-monetary benefits arising from the utilization of genetic resources [in any format] and/or traditional knowledge associated with genetic resources are [substantially increased and] shared fairly and equitably [, with an increase in open and appropriate access] [and contribute to] [for] the conservation and sustainable use of biodiversity in support of the SDGs."

Alternative 2 is less detailed in its distribution of benefits to the actors such as the indigenous people and local communities and rather focuses on the act of sharing fairly and equitably, keeping the clauses for increase in open and appropriate access ad well as substantial increase in the amount of benefits within brackets. Alt. 2 furthermore does not seem to presuppose that the benefits lead to the conservation of biodiversity or sustainable use. Lastly, Alt. 2 makes reference to the interconnectedness of SDGs and benefit-sharing.

The third alternative for Goal C deems to be the least detailed one in its wording as it does not deal with the distribution of benefits among different actors, nor does it include further additions that the first two alternatives make use of. The brackets seem to add to the notion of the presumption that benefits automatically contribute to conservation and sustainable use:

"Alt 3. The monetary and non-monetary benefits from the utilization of genetic resources [in any form] are shared fairly and equitably and substantially increased [thereby contributing to the conservation and

sustainable use of biodiversity].]”

4.2 Targets

In its present form, the draft GBF links Goal C to Targets 13 and 15. Due to their heavily bracketed formations in their current state (as of May 2022), this paper will not delve into their wording in detail, but review the proposed overall action that aims to enhance benefit-sharing. Target 13 aims at increasing the implementation of the Nagoya Protocol and other relevant international ABS agreements in order to enhance the amounts of benefits shared deriving from genetic resources. The Target foresees the enhancement of implementation either through capacity development, technical and scientific co-operation, technology transfer or by means of adopting and implementing effective legal, policy and administrative measures. Additionally, one of the suggestions foresee the establishment of the Global Multilateral Benefit-sharing Mechanism by 2023 which would then be fully operationalized in 2025.

Except for the latter suggestion, it is once again witnessed that the presumption of bilateral ABS agreements leading to benefits, and these benefits leading to conservation and sustainable use persists. The latter suggestion relates to that of the Global Multilateral Benefit-sharing Mechanism, as foreseen under Article 10 of the Nagoya Protocol. As previously mentioned, and further explored in Sirakaya (2022), Global Multilateral Benefit-sharing Mechanism is the only mechanism under the Nagoya Protocol which directly obliges Parties to channel the benefits into conservation and sustainable use. Nonetheless, the modalities of the Global Multilateral Benefit-sharing Mechanism are yet to be agreed upon by the Parties to the Protocol. Since the dates of the Conference of the Parties to the Convention on Biological Diversity as well as the Meeting of the Parties to the Nagoya Protocol, will only be held after the final negotiations of the GBF, this item requires further patience to delve deeply into. At this stage, some Parties as well as stakeholder representatives made some suggestions on the modalities of the Global Multilateral Benefit-sharing Mechanism. During the latest negotiations of the GBF, some of these suggestions based themselves around Digital Sequence Information (DSI), noting the shortcomings of the bilateral system in dealing with transboundary and multilateral nature of DSI (Scholz et al, 2022). Whereas others made more holistic suggestions on the operationalization of the GMBSM as well as the percentages of benefits which would be shared by the users of genetic resources. According to this suggestion, each Party who is a developed country, should ensure sharing of 1% of the retail price of “all commercial income resulting from all utilization of genetic resources, traditional knowledge associated with genetic resources or digital sequence information on genetic resources”. Here it should be noted that this suggestion bases itself not around Article 10 of the Nagoya Protocol but by activating provisions on financial mechanisms under the Convention on Biological Diversity, namely, Articles 20 and 15.7. The proposal furthermore suggests that the generated benefits are distributed through the Global Environment Facility in an open, competitive and

project-based manner. The negotiations during COP15 will demonstrate whether this will be deemed as an agreeable suggestion.

Another alternative suggested by the co-chairs of the Open-ended Working Group foresees the following: "Substantially increase the fair and equitable sharing of benefits arising out of the utilization of genetic resources in any form, and as relevant, of associated traditional knowledge, ensuring that resources from benefit-sharing reach, by 2030, an amount equal to at least X per cent of the total amount of international public biodiversity finance for developing countries, contributing to the conservation and sustainable use of biodiversity. This suggestion made by co-chairs has not yet been discussed by the Parties. However, the additional layer of accountability added by measuring the increased rate of benefits seems promising. How these amounts will be measured in an international ABS system known for its drawbacks due to the vast dominance of private contracts for benefit-sharing bound by confidentiality, is yet to be put under scrutiny.

The theme of the Target 15 bases itself around the engagement and mandatory requirements for businesses. The relevance for benefit-sharing is demonstrated through the bracketed suggestion of ensuring ABS compliance and reporting. This suggestion is also yet to be discussed by the Parties.

5. Discussion: Distribution of the benefits to those who conserve

Even though the concept of *theory of change* which surrounds the purpose of the draft Post-2020 GBF involve benefit-sharing as a self-standing concept, the language of the draft goals and targets combine the phrase benefit-sharing only with regard to its relationship to genetic resources. Such an approach results in the discrepancy of what the draft GBF promises to achieve and what it is equipping itself with in order to achieve this purpose. In other words, even though benefit-sharing finds its place as an integral part of the *theory of change*, its success is nonetheless bound by its relationship to genetic resources. This raises the question of whether the benefit-sharing within GBF will be able to reach its goals and targets via ABS, whose ability to achieve its goals have been time and again criticized, as previously detailed under section 2 of this paper. In addition, within these goals and targets, there exists no evident phrase connecting the rights-based approach and intergenerational equity with benefit-sharing. Therefore, benefit-sharing is left to the distributive devices under the international legal framework of ABS, which merely *presumes* that such distribution occurs automatically through benefit-sharing of genetic resources.

There nonetheless exist the term *benefit* in other goals and targets, yet it is not coupled with *sharing*. To name an example, one of the alternatives foreseen for Goal B reads as follows: "Nature's contributions to people [, including ecosystem services] are valued, enhanced and maintained through conservation, restoration and sustainable use supporting the global development agenda for the benefit of all." We find another example of

an acknowledged benefit under Target 5 on the prevention of the overexploitation of resources in which we see a bracketed phrase regarding the creation of conditions for the use and provision of benefits for IPLCs. A third example is the new target suggestion made by co-chairs which reads as follows: "[Target 22: Ensure women and girls equitable access and benefits from conservation and sustainable use of biodiversity, as well as their informed and effective participation at all levels of policy and decision-making related to biodiversity.]" Such suggestions clearly demonstrate that benefits exist beyond the use of genetic resources, however sharing, measuring, and targeting of those benefits are solely reserved for the utilization of genetic resources. It is palpably crucial to note that those who conserve and benefit from the biodiversity the most, as well as those who have not taken part in the exploitation of the nature of today, but will feel the effects tomorrow, have not been effectively considered under the benefit-sharing promises of the GBF.

Today, we are aware that the world's major centres of biodiversity coincide with the habitats of indigenous peoples. While the indigenous people comprise 5% of the global population, and indigenous territories make up for 22% of the world's total land surface, this surface coincides with the areas that hold 80% of the planet's biodiversity (WRI, 2005; Oliveira, 2011). The value of ecocentrism of indigenous peoples towards biodiversity conservation is increasingly recognised at the national level, where we see cases in which indigenous people act as the custodians and representative of actors of nature (Townsend et al., 2022). As previously explained under Section 2, Parties during the negotiations for the Nagoya Protocol also expressed this interconnectedness of indigenous peoples and biodiversity conservation. In relation to this, we have long known that the indigenous communities as well as their habitats are those that benefit majorly from the funding for biodiversity conservation (Khare, 2003; Sobrevila, 2008). Nevertheless, their share in the benefits is not safeguarded under the goals nor the targets of GBF.

The *theory of change* under the GBF does not only promise the full participation of the indigenous people and local communities, but also vouches for the recognition of gender equality, women's empowerment, youth, gender-responsive approaches. The vital role of women and play in conservation and sustainable use has not only been documented in both the Preamble of the Convention on Biological Diversity and its Nagoya Protocol, but it has also been demonstrated time and again in literature. Simultaneously, women, due to their roles in rural societies, are more susceptible to the effects of the biodiversity crises, since they are those who predominantly engage in generating provisions for their communities (Agarval, 2010; IPBES, 2015; Alvarez et al, 2016). Moreover, with regard to the aspect of intergenerational equity foreseen under the *theory of change*, we may yet again recall the Preamble of the Convention on Biological Diversity, emphasizing the importance of conserving and sustainably use biological diversity for the benefit of present and future generations. Here, again, we see lack of effective measures under the GBF that would safeguard the participation of women and future generations in receiving the shared benefits.

Consequently, enactment of both the rights-based approach and the principle of intergenerational equity at the level of implementation, as well as the effective participation of indigenous peoples and local communities are of direct and palpable relevance to benefit-sharing under the GBF and not only with regard to its context under the Convention on Biological Diversity as well as the Nagoya Protocol. GBF, therefore will not be able to properly function without combining such acknowledged benefits with the promise of intergenerational equity for the youth and future generations (GYBN, 2019).

6. Conclusions

This paper strived to serve as an initiating piece for a broader study on the holistic elaboration and conceptualisation of benefit-sharing in international law, without it being solely tied to its capacity as the factor of reciprocity in transactions relevant for the utilisation of genetic resources. The paper began by explaining the interconnectivity between human rights and environmental aspects of benefit-sharing, by firstly describing the capacity of benefit-sharing in international law as a system, under the systems definition of Meadows. On its section 2, the paper then tasked itself in describing the numerous realms of international law, human rights and environmental law alike, where benefit-sharing presents itself as the solution or the method towards the solution.

Section 3 of the paper dedicated itself to describing the latest GBF which is the living depiction of the interconnectivity and broad scope of benefit-sharing, since the GBF bases itself around the concept of *theory of change.* This means that the GBF incorporates benefit-sharing as one of its core solutions, taking into account a rights-based approach and intergenerational equity. Section 3 then moved on to providing a general overview of the goals and targets of GBF regarding benefit-sharing with the disclaimer that these goals and targets have been designed around benefit-sharing of genetic resources as implemented under the Convention on Biological Diversity, and its Nagoya Protocol. This in itself generated a warning on the approach of GBF over benefit-sharing, since the ABS regime under the Nagoya Protocol has long been criticised for its inability to function and its design's inability to achieve its conservation goals. This was followed by Section 4 which then delved into the language of the goals and targets with the aim of reviewing the ability of them in providing the holistic approach the *theory of change* under the GBF promises to hold on to. Finally, Section 5 discussed the importance of clearly incorporating the distributive element of benefit-sharing as a whole into the language of the GBF, while ensuring the distribution is directed towards the actors of conservation as well as the generations relevant for conservation of biodiversity.

The review of international law makes for clear evidence that, even though mainly developed under its capacity of striving to suffice fairness and equity in utilising genetic resources, benefit-sharing is a holistic concept of reciprocity under international law, touching upon numerous realms of human rights and

environmental law. The Post-2020 GBF is therefore ought to make use of this richness, in order to return the benefits to those who conserve and those who need conservation for their future. Such action requires initiating through clearly involving the rights-based approach and intergenerational equity in benefit-sharing, which GBF promises to achieve in the first place.

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Circular Economy and Industry Self-Regulation

Legal status and appreciation within the wind turbine industry

Bent Ole Gram Mortensen[1], Christian Frier[2]

[1]*Professor, Department of Law, University of Southern Denmark, bom@sam.sdu.dk*

[2]*Assistant Professor, Department of Law, University of Southern Denmark, cfr@sam.sdu.dk*

Abstract

The purpose of this paper is to draw attention to sustainability which is omnipresent in modern society. In some industries the technology readiness level is already well-advanced, whereas it is immature and still to be fully explored in other areas. Attempts to move forward from linear economy to circular economy is typically tackled on a sector-to-sector basis, also emphasising the reliance and importance of policies and law as a potential 'enabler'. This paper focuses on circular economy from a legal perspective, more precisely how industry self-regulation can aid to propel circular economy within the windmill turbine industry. The notion covers the multitude of normative instruments, including but not limited to standards, guidelines, codes of conduct and best management practices, which share the commonality of being fully or in part formulated by private actors. These instruments are generally praised for reasons of functionality as they are specifically useful to operationalise general principles or framework law. However, the distinct multi-level approach comprising of both formal and informal legal instruments, results in a fragmented regulation. Furthermore, industry self-regulation is often criticised for lacking legitimacy and their ambiguous binding effect. As pointed out in this paper, these challenges must be recognised, but at the same time understood and discussed based on the special configuration of the individual sector. Accordingly, it is argued that industry self-regulation has become an indispensable tool in every-day operations, especially as 'gap filler' which challenges the conceptual dichotomies between binding and non-binding, thus paving the way for a more gradual understanding of the concept of 'bindingness'.

Keywords: Circular economy, informal law, industry self-regulation, wind turbine industry

1. Introduction

Current trajectories indicate that wind energy constitute the main source of renewable energy, both present and especially in the future. Through that prism it is instrumental to ensure low-waste production, affordable decommissioning processes and recycling to stimulate the transition from linear economy to circular economy within the wind turbine industry. Circular economy, commonly defined as the sharing, reusing, repairing, refurbishing or recycling of raw materials or product, requires a holistic approach to all aspects of the wind turbines' life cycle. In particular, the recyclability of blades, which otherwise often end at deposits after use, must be considered from the perspective of the entire value chain. The majority of a modern wind turbine can be recycled. Measured by weight, this is 85-90%. It is especially the metals in the tower and the nacelle that can be recycled. Measured by volume, the proportion that can be recycled is somewhat smaller. The main problem is the blades, which are currently made as a composite material. Build of fiberglass layers with resin infusion and a light skeleton. These currently end up in landfill or in lucky cases as parts of for instance noise protection.

The problem has been known within the industry and by municipalities for years and in 2020 it became public known.[1] Work is underway on recycling existing wing types. Work is also being done on developing designs for wing types that can be recycled more easily. However, recycling is not just recycling. There is often a loss of quality for the individual materials or raw materials, so e.g. new wind turbine blades can not be built exclusively from recycled material from old turbines. Then the materials must instead be used for less demanding purposes. This problem is also known from other industries, e.g. the plastic industry. However, existing blades will still have to be dealt with. In 2020 WindEurope estimated that there were 34,000 wind turbines older than 15 years in Europe.[2]

The scope of this paper is to analyse the role of industry self-regulation from the perspective of circular economy within the windmill turbine industry, by raising the: *what is the legal status of industry self-regulation in promoting circular economy within the windmill turbine industry*? It requires a *de lege lata* examination to sketch out the applicable law as well as the interaction between traditional sources of law and industry self-regulation (section 2 and 3), and secondly some *de lege ferenda* considerations on the legal development (section 4).

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[1] Bloomberg, February 5, 2020: Wind Turbine Blades Can't Be Recycled, So They're Piling Up in Landfills. Available at https://www.bloomberg.com/news/features/2020-02-05/wind-turbine-blades-can-t-be-recycled-so- they-re-piling-up-in-landfills. Accessed May 28, 2022.

[2] Wind Europe: Decommissioning of Onshore Wind Turbines, Industry Guidance Document, p. 13. Available at https://windeurope.org/intelligence-platform/product/decommissioning-of-onshore-wind-turbines/. Accessed May 30, 2022.

2. Policies and legal framework

Law is in its essence state-centric, meaning that the principal legislators are states. States enjoy prescriptive powers which is either exercised nationally or through different multinational fora, such the European Union or on ad hoc diplomatic conferences. The latter is particular important in inherently international sectors. National requirements for products often reflect general safety requirements which are reflected in good industrial practice, standards or even in regional legislation. An example can be found in the EU Directive on General Product Safety (2001/95/EC).

As for wind turbines the value chain of the various sectors of the economy strives to ensure circularity, safety, and efficiency. Sustainability is a keyword branding the sector. The sustainability agenda within the wind turbine industry is in line with the United Nations Sustainable Development Goals (SDGs). Especially the 'renewable energy cluster' covering goal no. 7 and no. 12 on affordable and clean energy as well as responsible consumption and production. For instance, target 7.2. on ensuring access to affordable, reliable, sustainable and modern energy for all. In addition, the subject touches upon target 13 and 14 by mitigating the risk of marine pollution and waste when windmill farms are located offshore. The SDGs build on the advances made by the Millennium Development Goals (MDGs). While the MDGs were primarily focusing on developing nations and the alleviation of poverty, the SGDs are much broader in scope.[3] A general consensus exists among legal scholars that the SDGs are non-binding, however disagreement on their normative status is quite common.

However, sustainability is part of the EU system. In the EUF Treaty sustainability is found in Article 6. And regarding renewable energy we find the Green Deal regarding reduction of net greenhouse gas emissions by at least 55% by 2030 and the resent REPowerEU plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition from May 18 2022.

The term "recycling" is defined in art. 3(17) of the Waste Framework Directive[4]: "'recycling' means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations".

[3] W Scholtz & M Barnard, The Enviroment and the Sustaniable Developmoent Goals: 'We are on a road to nowhere' in Sustainable Development Goals (Edt. French & Kotzé), p. 222.

[4] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

Recycling is part of the waste hierarchy as found in the same directives art. 4(1) in: prevention; preparing for re-use; recycling; other recovery, e.g. energy recovery; and disposal. The idea is that the first mentioned is better than the later. In the context of wind turbines – recycling before dumping them on the landfill. However, in many countries typically no mentioning has been made on the recycling of the blades in the environmental impact reports. The same applies to local plant permits and building permits. The focus is on decommissioning requirements such as plant removal and landscaping restoration. It may be noted that the majority of wind turbines can be recycled without taking a closer look at the blades. While landfilling of blades is used in most countries, Germany, Austria, the Netherlands and Finland forbid composites from being landfilled or incinerated.[5]

3. Industry self-regulation

The notion industry self-regulation is understood as denoting instruments created by private actors, sometimes in collaboration with states or intergovernmental organizations. The private actors at the same time become 'regulatees'.[6] These instruments are typically established by organizations representing the interests of actors in particular sectors.

As a starting point, industry self-regulation can be considered market-driven or state-driven.[7] Market-driven industry self-regulation covers trade associations which exert control over members and their behavior on their own incentive.[8] The trade organizations can be on national or cross-national level. International self-regulations facilitates cross border trade.

Through choice of forum they create an internal order by setting up codes of conduct. The incentive to comply to the association's internal order is often justified as the so-called 'club-effect'.[9] Some trade associations go as far as exercising self-governance by sanctioning members that fail to comply. Accordingly, non-compliers risk to be excluded, which in a worst-case scenario can have a negative impact on the excluded part's business opportunities. However, industry self-regulation can also be considered state-driven. The distinction is not always clear or rigorous. State-driven industry self-regulation generally refer to cases where a competent legislator encourages private actors to draft instruments within certain legal areas as a supplement to or as an alternate to traditional sources of law.

[5] Wind Europe: Decommissioning of Onshore Wind Turbines, Industry Guidance Document, p. 13. Available at https://windeurope.org/intelligence-platform/product/decommissioning-of-onshore-wind-turbines/

[6] C Frier & K Østergaard, The Role of Industry Self-Regulation in Maritime Law (chapter is forthcoming 2022).

[7] O Hansen, C S Petersen & V G Ulfbeck, Private Governance and the Potential of Private Law in European Review of Private Law, 2000 28(2), 333-374.

[8] R Baldwin, M Cave & M Lawrence, Understanding Regulation: Theory, Strategy and Practice (2012) Oxford University press, 137.

[9] E R DeSombre, Flagging Standards: Globalization and Environmental, Safety, and Labor Regulations at Sea (MIT Press) 2006, p. 181-82.

State-driven instruments are sometimes also referred to as 'co-regulation' rather than self-regulation, hereby indicating an even closer partnership between lawmakers and private actors. Particularly, in the more formalised cases it can be argued that legislative competence is bestowed on private entities. When industry self-regulation is based on this type of public-private interaction it is also fair to presuppose a better fit with existing regulation compared to market-driven instruments that are not necessarily subjected to the same kind of cohesion. In the following subsections standardisation as well as best management practices and guidelines are discussed in more detail.

3.1 Standardisation

The notion "standard" entails several different meanings throughout legal texts and in commercial settings. In general, it refers to a certain level of quality and/or norm for measurement. The term also qualifies as an adjective intended to explain what is considered to be the accepted practice or required quality.[10]

Standardisation is spearheaded by the International Standardization Organization (ISO),[11] but the institutional architecture of standardisation organisations must be viewed in tandem with the continental, for instance European Union Standardisation Organisations (ESO),[12] and national standardisation agencies. It is common for states to have a national standardisation body, which is responsible for negotiating and issuing standards.[13] Standardisation are open to both private actors, public institutions and scholars regardless of discipline. Through membership it is thus possible to be involved in developing or amending standards. That is also the reason standardisation is considered a *bottom-up* process. A standardization work can be initiated at national level through the establishment of a standardization committee with representatives from interested parties. Often a standard will have

13 Regarding the nature of standards, see Bent Ole Gram Mortensen: Standards as an instrument of harmonisation in Birgitte Egelund Olsen & Karsten Engsig Sørensen: Regulation in the EU, Thomson 2006, p. 335 f.

13 Other global standardisation organisations with a narrower scope include

13 This include the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (Cenelec) and direct participation (the European Telecommunications Standards Institute (ETSI).

[13] For European Union member States this is a requirement cf.

international or at least regional interest, and the work will continue under the auspices of e.g. ISO (International Organization for Standardization), CEN (European Committee for Standardization)[14] or ICL (International Electrotechnical Commission). If the work results in an international standard, the national agencies will have to incorporate the standard and adapt existing national standards. This ensures international unification that facilitates cross-border trade.

ISO and CEN standards often are applied alongside with national standards such as DIN (Deutsches Institut für Normung) or ANSI (American National Standards Institute). Wind turbines are generally build after a standard – IEC 61400. Within the EU standards are used as an instrument of harmonisation.[15]

Still, the level of involvement is both subject and incentive oriented. For example, industry involvement varies, as it is both timely and costly. Access is based on a member's fee and time for meetings and travel costs are not included. Furthermore, standards are subjected to copyright protection and the use of standards requires an end-user payment. This means, that small and medium-sized enterprises (SME) might be more reluctant to be engaged in the process.[16] The cast of actors involved in standardisation has typically included manufacturers, customers and trade association. However, it is becoming more of a trend for public servants to be involved. Either with the intend to take part in negotiating standards, but more frequently as observants. The group of participants is not necessarily legal experts. Frequently, there is an over-representation of persons with backgrounds in technical faculties or natural science, which have earned standards their nickname as the "expert's law". Accordingly, standardisation is regarded as a useful way of incorporating the knowledge of experts from various fields along with industry represents.

[14] Together with CENELEC (European Committee for Electrotechnical Standardization) and ETSI (European Telecommunications Standards Institute).

[15] Bent Ole Gram Mortensen: Standards as an instrument of harmonisation in Birgitte Egelund Olsen & Karsten Engsig Sørensen: Regulation in the EU, Thomson 2006, p.333 ff.

[16] This issue is addressed in Regulation (EU) 1025/2012 art. 6 regarding better access for SMEs to standardisation

Standardisation in the field of circular economy is still in its premature phase. The ambition of ISO is to develop frameworks, guidance, supporting tools and requirements for the implementation of activities to maximise the contribution to sustainable development.[17] In the wind turbine industry it is attractive to be involved in standardisation. It allows multinational companies to influence the technical composition of the turbines. Furthermore, if a manufacturer succeeds in making their product compatible with the expected standard, it will typically gain an advantage ahead of competitors. In such case, they can sell their product or several different markets without adapting it to special requirements or needs. Along with the general TC 323, ISO entails number of trade specific committees of importance to wind turbine energy systems. This includes, inter alia, ISO/TC 108/SC 5 regarding condition monitoring and diagnostics of machine systems and ISO/TC 60 focusing on gears. Its is not exclusively ISO which are involved in standardising wind turbines. Also, TC 88 of the International Electrotechnical Commission (IEC) and TC 88 of European Committee for Electrotechnical Standardization (CENELEG) are focusing on issues such as site suitability and resource assessment, design requirements, engineering integrity, modelling requirements, measurement techniques, test procedures, operation and maintenance.[18]

Compliance with standards is based on voluntarism, meaning that standard is not binding *per se*. It requires a legal basis or contractual agreement for "non-compliers" to either be sanctioned or sued by a counter party. For standards to be mandatory, the lawmakers must ensure a certain degree of regulatory alignment which is difficult for several reasons. Firstly, there is not necessarily an overlap between the interest of lawmakers and parties involved in standardisation. Secondly, regulation is often limited in scope to the competence of the relevant ministry or to what states can agreed to. Standardisation is not limited to the same extent and parties can thus agree to a broader content. Thirdly, thought standardisation to some degree assembles traditional sources of law, they can be changed rather swiftly. This makes it difficult for lawmakers to rely on standards as an actual supplement or alternate to traditional sources of law.

3.2 Best management practices and guidelines

Industry organizations constitute the starting point of industry self-regulation. Most industries are rich on entities established with the purpose of promoting the interest of its members through all available

[17] See more about ISO Technical Committee 323 (https://www.iso.org/committee/7203984.html last visited May 30, 2022).

[18] See hereto CENELEC/TC or SC business plan (https://standards.cencenelec.eu/BPCLC/BP_TC_88.pdf).

channels. One type is trade associations open for companies and other non-state actors. They can be structured along geographical lines or organised around specific activities. They tend to offer a variety of services, including convention commentaries, guidelines, checklists and best management practices.

Among the main features to notice is the refereed club-effect. The incentive for the organisations to draft these instruments and exercise some degree of self-governance is to evades more bureaucracy and burdensome regulation. A point of criticism for relying on trade organisations as 'regulators' and potentially 'enforcers', is the fact that multinational companies are their main source of income. This could mean they refrain from exercising self-governance, especially if the non-compliant company is among their main contributors.

Within the wind turbine industry, it is relevant to mention WindEurope. It is an association for wind energy in Europe. They represent the entire value chain, including utilities/developers, manufacturers, insurance companies and research institutes. According to them, they analyse, formulates and establishes policy positions for the wind industry on key strategic sectoral issues, cooperating with industry and research institutions on a number of market development and technology research projects. Additionally, the lobbying activities undertaken by WindEurope help create a suitable legal framework within which members can successfully develop their businesses. Accordingly, the association is the "voice" of the European industry. However, one concern could be a potential competition between continental association for instance US-bound or Asian located associations. In terms of the legal instruments available to these associations it is notable to pay attention to best management practices and guidelines which tend to entail the code of conduct of the sector. Just like it was the case with standards, they are non-binding without a specific legal basis. Among the main differences between standards and best management practices or guidelines is the fact that the latter is not negotiated in the same open forum as standardisation. Accordingly, it can be argued that standardisation is most comparable to more traditional ways of legislation. WindEurope has issued industry Guidance Documents including a document regarding Decommissioning of Onshore Wind Turbines (November 2020) addressing issues of decommissioning planning, dismantling, resource management and site restoration.

4. Discussion

An inevitable contribution of any legal analysis is to determine the binding effect of the instruments, norms or principles discussed. A general categorisation of different sources of law are always arbitrary. Nonetheless, it is a prerequisite when discussing a larger group of legal instruments. In general, legal instruments come in two flavours: "hard" or binding, and "soft" or not quite binding. Hard law refers to binding sources of law that can be enforced. The status of soft law is more debated in literature but

are generally explained as quasi-legal instruments which do not possess legally binding force as such.[19] The binary understanding emanates from international law, but has also spread to other areas of national law. Still, the concepts offer little methodological substance and is not really useful when dealing with standards or legal instruments emanating from trade associations. As demonstrated in previous section standards influences the normative framework in different ways. Also, standards do not follow the monodisciplinary approach often present in national law. Standards do no create legal rights nor duties simply by existence and are thus considered to be legally non-binding, unless proven differently. Still, standards can become de facto binding for other reasons, such as the *inter partes* relationship in case of contractual agreement or based on a promise. Although helpful as a starting point the dichotomy between hard law and soft law fails to capture the fill range of options that lie between the two extremes. Industry self-regulation is generally praised for its ability to operationalise general principles and framework law. Accordingly, policy statements such as sustainability and circular economy can be achieved gradually through industry self-regulation. However, these instruments and "regulators" are also criticised for democratic deficiency. Although caution must be taken when making generalisation, one must consider the shortcoming of traditional sources of international law and national law and recognize industry self-regulation as gap filler. International businesses and sectors tend to rely more heavily on industry involvement compared to strictly national businesses. The wind turbine industry is perhaps among the blueprint industries to support this statement.

5. Conclusions

Circular economy bears a huge potential for individual companies, whole industries and the society in general. In certain areas the stage of development is already advanced, whereas it is underdeveloped and still to be explored within other industries. Attempts to stimulate circular economy is typically approaches on a sector-to-sector basis, thereby emphasising the reliance of various legal instruments to further promote developments.

[19] On the concept of soft law, se Pernille Wegener Jensen: Soft law as a regulatory instrument in the EU in Birgitte Egelund Olsen & Karsten Engsig Sørensen: Regulation in the EU, Thomson 2006, p. 171 ff .

Developing an Analytical Famework for Assessment of Adaptation Pathways: A case study of Food Production Systems in the Vietnamese Mekong Delta

Nguyen Thanh Binh[1(*)], Le Van Thuy Tien[1], Nguyen Minh Tu[2], Luu Thi Tang[2], Leon Hermans[3], Japp Evers[4], Assela Pathirana[4] , Truong Minh Huy Vu[5] and Nguyen Hong Quan[2]

[1]Mekong Delta Development Research Institute, Can Tho University, Vietnam

[2]Institiiute for Circular Economy Development, Vietnam National University, Ho Chi Minh City, Vietnam

[3]Delft University of Technology, the Netherlands

[4]IHE Delft Institute for Water Education, the Netherlands [5]Information Technology Park, Vietnam National University, Ho Chi Minh City, Vietnam [(*)] Corresponding and presenting (if accepted): ntbinh02@ctu.edu.vn

Abstract

Assessing adaptation pathways for sustainable food production systems has become one of the most challenging topics, especially in the complex ecological systems, high uncertainty and contested multi-stakeholder arenas like delta around the world. This paper presents an analytical framework for assessment of incremental and transformative adaptation pathways based on An Giang province case study in the flood plain areas – the biggest rice production area of Vietnamese Mekong delta. The framework is developed by a linkage of the MOTA and 4R framework with adaptation concept, so called the linked MOTA-R. Of which, the MOTA takes a multi-stakeholders and multi-level approach, focusing on the integrated relationship between "Motivation-Ability" whereas the 4R is used for resilience assessment through analysing the relationship among the four components of "Reform-Result- Resilience-Return". The new MOTA-R framework visualizes different adaptation pathways in different states of agricultural development including incremental and transformative as well as forward and back-casting. Each pathway considers not only the motivation and ability of MOTA, but also the reform, result, resilience, and return of 4R. The method takes into account co-benefits for related stakeholders under complex systems, climate change threats, and high uncertain situations. Therefore, the linked MOTA-R can be considered as bottom – up approach to help policy maker in selecting suitable pathways e.g. low or no- regret ones. Last but not least, the framework proposes a potential application to ensure sustainable food production systems and implement resilient agricultural practices that help maintain ecosystems and strengthen capacity for adaptation to climate change in other deltas.

Keywords: adaptation pathways, food production system, Mekong delta, resilience

1. Introduction

The world is facing many global challenges such as globalization, population growth, climate change, sea level rise, diseases (in humans, livestock, poultry, aquatic animals and plants), loss of biodiversity, resource scarcity, and environmental pollution (Coumou and Rahmstorf, 2012; Maru et al., 2014; Fazey et al., 2015; IUCN, 2020; Binh et al., 2021). Planning and strategy for socio-economic development at the national or local level requires not only relying on resources and motivation of different stakeholders (i.e. society, government and business) but also taking into account the impacts of above global challenges. However, these challenges are often change overtime and high level of uncertainty. Adaptation pathways are recommended as a promising decision-focused approach to incorporate flexibility into decision-making and account for future uncertainties including climate change adaptation and transformation (Wise et al., 2014; Bosomworth et al., 2017; Fazey et al., 2015; Werners et al., 2021). Adaptation pathways are broadly understood as sequences of actions which can be implemented progressively, depending on future dynamics (Werners et al., 2021) or as sets of decisions and actions that consider both short and long-term time horizons (IPCC, 2014). The approach has been changing from its initial application in the context of clear mandate and agency for decision makers to ambiguous adaptation outcomes and goals due to uncertain and resources constrained environments (Haasnoot et al., 2012; Ranger et al., 2013; Wise et al., 2014; Gajjar et al., 2018). While adaptation pathways are well conceptualized, their utility remains unproven, especially for practical application in complex ecological systems, high uncertainty and contested multi-stakeholder arenas (Butler et al., 2014; Bosomworth et al., 2017; Hermans et al., 2017; Bloemen et al., 2018; Werners et al., 2021).

Another potential tool to assess particular project implementation feasibility developed by Ho et al. (2015) is called the Motivation and Ability (MOTA) framework. The MOTA takes a multi-stakeholders and multi-level approach, focusing on the integrated relationship between "Trigger – Motivation – Ability", in which outcomes are conveyed through a combination of motivation and ability of multi-stakeholders at different levels co-existing within the implementation process. Of which, trigger is understood as external event or stimulus that can be perceived as threat, neutral or opportunity. Therefore, what actors do is based on their perception of some causative factor (trigger), their reference and level of commitment (motivation) and their capacity to act in a given manner (ability, whether technical, financial, institutional or social) (Nguyen et al., 2019; Sadik et al., 2021). By highlighting the interaction between these three components, the MOTA framework addresses potential influencing factors that can be adjusted in order to narrow the gap between desired outcomes (those assumed by planners or policy makers) and plausible outcomes (those likely to result from the collective actions of stakeholders during implementation) (Nguyen et al., 2019). Although the MOTA shows how an action (or adaptation pathway) can be implemented but it has not informed what

results, how resilience and what lessons learned from this action. A novel 4R (Reform, Result, Resilience and Return) framework is newly developed by Can Tho University and Vietnam National University in Ho Chi Minh city which can be used for resilience assessment through analysing the relationship among the four components of reform, result, resilience and return.

It is clear that there are different adaptation pathways can be developed for future socio-economic planning in a certain situation. However, the question remains how to assess and visualize different pathways taking into account low or no-regrets, co-benefits, complex systems, climate change threats, and high uncertain situations? This paper aims at answering this question via construction of an analytical framework for assessment of various adaptation pathways (including incremental and transformative) by a linkage of the MOTA and 4R approach (so called MOTA-R).

2. Methodology

This study consists of two main approaches as review of literature and application of some participatory rural appraisal (PRA) tools in An Giang province, Vietnam. First, scientific articles were collected and reviewed intensively to get understandings of related concepts. In this study, we focus on adaptation pathways, vulnerability, resilience, strategic planning, motivation and ability. Then such concepts are presented into three key parts: adaptation pathways, the MOTA framework (Motivation and Ability) and 4R framework (Reform, Result, Resilience and Return).

The PRA survey was conducted in An Giang province of the Vietnamese Mekong Delta – one of the biggest rice production areas in Vietnam. The PRA survey aims at discussing about various adaptation pathways as well as its drivers (i.e. water management regime, irrigation development, agricultural production, livelihood capital changes, and so on) since 1975 up to present. We applied key informant interview, timeline analysis, seasonal calendar and focus group discussion to collect information and data from province to district and commune levels. Totally, there are 45 participants involved in the survey.

Table 1: Number of participants involved in the survey

Level	Name of place	Number of participant
Province	An Giang	6
District	Tri Ton	6
	An Phu	5
Commune and farmers	Vinh Phuoc, Tri Ton	10
	Phu Huu, An Phu	18
	Total	***45***

3. Results and discussions

3.1 Review of literature

3.1.1 Adaptation pathways

Adaptation pathways concept is a new approach for adaptation planning in the context of high future uncertainty (Haasnoot et al., 2013). The approach is based on a sequence of adaptation options or alternative system states over time, their operational spaces, and the ability to shift to alternative options or systems when the future is unfolded. This approach considers adaptation, for instance to changing climate and socio-economic development, is a continuous process affected by multiple drivers of change across various scales, and adaptation actions should be able to sustain over a long period of time by maintaining the ability to adjust to the new situation (Haasnoot, 2013). It embraces flexibility in adaptation planning and implementation and accounts for the interactions between social-ecological systems in response to change (Werners et al., 2021). The adaptation pathway concept shares common features with the resilience, which embraces the ability of the system to persist, recover and transform to adapt to future changes (Folke, 2016). Adaptation pathways therefore can help to identify adaptation options that reduce vulnerability and enhance resilience in the context of climate change and multiple stressors (Maru et al., 2014). The concept is also acknowledged for building consensus among stakeholders for the need to change since it helps to identify no or low- regret adaptation actions and preserve the options for future generations (Barnett et al., 2014). The concept is however varied among scholars and different schools of thought. According to Werners et al. (2021), "a difference between scholars is whether pathways are understood as alternative sequences of measures to realize a well-defined adaptation objective or as broad directions of change for different strategic aims or outcomes". In terms of the intensity of change, adaptation pathway can be classified into incremental adaptation and transformative adaptation. Incremental adaptation measures involve adjustment of adaptation measures to persist in the same system (e.g. improvement of farming practices); while transformative adaptation refers to the transformation of the system states (e.g. shifting agricultural systems) (Nguyen et al., 2019; Butler et al. 2016).

The approach has been applied in various settings in both rural and urban region and for different humans and ecosystems such as farming systems, water management, land use, and forest ecosystems, etc. The adaptation pathways can be used as a metaphor or an analytical tool to facilitate strategic adaptation planning (Brenda et al., 2017). In the context of large uncertainty and undefined objectives, adaptation pathways can also be used as a metaphor to narratively describe adaptation options that will be unveiled over time. This approach can provide qualitative information on the adaptation and mal-adaptation options, path-dependency and lock- ins, as well as costs and benefits of certain actions (Brenda et al., 2017). The qualitative approaches could be based on forecasting of future vision or a back- casting of scenarios,

visions, objectives, which is considered as a "how-to-go-there" approach. The qualitative methods allow identification and discussion of available options, possible lock-ins, and preferences of involved stakeholders, etc. (Werners et al., 2021). Adaptation pathways can also be used as a decision support tool to strategic adaptation planning by establishing sets of principles and outcomes, options, and decision steps to guide the planning processes (Brenda et al., 2017).

In summary, the adaptation pathways approach would be helpful to illustrate different adaptation options, drivers, and future states of the analyzed systems (farming systems, water management systems, land use systems, etc.), as well as offering a tool for strategic adaptation planning. Depending on the uncertain nature of the analyzed systems, the availability of data and objectives of the study, a clear identification of system characteristics, thresholds and outcomes of changes would be appropriate for strategic adaptation planning. In the case of lacking data or when the objective of the study is to identify available adaptation actions to achieve certain (ambitious) objectives, the use of adaptation pathways as a metaphor would suit to explore available options. Adaptation pathways are a set of different ecosystem states and the transition or shifts from one state to another. The approach however does not identify the drivers leading to these changes, as well as the characteristics of each state (adaptation or maladaptation).

3.1.2 The MOTA framework

The MOTA (Motivation and Ability) framework developed by Ho et al (2015) takes into account the motivation and ability that helps to identify in more detail the differences between an expected outcome of a plan and a potential outcome resulted from the collective actions of stakeholders. The framework takes a multi-stakeholder and multilevel approach to assess and compare projects and plans, centering on the integrated relationship between "Trigger-Motivation-Ability". The outcomes are then conveyed through a combination of motivation and ability of multiple stakeholders, at different co-existing levels in the implementation process (Ho et al., 2015 and Nguyen et al., 2019) The MOTA approach is illustrated in Figure 1 with its main components.

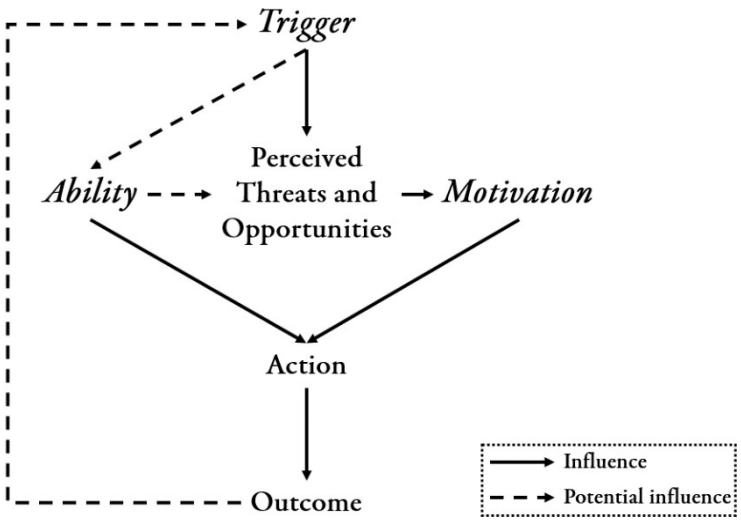

Figure 1. The MOTA framework (Adapted from Ho et al., 2015)

This framework recognizes that the influence of a trigger on a motivation is shaped by one's perception of threats and opportunities, or subjective assessment of that trigger, which may be either positive or negative and range in intensity from weak to strong. In other words, a specific trigger may be perceived as a threat, as neutral, or as an opportunity. Next, actors' actions and decisions are influenced by their motivation and ability. What actors do is based on their perception of some causative factor (the trigger), their preference and level of commitment (motivation), and their capacity to act in a given manner (ability, whether technical, financial, or institutional). The framework thus focuses on the integrated relationship between these three key variables: Motivation, Ability, and Trigger. These concepts may have different perspectives and different uses depending on the context and the authors. Nguyen et al (2019), define the concepts that will help to use the MOTA framework in a wide range of applications of plan and project implementations with multiple stakeholder involvement as:

- ***Motivation:*** the motivation is a pre-condition for action, together with ability. In the public policy domain that involves this tool, the motivations can have two classifications, depending on what kind of actors are scrutinized. One group are the "ground" stakeholders, who are mainly the ones in the field regarding a specific plan. They are citizens, farmers, users, etc. The types of motivations in this group are their points of view on threats and opportunities, which are related to the adoptability MOTA. The other type of actors is the institutional or governmental ones. This type of actors can be local authorities, department of agriculture, or Ministries. The motivations assigned to them are perception of risk, perception of solutions and institutional mandates.
- ***Ability:*** This concept can be understood also as influence, capacity or power. This relates to all the requirements on money, time, physical or mental efforts that allow change to happen. In

general, these abilities can be grouped in financial, institutional, social and technological.

- ***Trigger:*** Triggers are events that cause actors to consider a change in behavior. Trigger events can occur suddenly or gradually. In planning terms, planners would hope that the establishment or announcement of a new plan is a trigger for action among the implementing agencies and different stakeholders. However, triggers can also be external events: new information presented to actors, new market trends or even natural events.

The MOTA framework has successfully been applied to assess plan implementation maturity of flood management in Ho Chi Minh City, Vietnam (Ho et al., 2015), as tool to assess transformation potential of farming practices in the Vietnamese Mekong delta. Nguyen et al (2019) applied the MOTA as a bottom-up approach to understand the motivations and abilities of local farmers to adopt alternative livelihood models in Ben Tre province of Vietnam. The results showed that motivations and abilities were quite diverse among farmers and there is a clear link between motivation and ability. In addition, farmers' motivations and abilities to apply alternative models vary substantially among different groups, driven by their perceptions on triggers and opportunities. This understanding is useful for developing agricultural transformation plans for the province. The MOTA framework is also applied for assessing the societal adoptability of participatory water management in Bangladesh (Sadik et al., 2021). The results suggest that the MOTA is capable of informing policy makers and implementing agency about how to enhance the stakeholders' motivation and ability to ensure and enduring implementation of participatory water management reforms in Bangladesh.

3.1.3 The 4R framework

The novel 4R (Reform, Result, Resilience and Return) framework is newly developed for resilience assessment of household and ecosystems influenced by various innovative water management schemes in An Giang province. Innovative water management in the floodplains plays a critical role for people's livelihoods and sustainable development. It is also true to the Vietnamese Mekong delta, especially given multiple internal and external threats that impact the resilience of farming systems in the region. However, resilience assessment of innovative water management is still a challenge in theoretical and practical perspectives. By applying the grounded theory approach, the 4R is created (Figure 2) (see Binh et al., upcoming, for detail of 4Rs formation).

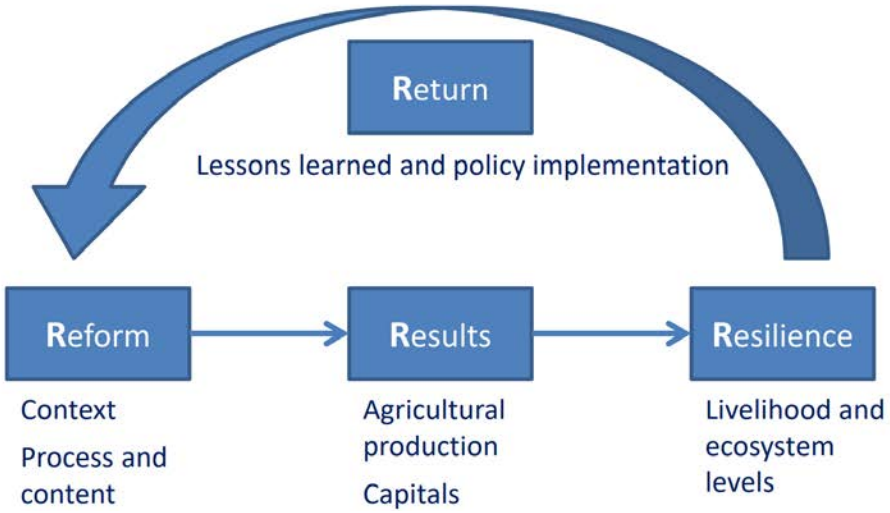

Figure 2. The 4Rs framework for assessment of innovative water management

The 4R framework includes four categories consisting of Reform, Result, Resilience and Return. Each category contains some sub-categories to characterize the category meanings.

- ***Reform:*** In this framework, reform refers to any change (soft or hard measures) in management to make sure that water is managed more sustainably in response to risk and uncertainty context and to meet community needs. The reform category has three sub-categories as context, process and content of water reform in the study site.
- ***Result:*** The water reform process has been gone through many stages since 1975 in An Giang province that result in changing food production system and livelihood capitals of local communities. The water reform process has created many different cropping patterns, achieving many positive results such as ensuring food security and socio-economic development in An Giang province in the last 3 decades. However, whether these achievements are stable or resilient in the long term is another matter.
- ***Resilience:*** In this framework, resilience refers to the capacity of a system potentially exposed to floods to adapt by changing in order to reach and maintain an acceptable level of functioning and structure (UNISDR, 2014). It is necessary to distinguish resilience by different levels because water reform in the research sites may bring positive outcomes for local communities but affect others at a larger scale. Therefore, we consider the panarchy aspects of resilience by assessing two levels such as livelihood resilience and ecosystem resilience.
- ***Return:*** The Return aspects of the 4Rs framework are presented by reflecting some lessons learned and future policy implication for resilience improvement in the case study example.

Findings with the 4R framework have implied a need to support agricultural transformation strategies, innovative strengthening under the water management scheme to improve the sustainability of the livelihoods and to enhance their resilience.

3.2 The linked MOTA-R framework

The linked MOTA-R framework for assessment of different adaptation pathways is presented in Figure 3 and Table 2, taking An Giang as a case study. The framework visualizes various potential options which can be forward or back-casting adaptation pathways in different states of development by taking into account "Trigger-Motivation-Ability" of MOTA and four components of 4R frameworks.

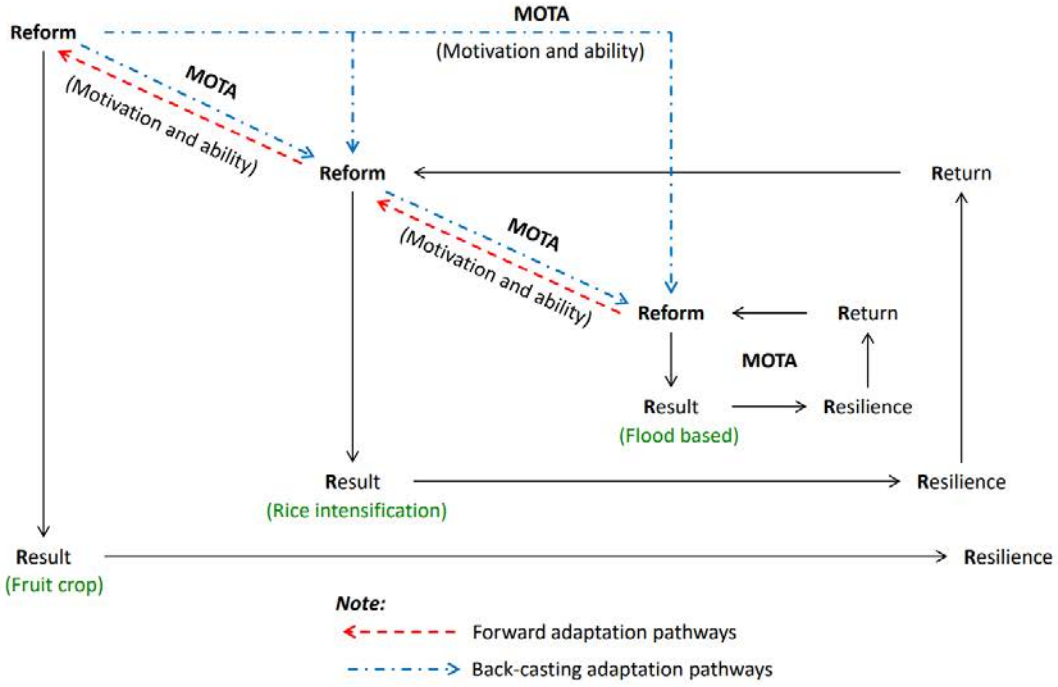

Figure 3: A linked MOTA-R framework for assessment of different adaptation pathways

Table 2: An example of MOTA-R matrix to assess different adaptation pathways, the case of flood plains in An Giang province, Vietnam

		Different adaptation pathways			
		Traditional flood based	***Traditional flood based to rice intensification***	***From rice intensification to fruit production***	***New flood based farming***
MOTA	***Trigger***	High risk to flood High poverty rate	Flood hazards Population growth Food security	Less sediments High costs for rice	River flow change, low discharge
	Motivation	Abundant natural resources Good environment	Flood control, low risk High price of rice	Fully control by dyke High income from fruits	Get more sediment Get more income sources
	Ability	Less capital for investment of infrastructure	Green revolution (technology, extension) Rice first policy from the government	Better-off farmers have financial capacities Re-structuring policy from the government	Resolution 120 (supporting nature-based solutions) NGO projects
4Rs	***Reform***	No-dike	Semi-dike to full-dike	Full-dike	Semi-dike
	Result	Low rice productivity High natural fish production	Increase rice production Decline natural fish resources Higher income	Fruit farmers have more profits but rice farmers must invest more for chemical fertilizers	Small-scale, not easy to scale-up More natural fish
	Resilience	High Diversification of income (fish, aquatic crops) Nature-based solutions	Medium Loss flood based income sources Damage ecosystem Land degradation Water pollution	Low High chemical uses No sediments Social conflict between annual crops and fruits (i.e. open gate to get sediment for annual crops cause flooding for garden)	Medium Less chemical uses Unstable markets for flood based products (i.e. lotus cultivation) Diversification of income
	Return	Low income High risk to flood	High costs for rice Less sediments	Informed decision-making to reduce conflict	Finding market for flood based products Recognize the value of ecosystem services of flood based

The adaptation pathways are distinguished between incremental adaptation and transformative adaptation. Incremental adaptation measures involve adjustment of adaptation measures to persist in the same system while transformative adaptation refers to the transformation of the system states. As showed in Figure 3, the flood based state (i.e. livelihoods rely on floating rice, natural fishing, aquatic plants) can be adjusted under motivation and ability but keeping in the same system (i.e. improve income by using floating rice straw to mulch upland crops) or can be transformed to another system (i.e. rice intensification). The incremental adaptation pathway occurs in the first case (still keep flood based system) and transformative adaptation pathway occurs in the later (shifting from flood based to rice intensification system). Like that, the adjustment can be happened within the rice intensification system itself under MOTA drivers, still persisting intensification (i.e. reduce 1 crop after 3 years to get sediment and clean the field); or rice intensification is transformed to fruit crops thank to the high profits of fruit gardens compared to paddy fields, and so on. The

adaptation pathways can be forward, from traditional flood based system to rice intensification and fruit crops as above illustration. Or it can be back-casting pathways; for example, from rice intensification back to flood based farming system. It is clear that the MOTA and 4Rs plays an important role in adaptation pathway analysis, whether incremental or transformative, forward or back-casting. For example, due to lack of governmental ability for flood control infrastructure in 1980s, farmers in An Giang could not shift to rice intensification but they could get higher profits by technical improvement within flood based farming (incremental adaptation). When infrastructure and irrigation systems have been invested, farmers are motivated to intensify rice production (transformative adaptation). That is forward adaptation pathway or a new reform in water management. However, high level of rice intensification system can result in better production in one hand and cause negative impacts on the other due to overuse of agro-chemicals, water pollution, land degradation, preventing sediments into rice fields, etc. Therefore, rice intensification is perceived as low resilience compared to flood based. In addition, the Mekong river flows have been changed because of hydropower dams and irrigation development from upstream countries which are perceived as a threat or negative trigger. Thus, some current projects want to return to the flood based system (i.e. the WB, IUCN, and GIZ). This depicts a back-casting adaptation pathway.

4. Conclusions

Based on review of adaptation pathway concept, MOTA and 4Rs frameworks and using data from An Giang province, a linked MOTA-R framework is developed for assessment of various adaptation pathways. The linked MOTA-R framework can be used as an analytical tool for strategic planning. It shows different adaptation pathways including incremental and transformative as well as forward and back-casting. Each pathway considers not only the trigger, motivation, and ability of MOTA framework, but also the reform, result, resilience, and return of 4R framework. Therefore, the linked MOTA-R can inform decision-makers valuable information in a simple visualization in order to select a low or no-regret pathway taking into account co-benefits for related stakeholders under complex systems, climate change threats, and high uncertain situations. Although the new framework promises a potential tool for strategic planning that can be applied in a complex system and high uncertainty to address current global challenges. However, this is an initial idea which should be tested and applied in reality.

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Indigeneity, Gender, Sustainability, & Development: Legal and political framework for CCUS with negative carbon emissions development in Asia

Eiji Komatsu [1,*], Kenichiro Yanagi [2], Akihiro Nakamura [3]

[1] *Meiji University Centre for Environmental Law and Policy, ccs2016@meiji.ac.jp or komatsu@lercs.co.jp*

[2] *Meiji University Centre for Environmental Law and Policy, k_yanagi@meiji.ac.jp*

[3] *Meiji University Centre for Environmental Law and Policy, akihiro1820@gmail.com*

[*] *Correspondence: ccs2016@meiji.ac.jp*

Abstract

Asia is one of the few regions where the proportion of coal in the primary energy mix is expected to increase until 2040. To limit the resulting increase in GHG emissions to achieve the 1.5 °C global temperature target, development of technologies and legal framework for the clean energy technologies with CCS/CCUS (Carbon dioxide Capture, Utilization and Storage), based on the specifications for coal storage sites and the regional energy mix, is strongly required. However, most Asian countries have not fulfilled this requirement yet.

The main objective of this study examines the applied technologies combined coal-fired power plants, biomass/waste power plant, Geothermal Power with negative carbon emissions using CCS, and the legal and economic aspects and long-term liabilities of those technologies through a comparative study of laws and policies of developed countries, and an analysis of economic model based on the life cycle cost. Based on the results obtained, a comprehensive legal and political framework for the long-term deployment of CCUS and rural carbon cycle society in Asia was studied.

Optimization of CCUS technologies to maximize negative emissions and identifying the optimal policy mix for those is extremely important to establish the legal and political framework for long-term liabilities of stored CO_2 and promote the large-scale CCUS technologies. In this study we proposed a realistic legal framework for CCS and political instruments mix for installation and wide-spread of CCUS technologies in Asia. Also we will address the open innovation model for the development and commercialization of negative emission technologies.

We conclude that the framework with the open innovation model that be integrated into the legal and political framework of CCUS large-installation and management that an investment in knowledge and a promotion of knowledge-production brings into play new and crucial impulses for innovation, know- how and the advancement of society. By initiating small steps toward sustainability, long-term and leading knowledge societies can emerge, which will live in balance with nature and ultimately, perhaps, lead to a

green and sustainable economic wonder.

Keywords: Mitigation of Climate Change, Legal and political framework, Open innovation model, Negative carbon emissions, CCUS.

1. Introduction

Global warming represents an ecological (also socioecological) issue of importance and concern. Due to the escalation of global warming, it is time for humanity to think and act responsibly and determine sustainable solutions. Global warming, in addition to climate change, has caused the world to undertake new responsibilities (e.g. IPCC, 2007), which not only include further climate change, but in the long term, also hold humanity accountable in the prevention of new political and/or social conflicts, war on resources, new environmental catastrophes as well as serious crises in the market economies (e.g. UNDP 2007; UNEP 2008). The special challenge of global warming can be tackled by 'sustainable development'. Sustainable development concerns us all and takes place on the local as well as global level. Hence, sustainable development has to be understood in the context of 'global knowledge economy and society' (e.g. Carayannis and Campbell 2011). Therefore, we must perceive global warming not as a challenge but rather as an opportunity to live innovatively and effectively in union with nature for a better tomorrow.

The Glasgow Climate Pact aims to strengthen the global response to the threat of climate change by restricting the rise of global temperature in this century to less than 1.5 °C above pre-industrial levels based on the funding fact showed by IPCC Sixth Assessment Report WG1 (2022). To achieve this target, an ambitious CCS/CCUS growth path is required, with many global CCS/CCUS projects needed by 2050 (Beck et al., 2011). The global consensus is that CCS will be a key technology for global decarbonization.

Japan's Intended Nationally Determined Contributions (INDC) toward post-2020 greenhouse gas (GHG) emission reductions refers to GHG emission reductions of 46% by FY 2030 compared to the FY 2013 level. In 2021, the Cabinet of Japan determined the strategic actions required to achieve the long-term target of Carbon neutrality by 2050. A key to maintaining compatibility between the global warming countermeasures and economic growth is the development of innovative technology (Overview of the Plan for Global Warming Countermeasures, which was determined by the cabinet on 13 May, 2016). The Government of Japan promotes the development and demonstration of many GHG reduction technologies including CCUS.

Asian high economic growth in recent decades has resulted in the region's equally high growth in carbon emissions. As a consequence, a significant part of global carbon emissions are now coming from China,

India, ASEAN and other Asian developing economies. Based on the regional distribution of global CO_2 emissions between 1990 and 2010 Asia-Pacific's share in global carbon emissions jumped from 25% in 1990 to 44% in 2010. In this regard, specifically, this paper has featured an urgent area of case studies within the Asia Pacific Region, which is the Association of Southeast Asian Nations (ASEAN) countries, including Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The countries within the ASEAN group have shown significant records of contributing greenhouse gas (GHG) emissions in recent years, especially in Indonesia, Thailand and Vietnam (GCCSI, 2014). Figure 1 and Figure 2 below show the future economic growth and CO_2 emission forecast in the ASEAN group respectively (ENC, 2016).

In the current academic debate, it is undisputed that a solution or a suitable answer regarding the challenge of global warming can only be found through utilizing the asset of human knowledge (e.g. Carayannis and Campbell 2011; Bhaskar 2010).

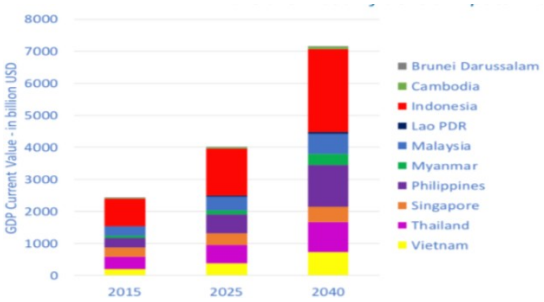


Figure 1. *Future Economic Growth in ASEAN*

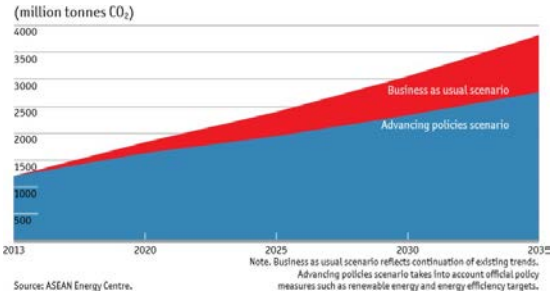


Figure 2. *ASEAN CO_2 emissions forecast*

The main objective of this study examines the applied technologies combined coal-fired power plants, biomass/waste power plant, Geothermal Power with negative carbon emission technology using CCS, and the legal and economic aspects and long-term liabilities of those technologies through a comparative study of laws and policies of developed countries, and an analysis of economic models based on the CCS/CCUS project life cycle. Based on the results obtained, a comprehensive legal and political framework and open

innovation model for the long-term installation and deployment of CCS/CCUS for large reduction of CO_2 in Asia was studied.

2. Methodology

2.1 Poetical risk of CCS and long-term liabilities

Several studies (e.g. Ingelson et al., 2010) have focused on the most serious risks associated with injection and long-term storage of CO_2, particularly the risk of leakage (i.e., the possibility of CO_2 escaping from the storage site). The risks associated with long-term carbon storage can be categorized broadly as local, regional, and global environmental effects arising from the release of stored CO_2 to the atmosphere. If leaks occur, a number of hazards may exist, ex. potential hazards to human health and safety, hazards to groundwater from CO_2 leakage and brine displacement, hazards to terrestrial and marine ecosystems, induced seismicity and implications of gas impurities under circumstances where other gases may be stored along with CO_2

On the other hand, injecting and storing CO_2 in geological formations beneath the seabed also could create risks of effects to the marine environment in the event of CO_2 leakage. However, the conclusion of the assessment of the Scientific Group in IMO was that CCS is technically feasible with risks that are local, lesser in comparison to those resulting from atmospheric CO_2, and potentially manageable with appropriate guidelines (IMO, 2006). Also, several analyses have acknowledged that managing these potential risks requires clarification of the responsibilities for maintenance, monitoring, and leakage prevention of CO_2 storage sites in the closure and post-closure stages (Finch, 2009). Recognizing these risks, risk mitigation activities are essential.

The Intergovernmental Panel on Climate Change (IPCC, 2013) and/or the CO_2 specific guidelines (IMO, 2007) have recommended the following interrelated development and management practices:

- Characterization of the CO_2 stream
- Screening for acceptability of substances to be disposed in the case that the CO_2 stream includes impurities
- Careful site selection, including performance and risk assessment and socioeconomic and environmental factors , including evaluation of potential exposure to CO_2 and substances mobilized by the CO_2, identification of leakage pathways and probabilities, and modeling of the CO_2 behavior
- Monitoring to provide assurance that the storage project is performing as expected and to provide early warning in the event that it begins to leak

- Effective regulatory oversight
- Implementation of remediation measures to eliminate or limit the causes and impacts of leakage

According to the discussion about the long-term management and long-term stewardship of the stored CO_2, the EU CCS directive is thought to be institutionalizing institutional measures to realize the long-term liability because this directive is a legal framework act that stipulates the responsibilities in the life cycle of CCS projects, such as selection of storage sites and exploration permits, storage permits, monitoring and reporting, closure and longer-term stewardship, and finally the transfer of responsibility

for a storage site to the relevant authority. When member states of the European Union implement of CCS, it is necessary to establish CCS law with the provisions in the EU CCS directive.

This paper examines the legal and socioeconomic aspects and the long-term liabilities of CCS technologies through a comparative study of the current laws and policies of Japan and other developed countries and also provides an analysis of economic models of the CCS project life cycle based the past study (Yanagi et al,. 2019). Based on the results obtained, a comprehensive legal framework and policy strategy for the long-term development and management of CCS in Japan and Asia were proposed. Issues related to ensuring the effective long-term stewardship of CO_2 storage sites and the protection of public health, safety, and the environment were addressed.

2.2 Open innovation model

The key to success for establishment of the long-term development and liabilities of CCS/CCUS , as being determined by our propositions, lies in using the available and newly created ‘knowledge’ in correspondence with Open Innovation Model (Carayannis and Campbell 2010). Thus is a model of innovation that can tackle existing challenges of global warming through the application of knowledge and know-how as it focuses on the social (societal) exchange and transfer of knowledge inside the subsystems of a specific state or nation-state (e.g. Barth 2011). The nonlinear innovation model which combines knowledge, know-how, and the natural-environment-system together into one ‘interdisciplinary’ and ‘transdisciplinary’ framework, can provide a step-by-step model to comprehend the quality based management of effective development, recover a balance with nature, and allow future generations a life of plurality and diversity on earth (e.g. Carayannis and Campbell 2010; Barth 2011). To sum up, this paper is as follows: the innovation model represents a suitable model in theory and practice offered to society to understand the link between knowledge and innovation, in order to promote a lasting development. This contribution, under the aspect of global warming, focuses on the potential of a nation-state in the twenty-first century and on the following pivotal question: How can sustainable development, with regard to global warming, be practiced step-by-step with and within the innovation model?

3. Results and Discussion

3.1 Policy strategy for CCS/CCUS development

In the current legal system for CCS development in Japan, the High Pressure Gas Safety Act, Mining Act, Mine Safety Act, Act on Services Related to Waterways, and Waste Management and Public Cleansing Act are applied individually to permit and implement CCS projects in each processes. On the other hand, both marine treaties, the London Convention in 2006 and OSPAR in 2007, proceeded to remove their prohibitions on storage of CO_2 in sub-seabed geological formations (Dixon, 2015). In Japan, the storage of CO_2 in sub-seabed geological formations became possible by the Act on Prevention of Marine Pollution and Maritime Disaster as amended in 2007. The application of such individual laws alone in Japan cannot correspond to all key issues relating to the CCS regulatory framework (IEA, 2010), and the urgent issues should be addressed by constructing a comprehensive legal framework that is compatible with all processes of CCS.

Based on these funding, key issues for the installation, dissemination, and commercialization of CCS in Japan are summarized in Table 1, and it was concluded that legal regulations and policies should be established to solve these issues in order to develop and commercialize CCS technologies. These issues is the same situation in the legal and political aspects in most ASEAN countries.

Table 1. *Key issues for a policy and legal framework for introducing and promoting CCS technology in Japan.*

Stage	**Research & development stage**	**Demonstration stage (installation)**	**Commercialization stage**
Key issues	・ Prepare for a strategic plan for CCS (quantified targets) under an energy plan and GHG mitigation targets ・ Address the importance and role of CCS and make decisions for building social consensus ・ Review the potential and technical feasibility of CO_2 storage	・ Establish an evaluation method for leakage risk and environmental impact assessment ・ Develop safety technology by conducting full-chain pilot projects ・ Achieve cost efficiency for CCS projects and consider ways to incentivise financial support for CCS	・ Throughout the stages of storage and post-closure management, establish responsible authority, permit systems for CCS operation, long-term monitoring processes, cost burden assessments, and an insurance and compensation system （establishing a CCS legislative framework） ・ Clarify the rules for transfer of responsibility, financial liability after the transfer, and management systems, because of the gap between the duration of business activities and the period of CO_2 storage （establishing a CCS legislative framework）

Optimization of policy instruments and identifying the optimal policy mix are extremely important for establishing the legal and policy framework for long-term liabilities and for promoting large-scale CCS/CCUS technologies. These actions can promote, for instance, rationalizing CSS installations and operations costs and expanding commercialization and scale of business (Finon, 2012). Based on the several existing frameworks (e.g. IEA, 2012), we proposed a long-term CCS/CCUS policy strategy framework for Japan that consists of two different frameworks: a CCS/CCUS Development and Installation Policy and a CCS/CCUS Legal Framework, which is similar to IEA frameworks such as the EU CCS directive (Figure 3).

Considering the CCS legal framework, most CCS legal frameworks in developed countries, such the EU, USA, and Australia, are institutionalized based on regulatory measures. On the other hand, from the experience of national involvement, such as for the Act on Special Measures Concerning Promotion of Proper Treatment of PCB Wastes in Japan, it is also possible to install a legal framework in Japan by public involvement and public funds. Therefore, we proposed two legal frameworks that were developed based on the existing laws and policy instruments of Japan, namely the Regulatory Scheme for Owner/Operator and the Public Promotion Scheme for Relevant Authorities (Figure 4).

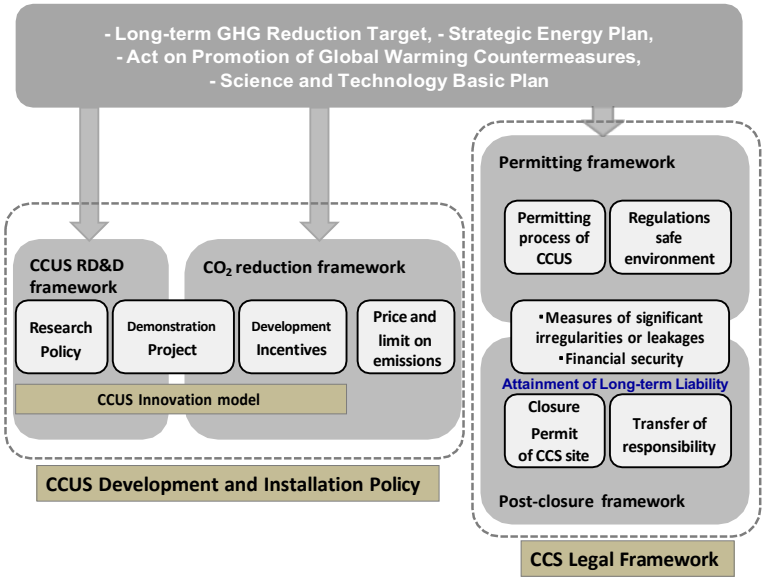


Figure 3. *Proposed policy strategy and legal framework for CCS/CCUS development*

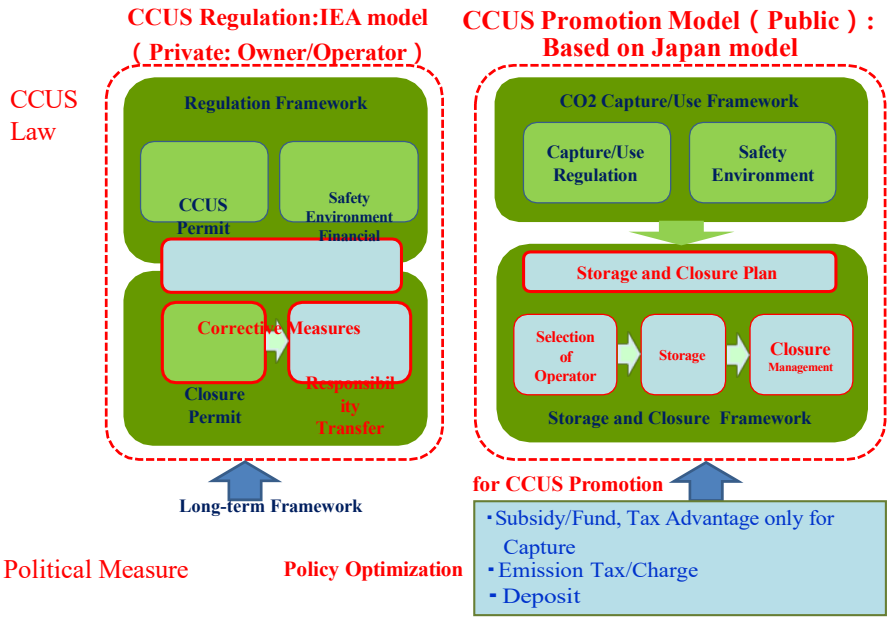


***Figure 4**. The two proposed types of legal and policy framework for CCS/CCUS*

3.2 CCS/CCUS development scenarios based on the legal and policy framework

The annual amounts of stored CO_2 required to attain the GHG reduction goals for 2030 and 2050 would be estimated, respectively, if the CCS/CCUS legal framework and policies shown in Figure. 4 were to be legislated in Japan. These estimated values are based on the GHG emission and the future scenario: the annual GHG emission (1.27 billion tons/year) in FY 2015, Japan's INDC base scenario in 2030, and the GHG emission scenario simulated by The Institute of Energy Economics, Japan. In the estimation, the GHG reduction amount is estimated based on the GHG emission standards to be imposed on each emission source, and the reduction technologies expected to be introduced in the future to achieve the GHG reduction goal and the required amount of stored CO_2 and installation rate of CCS in each sector are estimated.

Under Japan's INDC scenario and the Emissions Performance Standard (EPS) regulations, irrespective of the availability of CCS, a significant increase in nuclear and renewable electric generation is required to offset the decreasing use of conventional fossil fuels in the power sector. However, the proportion of nuclear power generation in the total generation will be small as restarting nuclear power plants is not acceptable. The results of our analysis show that CCS facilities should be installed for up to 35% of coal-fired power plants by 2030; thus, a target value of EPS in 2030 of 0.37 kg CO_2/kWh for the power sector will be attained. Utilizing CCS technologies for achievement of the 2030s target provides an economic advantage comparable with other mitigation measures such as wind energy and Mega-solar for power

generation based on an economic analysis for the levelized marginal cost of electricity (Yanagi, 2019). We conclude that CCS will be effective as a large CO_2 reduction measure for the attainment of long-term target of GHG reduction in the 2030s.

In the 2050s, our future scenario analysis result suggests that CCS facilities will need to be installed for up to 60 to 70 % of all thermal power plants and also for about 80 % of the CO_2 emission from plants in all sectors aside from thermal power plants. The total annual amount of CO_2 stored by CCS in this scenario is 0.57 billion tons. Based on the estimated CO_2 storage potential in the coastal area in Japan, CO_2 can be stored for more than 50 years in the aquifers of anticline structures, and this is thought to be a feasible scenario; however, a feasibility study for stored CO_2 in this scenario will be necessary based on the result of a survey of potential CO_2 storage being conducted currently by the government.

3.3 Open innovation model for global worming

3.3.1 Complex system emergence and mitigation innovation

Innovative mitigation technologies such CCS/CCUS are developed through a combination of existing technologies and progress in studies on complex systems. Due to the existence of chance and path dependence, it is difficult to predict the future of both feasible technologies as well as biological evolution (Kauffman, 2000; Arthur and Polak, 2006; Arthur, 2009, 2015; Solée et al., 2013). The development of relevant innovation has accelerated in recent years due to the accumulation of existing technologies and the development of IOT. Innovation related to global warming has never progressed based solely on one technology, rather through a combination of the progress of both science and technology; this is the basis of innovation theory. For example, using AI technology, a wide range of global warming countermeasure technologies such innovative energy saving and GHG reduction technologies are becoming possible through deep learning derived from game theory (GeSI, 2015; JEITA, 2016).

It has been suggested that once the possibility of adjacency was achieved, active research and development would be carried out and active innovation would occur. As such the development of AI and IOT as technological basis theories will lead to the emergence of innovative technologies to combat global warming as well as many large-scale GHG reduction technologies. Spillover in innovation theory plays an important role in the emergence of technology in a complex system. Thus, recent developments in information and ICT have proven that sufficient spillover from existing technologies can be a key factor in the occurrence of innovation. In recent years, this fact has been suggested to be the essence of innovation, and has consequently become a framework of complex systems theory.

Innovation will occur from the combination of existing and new technologies (Figure 5). Therefore, as

technology innovation for global warming can be accelerated by the spread of spillover, we conclude that a framework for open innovation that goes beyond companies and across countries is necessary for the development of these technologies.

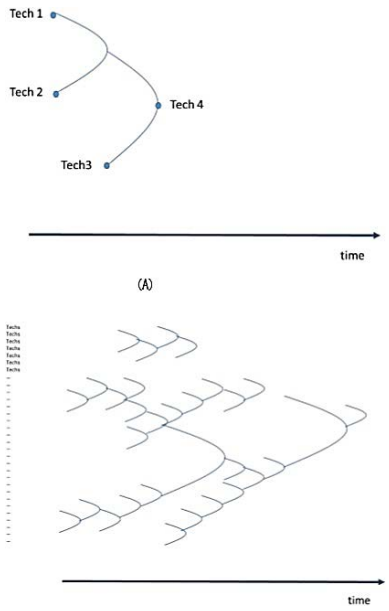


***Figure 5**. Complex system emergence and mitigation innovation*

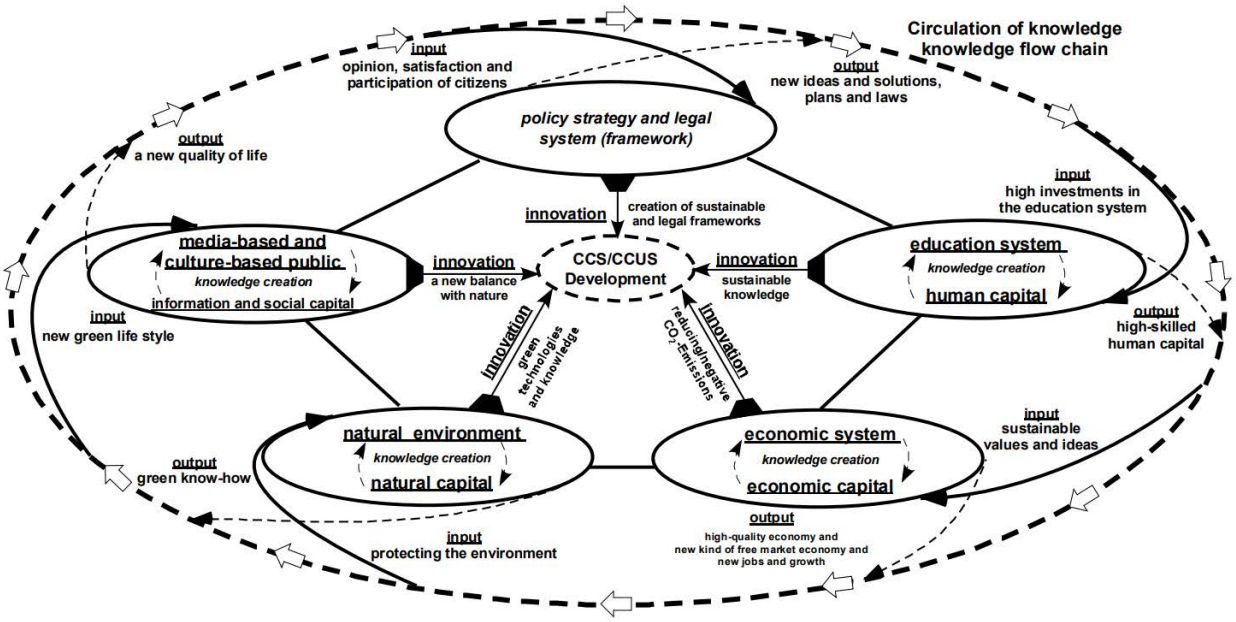
3.3.2 Open innovation model for global warming

It is clear that the challenge of global warming is accompanied with the challenge of sustainability in the twenty first century (e.g. Carayannis, 2011). Therefore, there are nine areas, of which Carayannis et al. write about, that require 'sustained action' , political and economic 'leadership' or 'empowerment',

and 'intelligent use of technology': 1) Financial/economic system, 2) Environmental challenges, 3) Feed and heal the world challenges, 4) Energy challenges, 5) Educational challenges, 6) Political democratic reform across the world, 7) Transformative government across the world, 8) Equity and Security across the world, 9) Technology, innovation and entrepreneurship as drivers of knowledge societies. The open innovation model for global warming with five-step flow analyses (Figure 6 modified from Carayannis, 2012) should be clear that all systems in an open innovation model perform a pivotal function, influencing each other. If more sustainable development is being considered (and demanded) on a national level, as a result of global warming, and if, for instance, more targeted investments in a specific helix of open innovation start flowing, and then there will be a positive impact on all other subsystems and on the society as a whole. The open innovation model demonstrates that an investment in knowledge and a promotion of

knowledge-production brings into play new and crucial impulses for innovation, know-how and the advancement of society.

To conclude, the open innovation model makes it clear that the implementation of thought and action in sustainability will have a positive impact on the society as a whole. The new quality management for more sustainability lies therefore in the creation of new knowledge, know-how, and innovation in balance with nature (e.g. Carayannis and Campbell 2010). One chief objective of this open innovation is to enhance value in society through the resource of knowledge. The discussion about this model indicates that striving for the promotion of knowledge as a knowledge nugget should be regarded as being essential: This means that knowledge is the key to and for more sustainability and to a new quality of life. Today, knowledge is the most fundamental resource (Lundvall 1992). Nevertheless, whether a state (nation-state or beyond-nation-state) is leading in different fields in the future, will be primarily, if not even solely, be decided by its potential to develop new knowledge, know-how and innovation in balance with nature. However, the improved exchange of knowledge and the striving for knowledge, new know-how, and innovations through the model can be, or at least, offer a solution for the challenges of sustainable development under the aspect of global warming in the twenty-first century. This open innovation model is essential for the development of technologies and infrastructure of the CCUS and applied to the policy strategy and legal framework presented in Figure 3 and 4.



The five-step is bellows;

(1) The education system: The education system, as the first step, defines itself in reference to academia, universities, higher education systems, and schools. In this model, the necessary human capital (for example: students, teachers, scientists/researchers, academic entrepreneurs, etc.) of a state is being formed by diffusion and research of knowledge.

(2) The economic system: The economic system, as the second step, consists of industries, firms, services and banks. This model concentrates and focuses the economic capital and financing mechanism (for example: entrepreneurship, machines, products, technology, money, etc.) of a state.

(3) The natural environment: The natural environment, as third step, is decisive for a sustainable development and provides people with a natural capital (for example: resources, plants, variety of animals, etc.).

(4) The media-based and culture-based public: The fourth step, media-based and culture-based public, integrates and combines two forms of capitals. On the one hand, this has through the culture-based public (for example: tradition, values, etc.) as a 'social capital'. On the other hand, the system of media-based public (for example: television, internet, newspapers, etc.) contains also capital of information.

(5) The policy strategy and legal system (framework) shown in section 3.1: as a fifth subsystem, is also of crucial importance, because it formulates the 'will', where to the state (nation-state) is heading toward in the present and future, thereby also defining, organizing as well as administering the general conditions of the state. Therefore, this has a political and legal capital (for example: ideas, laws, plans, politicians, etc.).

***Figure 6**. Open Innovation model to be integrated into the framework*

4. Conclusions

Although large-scale CCS/CCUS is an essential technology to attain the 1.5°C target stipulated in Glasgow Climate Pact, installation and promotion have not progressed globally. The reason for this can be identified by four main issues at the stage of installation/promotion of CCS/CCUS. In particular, the following two issues are thought to be very important for introducing and disseminating CCS/CCUS in Japan. The first is to gain market dominance of CCS/CCUS in GHG mitigation technologies by developing the appropriate

mix of policy measures based on the special issues of CCS, such as large- scale commercial CCS/CCUS deployment, long lead time, capital intensification, long-term management after site closure, and public acceptance. Secondly, to achieve scale-up of CCS/CCUS, the promotion of CCS/CCUS technologies is clearly described in upper level plans such as the Basic Energy Plan, and a proper policy mix is formulated for the CCS/CCUS installation stage from a long-term perspective based on the plan. If these issues can be cleared, CCS technologies will become feasible by obtaining market dominance and we will avoid the long-term potential risks of stored CO_2.

In order to actualize a social and economic system that promotes CCS/CCUS development reliably, the most appropriate legal framework and policy mix should be established considering the technological characteristics and social aspects of CCS/CCUS. By implementing regulatory impact assessment that can quantitatively evaluate the effectiveness and efficiency of these policy instruments and/or regal framework (project costs, administrative costs, social impacts, and so on), it will be possible to find a more appropriate policy mix and regulatory framework for CCS/CCUS. Moreover, by publishing this evaluation result to the public and hearing public opinions, it is expected that it will be possible to fulfill public accountability and gain public acceptance of CCS/CCUS technologies.

Reasonable policy instruments should be selected considering their economic and social aspects to implement policy strategies for CCS/CCUS and realize the CCS/CCUS scenario for achieving the long- term GHG reduction target. Also, the proposed legal frameworks and policy instruments for identifying the most appropriate policy strategies for long-term CCS/CCUS development should be assessed numerically. Therefore, it should be necessary to develop a regulatory impact assessment framework model that integrates the cost-benefit analysis of CCS/CCUS development with social aspects as well as the economic evaluation shown in 3.2.

In this paper it find also that the implementation of thought and action in sustainability will have a positive impact on the society as a whole. The new quality management for more sustainability lies therefore in the creation of new knowledge, know-how, and innovation in balance with nature. One chief objective of this open innovation is to enhance value in society through the resource of knowledge. Knowledge is the key to and for more sustainability and to a new quality of life. Today, knowledge is the most fundamental resource. Nevertheless, whether a state (nation-state or beyond-nation-state) is leading in different fields in the future, will be primarily, if not even solely, be decided by its potential to develop new knowledge, know-how and innovation in balance with nature. However, the improved exchange of knowledge and the striving for knowledge, new know-how, and innovations through the model can be, or at least, offer a solution for the challenges of sustainable development under the aspect of global warming in the twenty-first century.

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Lessons for International Aid from Indigenous Women's Rights Activism in Inle Lake, Myanmar

Jonathan Liljeblad[1], Ama Doe 1[2], Ama Doe 2[3], Ama Doe 3[4], Ama Doe 4[5]

[1]*Associate Professor, Australian National University, jonathan.liljeblad@anu.edu.au*
[2]*Pseudonym to protect identity, Faculty, Taunggyi University, e-mail withheld*
[3]*Pseudonym to protect identity, Faculty, Taunggyi University, e-mail withheld*
[4]*Pseudonym to protect identity, Faculty, Taunggyi University, e-mail withheld*
[5]*Pseudonym to protect identity, Faculty, Taunggyi University, e-mail withheld*

Abstract

Prior to the February 2021 Myanmar military coup, the Inle Women's Association (pseudonym) worked to advance women's rights among indigenous peoples of Inle Lake, Myanmar. The association advanced its agenda through an intersectional slate of projects that connected issue spaces of indigenous self-determination, gender, sustainability, & development. The association's agenda challenged national and customary legal orders delimiting the powers of indigenous women, and did so while simultaneously refusing international aid. The analysis explores the Inle Women's Association as a case of bottom-up indigenous approaches for self- empowerment, drawing upon field work conducted in 2018-2020 to delineate the motives and actions of the association. From such information, the analysis draws lessons for international aid efforts to promote sustainable development in indigenous communities, particularly for agendas that seek to change status quo legal orders.

Keywords: Burma, Myanmar, Indigenous, Sustainable Development, Gender **[Maximum of five words]**

1. Introduction

In September 2015, the United Nations (UN) General Assembly adopted Resolution A/RES/70/1 on "Transforming Our World: The 2030 Agenda for Sustainable Development" (2030 Agenda) prescribing 17 Sustainable Development Goals (SDGs) for all countries to meet by the year 2030 (UN 2022). The resolution included indigenous peoples in its text, explicitly mentioning indigenous peoples six times in relation to its political declaration and targets for hunger and education (UN 2022; UNGA 2015). The UN accompanied the resolution with statements that asserted the SDGs advanced the interests of indigenous peoples by addressing indigenous concerns over self-determination, development, and inequality (UN 2022; UNPFII 2022). Such efforts indicate sentiments to place indigenous peoples within global sustainable development efforts, not just as a way of furthering the broad economic, social, and environmental components of the 2030 Agenda but also as means of addressing the particular concerns

over the marginal status of indigenous communities (UNPFII 2022).

The association of indigenous peoples with the 2030 Agenda directs attention to the capacities of indigenous communities vis-à-vis sustainable development issues. Specifically, it calls for increased efforts at understanding indigenous cultures as part of advancing the global campaign towards the 2030 Agenda's SDGs. Indigenous peoples, however, should not be construed as simply recipients of international aid programs for the SDGs, since they hold agency in terms of exercising self-determination and functioning with autonomy separate from the larger world (Liljeblad 2022; Hall & Fenelon 2009; Jorgensen 2007; Lenzerini 2006; Niezen 2009; Niezen 2003). The meaning of indigenous agency is potentially wide, with self-determination and autonomy opening the possibility of indigenous activism that challenges international norms and institutions, national-level state power structures, and even local-level customary orders of communities hosting indigenous cultures (Lightfoot 2016; Hall & Fenelon 2009; Niezen 2009; Niezen 2003). As a consequence, aspirations for the inclusion of indigenous peoples in the SDGs incur a need for study of indigenous activism to better understand its significance for global sustainable development efforts.

The present analysis contributes towards such a need through a case study of an indigenous women's organization from Inle Lake, Myanmar. Applying the pseudonym Inle Women's Association (IWA) to protect the identities of its members, the case study explores the activities of the organization to build solidarity among women from different indigenous communities surrounding Inle Lake and mobilize them to advance a range of social causes regarding gender, human rights, and environment. The analysis begins with a statement on methods adopted in response to the risks posed by the position of indigenous women's activism in Myanmar's context. Following the methods section, the analysis turns to a summary of the results from field work identifying the IWA's separation from international, national, and customary indigenous orders, accompanied by a discussion of their subsequent implications for theories regarding indigenous peoples in international sustainable development aid programs. The conclusion finishes with final commentary and directions for further research.

2. Methods

The analysis draws on fieldwork conducted in the Inle Lake region of Shan State, Myanmar during January- June 2020. The fieldwork was an initial stage in a longer term study regarding indigenous women's activism in communities surrounding Inle Lake. Data for the analysis came from a focus group session with the founders of the Inle Women's Association (IWA) and an attendant survey distributed to all the organization's members at the time of study, supplemented with documents from the organization's

internet page, which consisted of a Facebook page. The focus group involved 11 participants held in-person in a secure space isolated from outside surveillance, and served the purpose of clarifying the organization's origins, motivations, and agenda. The survey, which included the focus group participants, was distributed via paper forms to organization members, with instructions that each respondent write their answers during times and places they felt secured privacy and safety, and then return the answers as images with no personal information via individual emails to the researcher. Survey responses were then de-identified and emails were deleted to maintain respondent anonymity. The survey yielded 33 responses out of IWA's slate of 55 members, with data indicating individual member perspectives about identity, membership in the organization, and the IWA's agenda.

It should be noted that the topics of the present study pose highly sensitive issues in Myanmar. The Myanmar state has a problematic record of human rights violations and poor environmental conservation (Liljeblad 2022; Miklian & Barkmeyer 2021; World Bank 2019; UNGA 2020; UNGA 2018; UNGA 2014), creating a domestic political space inimical to activism involving those issues. Further, the Myanmar state has sustained historical efforts at unification assimilating the country's various minorities into a dominant ethnic Bama culture (Cho & Gilbert 2020; Ferguson 2015), driving conflict with multiple ethnic armed organizations (EAOs) seeking various degrees of self-determination (Taylor 2015; Kramer 2010; Smith 2007). Such tensions pose hostile conditions for indigenous movements claiming greater autonomy from the state (Dunford 2019; Morton 2017; Einzenberger 2016). Compounding the aforementioned conditions, during the time of field work the country was attempting a democratic transition away from military rule while struggling with concurrent burdens of underdevelopment, corruption, and reconciliation with the military, all of which posed competing demands for reform efforts (Fink 2014; Ganesan 2013; Callahan 2012). As a result, at the time of field work the topics of indigenous rights, gender rights, or environmental conservation existed in a contested political space, placing activists on such issues in vulnerable positions.

Such vulnerability has been exacerbated by the February 2021 military coup, which replaced an elected civilian government with a military junta and instigated widespread political unrest (Bloomberg 2021; Cuddy 2021; The Guardian 2021a; The Guardian 2021b). The consequences have included increased human rights violations, resumption of internal conflict between the military and the country's ethnic minorities, and acceleration of environmental degradation (Bloomberg 2021; Engineering & Technology 2021; ICG 2021; PRIO 2021; UN News 2021; UNSC 2021). Further, the military junta has applied growing restrictions on the internet, including deployment of surveillance technologies to monitor users in Myanmar (Chandran 2022; OHCHR 2022; Januta & Funakoshi 2021; Walker 2021). Hence, while the data collection for the present analysis occurred before the military coup, the members of the IWA

continue to reside in Myanmar in conditions that have only increased their individual and collective danger.

To mitigate the risks to research subjects, the analysis applies measures to protect the identities and communications of the IWA, not just for the participants in the focus group and survey but also the organization's entire cohort of members. To begin, the IWA itself is a pseudonym for the original name of the organization. In addition, the analysis references documentary materials from the organization's Facebook page but shields the original URL. Further, all focus group documents and survey responses are de-identified, and records of personal information that might allow inference of individuals from the survey responses have been destroyed. Finally, the authors are bound by agreements of confidentiality with the research participants, with the publication and disclosure of data subject to participant review.

It should be noted that the risks extend beyond the research subjects to include the authors. The primary author is a scholar based at the Australian National University outside Myanmar, but the co-authors were all members of the faculty at Taunggyi University near Inle Lake. Collectively, all authors collaborated in the conduct of the focus and survey, and also maintained close relationships with the IWA and its members over the course of field work. As a result, the co-authors hold risk by association with the IWA, with their vulnerability heightened by the post-coup Myanmar military's persecution of university staff it deems contrary to its interests (Jamal 2021; Oxford 2021; Reuters 2021). At the time of writing the present analysis, several of the co-authors have been removed from their positions. To mitigate the reality of dangers presently affecting the co-authors, they are listed using pseudonyms without identifying titles or email addresses. Their identities will be restored at a future date when the risks facing them have decreased.

3. Results and Discussion

The UN efforts to include indigenous peoples within the 2030 Agenda and its SDGs aligns with scholarly indigenous studies literature that calls for greater engagement with diverse indigenous peoples in global sustainable development efforts (see for example Reed et al 2020; Yap & Watene 2019; Magni 2017; Watene & Yap 2015; Corntassel 2008; Loomis 2000). The calls for more inclusion of indigenous voices in sustainable development connect to deliberations over "bottom-up" approaches occurring concurrently in discourses of sustainable development (see for example Asmar et al 2021; Haller et al 2018; Smith 2008; Fraser et al 2006), environment (see for example Eicken et al 2021; Khadka & Vacik 2012; Schreuers 2008), and development aid (see for example Crescenzi & Rodriguez-Pose 2011). Relative to "top-down" models looking to centralized decision-making at global levels, "bottom-up" strategies favor

decentralized power structures that focus on the workings of "local" levels hosting sub-state community actions (see for example Khadka & Vacik 2012; Gomes et al 2010; Fraser 2006). An emphasis on community-based actions is consistent with indigenous peoples movements, which seek a general theme of greater self-determination enabling diverse indigenous groups to advance their own respective local-level interests within national and global hierarchies of authority (Liljeblad 2022; Reed et al 2020; Gilbert & Lennox 2019; Yu 2018).

On a general level, the fieldwork on the IWA aligns with the idea of bottom-up approaches in that the organization's membership was comprised of women from indigenous communities surrounding Inle Lake seeking to address common issues. The focus group, which consisted of the founding members of IWA, described themselves as businesswomen who sought to create an association that promoted women's solidarity and engaged with social issues facing their communities (Focus Group 2020). The focus group description largely aligned with the survey data. All 33 survey respondents were women, and 21 described their profession as being business (Figure 1). In terms of women's solidarity, the founding members asserted a purpose of encouraging networking and friendship among women across Inle Lake communities (Focus Group 2020). The sentiment was shared with the survey respondents, with 22 of them citing opportunities to build relations with other women as the reason for their membership in IWA (Figure 2).

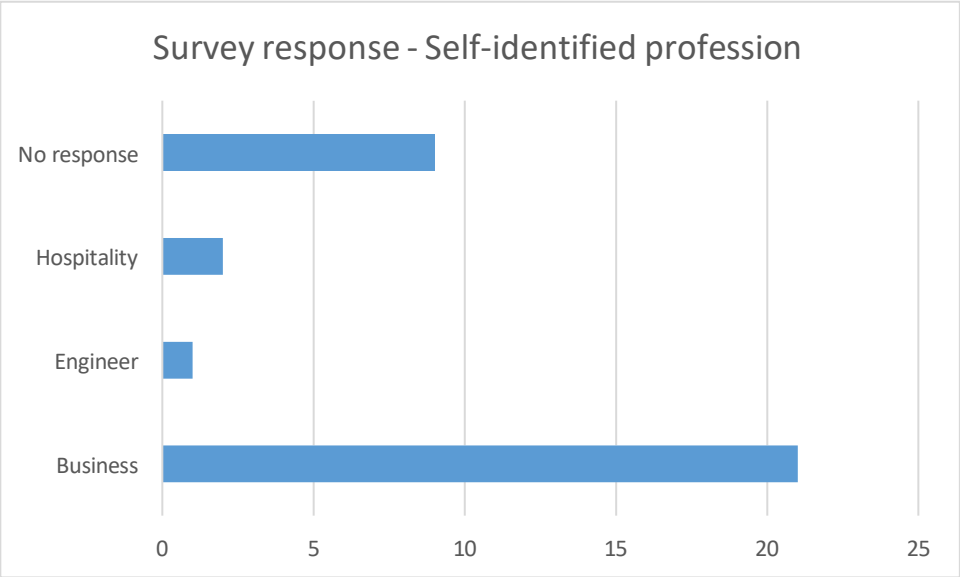

Figure 1: *Professions of survey respondents.*

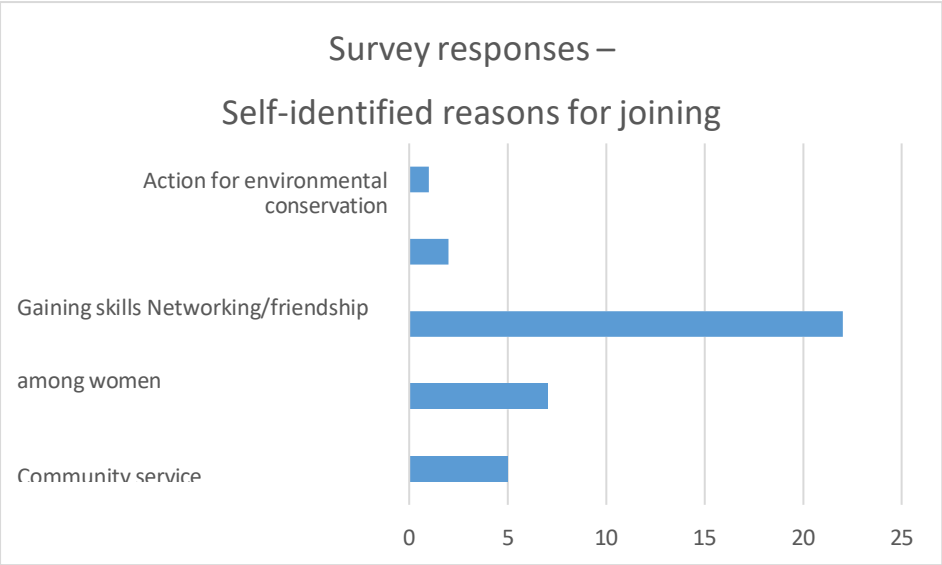

Figure 2: *Reasons for joining IWA.*

With respect to social causes, the focus group and the IWA Facebook page indicated a central organizational goal of advancing women's self-empowerment in Inle Lake communities through capacity-building programs that facilitated income generation, with examples including training for women in sewing and business entrepeneurship (IWA 2021; Focus Group 2020), The goal of self-empowerment, however, also entailed activism beyond the scope of income generation capabilities, with IWA mobilizing women to increase community attention to issues of domestic violence, family planning, and mobile public libraries (IWA 2021; Focus Group 2020). In addition, the IWA worked across a wider slate of issues, organizing its members for action on environmental issues such as waste removal, invasive species, air and water pollution, and organic farming (IWA 2021; Focus Group 2020). The breadth of IWA's agenda matches the concerns of survey respondents. Even as the survey respondents expressed their personal motivation for joining IWA as being female solidarity, only 3 of them cited the status of women as being the over-riding problem for Inle Lake communities (Figure 3). The remainder instead identified the most critical development priorities for the Inle Lake region as being better education, improved health care, or greater environmental conservation (Figure 3).

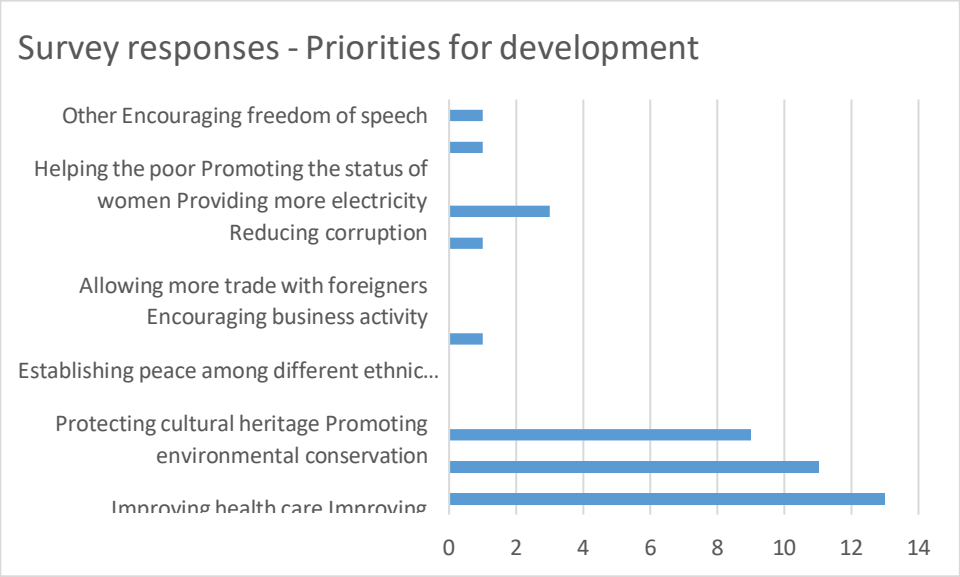

Figure 3: *Priorities for development for Inle Lake area.*

The body of issues concerning the IWA overlap with a number of components in the UN SDGs. Specifically, the IWA's attention to women's income generation, domestic violence, and family planning falls within the scope of the UN SDG Goal 5 on Women and Equality. SDG Goal 5 explicitly calls for equal participation for women in decision-making, reduction of violence against women, ending of child marriages, and assurance of access to reproductive health and reproductive rights (UN SDG 2022). Similarly, the IWA's efforts on waste removal, invasive species, air and water pollution, and organic farming align with both UN SDG Goal 6's aspirations for clean water, effective sanitation, reduction of pollution, and protection of freshwater ecosystems as well as UN SDG Goal 16's targets for the sustainable use of ecosystems and reversal of land degradation.

Neither the Facebook page nor the focus group explicitly declared the IWA as an indigenous peoples organization, but its locus on Inle Lake means that its membership draws from the indigenous communities surrounding the lake. In particular, 28 of the survey respondents identified themselves as belonging wholly or partly from 5 indigenous groups in the Inle Lake area. As a result, the IWA holds an intersectional status as an association with members who were both women and indigenous. The position of the IWA as an indigenous women's organization places it within the literature regarding indigenous peoples in bottom-up sustainable development, with IWA illustrating agency by indigenous women from Inle Lake communities in building their own organization with a central mission, an accompanying suite of agendas across a range of social issues, and slate of activities to implement them. The overlap between the work of the IWA and issue spaces covered by the UN SDG places the organization within the UN's sustainable

development discourses on indigenous peoples (UN 2022; UNGA 2015).

Challenging international, national, and local customary orders

Beyond such general parameters, however, the fieldwork also provided results that poses an intervention in the aforementioned literature on indigenous peoples in bottom-up sustainable development. The intersection of gender and indigeneity in the IWA raises implications for conceptions of indigenous cultures, national treatment of indigenous groups, and international development efforts for indigenous peoples. Specifically, the information gathered from the focus group and surveys, as well as from documents on the organization's Facebook page, raise a number of implications with respect to its position to international agendas, national government, and local customary norms. Each is addressed in the paragraphs below.

First, with respect to international agendas, the work of the IWA reflects notions of gender equity, human rights, and environmental conservation, but the extent to which those notions conform to conceptions held by international discourses is unclear. For example, while gender was a core motivation for the creation of the IWA, the founding members in the focus group nor the organization's Facebook page referenced international sources on gender equity. In addition, they did not describe their approach to the status of women in relation to human rights. Moreover, as much as the IWA's efforts to mobilize women's activism on social causes involved an exercise of free speech, the founding members and the Facebook page do not mention free speech or wider human rights, and only 3 of the survey respondents indicated the right to free speech as a priority (Figure 3). Further, the IWA's slate of activities encompassed environmental conservation and a larger portion of 9 survey respondents marked environmental conservation as the main development priority, but the focus group and Facebook page did not note international sources on environmental issues (Figure 3).

An absence of references to international discourses by a local organization such as the IWA does not, by itself, indicate a disconnect from international norms. However, it does open the potential for local understandings different from international ones. The possibility of such deviation is heightened by the IWA's approach to international aid, with the focus group noting that after the expiration of initial World Bank funds the founding members had decided to operate with no international assistance (Focus Group 2020). The rationale given in the focus group was that the founding members 1) felt international aid programs were not always appropriate for local political difficulties and cultural sensitivities, and 2) wanted to avoid the constraints set by donor conditions and allow more flexibility in formulating their own strategies in dealing with local political and cultural challenges (Focus Group 2020). The decision to avoid international aid demonstrates agency by the IWA through the articulation of its autonomy from international aid agendas. In combination with the absence of references to international sources in its

activities, such autonomy suggests that as much as the IWA may deal with issues that overlap with international discourses on gender equity, human rights, and environment, the organization retains to itself the power to exercise approaches to those issues in ways more expressive of its own preferences.

Second, the desire for a self-controlled agenda places the IWA apposite from national authority in that the organization's efforts seek to advance interests that do not necessarily align with national laws or state interests. Specifically, in seeking women's self-empowerment in the Inle Lake area, the IWA works to build female solidarity across the indigenous communities surrounding Inle Lake. This contrasts with the Myanmar state's treatment of group identities, in which both the 2008 Constitution and the country's citizenship laws insists on a classification system that categorizes the populace into 135 recognized "ethnic nationalities" (Constitution 2008; Citizenship Law 1982). The legal classifications have political consequences, with the Myanmar state using it in nationalization campaigns that in the decades since independence have selectively enfranchised and disenfranchised portions of the country's population (Waller 2020; Cheesman 2017; Morton 2017; Taylor 2015; Taylor 2009). The IWA reflects Inle Lake's complex space of identities, with only 7 survey respondents coming from Bama and Rakhine groups originating outside the Inle Lake area and the remainder identifying themselves, either wholly or as a mixture, as members of the indigenous Intha, Shan, Pa'Oh, Danu, and Karen peoples surrounding the lake (Figure 4). By advancing the status of women in all the communities around Inle Lake, the IWA nurtured a gender-based alliance covering diverse indigenous peoples inhabiting a specific location, and thereby deviated from Myanmar state policies that has historically worked to differentiate them from one another.

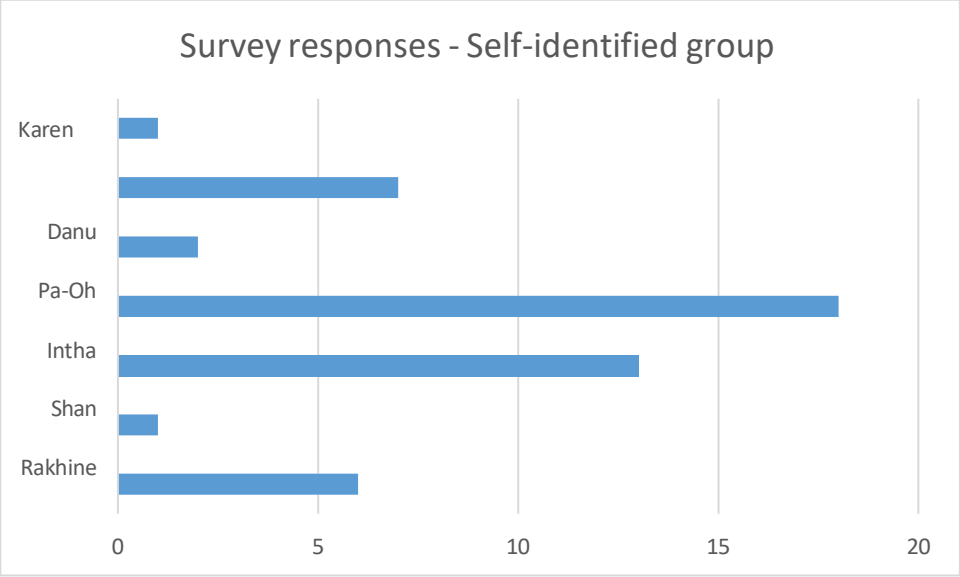

Figure 4: *Group identification.*

Last, in relation to customary norms, the IWA worked to change existing local cultures regarding the roles of women. In particular, the members of the focus group explicitly stated that one of the motivations to

form the IWA was to "dispel the culture that women's lives stop once they have family" (Focus Group 2020). Their motivations included corollary goals of encouraging women to "lift themselves" and "find balance between a family and job" (Focus Group 2020). To fulfil its aspirations, the IWA employed an agenda covering topics as diverse as income-generation, English language, health, and environmental welfare. Such breadth suggests a holistic approach to supporting broad activism by women that counters prevailing community norms confining women to more restricted roles as family care-takers. The IWA's existence in itself also challenges community norms on female solidarity, with the focus group noting that local men "don't like women taking time together" and that they had "not seen before a women's group working together" (Focus Group 2020).

In working to change indigenous cultures, however, the IWA adopts strategies that avoid confrontation in favor of engagement, with the IWA leaders encouraging the organization's members to educate male members of their respective families about the organization's purpose and activities (Focus Group 2020). In addition, the IWA trains members on conflict management to mitigate tensions with male relatives and acquaintances (Focus Group 2020). As a group, the organization also invites participation from men in its activities as a method of promoting persuasive spaces influencing male perceptions (Focus Group 2020). The IWA's strategies reflect a preference to change the indigenous cultures of its members while still operating within their respective indigenous communities. Hence, as much as they seek to retain existing indigenous identities, they do so while working to change the norms regarding women associated with those identities.

Implications for theory

The above findings from fieldwork delineated how the activities of the IWA differed from international, national, and local customary orders. Through identification of the motivations and strategies exercised by the IWA, the findings enrich understanding of the complexities associated with indigenous "bottom-up" approaches in sustainable development. Such complexities present broader implications for global sustainable development programs, particularly with respect to aspirations of aid efforts to promote international principles of sustainable development.

To begin, as a women's organization encompassing multiple indigenous communities, the IWA demonstrates 1) the existence of intersectionality between gender and indigenous identity and 2) the ways it can be expressed by indigenous women in a pluralist space of diverse indigenous peoples. Despite their origins from different indigenous groups, the members of IWA maintain an association directed to addressing common issues regarding the status of women around Inle Lake. Their existence as indigenous

women is not just a coincidence, in that the IWA uses strategies that its members deem consistent with their own cultures, which indicates their desires to maintain activism adhering to dual identities involving both gender and indigeneity.

Next, such activism illustrates the cultural dynamics of indigenous communities, with identity discourses sustaining cultural flux. While the members of the IWA try to retain consistency with their respective cultures, their agenda simultaneously advances programs for women's self-empowerment that challenge the status quo gender norms of those cultures. Moreover, in exercising self-empowerment, the IWA also employs a broad slate of activities connecting issues of gender, human rights, and environment that effectively work to transform the larger Inle Lake context hosting such cultures. The efforts of the IWA to promote the aforementioned change through strategies of engagement with male relative and acquaintances, when viewed with their concurrent avoidance of international aid, suggests an orientation for discourse specific to the space of Inle Lake's communities. As a result, for the IWA, self-empowerment by indigenous women means fomenting change through allied activism in dynamic discourses internal to their respective indigenous cultures.

Further, the autonomy of the IWA vis-à-vis international, national, and local customary orders raises issues for international aid programs. Specifically, the capacities of the IWA to form and implement its own agenda on norms involving gender, human rights, and environment creates an overlap with international aid efforts centered on those same issues. For agents of "bottom-up" international aid, the overlap creates uncertainties on how to approach such local activism, particularly when the IWA deliberately eschews international aid: observing IWA autonomy threatens to foster concurrent agendas that may either align or compete with each other, but seeking engagement with the IWA means contradicting their aspirations for self-control and consistency with local cultures. Compounding such a conundrum is the relationship between the IWA and the indigenous cultures of its members, which renders the cultural discourses of Inle Lake indigenous communities as dynamic, internally pluralist spaces of diverse interests. The absence of monolithic identity or uniform sensibilities means that international aid actors seeking to operate in Inle Lake face uncertainties regarding 1) who to engage as an appropriate representative of the area's various communities and 2) what consequences may arise for cultural coherence of a given indigenous community in deciding who serves as its representatives. While principles of self-determination would point to a strategy of allowing the members of an indigenous group to determine its own representation, it leaves the IWA with a dilemma of either subsuming itself within indigenous group discourses and thereby fracturing its solidarity, or insisting on a separate voice and thereby exacerbating division within multiple indigenous groups.

Finally, the complexities raised by the case of the IWA aids understanding of the linkage of multiple issues, with the IWA serving to illustrate how separate issues can be joined at a local level. In its efforts to promote

self- empowerment of women in indigenous communities, the IWA asserts an agenda covering a range of gender, human rights, and environmental concerns promoted through a broad slate of activities encompassing economic, social, and environmental projects. In effect, the IWA serves to open roles for indigenous women into issue spaces that were otherwise denied to them by their respective status quo cultures. The larger subsequent implication is that the IWA demonstrates that activism by a single organization for a single topic has corollary ramifications for other issues. For international aid programs, the case of the IWA clarifies how disparate issues can be interconnected, suggesting a need for more holistic aid agendas encompassing a wider scope of concerns. While global sustainable development discourses such as those held by the UN cover an array of diverse topics, the findings regarding the IWA point to similar reach of diversity in local-level discourses of indigenous communities. As a result, sustainable development aid efforts, particularly those seeking "bottom-up" indigenous approaches, must extend their diligence to consider the holistic cross-issue complexities not just within global aid agendas but also by various actors within local indigenous communities.

4. Conclusions

The above analysis provides several directions for future research. First, the IWA aversion to international aid and the absence of its reference to international sources points to its desire for autonomy, which raises a consequent potential for deviation from international norms, but it does not confirm the existence of such deviation. It is possible that the autonomous discourses of IWA members may lead the organization into a coincidence with international norms. In particular, to the degree that IWA activities overlap with issue spaces encompassed by global discourses on gender, human rights, and environment, it is conceivable that the organization could converge with international norms held within those discourses. Additional research would help to verify such possibilities, with methods focused on the discernment of subjectivities offering opportunities to explore 1) the extent to which the understandings of IWA members align or deviate from international norms, and 2) the sources—international or otherwise—that inform the understanding of IWA members in their advocacy.

Second, the IWA's position within Myanmar's national identity politics raises questions as to how the IWA negotiates its existence within the state's power structure. Specifically, its efforts to mobilize indigenous women for activism across a broad range of social issues elevates the IWA as a political and legal actor. To the extent that its activism seeks to change the status quo regarding gender, human rights, or environment, they threaten to challenge status quo interests. The reality of such prospects was heightened by the February 2021 Myanmar military coup, which spurred popular protests that were accompanied by the resumption of conflicts between the Myanmar military and various EAOs and the

acceleration of extractive natural resource industries by the military junta to finance its operations (Bloomberg 2021; Engineering & Technology 2021; ICG 2021; PRIO 2021; UN News 2021; UNSC 2021). Such conditions limit the political and legal space for the IWA's activism. As a result, there is value in further exploration of the IWA's methods to maintain space for itself vis-à-vis the power structure posed by Myanmar's current political and legal conditions.

Third, the strategies of the IWA members to change the cultural norms of indigenous communities while retaining the sensibilities of their indigenous identities points to the nature of cultural discourses internal to individual indigenous groups. For IWA members, their work in Inle Lake communities suggest cultures hosting dynamic struggles to change perspectives on women. The intersection of gender and indigeneity raise the possibility of additional points of struggle, further suggesting the existence of greater complexity in the form of additional intersections with interests beyond gender reflecting a larger range of perspectives regarding cultural norms. Additional study into the Inle Lake indigenous communities would clarify the details of the aforementioned complexities, and enrich the findings of the present analysis with greater nuance regarding the position of the IWA relative to other voices in the indigenous cultural discourses of Inle Lake.

In conclusion, the preceding sections further the scholarship on bottom-up approaches to sustainable development involving indigenous people, with the above analysis of the IWA presenting a case of indigenous agency in issue spaces that overlap with global discourses of sustainable development (MacNeill 2020; Yap & Watene 2019). In so doing, the IWA demonstrates a form of indigenous self-determination through the efforts of indigenous women to operate autonomously from international, national, and customary orders. In particular, the IWA highlights the capacities of indigenous women from Inle Lake to build a gender-based alliance across disparate indigenous groups, formulate their own common agendas, and implement strategies to advance those agendas within their respective communities. Such details inform the efforts of development aid programs, in the sense that understanding of cases like the IWA enable greater nuance in the deployment of context-sensitive international aid policies, furthering the aspirations of proponents calling for improved connections between bottom-up and top-down development approaches (Eicken et al 2021; Crescenzi & Rodriguez-Pose 2011).

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Log-off Right and Digital Technologies in Worker's Life. A«New» Fundamental Right?

Alessandra Buonasera[1]

[1] *Phd student at University of Messina in "Economics, management and statistics" course, alebuonasera@unime.it*

Abstract

The 17 Sustainable Development Goals represent common goals on a set of issues important for the planet. Goal 8 aims to create a world of work safe and secure for each worker.

Target 8.8 sets the goal of «protecting the right to work and promoting a healthy and safe working environment for all workers» in the sign to ensure the protection of the psycho-physical wellbeing of the person. The intention - linked to log-off right - is with the clear aim of «Achieving higher standards of economic productivity through diversification, technological progress and innovation, also with particular attention to high added value and labour-intensive sectors» as recalled in target 8.2.

The implementation of smart-working and generally, the use of technological devices in the performance of work is linked to goal 12 of the Agenda: «Ensuring sustainable patterns of production and consumption» through the promotion of resource and energy efficiency so as to «Progressively improve global efficiency in consumption and resource production by 2030 and attempt to decouple economic growth from environmental degradation, in accordance with the Ten-Year Framework of Sustainable Production and Consumption Programmes, with the most developed countries at the forefront» (target 8.4). This line is also linked to the Net Zero for Finance Programme signed by major central banks and financial institutions of the world for a financial trading market with zero emissions within 2050.

Nowadays we attend to a development – without regulation – of the use of technological devices in the life of the worker. The boundary line between rest time and work time is every day thinner, especially for the smart-working case.

We need a regulation about «log-off right» as a fundamental right. Actually, there isn't a complete regulation in the national or in the EU context about the log-off right but only a Recommendation of the European parliament signed on 21 January 2021 within the aim to describe the log-off right as a fundamental right. It is not possible to conduct a deep reflection without discussing with trade union as synthesis democratically elected spokesman of workers' tensions. Therefore, it seems necessary to arrive at a participatory conceptual abstraction of the right to disconnect in such a way that it is useful beyond the boundaries of the public or private.

Empirically important to weight the impact of regulation is the case model of Bank of Italy, that changed its standards of working into a hybrid model in presence and in remote together.

The scientific method of study, with the survey of the sources and of the most relevant jurisprudence and doctrine, is connected to an empirical comparison of the European sources to be compared with the national one of Italy.

We need a useful solution in the sign of SDGs, then the belief is: the protection of a fundamental right of the worker, of the human person and of the citizen must be seen as a barrier to the inevitable flooding of labour technology and as measure of his own identity and culture.

Keywords: Right to disconnect, Fundamental right, Hybrid work, Bank of Italy, Sustainable Development Goals.

1. Introduction: log-off right, basic thematic framework

Today's debate on emerging work models calls for reflection on the ever-changing boundary between worker life and work time.

About that, the *Sustainable Development Goals,* SDGs, represent common goals on a set of important issues for humanity for which «protecting the right to work and promoting a healthy and safe working environment for all workers», according to the Target 8.8 letter, is pivotal.

Th growing presence in our life of technological devices needs to rethink on improving «global efficiency in consumption and resource production by 2030 and attempt to decouple economic growth from environmental degradation, in accordance with the Ten-Year Framework of Sustainable Production and Consumption Programmes, with the most developed countries at the forefront» (target 8.4); according to the 12 goal of Agenda proposing «sustainable patterns of production and consumption» a change is crucial for the proceeding of human life.

In national context, although the nearby epidemiological contingencies have imposed a rethinking of the 'work-system', necessarily reactive and ductile in the face of the growing needs of a world that has suffered a setback, the emergency experience has taught us how much technology is capable of going beyond the classical tools of the ordinary, providing answers to which it is urgent to find a physiological foundation in those cornerstones that are embodied, even before Article 36 of the Constitutional Charter, in Article 1 itself, the root of Italian Republic.

In a forerunner of the turn of the century (Ray, 2002), the right to disconnect was outlined as a true new

generation right and, specifically, as '*droit à la vie priveé du XXI siècle*' in a reality where '*the divide between leisure time and work has vanished so that every aspect of life drives the digital economy,* Scholz (2012).

The '*always on culture'* raises questions about the construction of a modern welfare where technical disconnection is only a concrete projection of a real *'intellectual disconnection'*, Ray (2002), from work.

It is now clear, in fact, that *online is* transversally part of everyone's life and finds living emphasis in the possibility that the employee is always reachable, with obvious tensions in terms of protecting the safety and health of the worker.

This situation is, in fact, the direct impact of a technological evolution that, while advancing in stages, has not found an adequate organisational framework, slipping into fluid models, increasingly oriented towards objectives and projects, indifferent to the problems of *overworking*, hyper-connection, and a *time porosity that* transcends private and professional time (Dagnino, 2017).

2. The reference's current regulatory system: between act and power

In the framework described, labour law reflection can only start from the normative letter, before questioning the legal nature of the case.

In a comparative approach, the first legislative regulation appears in the French legal system in 2016: it is Article 55 of the *Loi Travail*[1] that provides the modalities for the implementation of a full exercise of the right to disconnect in the hands of social parties, delegating to them, in compliance with the principle of subsidiarity, the identification of compatible solutions with work's organisation.

The transalpine model sees negotiation as the link that, more than others, would be able to answer to different needs emerging in different production sectors, emphasising, moreover, the importance not only of the transversal and participatory involvement of all employees, but also of '*actions de formation et de sensibilisation à un usage raisonnable*' of digital tools.

[1] Art.55, C.7, Loi N° 2016-1088, *Du 8 Août 2016 Relative Au Travail, À La Modernisation Du Dialogue Social Et À La Sécurisation Des Parcours Professionnels*

In national context, the first provision on the right to disconnect is provided within Article 19, c. 1, of Law 81/2017, the final segment of the *Jobs Act* reform, and therefore - in the context of the law on smart working- in a reconstruction of subordinate work characterised by the use of technological devices. Both the French and Italian sources highlight two critical issues related to the focus of the institution:

- the necessary protection of the worker's health;
- the problematic distinction between working time and personal lifetime.

The risks linked to the absence of a sustainable work-life balance are connected both to the physical sphere - e.g., regarding the provision of adequate preventive measures in decentralised workplaces
- and to the psychological sphere (Genin, 2016) - ex. *burnout*, technostress, technological dependency
- and find in the mobile temporal boundary between private and professional life the breaking of working time protections in the absence, among other things, of remuneration.

The importance of the issue of the right to disconnect arises, in fact, for every mode of work, and not only for smart working, and it is here that the debate on its relevance takes on a definitional scope.

The question has been raised as to the conceptual autonomy of the right to disconnect from, for example, the right to rest recognised by national and European legislation.

Both the French and the Italian legislature configure the right to disconnect as a subjective right that requires the employer to prepare organisational measures to be put in place in a subsidiary perspective that identifies the agreement as its regulatory source, overcoming the logic of prohibition and placing training activities at the centre (Dagnino, 2017).

The education of the executive, managerial and operational area to a management of spatial- temporal deconstruction must aim at avoiding a 'spill-over' not only of work into private life, but also, of private into working time. But this is not enough.

The right to disconnect is a lens for deeper reflection on working time, beyond Article 7 of Legislative Decree 66/2003[2]. Identifying the lines that clearly define disconnection has heuristic scope for tracing rest time as "free from the constraint of production/subordination", Bavaro (2009).

[2] Art. 7, Legislative Decree 66/2003.

The European Parliament is aware of this and, in its Resolution of 21 January 2021, with recommendations to the Commission on the right to disconnect, 2019/2181 (INL), promoted its protection as a fundamental right, marking the way for the writing of a long-awaited Directive.

What is needed is a clear legislative regulation that marks out the basic pillars of an architecture of protections to which individual bargaining acts as a superstructure. The emergency context led to the affirmation of the right to disconnect of employees employed in the public sector in Article 2, c. 1-ter, of Law Decree 30/2021, now converted into Law 61/2021, albeit in the wake of Article 19 of Law 81/2017. The area of reference is, once again, smart working.

In addition to being characterised by a physiological spatial and organisational flexibility, the modality under consideration is characterised by an hourly flexibility allowed in compliance with the daily and weekly maximum limits deriving from the law and collective bargaining[3].

The area of risk referable to this form of work is realised not only in the commingling of private and professional life due to the possibility of working remotely, but also in the hypothesis that formally consensual decisions are, in essence, taken unilaterally by the employer; it is no coincidence, therefore, that the protection of the right to disconnect arises precisely with reference to smart working.

It should be noted that Article 19 of Law 81/2017 configures this right as reversing the technical-organisational modalities for the performance of the service. The emphasis on the organisational profile qualifies a positive content of smart working with regard, not so much to its provision, but to aspects concerning rest time and disconnection, without which it would be impossible to verify compliance with the maximum limits of the working day according to c.1 of Art. 18 of the same act.

Even the possible 'conduct outside' the company premises, which is disciplinarily relevant under c.2 of Art. 21, presupposes the drawing of the minimum requirements that are inseparable from the positivisation of the right to disconnect (Mainardi, 2018).

Although the identification of this right passes through the hourly measurement of work performed by digital means and the existence of the connection, as a period of connection with the employer's area, there is - at present - no legislative delimitation of its extension (Preteroti, 2021).

Interesting, in this key, is the configuration of the relationship between rest time and disconnection.

[3] Art. 18, L. 81/2017.

While it is true that the effective enjoyment of rest time, for the recovery of the worker's psycho-physical energies, is linked to the concrete respect of disconnection, in the hypothesis of a smart working, the reconciliation of life-work times characterised by the flexibility of this organisational model, would impose respect for consecutive rest, without taking into account the needs underlying the conformation of the same contractual hypothesis and without considering that the right to disconnect would lead to an absolute prohibition of worker contact outside all periods beyond working hours.

Such a conception goes beyond a reading of rest aimed at the employee's psycho-physical recovery and adheres to a dimension of the employee's free time as a right in its own right (Santucci, 2011).

On closer view, the identification of rest periods delimits, in a negative way, the area of 'contactability' within which it is possible to request work performance.

In the case of smart working in public sector, the employee - normally paid on an hourly basis - may not be subjected to variations with respect to the service to be rendered in attendance, in compliance with the principles of equal basic economic treatment with equal classification (Articles 2 and 45 of Legislative Decree No. 165/2001) and of non-regression of the economic- normative treatment of the smart worker.

But the time of disconnection appears, indeed, wider than those of rest, and perhaps, identifiable with those of non-work.

It's enough to think of executives and middle managers' case, for whom the limits on maximum working days or rest periods do not apply, though in compliance with the employee's health and the canon of reasonableness[4], the obligation to cooperate pursuant to Article 2104 of the Civil Code, or the specific requirements covered by collective and individual bargaining on 'contact time slots' where precise time constraints are left to the employee's choice.

Although part of the jurisprudence[5] is traditionally inclined to configure the indemnification of non-

[4] Cass. Civ. 5 August 2020, No. 16711.

[5] Court of Justice. EU, Sec. V, 21 February 2018, *Matzak*, C-517 E 518/2015, In *Dir. Rel. Ind.*, 2018, 959, Note by Moscaritolo and in *Arg. Dir. Lav.,* 2018, 4-5, 1163 ff. for which: '*a period of readiness on call, while not requiring the worker to remain at his place of work, must also be classified, in its entirety, as working time, within the meaning of Directive 2003/88, if it affects, according to the constraints imposed on the worker, the possibilitỳ of devoting himself to his personal and social interests, unlike in the case where the worker is merely required to be available to allow the employer to contact him*'.

working time while on call-time, it is certainly not desirable to extend this indemnity to an expansion

of the connection that, in any case, could never overstep the worker's rest time.

As mentioned, Law 81/2017 provides for the application of the provisions on smart working to relations with the public sector, insofar as they are compatible.

Directive No. 3 of 2017 of the President of the Council of Ministers - in the ordinary pre-emergency discipline - allows the activation of smart working by means of an agreement between the parties, through an authorisation or adherence of the worker to a programme predefined by the employer, regulating the organisational aspects, those pertaining to work management, *performance* evaluation and trade union relations.

The provision proposes, as a typical model, the operation by means of the P.O.L.A. (Piano Operativo Lavoro Agile)[6] through which the P.S. must adopt an internal regulation for the definition of the essential aspects relating to the organisation, planning, implementation, and development of smart working and in which, in particular, the concrete operation of the right to disconnect cannot fail to find an adequate regulation.

Although following the development of an articulated evolution of the emergent discipline, smart working is now recognised as "one of the ordinary modes of performance" and applied, primarily, through collective bargaining in compliance with the precepts set out in L.81/2017, and subsidiarily, unilaterally by the P.S. through simplified measures that disregard the individual agreements set out in Articles 18 et seq. of the same L.81/2017[7].

It is clear that such a conformation lends itself to a deficit in the protection of the right to disconnect that needs careful definition that cannot be reconciled with a provisional regulation of the matter.

The impact of the new provision of L.61/2021 is still emergency.

The law, entitled 'Conversion into law, with amendments, of Decree-Law No 30 of 13 March 2021 on urgent measures to tackle the spread of COVID-19 and support measures for workers with minor children in distance learning or quarantine', converts -with amendments- Decree-Law No 30 of 13

[6] Art. 263, Paragraph 4-Bis, Letter A), Decree-Law No. 34/2020, Introduced by Conversion Law No. 77/2020.

[7] In the same vein, the Ministerial Decree of 19 October 2020, extended until 30 April 2021 by the Ministerial Decree of 20 January 2021, recognises that access to smart working does not require the individual agreement referred to in Article 19 of Law No. 81/2017.

March 2021 on 'Urgent measures to tackle the spread of COVID-19 and support measures for workers with minor children in distance learning or quarantine'.

The rule, concerning -among other things- access to the so-called 'agile' working modalities, is addressed to both the private and public sectors, providing for the recognition of the right to disconnect even in the face of unilateral activation by the employer.

This provision, although not expressly referring to public sector, also covers 'public employment' and emphasises in this regard that there is a peculiar relationship of subsidiarity between law and collective bargaining, specifying that, for the right to disconnect, it is the national collective bargaining that prevails over the legal regulation.

According to Article 2, paragraph 1-ter, in fact:

> "Without prejudice, for the civil service, to the discipline of smart working institutes established by national collective agreements, the worker who performs his activity in agile mode is recognised the right to disconnect from technological instruments and IT platforms, in compliance with any agreements signed by the parties and without prejudice to any agreed stand-by periods. The exercise of the right to disconnect, which is necessary to protect the worker's rest time and health, may not have repercussions on the employment relationship or remuneration".

The affirmation of the worker's right to disconnect, whether public or private, even in a pandemic emergency, in the case of unilateral activation by the employer, appears important, as does the provision that the activation of smart working may not lead to repercussions on the employment relationship or on remuneration, as well as the recognition of the right to disconnect as “necessary to protect the worker's rest time and health”, Casillo (2018).

The latter assertion certainly does not imply a delimitation of the right to disconnect within the times and limits of the right to rest but, on the contrary, reinforces its scope by describing it as "essential to guarantee its enjoyment”, Preteroti (2021).

Moreover, the emergency regulation, without prejudice to 'any agreements signed by the parties', aims at guaranteeing from unfortunate elisions the most intense protections already achieved through individual bargaining, which is the ordinary mode of regulation in a situation of normality.

Ultimately, Paragraph 1-ter, of Article 2, of Decree No. 30/2021[8] , now converted in law, recognises the preeminent function of collective bargaining while admitting the provision of simplified unilateral employer activation - only - until the regulation of smart working is defined by collective agreements; in this regard, it is worth recalling that Law 81/2017, in the ordinary discipline, refers to collective bargaining in a parametric function (Art. 18 and 20) but does not stand as a subsidiary source with regard to the regulation of the right to disconnect. Moreover, even the possibility that individual agreements are 'preserved' is not in line with the concerted logic underlying the ordinary legislative framework.

It is, therefore, clear that the configuration of emergency legislation is ill-suited to the need to provide adequate structural solutions that are in line with the furrow traced by the previous legislation[9].

3. Application examples: the leading case of the Bank of Italy

One route is currently workable, that of collective bargaining. In the regulation of the right to disconnect, also regarding the letter of the text of the Directive No. 3/2017, the approaches reached in the national and supplementary collective labour agreements, as well as in the decentralized agreements, remain central, and this with particular regard to the rights and obligations pertaining to the employment relationship.

Among the first CCNLs, of interest is the one for the Education and Research sector, signed on 19 April 2018, which devolves to integrative bargaining the regulation of the use of technological equipment beyond working hours "for the purpose of a better reconciliation of work and family life", Zoppoli and Monda (2020) or, in other respects, the recent 'Protocol on safety and smart working in the Ministry of Infrastructure and Transport Continued in Central Functions', of 4 November 2020, which recognises, for the first time, not only the right to disconnect in a 'vertical' key, vis-à-vis the employee's hierarchical superiors, but also the 'horizontal' one, regarding relations with colleagues, also providing for time and daily operating bands.

Also very recent is the agreement for public work innovation and social cohesion, signed on 10 March 2021, in which the main objective appears to be to ensure - beyond emergency legislation – an improvement in public services through a smart working discipline that always guarantees a correct

[8] Decree-Law 30/2021, Art.2, C. 1-Ter.

[9] This also follows from a reading of Circ. Min. Lav. Pol. Soc. 2 August 2021, No. 9.

balance between productivity and respect for the worker's personal and professional time.

It seems appropriate to refer to the draft renewal of the CCNL relating to the central functions sector staff for the three-year period 2019-2021, in relation to Title V on 'agile work' for the interesting emphasis on the right to disconnect.

The worker's day would be divided into three bands: a first, dedicated to prompt operability in the performance of assigned tasks; a second reserved for 'contact', by telephone or email, without a provision for immediate operability; a third, 'disconnection' in which the worker is neither contactable nor required to perform (Preteroti, 2021).

In the panorama of the regulation of the right to disconnect in public sector, however, a real *leading case stands* out as a virtuous application example: the experience of the Bank of Italy.

In May 2020, the Bank of Italy launched a project destined to survive the emergency phase, bringing about an organisational and cultural change that is set to become, by now, structural.

In a discussion with the staff, the Bank experimented with a hybrid organisational module in which remote work coexists and is routinely integrated with face-to-face work.

Listening projects were initiated, including, among others, a survey proposed to employees, an analysis of operational and health and safety risks in remote working, and a focus on processes that cannot be worked remotely, which led to a new model, balanced by quotas, "adaptable, resilient and sustainable, goal- and result-oriented, people-focused, inclusive[10]" ", which provides - for all 6,500 employees - one day of *smart working* per week.

Remote working has not only ensured an enormous environmental impact - with a reduction in emissions of 1,414 tonnes of CO2 - by limiting city congestion and energy consumption, but also the saving of an average of 75 minutes per day for each worker's commute, as well as advantages in terms of reconciling personal life and work (Graziola, 2021).

The model proposed on a voluntary basis makes it possible to develop relationships of mutual trust between staff, reward *performance*, and remodel spaces with a view to *co-working*, while considering emerging risks.

[10] See Bank of Italy Editorial, 2021, Preface.

The adopted system was analysed from the perspective of six evaluation parameters[11] : effectiveness, efficiency, social and information linkage, people's health and safety, social responsibility, and operational risk control.

The first aspect, relating to effectiveness, concerned the analysis of the quality and timeliness of institutional functions, together with support activities.

Effectiveness can be said to be unchanged in terms of quality and timeliness for most of the bank's functions. The activities that could be worked well remotely turned out to be those of study and analysis or the standardised ones that benefited from greater flexibility in working hours. Those that benefited the least were the operational functions that were less remotely operable. The need emerged to build a control model adaptable to the sub-systems of Bankitalia's reality.

Efficiency, as the ratio of inputs to outputs and costs of goods and services, can be considered unchanged for most activities, improved for those that do not require frequent information exchange. Production has proven to be responsive to fluctuations in demand. Less tele-workable functions have declined, such as logistics or banknote production.

Sociality has emerged as one of the critical factors of remote work due to the reduction of information exchange and the risks of marginalisation, as well as the integration abilities of new hires, with repercussions on team cohesion and the composition of human capital.

In terms of occupational health and safety, risks related to psychosocial factors emerge.

Social responsibility relates to the reconciliation of personal and professional life, with benefits as a predominant component, including the possibility of inclusion of people with disabilities. Important benefits emerge in relation to the environmental footprint.

Regarding the control of operational risks and *business continuity,* although the experience during the emergency phase was overall positive, there is a need for a remodelling of processes that considers the risk factors emerging from working remotely.

Ultimately, what is needed is a design built around the different component structures of the Bank, which sets up different *control management* tools for this purpose.

[11] See Bank of Italy Editorial, 2021, 14.

With the agreement signed on 22 July 2021, the Bank of Italy, and the union unity table[12] designed a standard flexible model that provides for a package of smart working days for each employee, which can be used - even consecutively - for up to 10-12 days for a total of 100-120 days per year.

The lengthy negotiations led to an arrangement that - effective from January 2022 - configured an extended, neutral, voluntary, and inclusive form of smart working.

It is in this context that the right to disconnect is clearly stated:

To facilitate the reconciliation of life and work times and to ensure respect for private space, employees are not required, outside normal working hours and, in any case, once they have completed their daily work, to read e-mail and, more generally, to reply to company devices, except in situations of particular importance and urgency, including those related to the positions held.

The content is for the first time positivised in the provision of the absence of an obligation - outside normal operating hours and in any case after completing daily performance - 'to read e-mail and more generally respond to company devices'.

The provision is without prejudice to special situations of relevance and urgency also related to the positions held, but nevertheless marks a conceptual separation of the right from the regulation of working time, to which a different chapter is devoted.

Not least, the provision is teleologically precepted to facilitate the reconciliation of life and work times and to ensure respect for private space'.

Working time provisions assume conceptual autonomy:

> "The duration of the remote daily working time is equal to the theoretical average daily working time with respect to the weekly working time, without prejudice to existing flexible working arrangements. The direct supervisor identifies work activities, including training activities, to be performed remotely consistent with the standard daily schedule.
> The remote service is provided for full days and is normally within the Structures' normal operating hours (7:30 a.m. to 6:45 p.m.); however, the employee may agree with the line manager on a different location, partly outside normal operating hours, provided that sufficient time slots are provided, within the 7:30 a.m. to 6:45 p.m. time frame, during which the employee ensures contactability.
>
> Remote work does not entail overtime; except in cases where overtime is expressly requested by the Heads of the Services/Branches, and therefore recognised, outside the Structures' normal working hours.
>
> Remote work is compatible with shift work. An electronic meal voucher is recognised for remote working days".

[12] Composed of First, Fisac, Fabi, Sibc, Cida and Sinfub.

The full coincidence between the time range dedicated to work in presence and that remotely performed is affirmed, with the clear inclusion of training activities as an integral part of the content of the service itself. The manager is responsible for selecting the educational offer to be included in the training plan for employees.

The need to provide *smart working* services for the entire duration of the working day is also clearly qualified, and this is supported by its full coincidence with the Bank's operating hours, excluding - in general - excess services and contact hours beyond the ordinary operating hours of the structures, except in expressly agreed cases.

Employees are also guaranteed electronic meal vouchers and shift organisation.

The emphasis in the agreement also falls on health and safety provisions concerning generic and specific risks related to remote work, with the involvement of the Workers' Safety Representatives and the signatory Bank - Trade Union Joint Committee.

"The Administration will provide, on an annual basis, written information on the generic risks and specific risks related to the performance of remote work. Similar information will be provided to the Workers' Safety Representatives. The Administration will prepare training initiatives to sensitise employees on the prevention of health and safety risks at work and on the correct use of work tools".

The agreement then turns its attention to training initiatives as a fundamental moment of education on hybrid work, aimed at spreading a managerial culture of worker empowerment, increasingly oriented towards an effective and conscious construction of the skills of the employee working remotely, also and above all, in relation to the risks of hyper-connection.

"The parties agree on the need to prepare specific training initiatives for personnel to share the principles and operating methods of the new hybrid working model. Particular attention will be paid to the training of Managers, aimed at spreading a managerial culture increasingly oriented to the empowerment of employees and the enhancement of results, attentive to the involvement of employees, also in order to avoid marginalisation phenomena. Further training initiatives will foster the continuous updating of digital skills and the ability to work effectively and consciously from a remote location".

In fact, studies conducted on the subject by *management control* (MC) experts (Malmi and Brown, 2008) reveal a problem linked to organisational control lines defined as 'cultural', i.e., linked to the system of informal behaviour and conditioning determined within the work environment to orient employees to the result (Cäker and Siverbo, 2011).

If smart working brings with it the advantages mentioned, as well as the risk of hyper-connection and

overstepping the worker's private life space, problems related to the feeling of 'isolation', lack of trust, and poor communication are highlighted as critical issues emerging from the empirical experimentation of remote working.

The cultural controls referred to essentially focus on motivational incentives and the creation of a sense of belonging to the work group.

The Bank of Italy, in the agreement reached, also aware of these risk factors linked to the smart working experience, in addition to clearly defining the right to disconnect, recognises the importance of the role played by training in the correct exercise of this right, proposing to guarantee training and educational paths precisely to bridge the gap relating to cultural controls, for example by proposing the correct use of company devices or the development of soft skills on transversal competences.

Moreover, these problems would appear to be surmountable by means of controls that relate not so much to the output of the individual process concerning work performance, but to the overall result achieved in relation to the set objective. This presupposes a remodelling of the employee *performance* appraisal processes.

The example of the Bank of Italy, in short, starts from the necessary involvement of social parties in a transition that, although initiated unilaterally in the emergency phase, has found its natural continuation in a physiologically concerted consensus, mindful of the importance assigned to trade union organisations by the current legislative framework. No provision would have been truly participatory without the fundamental listening of the representatives, whose involvement appears, today more than yesterday on such pervasive issues, absolutely essential, in fact:

"In order to share data on the functioning of the new model and to monitor its application, particularly in the start- up and testing phase outside the emergency context, a mixed Bank - Trade Union Organisations Commission signed these understandings and the subsequent implementation agreements is set up, with the participation of one member from each Trade Union Organisation; the competences and operating procedures will be defined during the implementation of these understandings. The parties agree on the need for a review of the internal regulatory framework on trade union relations and therefore agree to place this issue on the negotiating agenda".

The parties conclude by significantly stating that:

"These understandings represent an important step in the introduction of new working methods; this change requires an evolution in various aspects of the Bank's organisation and management systems. The parties therefore

agree to continue negotiating on time management issues as well as on regulatory and economic institutes that require a consistent adjustment of the employment relationship regulations".

Here, the path undertaken -especially on the right to disconnect- appears to be fully *underway*.

4. Conclusions: prospects of a necessary investigation for an 'increasingly fundamental' right

In the framework described the evolution of the right to disconnect has not yet reached satisfactory landfalls in terms of enforcement, definitional and, before that, theoretical guarantees.

The experiments conducted within public sector, first and foremost the Bank of Italy, have highlighted the centrality of the importance of dialogue with social parties to respond to the different needs emerging from qualitatively and quantitatively different contexts, in need of dynamic but, increasingly, ready solutions.

The prospects for the protection of the psychic, psycho-social and physical integrity of the worker are manifold and do not admit of exceptions as they inevitably mirror the result expected by the employer.

The guarantee of transparent, result-oriented, and productivity-developing working conditions goes through the physiologically related effects of improving the working environment.

What is needed is a nuclear regulation that, as recalled by the EU Resolution of 21 January 2021, places the right to disconnect as a genuine fundamental right, framing its constitutional dignity (Biolchini and Bifano, 2021).

The provision of a source of legislative regulation determines the very possibility of protection of disconnection not only positively, but also negatively, justifying the necessary measures of a preventive and sanctioning nature that also open the way to the possibility of the configuration of a real damage in the event of violations.

The European proposal outlines a right to disconnect that concerns all workers, public and private, regardless of the concrete ways in which they perform their duties, and it is in this sign that labour law reflection should be oriented.

There is a need to configure the right to disconnect across the board, calling into question all possible implications related to the use of digital work tools.

There is an urgent need, especially on the part of the legislator, for a careful examination of the aspects reversing the right to disconnect as a fundamental, new generation right.

Only by means of an in-depth analysis of the abbreviations reached by doctrine and jurisprudence, in national and comparative contexts, is it possible to trace the profile of an emerging right whose projections on the life of every worker are in continuous and current evolution.

The march of the process of change of the three spatio-temporal directions of labour law is clearly unstoppable and risks leading to a deconstruction not so much - and not only - of the physical place, time and referable to work performance, as to a dangerous axiological mixing of the safeguards placed in place to protect the employee's private life.

One above all, however, is the *trait d'union* of a necessary intervention: the indispensable contribution of the social parties as the authentic orientation of any productive reflection on law as it is teleologically devoted to respect for the principles underlying our legal system (Bossotto, 2021).

No heuristic reflection is possible without the fundamental contribution of trade union representatives as the democratically elected synthesis of workers' tensions.

It is here that the sanctions placed to safeguard respect for the right to disconnect, assume a subsidiary and additional scope, since although they must in any case be effective, proportionate and dissuasive, they must find the counterbalance of a clear and precise positive definition of the protected right and constitute, within a general framework of reference, always and in any case the last mission of a generally spontaneous and participatory implementation of the prescriptions rather than imposed, proposed (Merola, 2021).

Heuristic in this sense appears to be the scope of the provision for emergency protection in the above-mentioned January 2021 Resolution, which prescribes the possibility of a genuine 'Right of Appeal':

“Member States shall ensure that workers whose right to disconnect has been infringed have access to a prompt, effective and impartial dispute resolution mechanism and benefit from a right of recourse in the event of infringements of their rights under this Directive (Art. 6)”.

The provision recalls, on a general level, Article 700 c.p.c and, on a special level, the rite of Law No. 92/2012 (Preteroti, 2021).

The distribution of the burden of proof, in the case of dismissal connected with the exercise of the right to disconnect, is also reversed in the intention of Article 5 of the Resolution, falling on the employer in the same way as in the case of equal opportunities.

It is clear, therefore, the depth of the change implied by the requirement of the right to disconnect not only on the substantive level, but also on the properly procedural one.

In the wake of Directive 2019/1152 mentioned in the preamble of the Resolution, the creation of a common minimum threshold of protection about the right to disconnect is expected.

In addition, the abbreviations to which the legislator is called cannot but be oriented towards the perspective of realising Goal 8 of the 2030 Agenda for Sustainable Development, the Programme of Action for People, Planet and Prosperity signed in September 2015 by the governments of the 193 UN member states.

The *Sustainable Development Goals,* SDGs, follow up on the achievements of the *Millennium Development* Goals (MDGs) that preceded them, and represent common goals on a set of important issues for the planet.

The Goal 8 aims to 'stimulate lasting, inclusive and sustainable economic growth, full and productive employment and decent work for all'.

In particular, point 8.8 sets as a goal that of "Protecting the right to work and promoting a healthy and safe working environment for all workers" in the clear sign, therefore, of guaranteeing also the protection of the psycho-physical well-being of the employee, an intent towards which the right to disconnect cannot fail to find adequate recognition, and this, with the clear aim of "Achieving higher standards of economic productivity through diversification, technological progress and innovation, also with particular attention to high added value and labour-intensive sectors", as recalled by the same point 8.2.

The implementation of smart working and, more generally, of the use of technological instrumentation in the performance of work - as highlighted by the Bank of Italy's *green* experience
- does not leave the same Goal 12 of the aforementioned Agenda indifferent: "Ensure sustainable patterns of production and consumption" through the promotion of resource and energy efficiency so as to "Progressively improve, by 2030, global efficiency in resource consumption and production and attempt to decouple economic growth from environmental degradation, in accordance with the Ten-Year Framework of Programmes related to sustainable production and consumption, with the most developed countries in the forefront" (point 8.4).

The intention also brings into system the expected results of the *Net Zero for Finance Programme*, the commitment signed by the world's major Central Banks and Financial Institutions - including the Bank of Italy - for a transition to net zero emissions by 2050.

As stated by the *Net Zero Asset Owner Alliance*: 'Asset owners have a unique role in the global

economy and financial systems: we can drive the development of industry best practices through our investment mandates.

This commitment, however, passes not only through sustainable investments that include a gradual abandonment of the fossil fuel market, but also through the implementation of plans and projects that rethink the labour market in an ambitious perspective of eco-sustainable transition in which the incremental use of technological instrumentation at the service of the worker will - without a doubt - find its place, not so much and not only, for the smart working model.

The realisation of the Objectives and Programmes - which are closely interconnected - cannot disregard a necessary scientific reconstruction of the system of protections for workers operating in the digital age and the indispensable participation of the social partners for whom the right to disconnect is of fundamental importance.

Mindful of the pioneering experience of the Bank of Italy, we cannot think of a definitive digital transition that does not draw lessons from the emergency pandemic event. This contingency has, in fact, forced us to remedy an unprecedented situation, with means whose pitfalls have manifested themselves in such a way that we are now able to recognise them and combat them normatively.

It therefore appears necessary to arrive at a shared conceptual abstraction of the right to disconnect in such a way that it is useful beyond the boundaries of the public or private sector and beyond the concrete modalities of work performance, in the conviction that in the face of the labile boundaries of literal definitions, the concept of protection of a fundamental right of the worker, of the human person, of the citizen, as a measure of his very identity, must be placed as a barrier to an inevitable overstepping of work technology.

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Participatory Democracy, Access to a Fair Decision and the UN's SDG 16

Victor Athayde Silva[1]

Master Student of the National Professional Master's Degree Program in Management and Regulation of Water Resources (PROFÁGUA), at Federal University of Espírito Santo (UFES), 2021-2022, e-mail: athayde.victor@gmail.com.

Abstract

This paper focus on Brazil's Law 9433/1997 that created the National Water Resources Policy, institutionally executed by the National Water Resources Management System (SINGREH in Portuguese), and established a public, but non-state-operated, water management system in the country (through the creation of collegiate bodies with multiple stakeholders' participation). It's important to understand that water is a fundamental human right and, therefore it's important to have multiple levels of participation in the management of this scarce and economically valuable resource. As a limited natural resource, but with several different uses, it has a high potential for conflicts, and, according to the National Water Policy, the collegiate bodies should solve all the conflicts that arise from users within the hydrographic basin. However, it's important to understand if this body would have adequate institutional dimension of state capacity to solve conflicts by using alternative dispute resolution systems and avoid taking cases to the courts. This research aims to analyze a significant national repercussion conflict and the mechanisms that took place in forms of participatory democracy by several institutions that are part of the SINGREH. It is also important to understand nowadays, from the United Nations' Sustainable Development Goals perspective, especially SDG16, the concept of "access to justice" which it doesn't necessarily mean to have access to the Judiciary branch, but, mostly, to receive a definitive solution, a fair decision, in an adequate time. So, considering that a judgment can take many years through the Brazilian Courts, it makes sense that the basin committees have this special power for solving water conflict in a way that it may guarantee access to a fair decision, by pairs, in a satisfactory time. The role of law to achieve a more sustainable water management within a river basin will be the focus of this research.

Keywords: Participatory democracy; Water resources management; Non-judicialization; Alternative conflict resolution methods.

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1. Introduction

Gonschorowsky and Moura (2019) emphasize that life on earth, regardless of the species, relies on the water and this is a finite resource which offer limited access. For the authors, water use conflicts result both 'from geographical use of such resource', and 'from existing water quantity within a specific region', as well as its quality. Even though it is one of the countries with the world´s highest water availability, Brazil faces supply crises, even in the Northern Region, where there is more than eighty per cent of this resource national discharge (Gonschorowsky & Moura, 2019).

Watanabe (2018) states that there is a challenge within Brazilian society: overcoming the legal culture of lawsuits through the presentation of conflicts before the Courts.

In this scenario, this article aims at assessing the case in which the water use conflict ended up in courts, namely, Paraíba do Sul basin water crisis, that started in mid-2014.

In topic two, it will be presented the participatory democratic model and the National Water Resource Policy aspects, focusing in participatory democracy collegiate bodies, and it's power to solve conflicts. Then, it will be presented, the geographic characteristics of the abovementioned river basin.

Followed by topic 3, which will focus on the Judiciary Power crisis and the need in: reducing judicial involvement to achieve conflict resolution. It is seen that, in terms of public policy judicialization, public interest and relevant institutional are biases.

In topic 4, it is analyzed conflict resolution within Rio Paraíba do Sul basin water crisis, that started in 2014.

Finally, as a conclusion, it is evidenced that water crises, as well as sentence culture maintenance, that is one of judiciary crisis causes may have its origin in the country's low level of education, and thus, how two Public Policies are related.

2. Participatory Democracy and National Water Resource Management System

2.1 Participatory Democracy

Quintão (2014) says that "participatory democracy theoretical field greatest inspiration is Jean-Jacques Rousseau". According to him, "[...] to Rousseau, the political power is originated from people's sovereignty, coming from a social contract establishment".

Also based on Rousseau, Quintão (2014) states that people´s general will be public interest that should have a purpose achieving the common good. On the other hand, the will of the majority is achieved '[...] during deliberation activity in popular meeting [...]'.

As he approaches modernity, Quintão (2014) summarizes:

> Assessed theoretical of participation, Pateman, Macpherson, Barber and Santos, intend to debate political participation situations beyond the election moment, expanding participation spaces and focusing on situations, especially within local scope.

In this line, but from political science perspective to law, Sarlet and Fensterseifer (2014) state that:

> [...] public participation, in this context, is located as a central element of democracy in contemporary constitutional concept, which, it shall be reiterated, extrapolates substantially the spectrum particularly limited of popular vote.

Brazil's 1988 Federative Republic Constitution (CRFB, in Portuguese), the Brazilian social contract, sets as a milestone, in its article 1, that 'all power comes from the people, that performs it by means of elected representatives, or directly, as per this Constitution.'

In this excerpt of CRFB foresees representative democracy, performed through representatives elected by direct, universal, and secret vote, but people´s direct participation is also foreseen in decision making.

Montambeault (2018) states that this constitutional characteristic incurs of the popular will to break with previous republican period, where a military dictatorship was in force (from 1964 until 1985).

Quintão (2014) says that 'participatory democracy model is a heir of popular movements protests [...]' of the 1960´s, and its decline started in mid-1990´s in the United States of America, but it beings '[...] to become relevant in transition countries and that were experiencing re-democratizarion processes, especially in Latin American countries'.

This principle's concretization (public participation), however, is performed through 'specific local initiatives or infra-constitutional regulations, in which public participation mechanisms were set into place along the years' (Montambeault, 2018).

Montambeault (2018) analyzes that, even though there is a legal framework to expand Brazil's participatory democracy, its development was not significant, due to political will, and lack of bureaucratic structure.

Thus, let us have a look at infra-constitutional regulation related to popular participation in meetings, concerning decisions related to water resource management in Brazil.

2.2 SINGREH's Participatory Democracy and conflicts: the National Water Resource Council (CNRH) and River Basin Committees (CBHs)

Water is needed for life, regardless of the species. However, inexplicably, it took a long time so that water access was internationally acknowledged as a human right. The absence is noticed in 1948 Universal

Declaration on Human Rights, or '[...] not even International Covenants on Civil and Political Rights and Economic, Social and Cultural Rights, both developed in 1966' (Noschang & Scheleder, 2018).

According to Noschang and Scheleder (2018), only in 2002, with the United Nations (UN) Committee on Economic, Social and Cultural Rights *General Comments (GC)* no. 15 that water was acknowledged as a limited natural resource, and an essential public asset to life and health, thus: '[...] the right to the water includes sufficient supply, physically accessible and at a compatible cost, of safe water with acceptable quality for personal and domestic uses for every one.'

On the other hand, Ponzilacqua and Sacilotto (2021) state that 'internationally, human right to water and basic sanitation were acknowledged by the UN, by means of Resolution no. 64/292, as of July 28, 2010.' Authors consider GC no. 15 only as a turning point.

Regardless of the year deemed as international milestone for water access inclusion as a human right, the delay to formalize water as a right directly linked to welfare can be noticed in Ponzilacqua & Sacilotto (2021).

In Brazil, since 1997, water is acknowledged as a public domain, a finite natural resource, with economic value and in case of scarcity, its priority use shall be for human consumption and animal thirst-quenching, as per article 1, I, II and III of Law no. 9.433 (1997), the National Water Resource Policy (PNRH, in Portuguese).

Public participation is also a foundation within the PNRH, as provided in article 1, VI, that 'water resource management shall be decentralized and rely on the public administration, on the users and community participation.'

Fernanda Helena Gonschorowsky and Analice Schafer de Moura state:

> [...] social participation in National Water Resource Policy is relevant not only to democracy performance, but also as a state's mechanism execution assurance, as the environment is a common use good to the people, and it is related to present and future generation's life quality.

What happens is that, according to Gonschorowsky and Moura (2019), in water resource participatory management, there is lack of incorporation of historically excluded groups, also due to the "[...] lack of public knowledge, that do not have proper access to information, and therefore do not participate effectively within the national water resource policies".

Briefly, this participation is performed, at the federal level, through the National Water Resource Council (CNRH, in Portuguese) and the River Basin Committees (CBHs, in Portuguese) of waters governed by the Federal Government, and in both cases, there are several stakeholders' participation legal assurance, including civil society.

Concerning such collegiate bodies duties, it is necessary to do a congruent cut with this study general's objective, which is to analyze their role in user conflicts resolution. Thus, CNRH has the role of 'arbitrating, in higher administrative level, existing conflicts between state water resource councils' (Article 35, II of Law no. 9.433/1997); to CBHs is reserved the role to 'arbitrate, in lower administrative level, conflicts related to water resources' (art. 38, II Law no. 9.433/1997).

A significant difference is noticed as CNRH 'arbitrates' occasional regulation conflicts between state water resource councils while the, CBHs can be the arena to conflict management between users, including a significant range of other potential stakeholders.

2.3 Paraíba do Sul River Basin and River Basin Integration Committee (CEIVAP)

Law 9.433/1997 sets river basin as a "territory unit to implement the National Water Resource Policy and the National Water Resource Management System operation" (Article 1, V of Law no. 9.433/1997). A

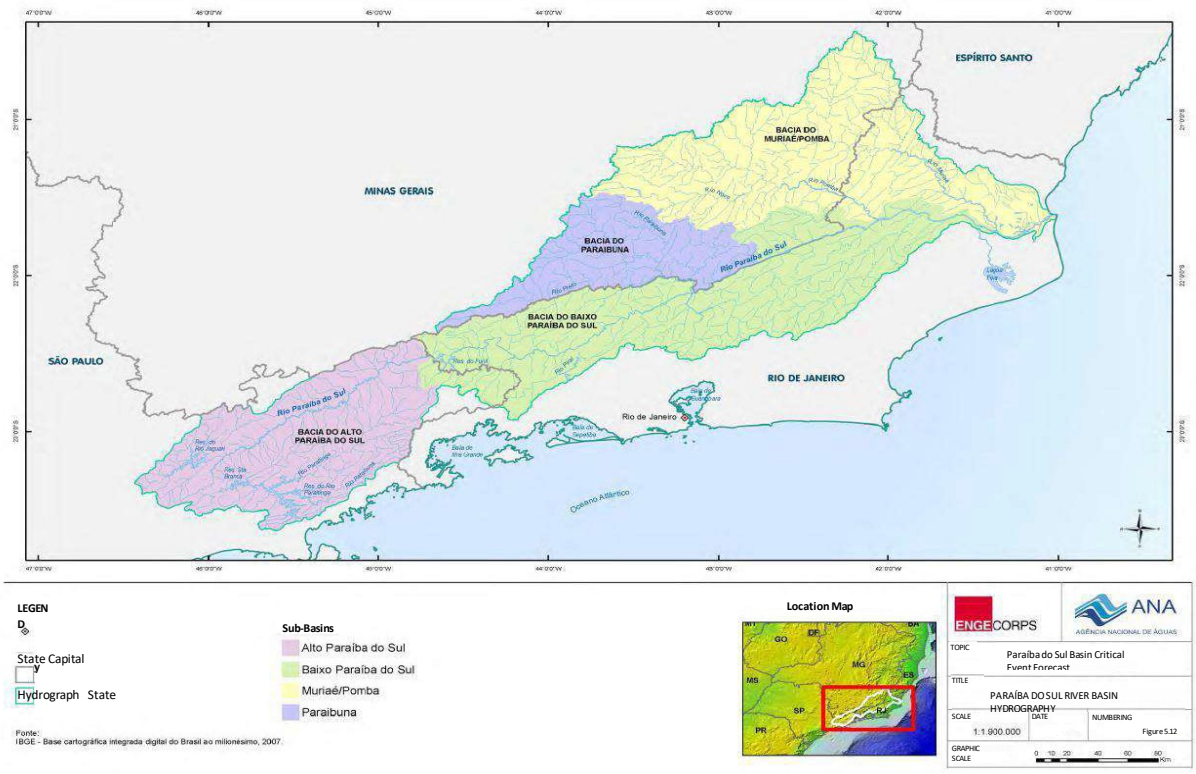

Figure 1 – Paraíba do Sul River basin hydrography (Agência Nacional de Águas e Saneamento Básico, ????).

geographical cut set forth from technical criteria related to water dividers and drainage systems according to a main river. In general lines, CBHs perform water resource management in this space, as from the powers established in Article 38 of Law no. 9.433/1997.

Concerning Paraíba do Sul River, the basin cover 184 municipalities, which 39 are located in São Paulo State, 57 in Rio de Janeiro State and 88 in Minas Gerais State. It is estimated that the basin population is just about 5.5 million people, but the basin supplies around 14.2 million people.

> CEIVAP is the parliament, with decision power, in which debates and decentralized decisions on questions related to Paraíba do Sul River basin waters. It formed by 60 members, three of Federal Government and 19 of each state (São Paulo, Rio de Janeiro and Minas Gerais) of Paraíba do Sul basin [...]. (Comitê de Integração da Bacia Hidrográfica do Rio Paraíba do Sul, s.d.).

CEIVAP composition is 40% of water users; 35% of Public Power and 25% by civil organizations.
About main river's bed water use, as provided in Paraíba do Sul River Basin Water Resource Integrated Plan (Comitê de Integração da Bacia Hidrográfica do Rio Paraíba do Sul, 2021), the largest demand is the industrial sector, that corresponds to approximately one third, following by urban uses, and irrigation comes next, with one fourth of volume. Mining, rural supply, thermal power plants and animal raising demand, if added, around 10% of cubic metering per second.

Dias et al. (2015) reports that basin has a strategic role at national level, as it supplies Brazil´s two largest industrial complexes, that are also the largest metropolitan regions (São Paulo and Rio de Janeiro states and cities, respectively), and 'consequently, this river basin passes through a complex management process that involves multiple use hard conflict mediation (...)'.

3. Reducing Judicial Involvement as Public Policy: public interest negotiability in water resource management and Unit Nations (UN) Sustainable Development Goals

3.1 Reducing Judicial Involvement as Public Policy

Cabral (2021) states that there is sentence and litigation culture in Brazil, which 'has always relied on a judicial sentence enforcement as the only way to settle disputes.' Judiciary crisis has resulted in the need for legitimating access alternatives to a fair decision and give a new meaning to Judiciary Power access.
However, it takes time until a judicial sentence is ruled, and its enforcement takes even longer. The Brazilian National Justice Council (CNJ, in Portuguese) provides at "Justiça em Números" [Justice in Numbers] 2021 that a legal process average time in Brazil, until sentence delivery is three years and four months, however, to enforce it, seven years and one month are required, in average. From the sentence to its enforcement, there is the higher-level appealing phase, which is two years and two months (Conselho Nacional de Justiça, 2021).

Also, according to National Justice Council (2021), the highest topic volumes submitted to judicial level (lower level) correspond to demands on labor (7.2%); civil contractual (5.08%); and consumerism relations (3.15%). It would be relevant to add some figures here, statistics concerning the judicialization of

everything in Brazil. This point is significant to its counterpoint. Judicial action average time and cost shall also be considered.

Watanabe (2018) explains that judiciary correct performance includes conflict consensual solutions, accessing such services is citizen right and that it is 'State obligation to organize and offer all such services, including the so-called conflict amicable solution alternative.'

However, there is lack of information to "overcome today´s prevalent mentality among law professionals, and also among litigation consensual solution service recipients' themselves" (Watanabe, 2018).

Similarly, Law 13.105 (2015), according to the understanding of Didier Jr. (2015):

> '[...] §2 of Art. 3 provides a public policy institution legal statement'. The same author teaches that procedural law is aimed not only at judicialized litigation, as he says, concerning Article 3, '[...] even though CPC is designed, basically, to regulate the conflict jurisdiction solution, the legislator announces, through such devices, that the goal is searching for the conflict best and more adequate solution, not necessarily by judicial ruling'.

Indeed, Cabral (2021) adds that 'the Brazilian legislator has widely supported de- judicialization, that consists in avoiding conflict judicialization.' The professor explains that Law no. 13.105 (2015) itself, Mediation and Arbitration Laws comprise an 'appropriate method microsystem for Brazil dispute resolution' (Cabral, 2021) and 'such varied instruments provided to jurisdiction stakeholders comprised what we name multiport justice', inspired in teachings of Harvard Professor Frank Sanders.

What can be realized, thus, it is that, even though there is a strong litigating and sentence search culture, the Brazilian legal system offers several instruments that aim at reformulating this paradigm, through multiport justice, changing justice access conception, to a wide access to a fair controversy resolution that can take place without, necessarily, Judge-State intervention. The challenge would rely on the proper information provided to law professionals and judiciary service recipients, as well as in relevant player engagement (Watanabe, 2018).

3.2 Primary public interest negotiability (water resource management) and conflict resolution alternative methods

Sundfeld (2014) in regards to the legislative evolution related to public interest states that 'common sense' has designated to the Public Administration to build public interest building from the legal approach (the Executive and Legislative symbiosis), nevertheless, specific legal diplomas grant to other public actors such development (the Judiciary branch and the Public Attorney´s Office itself), in cases such as public servants liability and civil lawsuits, even against the Public Administration itself. He affirms that 'the scheme is: Public Administration is concerned with public interest, and the Judiciary controls Administration' (Sunfeld, 2014), while public interest analysis includes the environment or any

other diffuse interest, according to the general purpose of Brazil's Public Action Law 7347/1985.

As it can be seen, public interest management in the country is subject to guardianship of several power branches, and as years go by, the Executive and the Legislative lost the monopoly to the Judiciary and Public Attorney´s Office (Sunfeld, 2014). It is a field that demands cautious guardianship, under penalty of control through judicialization.

According to Oliveira (2014), citing Renato Alessi in his scholarship from Italy that there are primary and secondary public interests and, it is, as abovementioned, engaged with 'essential right satisfaction by means of administrative activities provided to collectively', and secondarily by 'interest of State itself, as subject to rights and obligations, being fundamentally linked to treasury interest notion.'

If there is a conflict between primary public interest and individual interest, the one with supremacy prevails. However, such criterion (supremacy) is not imposed whenever the State interest conflicts with a particular interest, in case both are supported constitutionally, as taught by Gustavo Binenbojm (*apud* Souza, 2018).

Luciane Moessa de Souza teaches that, in case of public interest, 'unavailability is not to be confused with intransigence capacity' (Souza, 2018), and harmonization is perfectly possible by means of adequate conflict composition methods. According to Souza: "[...] whenever one thinks of a transaction related to an inalienable right, there is no discussion on renouncing this right to negotiate its existence, but on the other hand, it should be searched to the best way to protect it."

In case of primary inalienable public interest conflict mediation, Souza (2018) reports that collaborative participation, including groups involved in the conflict, gives legitimacy and representativeness to such dispute resolution.

Júnior and Oliveira (2020) point out that water management and environmental law are connected subjects in Brazil even before CRFB itself. It was also present in Federal Law no. 6.938 (1981), that created the National Environmental Policy. In this later legal instrument, the conscious water use is one of its main guiding principles, under art. 2º, and it is also foreseeing that those who use natural resources and take economic advantage should pay.

Machado (2018) teaches that "water is a natural element within the environment", on the other hand, "public domain [...] does not change Federal and state powers in water owners, but it becomes the managers, to everyone´s interest" (Machado, 2018). Thus, considering that 'water has a 'common use', according to the CRFB, it is a natural right of every individual, an inherent feature to human personality, and it is, then, a State pre-existing right' (Machado, 2018), it is possible to affirm that water management is

a primary public interest.

It is also important to note that mediation and arbitration laws in the country (Cabral, 2021) in the extrajudicial level, concerning to primary public interest negotiability, Bacellar (2012) explains that:

> Alternative conflict resolution methods (Mascs, in Portuguese) represent a new type of culture in litigation solution, far from acute antagonism of classic struggles between parties - Judiciary Power claimant and defendant - and more focused on attempts to negotiate such conflict solution harmoniously, in a sense, actually, designed to social pacification [...].

Bacellar (2012) teaches that alternative means that it could "be developed according to a consensual method (negotiation, mediation, and conciliation) or adversary methods (arbitration)". The same author concludes that "all these methods are developed outside the Judiciary branch and may find lawful solutions". The next section of this paper will present brief reflections on primary public interest, mediation, and arbitration.

3.2.1 Mediation

In Brazil, Law no. 13.140 (2015), the Mediation Law, describes, according to Bacellar (2012) that a procedure included "in the self-composition consensual method" for conflict resolution can be defined as:

> [...] conflict resolution art and technique intermediated by a third mediator (public or private agent) - which goal is to solve peacefully conflict among people, strengthening their relations (at least, without or with the least possible distress), preserving trust and mutual commitment that connect them.

However, the agreement engaging inalienable rights shall be ratified judicially, frustrating, in part, de-judicialization as a public policy, as provided by CNJ Target number nine, focusing SDG no. 16, as it will be better linked in topic 3.3 ahead.

It should be noted that even confidentiality being a mediation principle under Law no. 13.140 (2015), "it is not an absolute rule" (Takahashi et al., 2019). Article 37 of the CRFB states the need to publicize administrative acts in case of procedures involving the management of public interests.

3.2.2 Arbitration

Law no. 9.307 (1996), the Arbitration Law, regulates arbitration in Brazil and it includes 'four essential elements' (FICHTNER, et al., 2019, p. 30): an alternative dispute resolution; it comes from private parties' private autonomy principle; an impartial third party is in charge of the decision; and it forms a material *res judicata* (the arbitrator is not a reviewer, but a decision maker).

Carlos Alberto Carmona (Fichtner et. al., 2019) a Brazilian pioneer on the topic, says that arbitration: "is a technique to settle controversies through the intervention of one or more person that receives their powers

from a private convention; deciding based in this convention without state's intervention, and the decision is designed to have the same effectiveness as a judicial decision".

Law 9307/97 predicts on it's article 1st that "direct and indirect public administration may use arbitration to resolve conflicts regarding transferable public property rights". With this law in place, it is excluded the possibility to use arbitration to solve primary public conflicts, limiting its application to property rights or secondary public interests (SOUZA, 2018, p. 539). Focusing on alternative dispute resolution methods that involve water resources management, a brief digression needs to be performed. Machado (2018) states that human rights do not incur from someone's effort or merit; it is acquired by the simple from being born and he defends that legislating on water is "the codification of a natural right so nobody – public administration or private party – would be indifferent to the situation of water as a vital source."

3.3 Sustainable Development Goals (SDG) Target 16, the National Justice Council (CNJ) and the regulatory gap to CBHs perform conflict resolution

The United Nations (2015), through SDG 16, established the target for "Peace, justice and strong Institutions" that provides the desire to "access to justice for all, and building effective, accountable institutions at all levels".

This object is divided in levels which there are specific purposes related to everything that was previously explained as follows:

> 16.3. Promote the rule of law at the national and international levels and ensure equal access to justice for all [...]
> 16.6 Develop effective, accountable, and transparent institutions at all levels
> 16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

The Brazilian Judiciary system was also willing to achieve such goals. The National Justice Council (CNJ in Portuguese) has recently (2020) set forth their "Goal 9" , that provides the need to "prevent or non-judicialize litigations towards the 2030 Agenda, the SDGs" (Conselho Nacional de Justiça, 2019).

According to Cabral (2021) the right to access a fair decision is also performed through extrajudicial methods, therefore, assuring that CBHs perform conflict resolution tasks assures the efficacy of essentially inclusive and participatory body, thus aligned with SDG 16.

Note that if on one hand the de-judicialization is foreseen as a Public Policy in Brazil, and if there is a possibility of negotiating primary public interests, including water resource management, on the other hand, local laws set forth a participatory democracy system, where collegiate bodies have the legal powers resolve conflicts. In bodies of water owned by the Federal Government[2], while the CNRH (2008) has regulatory powers to resolve conflicts, the CBHs do not have such parameters, even though, "in its original

conception river basin committees represent a space to solve conflicts and to create rules to water use within the river basin" (Orosco, 2018).

Souza (2017) adds that, "while thinking about the promotion of participatory processes, it is useful to understand state's capacity, including conditions to state acts, covering institutional, political, administrative and technical resources". Concerning such state's capacity institutional dimension, Souza (2017) defines it as a "condition to set forth parameters to develop participatory process in an adequate way to agency's organizational reality that promotes the process and the political field of involved stakeholders".

Without the establishment of parameters for social participation within the CBHs with powers to solve conflicts, there is a state capacity deficiency. Machado (2018) understands that, in regards to the possibility to CBHs to "arbitrate" conflicts, " the Committee's regulation and its bylaws are able to provide the required guidelines to implement this activity [...]".We disagree with this formatting and we defend that this activity should be regulated by the higher collegiate bodies, such as the National and States' Water Resource Councils; and observed by their correspondent CBHs, under penalty of fostering wide regulations and multiple procedures that can generate a mess concerning legal predictability, management and legal certainty. After all, in 2019 alone there were 223 CBHs, within the 26 Brazilian states (Agência Nacional de Águas e Saneamento Básico, 2020), apart from those managed by the federal government and the ones that can still be established.

[2] It refers to the Union, because of the PNRH [National Water Resources Plan] text, but the model is essentially replicated in State Policies.

4. Case analysis: Paraíba do Sul River Basin 2014 Water Crisis

Teixeira (2018) reports that the 2014 Paraíba do Sul River water crisis was the worst in 84 years, "'worsening the water stress experienced in São Paulo State" (Orosco, 2018).

The crisis was intensified due to São Paulo State's intention to foster Paraíba's do Sul System interconnected with the Cantareira System (in São Paulo) to assure water distribution within the state's metropolitan region (TARGA et al., 2015). This intention caused conflicts, due to the likely reduction of flow downstream and to the "strong dependence of Rio de Janeiro State to the Paraíba's do Sul System, which represents one of the only supply options to the state", even though Rio de Janeiro´s supplies exceeded a lot the minimum daily limits to comply with basic water human needs by the UN (Orosco, 2018).

During the crisis, CEIVAP assigned the river's management to the Permanent working Group on the Paraíba do Sul River Basin (GTAOH, in Portuguese). In 2014 and 2015, they hold 49 meetings to discuss the crisis, all of them surrounded by high stress due to the lack of rain (Teixeira, 2018), it was a hard work done under a lot of uncertainties.

CEIVAP Resolution 211 from May 20, 2014, provides that GTAOH membership has users from Minas Gerais state, Sao Paulo state and Rio de Janeiro state; from other committees; from municipalities; from states water resource management agencies, among others. That is, there is a diversified attendance, and meetings took place in a participative way (Teixeira, 2018).

Overall Teixeira (2018) points out that the work made by GTAOH during the crisis, was related to decision-making to reduce water withdrawal (and other restrictions) after listening to the collegiate body, however many mistakes were made due to the rain that never felt.

During this process, still in 2014, the Federal Public Attorney´s Office filed two Public Civil Actions if there was a need to deliberate over the water crisis. One lawsuit[3] was related to prevent the construction of infrastructure for the transposition of the waters of the Paraíba do Sul river to the Cantareira system.

[3] The defendants in this Original Civil Action (No. 2.536 RIO DE JANEIRO) were the Union; the National Water Agency (ANA); the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA); and the States of SP, RJ, and MG (Decisão Monocrática. Projeto de interligação do Rio Paraíba do Sul à Cantareira. Redução da vazão mínima afluente à barragem de Santa Cecília., 2017a).

The other[4] one was against the minimum affluent flow reduction concerning the same Santa Cecília Dam, at Paraíba do Sul River (provided by ANA Resolution no. 1.309, as of August 29, 2014).

They were both submitted to the Federal Supreme Court (STF, in Portuguese), due to an alleged original power the court must judge interstate conflicts, provided in Article 102, I, f, of CRFB (1988). Once there, they were assigned to Justice Luiz Fux. However, the understanding that the proceedings did not approach conflicts that resulted in weaking the federative pact, as they were a simple litigation between federated entities, based on technical issues, so they had to be moved to the lower court's. The review of the cases were denied, and they returned to the original court (STF, 2017a).

Before such decisions (from 2017), the lawsuits were gathered and a public hearing took place (November 2014), in an attempt to solve the conflict and, in such occasion the judge suggested a deal, that was accepted by the parties, including the Federal Public Attorney´s Office.

Overall, the deal provided that the parties should make efforts to find solution to the water crises and, that it demanded that no individual federative entity should take unilateral measures that could affect the flow and water availability within the Paraíba do Sul River basin.

According to Falcão (2019)**,** "the three states involved should present by February 28, 2015, a solution to reduce the water crisis effect in the Southeast Region". A working group was established including among the members agencies such as ANA, DAEE from Sao Paulo, INEA from Rio de Janeiro, IGAM from Minas Gerais and CEIVAP. All of them should develop an evaluation report, highlighting the new operation rules for Paraíba do Sul Hydraulic System. In March 2015 they started to discuss a Joint Resolution for the committees' and to the National System's Operator contributions (Falcão, 2019). The result was joint publication of resolution 1.382 (ANA; IGAM; INEA; DAEE) from December 7, 2015 (more than one year after the public hearings).

Pedrosa (2017) summarizes that the conflict "resulted in a rule related to reservoir's operation subject to a series of hydrological situations in rivers and reservoirs", concluding that this is common practice in

[4] The defendants in this Original Civil Action (No. 2.550 RIO DE JANEIRO) were the Federal Government; the National Water Agency (ANA); the Ministry of the Environment (MMA); the Basic Sanitation Company of the State of São Paulo (SABESP); the Department of Waters and Electric Power (DAEE); the Environmental Company of the State of São Paulo (CETESB) (Decisão Monocrática. Projeto de interligação do Rio Paraíba do Sul à Cantareira. Redução da vazão mínima afluente à barragem de Santa Cecília., 2017b).

Brazil. However, SINGREH bureaucratic structure was not capable of managing the conflict, as it only became effective upon the judicialization, that forced the system's players to develop the regulation.

On the other hand, according to Falcão (2019) one of the water crisis legacies was "the strengthen of Paraíba do Sul River basin shared management system, narrowing the relation between the Committee and state managing bodies with ANA". Cavalcanti and Marques (2016) state that even if the basin had the institutional structure "federal agencies – ANA and STF – along with the governors' roles – Minas Gerais, São Paulo and Rio de Janeiro – they had to meet in order to reach mutual agreement".

5. Final remarks

Cabral (2021) teaches that alternative conflict resolution methods should be welcomed with "highly enthusiasm as society is the one that benefits the most from quicker, cheaper and less complex solutions". In case of SINGREH, society itself shall be the main players if the collegiate bodies, River Basin Committees, that have the power to promote conflict resolution related to water use, did that. That would legitimate the process.

Therefore, it is necessary that the population is aware of the importance of participation in such venues through education, which is one of the Public's Administration responsibilities (including legal professionals, to quit the so-called 'litigating culture').

However, what has been seen at the federal level, according to Pereira & Vieira (2020), is the council's impairing and extinction, "incurring in a legal and social insecurity, as many of these councils enable the development of effective and significant public policies".

Recently, Brazil's National Congress turned down the President´s vetoes to parts of Law 14.119/2021; specifically related to this research, the veto to establish a collegiate body, with parity formation, to enable the Federal Program on Environmental Services Payment (PFPSA in Portuguese).

Observe that it is essential that the bureaucratic structure for SINGREH alternative conflict resolution is structured and regulated with a minimum structure, and awareness alone would be pointless.
In case the Paraíba do Sul River Basin 2014 water crisis, conflicts were faced within the relevant Committee scope, but they were only effectively after the judicialization and the public hearing within Brazil's Supreme Court, and finally, the issue of an administrative, interstate standard, debated for around a year.

The non-judicialization of cases in Brazil and water resource management are topics designed to public

policies. If the conjunction of both can maximize its beneficial effects, the weakening of one of them shall be damaging to both.

Brazilian laws have changed along the years, in relation to who has the legal ownership to manage primary public interests (the Executive and the Legislative, then including the Judiciary and the Public Attorney´s Office) (Sunfeld, 2014). It should be taken seriously that actual stakeholders, focusing on the public, should manage interest through democratic participation mechanisms, after all, the Constitution itself foresees that the Power results from the people, and it can be performed directly by the people. The debate cannot be disregarded.

By being a non-judicial resolution arena, it is not only a power provided by the PNRH to the CBHs, but it is also about enabling operation and enforcing a right to all society to manage water, this vital asset for people to use. However, it is essential that there is institutional capacity to set forth relevant participation parameters, that can provide legal certainty to the procedure and stimulate non-judicial conflict resolution.

Finally, in order to that right become effective, legal professionals should start to add this discussion within their regular work, by identifying which legal arrangements should be enforced to each case, and to innovate, to engage. But by not allowing that this public interest protection, often extremely urgent and involving technical, engineering, and biological sciences, end it up solely in legal professionals that are members of the Brazilian Public Attorney´s Office and Judiciary Power.

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Rivers Weep and Trees Hurt – Recent Legal Developments in South Asia Concerning Rights Relating to Nature

Dr. Asanga Gunawansa[1], Shenella Fonseka[2]

[1]University of Moratuwa, Sri Lanka and Colombo Law Alliance, asanga.gunawansa@colombo-law.com
[2]Colombo Law Alliance, shenella.fonseka@colombo-law.com

Abstract

Respecting and recognizing basic human rights have been universally accepted for quite some time, at least since the adoption of the universal Declaration of Human Rights in 1948. Compared to this, environmental rights, including rights relating to nature, entered the legal landscape at a latter stage. The importance of environmental rights was felt immensely when consequences of non-protection of the environment was made evident with the rise of global warming, melting ice glaciers, rising sea levels, climate change, deforestation, droughts etc. Therefore, environmental rights have become as equally important as human rights. According to the United Nations Environmental Programme (UNEP), human rights and the environment are intertwined; human rights cannot be enjoyed without a safe, clean and healthy environment; and sustainable environmental governance cannot exist without the establishment of and respect for human rights. Some countries had identified the importance of environmental rights fairly earlier on and enshrined rights to the environment as a fundamental right or as a right to life in their respective constitutions, whilst certain other countries have failed to do so.

This Article analyzes the recent legal developments based on judgements delivered by superior courts in three South Asian countries, namely, India, Sri Lanka, and Bangladesh, on the need to recognize the right of providing protection to environmental assets such as rivers, and forests. In particular, this article discusses the active role played by the judiciary in strengthening the law relating to protection of environmental assets to ensure that the development path of countries recognizes the need for sustainability. This Article points out that whilst some nations have bestowed upon their citizens a right to life and a clean environment, the judiciary has gone a step further in according natural resources such as rivers the status of a living human being. Further, this Article shows that there are other countries where a right to the environment is not guaranteed by the Constitution, but the judiciary has played an active role in stretching the guaranteed human rights to cover the need to protect natural resources for present and future communities.

Keywords: Environmental Rights, Rights of Nature, Sustainable Development, Environmental Assets, Legal Personhood

1. Introduction

The importance of protecting the environment and the need to recognise the rights of persons to ensure such protection have been felt immensely in recent times as a result of the human population as well as all living beings been threatened with the adverse impacts of global warming, melting ice glaciers, rising sea levels, climate change, deforestation, droughts etc. It is now debated in various forums, both international and national that whilst the consequences of non-protection of the environment will reach deeply staggering heights, it is the duty of the current governments, organizations, communities and even individuals to ensure that all reasonable and attainable steps are taken to protect the environment we live in and to act in the best interest of not only the present communities, but of the future communities.

2. Environmental Rights

Environmental rights entered the legal landscape as a fairly new field of study. According to the United Nations Environmental Programme (UNEP), human rights and the environment are intertwined. Human rights cannot be enjoyed without a safe, clean and healthy environment; and sustainable environmental governance cannot exist without the establishment of and respect for human rights (UNEP, 2020). According to 'Friends of Earth International', environmental rights mean access to the unspoiled natural resources that enable survival, including land, shelter, food, water and air. They may also include more purely ecological rights, including the right for a certain beetle to survive or the right for an individual to enjoy an unspoiled landscape (Friends of Earth International, 2003).

The then Vice President of the International Court of Justice, Justice C.G. Weeramantry in the case of *Gabcikovo-Nagymaros Project* emphasizing the importance of environmental rights stated as follows;

> *"the protection of the environment is... a vital part of contemporary human rights doctrine, for it is sine qua non for numerous human rights such as the right to health and the right to life itself. It is scarcely necessary to elaborate on this, as damage to the environment can impair and undermine all the human rights spoken of in the Universal Declaration on Human Rights and in other human rights instruments".*

Some countries had identified the importance of environmental rights fairly earlier on and implemented rights to the environment as a fundamental right or as a right to life (Gellers 2012, 2014, 2015, 2017, and Jeffords and Gellers 2017). Some South Asian countries such as India and Bangladesh too have identified the importance of ensuring environmental rights and constitutionalized rights to the environment by enshrining them in their respective Constitutions (Gellers, 2013). For example, Article 51-A(g) of the Indian Constitution provides that "*It shall be the duty of every citizen of India to protect and improve the*

natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures." Article 18A of the Bangladeshi Constitution provides that *"The State shall endeavour to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wild life for the present and future citizens."*

As stated above, rights to the environment are intertwined with human rights itself. Many scholars have argued that the importance of environmental rights cannot be separated from those of a human. Thus, there is justification for treating the right to the environment as being equally as the right to life, and for treating the two as intertwined rights as against treating them as two distinct rights. This is because the protection of the environment is of paramount importance when it comes to protecting the right to life. Without a clean and liveable environment, life cannot exist. Thus, it could in fact be argued that environmental rights are an extension of the basic human rights that mankind requires and deserves.

In addition to having the right to food, clean water, suitable shelter, and education, having a safe and sustainable environment is paramount as all other rights are dependent upon it. The desire to ensure access for all of Earth's inhabitants to this essential standard of living is the primary concern of environmental rights. It is important to note that, beyond equal distribution and access to clean and sustainable resources, environmental rights also demand an additional obligation from those in the industrialized nations as well as those in developing nations, to act responsibly in the use of natural resources, and to regulate the levels of consumption in a more equitable manner.

It is interesting to note that some scholars and various jurisdictions have considered the protection of the environment as being religious too. For example, C.G. Weeramantry in his book, "Tread Lightly on the Earth, Religion, The Environment and the Human Future" cites various religious texts to emphasize that several religions speak of the need to protect the environment and follow sustainable development. He states that *"trusteeship of the universe is recognized in Islam and any violation of it by man is accountable and subject to punishment as the Qur'an states "It is He who made you trustees of the earth...Indeed your Lord's retribution is swift, yet He is forgiving and kind (6:165)."* [Weeramantry, 2009, p.228].

The research done by us of the recent legal developments in connection with the recognition of environmental rights as a fundamental and/or constitutional right of the people have shown that the judiciary has started playing a very significant and active role in establishing the environmental rights of the people as well as the duty of governments and people to safeguard such rights.

3. Rights of Nature

Quite apart from the environmental rights that have been guaranteed to human beings to ensure they have a safe and clean environment to live in, in the recent past we have also seen rights and legal personhood being granted to environmental assets such as rivers and trees. This involves recognizing nature—either as a whole, or a specific part, such as a river or a tree—as a legal person. In law, this means that nature has a basic set of legal rights that grants it certain rights, duties, and responsibilities (Naffine 2003). It can also be defined as the 'calling for acknowledgement of the fact that [non-human Nature has] rights that humans are morally obligated to respect and protect' (Boyd, 2017, p. 219).

Legal rights are not the same as human rights, and so a "legal person" does not necessarily have to be a human being. Corporations, for example, are also treated in law as "legal persons", as a way to endow companies with particular legal rights, and to treat the company as legally distinct from its managers and shareholders. Giving nature legal rights means the law can see "nature" as a legal person, thus creating rights that can then be enforced. Legal rights focus on the idea of legal standing (often described as the ability to sue and be sued), which extends such right to stand before a court of law and be heard to "nature" to protect its rights. It is pertinent to note however that as natural resources do not have a voice of their own to assert their rights. Whereas, the humans who assert human rights come before courts and/or tribunals to assert their own rights or rights of their own kind, the nature does not have the capacity to do it by themselves. Therefore, in order to assert rights of the nature those enjoying the nature should pursue appropriate action when the rights of nature need to be asserted. Therefore, as Magallanes explains "indeed, where legal personality has been adopted, it has occasionally been framed not as a matter of rights but of responsibility" (Magallanes, 2021, p.1).

Some of the examples in which rights of nature have been bestowed on environmental assets include; the constitution of Ecuador, national legislation in Bolivia, local ordinances in the USA and recent court decisions in Columbia and India which have recognized the legal rights of nature. Also, the recent developments in New Zealand under the Treaty of Waitangi, which have seen several ecosystems granted legal personhood and in Australia, the creation of 'environmental water managers' in domestic law where legal rights have been allocated to environmental water flows (Magallanes, 2021) are worth mentioning.

4. Why Rights of Nature?

In 2015, Pope Francis delivered a speech before the United Nations (UN) General Assembly. He claimed that 'a true "right of the environment" does exist' (Goldenberg and Kirchgaessner, 2015) and argued that humanity's survival depends on its natural habitat; thus, nature needs to have rights that protect it against degradation and, consequently, secure the continued existence of the human species.

The need for rights of nature have been justified by many academics and scholars. From a philosophical perspective continuing to prosecute environmental cases on the basis of "harm" caused to humans relies on an increasingly convoluted and anthropocentric argument, which **obscures the needs of nature** (O'Riordan 1981, 1991). Therefore, by the recognition of the rights of nature, the needs of nature have been brought to the forefront. Whilst many policies, principles, and actions are already part and parcel of the environmental law regime, scholars have argued that these approaches have often obscured the particular interests of "nature" itself (Carlson, 1998, Bertagna, 2006, Sands, 2012). For example, the public trust doctrine places emphasis on the public use of natural resources rather than the protection of nature itself (Sax, 1970 and Preston, 2005).

As Daly frames it, the key question has become how to best represent the nature in court, and how to frame the legal challenges to deliver "judicial protection of nature for the sake of nature itself" (Daly

,2012, p.63). In this regard, Stone (1972) proposed a method to recognize the rights of nature in his seminal paper *Should Trees Have Standing?* Stone identified three legal criteria that "go toward making a thing count jurally". These are (1) "that the thing can institute legal actions **at its behest**"; (2) "that in determining the granting of legal relief, the court must take **injury to it** into account"; and (3) "that relief must run to the **benefit**" of it (Stone, 1972, p. 458 [emphasis in the original]). It is noteworthy that the essence of these legal criteria is to create the possibility for nature to take action in court to protect its own interests: to give nature itself legal standing.

Recognition of the rights of nature and according legal personality to nature ensures efficiency and cost effectiveness in the protection of the environment. If the injuries to the environment (as opposed to the human users of, or participants in, that environment) are ignored, then a significant proportion of the total injuries are not accounted for (O'Donnell and Talbot-Jones, 2018). O'Donnell and Talbot-Jones (2018) have explained the above concept substantially in their article, and stated;

> *"the cost of poor water quality to users is calculated in terms of the costs of treatment necessary to improve the water quality to the required standard. However, this treatment may fail to address the broader issues associated with the river's ecosystem health and well-being. If the injuries to the river are not recognized in court, then they cannot be compensated for, which means that the true costs of environmental impacts may be underestimated. Further, without giving due consideration to the injuries imposed on the river, the damages to other potential plaintiffs may be insufficient to cover the costs of litigation. In some cases, this may result in the litigation not proceeding."*

5. Issues with Rights of Nature

a. Enforceability

Whilst supporting the view that natural resources should in fact be considered as living entities which have rights to be protected for the benefit of current as well as future communities, we are also of the view that the practicality of enforcing such rights granted to natural resources need to be examined. According to Challe (2021);

> *"Legal personhood attributed to ecosystems has so far been mostly symbolic and it remains unclear how successful these lawsuits can be in gaining adequate, long-term protection of ecosystems. Outcomes can vary based on how a case is framed and on what the interests of the claimants are. Questions surrounding these potential outcomes continually arise: What exactly is the party seeking on behalf of the injured entity? Does the party seek to compel an authority figure to pay for damages incurred? How are these damages measured? Who can be held responsible for these damages? Could the appointed guardian be held responsible if a river floods and causes damages? Who has a say over a trans-boundary river, such as is the case in India where the Ganges and Yamuna rivers extend beyond the border of Uttarakhand? If a complaint alleges that climate change is a threat, how much liability does a specific industry's activities bear in that respect?"*

Further, it is important to note that legal rights are only worth having if they can be enforced. Thus, for example, to enforce legal rights of a river, several practical factors must be accounted for. O'Donnell and Talbot-Jones (2018) identified three such requirements. First, an individual or organization must be appointed to act on a river's behalf, to uphold the rights of, and speak for nature. Second, capacity in the forms of time, money, and expertise may need to be made available so that the rights of the river can be upheld in court. And third, river representatives and funding sources are likely to need some form of independence from state and national governments, as well as sufficient real-world power to take action, particularly if such action is politically controversial (O'Donnell, 2012). Therefore, it is clear that affording legal personhood to an environmental asset come with its own hurdles.

b. Jurisdiction

Sometimes, an issue that arises in the enforcement of rights granted to nature is jurisdictional. For example, rivers don't obey borders and often traverse more than one country. If a certain country has granted rights to a river but a neighbouring country has not, that makes it difficult to legally protect the waterway from environmental harm. In this connection, it is interesting to note that the Bangladeshi environmental activists are already talking about how they won't be able to compel India to comply with the new law on rivers (Samuel, 2019).

India too dealt with a similar problem as after the High Court in Uttarakhand state granted personhood

status to the Ganges and Yamuna rivers in 2017, appointing the State government as the rivers' legal guardian[1]. The State government challenged the High Court's decision in India's Supreme Court on the grounds that it was impractical because the river stretched far beyond Uttarakhand. The Supreme Court accepted the State Government's argument and stripped the rivers of their short-lived legal rights (Kukreti, 2017).

6. Recent Developments in South Asia in Connection with the Rights Relating to Nature

a. India

India, is the seventh largest nation in the world and the second most populous state. India has been a trailblazer in terms of adopting environmental rights. In fact, environmental rights have been enshrined in the Constitution of India as a right to life. The modern Environmental jurisprudence in India has essentially developed through the legislative awakening post Bhopal gas tragedy, the adoption of Stockholm and Rio Conventions and the creative interpretation of Article 21 of the Constitution of India by the Indian judiciary (Oak, 2012). In this light, it is pertinent to note that, the right to life (Article 21) in the Constitution of India has been used in a diversified manner. It includes, *inter alia*, the right to survive as a species, quality of life, the right to live with dignity and the right to livelihood. Article 21 of the Indian Constitution states: *"No person shall be deprived of his life or personal liberty except according to procedures established by law".* Further the Constitutional (forty-second Amendment) Act, 1976, has incorporated two significant articles; Article 48-A and 51A (g) thereby making the Indian Constitution the first in the world conferring constitutional status to the environment protection. Article 48-A provides that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country, and Article 51A(g), states that it is a duty of every citizen to protect and preserve the environment.

The higher judiciary in India has often acted as the protector and guardian of fundamental rights of the people in India. Through judicial activism, the Indian courts have secured a number of rights relating to nature which are not expressly mentioned in the Constitution (Oak, 2012, p.1). Article 21 is one of the

[1] Mohamed Salim v. State of Uttarakhand and others, Writ Petition (PIL) No.126 of 2014, decided on 20th March 2017.

most significant provisions in the Constitution of India as it takes within its fold a number of other rights. While creatively interpreting right to life as a fundamental right in Article 21, the Supreme Court and High Courts in India have consistently recognized that right to pollution free environment is very much implicit in Article 21. For example, in the year 2017, the Uttarakhand High Court (UHC) ruled that the Indian rivers Ganga and Yamuna, the Gangotri and Yamunotri glaciers, as well as other related natural elements are 'legal persons' with all corresponding rights, duties and liabilities of a living person.[2] The High Court of the State of Uttarakhand declared that;

> *"... the Rivers Ganga and Yamuna, all their tributaries, streams, every natural water flowing with flow continuously or intermittently of these rivers, are declared as juristic/legal persons/living entities having the status of a legal person with all corresponding rights, duties and liabilities of a living person in order to preserve and conserve river Ganga and Yamuna."*

The court reached this decision for two reasons. First, the judges identified the significant risks posed to the Ganges and Yamuna Rivers by pollution, and climate change, and argued that a new and more powerful approach was required in order to adequately protect them. Second, the judges argued that this step was necessary because of the status of the rivers as 'sacred and revered... central to the existence of half the Indian population'. Just a few days later, on the 30th of March 2017, the High Court of Uttarakhand extended similar legal rights to the 'Glaciers including Gangotri and Yamunotri, rivers, streams, rivulets, lakes, air, meadows, dales, jungles, forests wetlands, grasslands, springs and waterfalls' of the Himalayas, in order to preserve and conserve these natural features. In both cases, the court recognised the rivers and other natural objects as legal minors (which relies on a human construction of legal personhood, rather than a more legalistic construction such as the corporation), and nominated particular individuals to speak on their behalf. As recently as March 2020, the Punjab and Haryana High Court has made an order declaring the Sukhna Lake in Chandigarh city as a living entity, also with rights equivalent to that of a person (Ashan, 2020).

On 7 July 2017, the Supreme Court of India agreed to hear an appeal against the Ganges and Yamuna case referred to above by the State government, and in the interim, stayed the effect of the original ruling, thus removing the legal rights of the rivers once more. The State government had appealed the case for two reasons. Firstly, they argued that as the Ganges and Yamuna rivers extend beyond the borders of the state of Uttarakhand, this would make it difficult for the state government to be responsible for the entire river.

[2] Mohd, S.V. State of Uttarkhand and Others (Writ Petition (PIL) No. 126 of 2014.

Secondly, and perhaps most tellingly for the future application of the legal rights concept, the State government argued that, as the guardians of the river, they may be liable for the actions of the river, including floods. The

Hight Court had earlier used the guardianship model to create the legal personality for the Ganges and Yamuna Rivers by establishing them as minors under the law. This arrangement ensured the legal status and rights of the rivers, whilst acknowledging that they cannot speak for themselves. Following Stone's model (Stone 2010), the court identified specific positions within the state government to act in *loco parentis* for the rivers, including the Director NAMAMI Gange, the Chief Secretary of the State of Uttarakhand, and the Advocate General of the State of Uttarakhand. Their responsibilities as set by the court are to be "the human face [and] to protect, conserve and preserve Rivers Ganga and Yamuna and their tributaries" (Indian Courts 2017:11-12). The final decision by the Supreme Court of India on this dispute would finally settle the legal status of a river in India.

b. Sri Lanka

In Sri Lanka, protection of the environment and right to the environment have been mentioned only twice in the Constitution. Firstly, under the 'Directive Principles of State Policy' in Chapter VI of the 1978 Constitution of Sri Lanka, the State is required to "protect, preserve and improve the environment for the benefit of the community"[3]. These Directive Principles are supposed to 'guide Parliament, the President and the Cabinet of Ministers in the enactment of laws and the governance of Sri Lanka'. Secondly, under the section on 'fundamental duties' in the same chapter, it is made the duty of every person in Sri Lanka "to protect nature and conserve its riches".[4] However, it is expressly declared that the Directive Principles and Fundamental Duties "do not confer or impose legal rights or obligations and are not enforceable in any court or tribunal", therefore are not justiciable[5], which means that the judiciary has no authority to pass judgements based on the above sections.

Hence, in Sri Lanka, there is no specific and precise constitutional guarantee of the Environmental rights, unlike in the case of India. Research conducted in Sri Lanka with regards to environmental laws are limited. Gellers (2013) provides an in-depth historical and contextual analysis of the absence of Constitutional Environmental rights in Sri Lanka's legal landscape. Atapattu (2001) analyses the reality of the legal system with regards to sustainable development and environmental laws in Sri Lanka and argues for the need to demystify the concept of sustainable development and to seek positive ways in which the concept could be incorporated into our judicial decision-making process.

[3] Article 27 (14) of the Constitution of Sri Lanka

[4] Article 28 (f) of the Constitution of Sri Lanka

[5] Article 29 of the Constitution of Sri Lanka

An analysis of the relevant judicial decisions shows that most cases concerning the environment had been instituted before the Supreme Court under Article 12 (1) of the Constitution, which ensures that all persons are equal before the law and are entitled to the equal protection of the law. The Supreme Court of Sri Lanka has been very active in creatively interpreting the Constitution, in particular, Article 12 referred to above, to ensure the protection of the environment and other inhabitants are covered under the constitutional guarantee given in Article 12 to equal protection of the law. In giving such liberal interpretations, the Supreme Court of Sri Lanka has found ways to welcome many environmental law principles such as the "polluter pays principal" and the public trust doctrine in to the jurisprudence of Sri Lanka.

The idea of the State as a 'Guardian', 'Protector' and 'Trustee' of environmental resources, and thus as the primary party responsible for protecting environmental rights of the people, first appeared in the landmark case of *Bulankulama and others v. Secretary, Ministry of Industrial Development and* Others [2000] 3 Sri L.R. 243-321. It is also pertinent to note that the polluter pays principal was also first adopted in the same case.

In the very recent case of ***Center for Environmental Justice (Guaranteed) Limited v Anura Satharasinghe and 8 others (CA (Writ) 91/2015),*** decided in 2021, the Appeal Court of Sri Lanka, considering a dispute in connection with the alleged deforestation of the Wilpattu Natural Reserve for settling down Internally Displaced Persons, allowed an application for an orders in the nature of a Writ of Mandamus under and in terms of Article 140 of the Constitution, ordering the 1st Respondent to take action against the illegal removal of forest cover, and illegal re-settlement done by the encroachers and re-instate the forest lands to the forest reserve and organize forest replanting programme under and in terms of the provisions of the Forest Ordinance No. 16 of 1907. Further, applying the "Polluter Pays" principle, the Court of Appeal ordered that the 7th Respondent to the case, a former Minister who had been responsible for the deforestation, should meet the cost of planting trees in the deforested areas. The Court observed that Sri Lankan Courts have long recognized and applied the "public trust" doctrine: that powers vested in public authorities are not absolute or unfettered but are held in trust for the public, to be exercised for the purposes for which they have been conferred, and that their exercise is subject to judicial review. Further, the Court observed that the polluter pays principle enshrined in Principle 16 of the Rio De Janeiro Declaration has been recognized and applied by the Sri Lankan Courts.

The Polluter Pays Principle means that the absolute liability for harm to the environment extends not only to compensate the victims of pollution but also the cost of restoring the environmental degradation. Remediation of the damaged environment is part of the process of sustainable development and as such, the polluter is liable to pay the cost to the individual sufferers as well as the cost of reversing the damaged ecology. The Court of Appeal in the above case further observed that in Buddhism, the religion followed by the majority of Sri Lankans, the Kutadanta Sutta states that it is the responsibility of the government to

protect trees and other organic life and that government should take active measures to provide protection to flora and fauna. According to Hinduism, (as stated in Padmapurana, Bhoomikhanda 96.7-8) when a person is engaged in killing creatures, polluting wells, and ponds and tanks, and destroying gardens he goes to hell.

In pronouncing his judgement Janak De Silva J stated that whilst noting the importance of resettling the displaced persons affected by the civil war in Sri Lanka, that it should be subject to other overriding concerns and above all the respect for the rule of law which is the foundation of the Constitution of Sri Lanka. Accordingly, he identified the importance of the protection of the environment as being at a higher level than that already envisaged. In essence, it was decided that the habitat of the trees cannot be taken away or destroyed for the purpose of resettling displaced persons, although that too was a noble cause. Thus, giving higher priority to protecting nature, taking into consideration that nature provides not only for the current community but also for the future communities.

c. Bangladesh

Bangladesh is one of the most environmentally vulnerable States due to the imminent threat of climate change that may take a major toll in Bangladesh. In this light, Bangladesh has actively been trying to protect its environment.

It is important to note that Bangladesh guarantees Constitutional Environmental rights under Article 18A[2] of the Constitution of Bangladesh, which states that the State shall endeavour to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wildlife for the present and future citizens. Bangladesh is also a signatory to many international conventions, treaties, and protocols, etc. in connection with the conservation and protection of the environment and ecology, such as Convention on Biological Diversity, Nagoya Protocol, Cartagena Protocol, UNFCCC, Kyoto Protocol, Paris Agreement, UN Convention on Non- navigational Uses of International Watercourses, Basel Convention, Vienna Convention for the Protection of the Ozone Layer, Montreal Protocol, Transforming our world: the 2030 Agenda for Sustainable Development, etc.

However, despite the different national laws and international guidelines, adequacy of environmental protection is still questionable in Bangladesh. Dhaka, the capital city of Bangladesh has been cited as the most polluted city in the world, according to US Air Quality Index (AQI) in January 2018. Since the report, the air quality has improved but it is still unhealthy according to AQI.

Despite the issues with inefficient and/or ineffective implementation of the environmental laws and poor regulation, as is the case in India and Sri Lanka, in Bangladesh too, the judiciary has not hesitated to liberally

interpret the statutory laws to ensure that Environmental rights are adequately protected. In January 2019, for example, the Dhaka High Court recognized the River Turag as a living entity with legal rights and held that the same would apply to all rivers in Bangladesh. The Appellate Division of the Supreme Court of Bangladesh upheld the said 2019 decision of the High Court which declared that the Turag River and all other rivers in the country are "living entities" with rights as "legal persons" in 2020.[6]

In the above landmark decision, the National River Conservation Commission was declared "in loco parentis" for the rivers of Bangladesh, to protect and conserve them, and prevent pollution and encroachment. The Commission is thus expected to serve as a guardian for the rivers, to ensure their rights and the riparian ecosystems are protected. Further, according to the said Bangladeshi court decision, the rights of the rivers may be enforced against both private and public (government) entities (Margil, 2020).

7. Practical Concerns

Whilst we argue that the courts in India, Bangladesh and Sri Lanka have followed an admirable approach towards recognizing rights of nature, the fact that the recognition of such rights will continue to cause practical problems cannot be ignored. For example;

Does a river have the right to improve its health, or do the new legal rights only protect existing conditions?

- Can the river recover rights to water from existing water users to improve its own health?
- What is the relationship between the 'voice' for the river, and the existing river management agencies?
- Do the legal rights for rivers include access to water infrastructure?
- Can the rivers now request payment where they provide services to other users for ensuring their sustainability?
- Can forests be preserved compromising issues such as poverty and hunger of humans?
- How can the compensation be received under the Polluter Pays Principle be best used?

[6] Writ Petition No. 13989 of 2016.

- When the river and its catchment is a legal person, what would this mean for interbasin transfer of water? How does bulk transfer of water outside the boundaries of the legal person affect the rights of the river?

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- How can the compensation be received under the Polluter Pays Principle be best used?
- When the river and its catchment is a legal person, what would this mean for interbasin transfer of water? How does bulk transfer of water outside the boundaries of the legal person affect the rights of the river?

Whilst the above are very valid and pertinent issues and hurdles in connection with Rights of nature and legal personhood being granted to environmental assets, it must be noted that reaching a balance or an equilibrium is of the essence. The concept of Sustainable Development must also be borne in mind when attempting to answer the above questions. Treasures of the environment are not only meant for enjoyment by the present generation but also to be protected, safeguarded and saved for the generations to come. Therefore, although the response to the issues laid out above would need philosophical analogy and may even be considered to have no answer, concepts such as Sustainable Development should be instructive in even attempting to answer them.

Furthermore, in answering the above issues and also in finding the balance, it is of utmost importance to adopt the creativity, liberality and innovativeness shown by the judiciaries of India, Bangladesh and Sri Lanka.

8. Conclusion

In this Article, we have briefly dealt with some recent developments in India, Sri Lanka and Bangladesh in connection with rights relating to nature and the extension of concepts such as Right to Life and Equality before the Law by liberal judicial interpretation of the Statutory legal provisions to ensure that adequate protection is provided to the natural resources. In particular, we have highlighted instances where the Courts have recognized the need to and the duty of Governments and people to protect natural resources such

as rivers and trees, sometimes by even going as far as recognizing such natural resources as living entities with the legal rights. We have also pointed out that whilst it is important that the rights to nature are recognized and protected, due attention must also be paid to identify the practical drawbacks in enforcing such rights, the purpose of that being to develop mechanisms to overcome difficulties in enforcing such rights.

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Realizing Equity and Sustainable Development in Climate Regime of Bangladesh

Mahatab Uddin*

mmuddin.ipl@gmail.com

Southern Denmark University, Odense, Denmark
Guelph University, Guelph, Canada
International Centre for Climate Change and Development, Dhaka, Bangladesh

Abstract:

Equity and Sustainable Development are two important guiding principles of the international climate regime formed under the umbrella of the United Nations Framework Convention on Climate Change (UNFCCC) 1992. All international legal instruments concluded under climate regime including the recently adopted Paris Agreement have acknowledged these two principles as their guiding principles. Consequently, all countries or Parties to the UNFCCC and its subsequent international agreements require integrating these two principles with their national level climate change related laws and policies. Bangladesh as a Party to the UNFCCC and all other subsequent instruments including Paris Agreement also requires incorporating the principle of equity and sustainable development into its national laws and policies. This article examines to what extent Bangladesh successfully integrated these principles with its legal and executive instruments adopted for the purpose of dealing with climate change. The article also examines possible ways as to how the principle of equity and sustainable development can be judicially enforced by the national courts of Bangladesh. The article finds that although most of the relevant legal and executive documents have adopted equity and sustainable development, problem remains with judicial enforcement of the relevant executive instruments. The study also finds that equity and sustainable development principles can be realized as a

* Mahatab Uddin is a Postdoctoral Researcher at the Centre for Law, Sustainability and Justice, Southern Denmark University and an Adjunct Professor at the School of Environmental Design and Rural Development, University of Guelph. He is a Ph.D. in Public International Law on Climate Change and Sustainable Development (Aarhus, Denmark), an M.Sc. in Sustainable Development (Uppsala, Sweden), and an LL. M. in Intellectual Property Law (Stockholm, Sweden).

citizens' constitutional right if national courts tend to broaden the scope and definition of some constitutional human rights such as human right to life.

1. Introduction

Equity and sustainable development are two most vital guiding principles for attaining all commitments agreed by the Parties to the 1992 United Nations Framework Convention on Climate Change (UNFCCC)[1]. The UNFCCC provisions implementing key global legal instruments Kyoto Protocol as well as Paris Agreement also adopted equity and sustainable development as its own guiding principles.[2] Hence, equity and sustainable development remain as two important factors for combating climate change under international laws on climate change or under international climate regime. Accordingly, all nations or Parties to the UNFCCC and/or its subsequent legal instruments are also required to follow the same in taking national initiatives on dealing climate change.[3] However, in practice it is less likely that all countries managed to integrate these two vital principles with their national legal and executive instruments. This article aims to examine how principles of equity and sustainable development are integrated with the national climate change related initiatives taken by the government of Bangladesh and whether these principles are legally enforceable. In view of that, this study will first entail a short overview of equity and sustainable development principles.

[1] The United Nations Framework Convention on Climate Change (UNFCCC), New York, NY (US), 9 May 1992, in force 21 Mar. 1994, Art. 3 (1), and Art. 3 (4), available at: http://unfccc.int. (last accessed on June 25, 2020). Art. 3 (1) states : 1. The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Art. 3 (4) states: The Parties have a right to, and should, promote sustainable development.

[2] The Paris Agreement, Paris (France), 12 December 2015, in force 4 Nov. 2016, Preamble, available at https://unfccc.int/ files/meetings/paris_ nov_2015/ application/pdf/paris_agreement_english_.pdf (last accessed on June 25, 2020); Kyoto Protocol to the UNFCCC, Kyoto (Japan), 11 Dec. 1997, in force 16 Feb. 2005, Preamble, available at: http://unfccc.int/resource/docs/ convkp/kpeng.pdf (last accessed on June 25, 2020). As like as Kyoto Protocol 1997, the Paris Agreement 2015 is adopted to implement the objectives and provisions of the UNFCCC. Hence, both Protocol and Agreement do also expressly or impliedly accept the guiding principles of the UNFCCC as their own guiding principle.

[3] This is consistent with the principle of *pacta sunt servanda* as enshrined under Art. 26 of the Vienna Convention on the Law of Treaties (VCLT), Vienna (Austria), 23 May 1969, in force 27 Jan. 1980, available at: https://treaties.un.org/doc/Publication/UNTS/Volume%201155/volume-1155-I-18232-English.pdf (last accessed on July 5, 2020).

Thereafter, this study will provide a brief outline of the national executive and legislative initiatives taken by Bangladesh government followed by an analysis as to what extent the principle of equity and sustainable development are reflected in relevant national instruments of Bangladesh. Finally, this paper will assess the possibility of judicial enforceability of equity and sustainable development principles under current legal system of Bangladesh.

2. Equity and Sustainable Development

2.1 Equity

Being derived from the concept of social justice[4], the principle of equity refers to 'a need of fairness in the distribution of gains and losses, and the entitlement of everyone to an acceptable quality and standard of living.'[5] One may also consider it as a concept of 'fairness and justice'.[6] For the purpose of upholding fairness and justice, arguably equity demands certain level of consideration to the specific needs of a society's marginalized or disadvantageous group of people. An useful tool of realization of the principle of equity can be 'strengthening and facilitating pluralisms and promoting participation of the disadvantaged group of people in decision-making'. [7] The 'disadvantaged group of people' can be determined on socioeconomic factors like gender, ethnicity, religion, or income etc.[8]

However, the principle of equity has two aspects such as the 'inter-generational equity' and the 'intra-generational equity'.[9] The 'inter-generational' aspect of equity is essential to address the inequalities between present and future generations, whereas the 'intra-generational' aspect of

[4] Mahatab Uddin, 'Climate Change Law, Technology Transfer, and Sustainable Development', Routledge, UK, 2021, 44

[5]Sharon Beder, 'Costing the Earth: Equity, Sustainable Development and Environmental Economics', *New Zealand Journal of Environmental Law,* Vol. 4, 2000, 229.

[6]Antoinette Heidering , *International Law, Sustainable Development and Water Management*, Netherlands, Eduron Publishers, 2004, 89.

[7]Harry Jones, *Equity in development: Why it is important and how to achieve it,* Working Paper 311 Results of Overseas Development Institute (ODI) research presented in preliminary form for discussion and critical comment, ODI, London, UK, 8.

[8]Ibid, 14.

[9]See generally Sharon Beder, 'Costing the Earth: Equity, Sustainable Development and Environmental Economics', New Zealand Journal of Environmental Law, 4, 2000, pp. 227-243.

equity addresses equal distribution of resources among communities or among people of the present generation.[10]

The independence of the two aspects of equity has been questioned by some scholars. There is a common consensus that if inequality exists in terms of economic development and environmental quality among present generation, it must affect equity of the future generations. In view of that "equity within the current generation is necessary for equity between generations."[11] But, since inter-generational equity argues for taking care of environment of the future generations, it is not clear "how the burdens and fruits are to be borne by members of the present generation…".[12]

In fact, failure of attaining intra-generational equity results into poverty and poverty leads to a scenario of environmental degradation. To maintain their livelihoods, poor people degrade natural resources in an unsustainable manner; as such they do not have opportunity to take care of the natural resources for future generation.[13] For this, an important question as to division of equity into inter-generational and intra-generational aspect concerns which aspect of equity should be of people's priority concern. Stone (1998) argues that present generation's moral duty to conserve natural resources for future generation may create a competing scenario with the present generation's financial necessity of eradicating poverty and environmental risks, especially in poverty stricken localities.[14] Hence, Brown Weiss (1990) thinks that attaining inter-generational equity requires "attention to certain aspects of intra-generational equity… ".[15] In view of that the theory of Brown Weiss in principle does not necessarily consider inter- generational aspect of equity as an independent issue, rather considers it as an extended form of intra-generational equity.

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[10]Ibid.

[11] C. Dernbach, "Sustainable Development as a Framework for National Governance" (1998) 49 Case W. Res. 1, pp. 31-32 cited in Tung-Chieh Jansen Wu , *Intergenerational and Intragenerational Equity and Transboundary Movements of Radioactive Wastes*, Master thesis, Faculty of Law, McGill University Montreal, Canada , July 2002, pp. 35.

[12] J.R. Des Jardins, Environmental Ethics: An Introduction to Environmental Philosophy, Wadsworth Publishing Company, 1997, pp 21 cited in Tung-Chieh Jansen Wu , July 2002, pp 35.

[13] Fiona Nunan et al., 'Poverty and the Environment: Measuring the Links, A Study of Poverty-Environment Indicators with Case Studies from Nepal, Nicaragua and Uganda', DFID, Environment Policy Department Issue Paper No. 2 February 2002, 11; Ibimilua, Foyeke Omoboye, 'Linkages between Poverty and Environmental Degradation', *African Research Review*, Vol. 5 (1), Serial No. 18, January, 2011. pp. 475-484, 479.

[14] C.D. Stone, "Safeguarding Future Generations" in E. Agius et al., eds., Future Generations and International law, London: Earthsean Publications, 1998, pp 76-77 cited in Tung-Chieh Jansen Wu , July 2002, pp 37.

[15] E. B. Weiss, "What Obligation Does Our Generation Owe to the Next? An Approach to Global Environmental Responsibility: Our Rights and Obligations to Future Generations for the Environment" ,1990, 84 A.J.I.L. 198 , pp. 201.

However, as per Report of the seventh conference of the International Law Association (ILA) the *inter-generational* dimension of the principle of equity means 'the rights of future generations to enjoy a fair level of the common patrimony'.[16] Agius (1998) refers to the inter- generational equity as '…principle of ordering of the community of mankind, which will make it possible for every generation, by virtue of its own effort and responsibility, to secure a proportionate share in the common good of the human species.'[17] One way of realizing inter- generational equity is promotion of capacity building at global and local level.[18]

The above-mentioned Report of the seventh ILA conference defines the *intra-generational* aspect of the principle of equity as 'the rights of all peoples within the current generation of fair access to the current generation's entitlement to the Earth's natural resources'.[19] It is closely related to eradication of poverty, which is also a pre-requirement of ensuring environmental protection. In this connection, denoting poverty as 'a major cause and effect of global environmental problems' the 1987 Brundtland Report states - 'Many parts of the world are caught in a vicious downwards spiral: poor people are forced to overuse environmental resources to survive from day to day, and their impoverishment of their environment further impoverishes them, making their survival ever more difficult and uncertain'.[20] Accordingly, the Brundtland Report remarks that, 'it is therefore fruitless to attempt to deal with environmental problems without a broader perspective that encompasses the factors underlying world poverty and international inequality.'[21]

In fact, negative impacts of poverty over environment have diverse aspects. Eradication of poverty will certainly promote environmental quality through eradicating those negative environmental impact aspects. For instance, poverty can lead to extra pressure on land, forest, and natural resources to meet basic needs of the poor people. Poverty is also a reason of improper human waste disposal

[16]ILA Resolution 3/2002(ILA *Report of the Seventieth Conference*, 2002, Principle 2).

[17]E. Agius, 'Obligations of Justice Towards Future Generations: A Revolution on Social and Legal Thought', in E. Agius (ed.), *Future Generations and International Law*, 1998, 10.

[18]The doctrine of Inter-generational equity in global environmental governance, Lynda Collins, A master thesis submitted as partial requirement of the Master of Laws, Department of Law, University of British Columbia, 2006, 93.

[19]Principle 2 of the ILA Resolution 3/2002.

[20] World Commission on Environment and Development (WCED), *Our Common Future,* WCED, 1987, 27.

[21]Ibid, chapter 1, Para 8.

leading to unhealthy living conditions. Besides, financial insecurity caused by poverty also

misleads people to build large family, which in the long run create extra pressures on environment. Moreover, poverty impedes people from access to education and sufficient knowledge about scientific agricultural practice. This might not only result in declined crop productions, but also result in negative impact on soil quality and fertility of the concerned land. Once these negative environmental causes are created by poverty, it further worsens the life quality of the people of the concerned locality. People become even poorer as because degraded lands yield less crops, the depleted forests yield less woods and fruits, and over all access to natural resources are reduced. It arguably leads to a scenario of 'vicious cycle of environmental degradation'.

Conversely, if intra-generational equity is attained and poverty among current population is eradicated, it will prevent environmental degradation and protect environmental quality. Consequently, current generation population will be able to reserve natural resources for future generation too. However, in addition to eradication of poverty issues, another important concern of intra- generational equity is the necessity of the elimination of inequalities in decision-making processes concerning environmental impacts or environmental policies.[22]

2.2 Sustainable development

Among all definitions and interpretations, the most accepted definition of sustainable development is found under the 1987 Brundtland Report. The definition of sustainable development of this Report refers to meeting the 'needs of the present generation without compromising the ability of future generations to meet their own needs.'[23] From this definition of sustainable development, it is clear that the concept is composed of both 'intra-generational' and 'inter-generational' dimensions of the principle of equity, where the notions of meeting 'the needs of the present generation' refer to 'intra-generational' and the notions of 'without compromising the ability of future generations to meet their own needs' refer to the 'inter-generational' aspect of the principle of equity.

[22]Sharon Beder, 'Costing the Earth: Equity, Sustainable Development and Environmental Economics', *New Zealand Journal of Environmental Law,* Vol. 4, 2000, 230.

[23]WCED, 1987, chapter 2, Para 1.

In line with the Brundtland Report's definition of sustainable development, sustainable development is based on three basic pillars: social justice, environmental protection and economic viability- popularly known as 'Triple Bottom Line'.[24] For this, sustainable development needs to follow an integrative approach that concerns economic sustainability, social sustainability, and environmental sustainability altogether. Taking care of all these environmental, social, and economic sustainability issues all together is known as an 'integration approach' of sustainable development.[25] In considering these three basic elements simultaneously, the 'integration' approach suggests providing priority (in terms of both theory and practice) to the protection and promotion of the environmental resources (*i.e. natural life supporting system)*.[26]

A grave criticism on sustainable development concerns its success in attempt of combining two contradictory discourses – economic expansion and environmental protection. Some scholars think that the idea has given an advantage to economic growth over environmental protection issues. For instance, Escobar (1995) states: "By adopting the concept of sustainable development, two old enemies, growth and the environment, are reconciled. [...] It is growth (read: capitalist market expansion), and not the environment, that has to be sustained"[27.] Besides, as per Sen (2004), Brundtland Commission's definition of sustainable development mainly includes an obligation to future generations, but it lacks considering intergenerational justice.[28]

Taking Sen's and other scholars' criticisms into account, this study considers that proper implementation of the principle of equity that includes both intergenerational and intra-generational aspects of the equity can promote both environmental protection and economic development in tandem. In this manner these two aspects of equity can assist the world in attaining global sustainable development. This is justifiable by two facts. First, intra-generational equity

[24]The 'three pillars' concept was first introduced by John Elkington in the book Cannibal with Forks, 1998. This is also known as the 3 Ps of sustainability - people, planet, profit. Online source: http://whatisenvironmental.blogspot.com/2012/09/the-3-ps-of-sustainability.html (last accessed on January 30, 2019).

[25]Ramon Pichs et al. (eds), *Development, Sustainability, and Equity*, IPCC and WMO, 2000, 67.

[26] Voigt, C., 'Sustainable Development as a Principle of Integration in International Law: Resolving conflicts between WTO Law and Climate Change Mitigation Measures', Doctoral Thesis, University of Oslo, 2006, 220.

[27]A. Escobar, Encountering development: The making and unmaking of the Third World, Princeton: Princeton University Press, 1995, pp. 195-6.

[28]A. Sen, 'The means and means of sustainability', key note address at an international conference on "Transition on sustainability", May 2000.

facilitates eradication of poverty, which as a result prevent environmental degradation and promotes environmental protection.[29] Second, the inter-generational aspect of equity inspires poverty-free people to conserve environmental quality and natural resources for future generations.

3. National climate change regime of Bangladesh

After signing and ratifying the UNFCCC on July 15, 1994, Bangladesh Government provided a 'high priority' to the climate change related issues through establishing a high-level national committee constituted with representatives of stakeholders, ministers, non-government organisations (NGOs) and academia in view to receive guidance to the activities.[30]At the same time, Bangladesh also gave 'high priority' to address the disaster management issues and formed a National Disaster Management Council, which is responsible to lay down policies and provide with over all instructions for different aspects of disaster management including the climate change posed disaster management.[31] In December, 2007, the government of Bangladesh also launched the National Capacity Self-Assessment for implementing the provisions of multilateral agreements that also includes the Climate Change Convention.[32] The National Capacity Self- Assessment of Bangladesh was conducted through financial support of GEF. All these steps taken by Bangladesh government arguably explain country's commitment to battle climate change.

The national laws and policies of Bangladesh that concern dealing climate change can be grouped into two groups- i. laws and policies adopted to address environmental issues, but also concern some of the climate change related issues ii. laws and policies adopted exclusively to deal with climate change issues. The following table enlists the laws and policies, which are adopted to address diverse environmental issues, but also cover some issues essential for battling climate change.

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[29] C.f. Fiona Nunan et al, 2002, 11; Foyeke Omoboye Ibimilua, 2011, 479.

[30]MOEF, *Initial Communication under the United Nations Framework Convention on Climate Change (UNFCCC)* , The Government of the People's Republic of Bangladesh, October 2002, 150.

[31]Ibid, 50.

[32]MOEF, *Bangladesh Capacity Development Action Plan for Sustainable Environmental Governance,* The Government of the People's Republic of Bangladesh, December 2007,132.

Table 1: Laws and policies adopted to address environmental issues that also concern some of the climate change related issues

Name of the policy	Focus and objective of the policy that concerns battling climate change	Year of adoption
1. National Environmental Policy (NEP)[33]	Eradicating adverse environmental impacts. (e.g. water resource and flood control issues	1992
2. National Environnemental Management Action Plan (NEMAP) [34]	Identifying key environmental issues, conserving the nature, reducing environmental degradation, promoting sustainable development, and generally raising the quality of human life	1995 1999
3. National Agricultural Policy (NAP) [35]	Building up necessary arrangements for the rural disatser mitigation.	1999
4. National Water Policy (NWP) [36]	Joint activities with upstream neighbouring countries for development, collection and distribution of water resources on international rivers increasing water flow in the dry seasons and reducing flood intensity during the rainy seasons.	2004
5. National Water Management Plan (NWMP) [37]	Implementing objectives of the National Water Policy	2005
6. The Coastal Zone Policy 2005[38]	Monitoring the climate change and adaptive measures to climate change for coastal zones and resources	2005

[33]National Environment Policy (NEP) 1992, available at http: // www. Bdix .net /sdnbd_ org/world _env_ day/2004/policies/31_Environment%20Policy%20Programme_92_F.doc (last accessed on January 3, 2021).

[34]National Environmental Management Action Plan (NEMAP) 1995, available at http://documents.worldbank.org/curated/en/830211468743375359/Bangladesh-National-environment-management- action-plan-NEMAP (last accessed on January 30, 2020).

[35] National Agricultural Policy 1999,available at http://dae.portal.gov.bd/sites/default/ files/ files/dae. portal.gov. bd/page/dd7d2be1_aeef_452f_9774_8c23462ab73a/NAP.pdf (last accessed on January 3, 2021).

[36] National Water Policy 1999, available at https://web. archive.org/web /20080528063843 /http://www .warpo.gov. bd/nw_policy.pdf (last accessed on December 30, 2020).

[37]Bangladesh National Water Management Plan 2001, available at http:/ /www. warpo. gov. bd /NWMP /main_ report. pdf (last accessed on December 30, 2020).

[38]Bangladesh Coastal Zone Policy 2005, available at http:/www . warpo .gov .bd / Coastal% 20 Zone % 20Policy/czpo _eng.pdf (last accessed on December 30, 2020).

However, the government of Bangladesh initiated its first specific focus on climate change dealing mechanism through submitting its first Initial National Communication (INC) to the UNFCCC. The Initial National Communication was conducted in 2002 to fulfil the international obligation of Bangladesh derived from Art.4.1, and Art.12 of the UNFCCC. All Parties to the UNFCCC are obliged to report on the steps they are taking to implement the Convention.[39] All non-Annex I Parties have obligation to submit their initial communication 'within three years of the entry into force of the Convention for that Party, or of the availability of financial resources'[40]. As the obligation to the least developed countries, are dependent on their discretion, Bangladesh submitted its first communication paper on 12 November, 2002.In addition to the national circumstances, mitigation, greenhouse gas inventory, vulnerability etc., the Initial National Communication is comprised with chapters on adaptation to climate change and a strategic response to climate change. The government of Bangladesh submitted its second Initial National Communication to the UNFCCC in 2012.[41] Both first and second Initial National Communications were conducted through financial and technical cooperation of the UNFCCC financial cooperation mechanism- Green Environment Facility (GEF).

Besides the above-stated two Initial National Communications, all other official documents of Bangladesh that concern dealing climate change can be broadly divided into two portfolios: i. executive instruments and ii. legislative instruments. Main differences between executive and legislative instruments lie in their judicial enforceability, which will be discussed in detail under section 6.2 of this study. Table 2 below lists Bangladesh's all executive and legal instruments which concern battling climate change.

[39]Art 4of the UNFCCC states: 1. All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:

(a) Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties;

[40] Art. 12(5) of the UNFCCC 1992.

[41]See generally MOEF, *Second National Communication of Bangladesh to the United Nations Framework Convention on Climate Change (UNFCCC),* The Government of the People's Republic of Bangladesh, October 2012, available at http://unfccc.int/resource/docs/natc/bgdnc2.pdf (last accessed on December 30, 2020).

Table 2: Bangladesh's executive and legal instruments on climate change issues

Type of the Instrument	Name of the Instrument	Year of Adoption
Executive	National Adaptation Programmes of Action	2005
	Bangladesh Climate Change Strategy and Action Plan (BCCSAP)	2009
Legal	Renewable Energy Policy	2009
	Action Plan for Energy Efficiency and Conservation	2009
	Climate Fiscal Framework	2013
	National Sustainable Development Strategy	2014
	Sixth (6^{th}) Five Year Plan	FY 2011-FY 2015
	Seventh (7^{th}) Five Year Plan	FY 2011-FY 2015
	The Climate Change Fund Act Fund Act	2010
	Disaster Management Act Sustainable and Renewable Energy Development Authority Act	2012
		2012

4. Equity and sustainable development under climate regime of Bangladesh

Since equity and sustainable development are two important principles of international legal instruments on climate change *e.g. UNFCCC, Paris Agreement*,[42] being a Party to those legal instruments, national climate change instruments of Bangladesh needs to be in line with these

[42]See *supra note* 1 and *supra note* 2.

principles. However, like most other former colonies of Britain, Bangladesh follows common law system,[43] and like all other common law countries Bangladesh follows 'dualist'[44] approach for implementation of international treaties or provisions of international law. For this reason, even after appropriate ratification of any international treaty or law by Bangladesh government, national courts of the country cannot directly enforce any provision of the concerned international law or any principle of the concerned international treaty. It means, in order to implement any principle or objective of international law at national level Bangladesh government needs to integrate the concerned principle and objectives with concerned national documents or instruments. In view of that the following two sub-sections of this article aims to assess to what extent the principle of equity and sustainable development are integrated in national climate regime of Bangladesh.

4.1 Equity and sustainable development under national executive instruments

In 2005, the Ministry of Environment and Forest (MOEF) of Bangladesh Government prepared the National Adaptation Programmes of Action (NAPA).[45] Since the effectiveness of the National Environmental Management Action Plan (1995 to 2004) came to an end in 2004, the National Adaptation Programmes of Action arguably filled the vacuum. More importantly, while the National Environmental Management Action Plan was a mere environmental management plan of the country, the National Adaptation Programmes of Action was exclusively aimed to deal with climate change adaptation issues of the country.

Preparing the National Adaptation Programmes of Action is arguably an instance of Bangladesh's compliance with Art. 4(1)(b) of the UNFCCC.[46] The preparation process of the National Adaptation Programmes of Action followed the general guiding principles drawn by the Conference of the Parties to the Convention[47] as well as the annotated guideline given by

[43] See generally Kazi Ebadul Hoque, *Administration of Justice in Bangladesh* (Asiatic Society of Bangladesh, 2003).

[44] 'For States with a "dualist system", international law is not directly applicable domestically. It must first be translated into national legislation before it can be applied by the national courts.', see https://www.peaceandjusticeinitiative.org/implementation-resources/dualist-and-monist (last accessed on 5 January, 2020)

[45]Decision 28/CP.7, FCCC/CP/2001/13/Add.4.

[46]Art 4(1)(b) of the UNFCCC states : All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall: Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change

[47] Decision CP- 28/7 , FCCC/CP/2001/13/Add.4 .

the by the Least Developed Countries Expert Group (LEG)[48]of the UNFCCC.[49] The guiding principles explicitly mention about sustainable development issues that countries need to consider while preparing their own National Adaptation Plan of Action.[50]The guideline does not directly mention anything about principle of equity but it covers the equity issue through addressing participatory process and gender equity issues. It requires countries ensuring participation of all stakeholders and specially the local communities in decision making process.[51] Besides, the LEG guideline acknowledges that the climate change has more adverse impacts on women than that of man. For instance, in increased circumstances of droughty atmosphere, women will require walking further than usual distance to collect drinking water. Moreover, women are the main sources of local and traditional knowledge of any locality. For these reasons, the LEG guideline requires countries to recognize women as key stakeholders in decision-making process.[52]

However, as not recommended by the LEG guideline, the National Adaptation Programmes of Action of Bangladesh does not explicitly refer to the notion of equity, but attaining sustainable development is adopted as one of the main goals of the instrument. The Programmes of Action clearly states that the 'strategic goals and objectives' of future climate change coping mechanisms are 'to reduce adverse effects of climate change' and to 'promote sustainable development'.[53]

An implication of indirect reference to the principle of equity *i.e. inter-generational equity* is manifested through putting four projects on capacity building on its priority list.[54] Another indirect reference to the principle of equity *i.e. intra-generational equity* can be found in this program of action through its acknowledgment of vulnerability and necessity of special care

[48]The Least Developed Countries Expert Group was established by Decision 29/CP.7 of the COP 7, FCCC/CP/2001/13/Add.4 .

[49]Ibid.

[50]Decision 28/CP.7, FCCC/CP/2001/13/Add.4 .

[51]Ibid.

[52]Least Developed Countries Expert Group, Annotated guidelines for the preparation of national adaptation programmes of action, UNFCCC, July 2002, 3

[53]NAPA, 2005, 21.

[54] Four projects are as follows: 1. Integrating Climate Change in planning, designing of infrastructure, conflict management and land water zoning for water management institutions. 2. Climate change and adaptation information dissemination to vulnerable community for emergency preparedness measures and awareness raising on enhanced climatic disasters. 3. Mainstreaming adaptation to climate change into policies and programmes in different sectors (focusing on disaster management, water, agriculture, health and industry). 4. Enhancing resilience of urban infrastructure and industries to impacts of climate change. See NAPA, 2005, 24-25.

to women, elderly and children.[55] Accordingly, an instance of manifestation of the principle of equity can be found while at the time of taking 'eco-specific actions for helping vulnerable communities' it confers priority to women, elderly and children.[56] But, the programme of action lacks conferring more emphasizes on involvement of local women in adaptation related decision taking matters.

However, the preparation process of the Programme of Action has impliedly facilitated principle of equity through ensuring participation of 'stakeholders in bargaining over resource use, allocation and distribution'.[57] In order to ensure participations of all concerned stakeholders, which is an important component of 'intra-generational equity',[58] the preparation process of the National Adaptation Programmes of Action included government policy makers, local representatives of the government, members of the scientific community of different research institutes, academicians, teachers from primary to tertiary level, doctors, lawyers, and representatives from different ethnic groups, media, non-governmental organizations (NGOs), community based organizations (CBO), and indigenous women.[59]

In 2008, Bangladesh government adopted the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). This Action Plan is Bangladesh's first effort to combat climate change through adopting 10 years (from 2009 to 2018) strategy. Although adopted in 2008, it was revised and republished in 2009.

In addition to outlining probable impacts of climate change and providing an overview of different adaptation strategies, the Bangladesh Climate Change Strategy and Action Plan contains a ten years programme with a view to building capacity and resilience of the country to deal with the challenges posed by climate change.[60] Arguably, this aim of building capacity and resilience of the country to combat climate change observes 'inter-generational' aspect of the principle of equity. Hence, it also facilitates national sustainable development as because promotion of inter-generational equity is as an essential condition of promotion sustainable development.[61]

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[55]NAPA, 2005, 17.

[56] NAPA, 2005, 34.

[57] NAPA, 2005, 42.

[58]See *supra* section 2.1. Equity.

[59]NAPA, 2005, xv; See also Aminul Islam et al., 'National Adaptation Programme of Action' in Rajib Shaw et al. (eds.) , *Climate Change Adaptation Action in Bangladesh*, Springer, 2009, 99-100

[60]The BCCSAP 2009*,* xvii.

[61]C.f. *supra* Section 2.1: Equity, and Section 2.2: Sustainable Development

Through acknowledging the role of 'accelerated development' in building 'resilience to climate change', the objective of the Action Plan arguably accepts and endorses that social and economic development of the country is an integral part of climate change adaptation.[62] In fact, such integration of national social and economic development issues with 'resilience to climate change' mirrors the guiding spirit of the UNFCCC: 'Responses to climate change should be coordinated with social and economic development in an integrated manner with a view to avoiding adverse impacts on the latter'.[63] Pursuant to the just-mentioned texts of the UNFCCC Preamble, the Bangladesh Climate Change Strategy and Action Plan also includes the notion of 'rapid development' to accompany with main aim of the Action Plan of increasing 'the country's resilience to climate change'. In this connection, it is mention-worthy that the integration of 'development' with 'resilience to climate change' is also a reflection of the notions of Principle 8 of the Stockholm Declaration, and Principle 4 of the Rio Declaration which urge for reconciliation of 'environment' with 'development'.[64]

While in taking responsive steps against climate change 'the first and overriding priority' for Bangladesh is eradicating poverty,[65]the country requires setting a priority list of its development goals.[66]Accordingly, the Bangladesh Climate Change Strategy and Action Plan confers highest priority on food security, social protection and health followed by comprehensive disaster management, infrastructure, research and knowledge management, mitigation and low carbon development, and capacity building and institutional strengthening. These six thematic sectors are known as six pillars of the Action Plan.[67] The inclusion of 'capacity building' as one of the thematic sectors undoubtedly reflects the scope of realization of 'inter-generational equity' and promotion of sustainable development.[68] Besides, conferring highest priority on food security, social protection and health is not only an instance of providing special attention to the special necessities, but also an instance of giving priority to the needs of most marginalized people of the land. Therefore, it also gives an instance of observance of the main spirit of the principle of equity that requires special

[62]Paragraph 43 of the Bangladesh Climate Change Strategy and Action Plan 2009 states its objective as: 'to increase the country's resilience to climate change, reduce and/or eliminate the risks climate change poses to national development, and rapidly develop the country, following a low carbon growth path. The country firmly believes that accelerated development is the most effective way to eradicate poverty and build resilience to climate change.' [63]Para 21, Preamble to the UNFCCC 1992.

[64]C.f. M.C. Cordonier-Seggerand A. Khalfan (eds.), *Sustainable Development Law: Principles, Practices, and Prospects,* Oxford University Press, 2004, (eds.), 2004, 46; See also *supra* Section 2.2. Sustainable Development.

[65]Art. 4(7) of the UNFCCC.

[66]Para 22 of the Preamble to the UNFCCC.

[67]Ibid, xvii, xviii.

[68]C.f. *supra* Section 2.1:Equity and 2.2: Sustainable Development.

attention to the special necessities and priority to the socially marginalized people.[69]

In view to fill up the existing gap on national policy on renewable energy issues, in 2009, the Government of Bangladesh also adopted a Renewable Energy Policy (REP) followed by establishment of an independent entity- Sustainable Energy Development Agency (SEDA).[70] The main objective of the Sustainable Energy Development Agency is to promote generation of energy from renewable sources. The Renewable Energy Policy requires the Sustainable Energy Development Agency Board to be composed of representatives from different concerned stakeholders that include business community, NGOs, academics and/or representative from Bangladesh Solar Energy Society, financial institutions and implementing agencies, and business community.[71] Through ensuring participation of representatives from different concerned stakeholders, the Renewable Energy Policy arguably aims to promote intra-generational aspect of the principle of equity and sustainable development.[72]But, the above-stated list does not include local stakeholders and also lack assurances of women participations, which as a result can be seen as an impediment for observance of equity and promotion of sustainable development.

The Renewable Energy Policy of Bangladesh also aims to promote clean energy for establishing Clean Development Mechanism (CDM) projects.[73] The above-mentioned role of the Renewable Energy Policy to encourage establishing more Clean Development Mechanism (CDM) projects fulfils country's aim to co-operate other Parties in attaining the goals and objectives of the Convention.[74]This is because, since CDM is a tool of emission reduction,[75] any legal or executive initiative of Bangladesh that facilitates emission reduction activities *e.g. establishing CDM* should be considered as equivalent to cooperation with other Parties in mitigating the greenhouse gas concentration in atmosphere. Regarding CDM, although it

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[69] C.f. *supra* Section 2.1. Equity.

[70] Bangladesh Renewable Energy Policy is available at https:// www.iea.org/ media/pams/ bangladesh/ Bangladesh_RenewableEnergyPolicy_2008.pdf (last accessed on December 30, 2020). ; and Para 3.1 of Bangladesh Renewable Energy Policystates: ' An institution, Sustainable Energy Development Agency (SEDA), shall be established under the Companies Act, 1994, as a focal point for sustainable energy development and promotion, 'sustainable energy' comprising renewable energy and energy efficiency.'

[71]Bangladesh Renewable Energy Policy 2008, Para 3.1.

[72]C.f. *supra* Section 2.1. Equity.

[73]Para 2 (x) of the Bangladesh Renewable Energy Policy, 2008. The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO2, which can be counted towards meeting Kyoto targets. See more about CDM on https://unfccc.int/process- and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism (last accessed on December 30, 2020).

[74]C.f. Art. 2(b) of the Kyoto Protocol 1997.

[75]See Art. 12 of the Kyoto Protocol 1997.

was introduced by Kyoto Protocol, a similar kind of 'sustainable development mechanism' has also been introduced by Paris Agreement.[76] For this reason, the above-mentioned provision of the Renewable Energy Policy of Bangladesh not only complies with requirements of Kyoto Protocol but also facilitates lately enacted Paris Agreement's objectives. Although the overall success of CDM in promoting sustainable development is not easy to determine, study shows that CDM projects played positive role in facilitating sustainable development in Bangladesh.[77]

Besides, the Renewable Energy Policy of Bangladesh opens doors for increased source of renewable energy, and increased possibilities of public and private financing. These can also play a mammoth role in eradication of poverty, which is an important part of realization of 'intra-generational equity' and promotion of sustainable development.[78]

Henceforth, the Renewable Energy Policy of Bangladesh has two-fold implications in promotion of sustainable development. First, it promotes local sustainable development through promoting 'intra-generational equity' by way of playing role in poverty eradication in the country.[79]Secondly, it has implication in promotion of 'integration' approach of sustainable development through taking part in facilitating environmental, social, and economic developments of the country with conferring special priority to environmental development.[80]

In 2010, Bangladesh government adopted National Sustainable Development Strategy for 2010- 2021 which specially realizes and observes the principle of equity through emphasizing on gender parity in country's all level of education,[81] improving labor force participation of female,[82] and mass people's participations in forest development activities.[83] In addition, the strategy also observes the principle of equity through emphasizing on participation of the disabled people in mainstream social, political and cultural lives,[84] and participation of local

[76] Art. 6 (4) of the Paris Agreement 2015.

[77] Mahatab Uddin, 2021, 171 ff.

[78]C.f. *supra* section 2.1. Equity.

[79]C.f. *supra* section 2.1. Equity.

[80]C.f. *supra* Section 2.2. Sustainable Development.

[81] National Sustainable Development Strategy of Bangladesh (2010-21), 17, 82.

[82] Ibid,104.

[83] Ibid, 121.

[84] Ibid, 107.

people as well as local governments in natural resources management.[85] Moreover, in line with the main spirit of the principle of equity, it further requires taking 'initiatives to make women politically more conscious encourage women to participate in politics and to build leadership among women at all levels'.[86]

In 2013, the Ministry of Power, Energy and Mineral Resources of the government of Bangladesh published another executive level national instrument named as Action Plan for Energy Efficiency and Conservation. The Action Plan aims to set a unified framework for energy efficiency and conservation activities under the supervision of the Sustainable and Renewable Energy Development Agency (SREDA), which was established in 2012 through The Sustainable and Renewable Energy Development Authority Act 2012.[87] Under the Action plan the government expresses its interest to ensure primary and secondary energy saving 10% by 2015, 15% by 2021, and 20% by 2030.[88] In this manner, through planning for saving energy this executive approach of the government of Bangladesh plays role in saving environment and natural resources for future generations as such realizes inter-generational aspect of the principle of equity.[89] This is because energy is produced at the cost of environmental degradation and the less energy is consumed the more environment is saved.[90]

However, to fulfill the expressed target of the Plan, it provides an overall outline of the energy sector of Bangladesh that includes country's legal and institutional framework on energy sector including possible ways of enhancing capacity as well as managing the energy sector of the country.[91] Its role in enhancing capacity also refers to realization of the inter-generational approach of the principle of equity.[92]

In 2014, the Ministry of Finance of Bangladesh government published the Climate Fiscal Framework (CFF). In addition to ensuring a sustainable and transparent climate fiscal policymaking, the Climate Fiscal framework aims to assist identifying supply and demand

[85] Ibid, 115, and 112.

[86] Ibid, 105.

[87] Act no. 48 of 2012.

[88]Action Plan for Energy Efficiency and Conservation 2013 , ab- iv, 65

[89] C.f *supra* Section 2.1. Equity and Section 2.2. Sustainable Development.

[90] See generally Mustafa Balat, Usage of Energy Sources and Environmental Problems, Energy Eploration & Exploitation,Vol. 23, No.2 , 2005, pp. 141–168.

[91] Ibid.

[92] C.f. supra Section 2.1. Equity

sides of climate fiscal funds. In line with the spirit of the principle of equity and sustainable development, the Climate Fiscal Framework stipulates its one of the main objectives as to determine 'the equitable division of climate funds and their allocation to relevant sectors.'[93] To achieve sustainable development, it argues for 'involving all players in the economy — the Government, NGOs, markets, corporate entities, local businesses, civil society and, of course, the financial sector'.[94] In line with promotion of sustainable development, the framework also argues for promotion of green banking. [95] Since aim of green banking is to facilitate environmentally friendly banking system, it implicitly realizes the 'inter-generational' approach of sustainable development through its role of preserving environment and natural resources for future generation.[96] However, this framework directly manifests the principle of equity through accommodating the issue of gender equity in national financial instruments.[97]

Apart from the above-mentioned national executive policies and plans, both sixth five- year plan (FY 2011-2015), and seventh five-year plan (FY 2016-2020) of Bangladesh government adopts sustainable development as one of their main objectives. The Sixth Plan clearly stipulates that 'a firm commitment to pursue an environmentally sustainable development processes' is a 'key strategic element' of the Plan. [98]

The seventh five years plan of the country was adopted in 2016 while the United Nations Sustainable Development Goals (UNSDGs)[99] was already in hand. Hence, it is found that the seventh five years plan of Bangladesh emphasizes on promotion of sustainable development in numerous places. In the whole document, the notion of 'sustainable development' is found in sixty-two places, while the notion of 'equity' is found in fifty-nine places. A whole chapter of the Plan is named as 'Sustainable development: Environment and Climate Change'.[100]

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[93] Bangladesh Climate Fiscal Framework (CFF) 2014, 2.

[94]Ibid, 44.

[95]Ibid, 44.

[96] C.f. *supra* Section 2.1. Equity, and 2.2. Sustainable Development.

[97]Ibid, 46.

[98]Sixth five year plan of Bangladesh (FY 2011-2015), 8.

[99] Details about UNSDGs are available here https://www.un.org/sustainabledevelopment/sustainable-development- goals/ (last accessed on December 30, 2020).

[100]Seventh five-year plan of Bangladesh (FY 2016-2020), Chapter 8, 445.

The main objectives in connection with climate change, environment and disaster management of the Seventh Plan noticeably embraces those issues that ultimately realize, observe and promote inter-generational and/or intra-generational equity as well as sustainable development. The first objective of the Seventh Plan is ensuring appropriate environment management system for sustainable development.[101] This is clearly connected with promotion of inter-generational equity through protecting environment. The second objective is also directly linked with promotion of intra-generational equity, as it requires eradication of extreme poverty.[102]

4.2 Equity and sustainable development under national legislative instruments

In 2010, Bangladesh Government enacted Bangladesh Climate Change Trust Fund Act, which can be denoted as a speedy response of government to climate change adaptation activities. In fact, as one of the most climate change vulnerable non-Annex I Party to the Convention, Bangladesh required conferring immediate priority on adaptation activities.[103] The Act established Bangladesh Climate Change Trust Fund (BCTF).[104] This Trust Fund is a 'block budgetary allocation' of USD 100 million each year for three years (2009-2012)[105]. The source of finance for this fund is mainly the revenue earned from the domestic resources.[106] The Act upholds the principle of sustainable development in its objective clause. In objective clause it mentions that one of the objectives of the Act is 'to initiate and implement suitable action plan for implementation of special programme regarding climate change and ensuring sustainable development'.[107]

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[101] The other objectives of the Seventh Plan include eradicating extreme poverty and achieving national food security; addressing environmental health, ensuring that cities are sustainable and more efficient; establishing the quality of life for the rural people of all regions; preserving agricultural land water ensuring production growth for food security with minimum environmental degradation; holding water of wetlands and rivers in dry season; meeting national air and water quality standards; achieving tree cover over 20% of the land surface (with tree density > 70%) and ecologically healthy native forests are restored and protected in all public forest lands (about 16% of land); ensuring no new extinctions of globally and nationally threatened species; meeting energy demands of development through a low carbon strategy; and above all reducing potential economic losses due to Climate Change (particularly from floods, drought and salinity), see Ibid, 449-452.

[102] Ibid.

[103] Art. 4 (1)(b), Art. 4 (1) , Art. 4 (1) (f), and Art. (4) of the UNFCCC 1992.

[104] Section 15 of the Bangladesh Climate Change Trust Fund Act, 2010, available at http://www.dpp.gov.bd/upload_file/gazettes/15741_60576.pdf (last accessed on December 30, 2020).

[105] Mahatab Uddin, 'Transfer of Environmentally Sound Technologies and Promotion of Sustainable Development in the Least Developed Countries', PhD Thesis, Department of Law, Aarhus University, 2016, 187.

[106] Section of 15 of the BCTF mentions following entities as source of : 1) There shall be a fund of the Trust to be called the climate Change Trust Fund to which the following sums of money shall be credited, namely : (a) money granted by the Government from the National Budget; (b) money received from the donor countries, organisations and institutions approved by the Government; (c) money received from the local and foreign sources approved by the Government; (d) income accrued from investment of the fund; (e) money received from any other sources approved by the Government, available at http://www.dpp.gov.bd/upload_file/gazettes/15741_60576.pdf (last accessed on December 30, 2020).

[107] Climate Change Trust Fund Act, 2010, Section 6 (b).

No direct reference of the principle of equity is found in this Act. However, implicit reference to the inter-generational approach of the principle of equity is found while aims and objectives of the Act specifies that building capacity in adaptation, mitigation and other essential sectors for battling climate change is part of aims and objectives of the Act.[108] Similarly, the act has indirect reference to the 'intra-generational' approach of the principle of equity while objective of the Act includes assisting in eradication of poverty.[109]

In order to guarantee reduction of overall disaster risks to a tolerable level through taking proper risk reduction approaches, in 2012, Bangladesh enacted its national legislative instrument Disaster Management Act. The Preamble to the Act denotes its objective as- 'to make the activities about disaster management coordinated, object oriented and strengthened and to formulate rules to build up infrastructure of effective disaster management to fight all types of disaster'. Though the Act's objective is to deal with all kinds of disasters, the Act has special relevance with dealing climate change posed adversities. This is because majority of the disasters that Bangladesh face are fallen under the category of natural disasters, which are recently geared up and enhanced by climate change. The Disaster Management Act specially realizes the principle of equity through containing provision of emergency humanitarian assistance to the most vulnerable community people.[110]

In 2012, Bangladesh also enacted the Sustainable and Renewable Energy Development Authority Act that established an authority aimed to promote the development and use of renewable energy. Since promotion of sustainable energy is an important tool of reduction of greenhouse gas in atmosphere, this Act is a clear instance of positive role that Bangladesh government plays in climate change mitigation. For the purpose of promotion and development

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[108]Climate Change Trust Fund Act, 2010, Section 5 (a) (b) , and Section 6 (c) ; Section 5: Aims of the Trust: The Trust shall have the following aims, namely : (a) to make necessary action plan for capacity building for adjustment of the people or groups of people of the affected and risky areas resulting from climate change, upgrading their life and livelihood and facing the long term risk, and to take measures for implementation there of ;

(b) to take measures for adaptation, mitigation, technology development and transfer, capacity building and funds for facing adverse effect of climate change on man, biodiversity and the nature.

Section 6: Objectives of the Trust: The objectives of the Trust shall be as follows, namely : (c) to initiate project or programme regarding institutional and social capacity building of the local people and development of human resources in the grass root level for facing climate change;

[109]Climate Change Trust Fund Act, 2010, Section 6 The objectives of the Trust shall be as follows, namely: (g) to assist in initiating suitable programmes and implementation thereof in order to eradicate poverty by building up the institutional, social or local people's capacity for creating public awareness on possible environmental disaster arising out of climate change and for facing the disaster;

[110] Disaster Management Act, 2012, Section 27.

of renewable energy and energy efficient activities, the Act confers a set of responsibilities and functions to the Sustainable and Renewable Energy Development Authority of the country.[111]

Although the Sustainable and Renewable Energy Development Authority Act does not directly refer to promotion of equity and sustainable development, the purpose of the Act ultimately results in promotion of equity and sustainable development in the country. Promotion of renewable energy itself has diverse folds direct impact over sustainable development. It promotes both intergenerational and intra-generational equity elements of sustainable development. First of all, sustainable and renewable energies promote inter-generational equity through saving depletion of fossil fuels and reserving those for future generation. Secondly, in the context of Bangladesh, promotion of renewable energy has a noteworthy positive impact in promoting intra-generational equity through helping reduction of poverty by creating new job opportunities in the newly established renewable energy sectors. Thirdly, by way of reducing use of fossil fuel it reduces air pollution, which helps improving healthy lifestyle of people.[112] In consequence, it not only improves healthy environment through reducing air pollution, but also helps promoting sustainable development through promoting social development.[113]

However, although observation of the principle of equity inherently lies in promotion of sustainable development, the Sustainable and Renewable Energy Development Authority Act 2012 of Bangladesh lacks any direct reference to the principle of equity. Its preparation process also contains a lack of considering participation of local people or considering gender equity.

5. Judicial enforceability of equity and sustainable development

5.1 Equity and sustainable development as constitutional right

In connection with conferring some constitutional standing to the principles of equity and sustainable development, 15th amendment of Bangladesh Constitution can be considered as a breakthrough amendment. In 2011, through its 15th amendment, Bangladesh constitution

[111]Section 6 of the Sustainable and Renewable Energy Development Authority Act 2012.

[112]Mahatab Uddin, 2016, 187.

[113]Ibid.

included 'protection and improvement of environment and biodiversity' as one of the fundamental principles of state policy which was placed under Part II of the constitution. It calls for the Government to take 'endeavour to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wild life for the present and future citizens'.[114] Arguably, by inserting the notions 'present and future citizens', Art. 18(A) impliedly refers to the inter-generational and intra-generational aspects of the principle of equity as well as the principle of sustainable development as fundamental principles of state policy. While it urges to 'preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wildlife' for both 'present and future citizens', it refers to observation of both 'intra- generational equity' and the 'inter-generational equity'. [115]

In connection with observation and promotion of the principle of equity especially intra-generational equity through eradication of poverty, similar kind of references can also be found under Art. 14 of Bangladesh constitution. Art. 14 denotes emancipation of 'toiling masses, the peasants, and workers and backward sections of the people from all forms of exploitation' as a fundamental responsibility of a state.

While as a party of many international legal conventions and treaties, Bangladesh is committed to observe and promote sustainable development,[116] the concept of sustainable development as fundamental principle of the state policy is arguably in line with those commitments. It should further be noted that the implied reference to 'sustainable development' of Art. 18(A), and the notions from Art. 14 of Bangladesh Constitution also conform to the Bangladesh's 'first and overriding priority' obligation under the UNFCCC - eradicating poverty.[117]

However, although the notions of Art. 14 and Art. 18 (A) of Bangladesh constitution have conferred equity and sustainable development a constitutional merit these principles are not judicially enforceable by the courts of Bangladesh. This is because, the socio-economic rights enumerated as fundamental principles of state policy under Part II of Bangladesh constitution

[114]The Constitution of the People's Republic of Bangladesh, Art. 18A.

[115]C.f. *supra* section 2.1. Equity.

[116]For example, the UNFCCC 1992, the Kyoto Protocol 2017, and the Paris Agreement 2015.

[117]Since 'eradication of poverty' is an essential principle of sustainable development, see *infra* Section 2.1. Sustainable Development. See also Art. 4(7) of the UNFCCC.

are considered as merely 'aspirational provisions'.[118] In connection with judicial enforceability of the fundamental principles of state policy, Art. 8(2) of Bangladesh constitution clearly states that these principles (those placed under part II of the constitution) 'shall be fundamental to the governance of Bangladesh, shall be applied by the state in the making of laws, shall be a guide to the interpretation of the Constitution and of the other laws of Bangladesh, and shall form the basis of the work of the State and of its citizen, but shall not be judicially enforceable'. The judicial non-enforceability of the provisions of Part II of Bangladesh Constitution was reconfirmed by several judgments of the High Court Division of Bangladesh.[119] For instance, in Kudrat-E-Elahi Panir Vs. Bangladesh (1992), the Appellate Division of the Bangladesh Supreme Court observed:

The reason for not making these principles judicially enforceable is obvious. They are in the nature of people's programme for socio-economic development of the country in a peaceful manner, not overnight, but gradually. Implementation of these programmes requires resources, technical know-how and many other things including mass-education. Whether all these pre-requisites for a peaceful socio-economic revolution exist is for the State to decide.[120]

However, the fundamental principles of state policy of Bangladesh constitution have guiding impact over state's activities.[121] In this regard, 'the state has an obligation to act on this principle'. [122] Besides this, after fifty years of independence of Bangladesh, considering the fundamental principles of state policy of Bangladesh constitution as 'judicially unenforceable' is also 'against the spirit of the constitution.'[123]

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[118]See generally Kamal Hossain, Economic and Social Justice Under the Constitution of Bangladesh (First AK Khan Memorial Law Lecture, University of Chittagong, 27 February, 2016) cited in Md Saiful Karim, Shipbreaking in Developing Countries: A Requiem for Environmental Justice from the Perspectives of Bangladesh, Routledge , Abingdon 2018, 38.

[119]Kudrat-E-Elahi Panir Vs. Bangladesh (1992) 44 DLR (AD) 319 ; M Saleem Ullah v. Justice M A Quddus Chowdhury (1994) 46 DLR (HCD) 691; Aftab Uddin vs. Bangladesh (1996) 48 DLR (HCD)1 cited in Md Saiful Karim, Shipbreaking in Developing Countries: A Requiem for Environmental Justice from the Perspectives of Bangladesh, Routledge , Abingdon 2018, 39.

[120]Kudrat-E-Elahi Panir Vs. Bangladesh (1992) 44 DLR (AD) 331.

[121]Wahab vs. Secretary Ministry of Land, (1996) 1 MLR (HC) 338.

[122] Md Saiful Karim, *Shipbreaking in Developing Countries: A Requiem for Environmental Justice from the Perspectives of Bangladesh,* Routledge, Abingdon 2018, 39.

[123] Ibid, 40.

The preamble to Bangladesh constitution aims for a 'society in which rule of law, fundamental human rights and freedom, equality and justice, political, economic and social , will be secured for all citizens' as a fundamental aim of the country.[124] If intention of the original constitution is to ensure a state of fundamental human rights and freedom and a state of equality in terms of political, economic and social justice, then question comes as to why the socio- economic rights and fundamental principles of state policies of Bangladesh constitution should remain judicially unenforceable.

Hence, after around fifty years of adoption of the constitution, when Bangladesh is already moving towards a middle-income country from a least developed country,[125] the lawmakers may reconsider the judicial enforceability issues of the fundamental principle of state policies of Bangladesh constitution. Until any reconsideration takes place, the implicit reference to sustainable development and the principle of equity will mainly remain as guidelines for interpreting environment and climate change related legal provisions of the country.[126]

5.2 Judicial enforceability of the legal and executive instruments

In Bangladesh, like many other common law countries, the instruments fallen under executive portfolio are known as policies and the instruments fallen under legislative portfolios are known as laws. In terms of judicial enforceability, national executive instruments of Bangladesh do not hold strong merit as like as national laws. If any government authority violates or fail to enforce any provision of law, it can be enforced through judiciary intervention by way of judicial review done under Article 102 of Bangladesh constitution. But since policies do not create any legal right, in case of violation or derogation from policies, it is not enforceable by way of judicial review.[127]

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[124]Preamble to The Constitution of the People's Republic of Bangladesh.

[125]Nayon Sarkar, Developing Bangladesh : A New Identity , Dhaka Tribune , March 18th, 2018 , available at https://www.dhakatribune.com/bangladesh/2018/03/18/developing-bangladesh-new-identity-2 (last accessed on November 26, 2020) ; See generally Gimenez, Lea; Jolliffe, Dean; Sharif, Iffath. , 'Bangladesh, a Middle Income Country by 2021: What Will it Take in Terms of Poverty Reduction? *World Bank, Washington, DC, 2014,* available at https://openknowledge.worldbank.org/handle/10986/18668 (last accessed on November 26, 2020).

See also Nathalaie Risee , Bangladesh, UN Consider Expected LDC Graduation in 2024, December 18, 2018, https://sdg.iisd.org/news/bangladesh-un-consider-expected-ldc-graduation-in-2024/ (last accessed on December 30, 2020).

[126]C.f. Art. 8(2) of the Constitution of the People's Republic of Bangladesh.

[127]Abdul Bashar v. Bangladesh, 50 DLR (AD) 11; Kazi Mukhlesur Rahman v. Secretary, Ministry of Law, 2 BLC 286; See also Constitutional Law of Bangladesh, Mahmudul Islam, 2nd edition (with 2010 Supplement), Mullick Brothers, p. 530, paragraph 5.87.

Hence, unlike the legal instruments, the references to the principle of equity and concept of sustainable development in several executive policies on climate change issues are not judicially enforceable as per general understandings of the current legal system of Bangladesh. However, exception may be created on the basis of some different legal premises. For instance, in a judgment, Bangladesh Supreme Court held, if it is possible to establish that inclusion or exclusion of any certain issue in any policy might affect the fundamental rights laid down under third chapter of Bangladesh constitution then a policy document can also be brought under judicial review.[128] The issue was addressed in 1994, while Dr. M. Farooque being a petitioner brought public-interest litigation against the government of Bangladesh. The subject of the litigation was air and noise pollution. Since Bangladesh constitution does not contain any fundamental rights for citizen as right to 'healthy or clean environment', the petitioners argued that access to clean air and noise free atmosphere should be considered as essential part of 'right to life' of the citizens as articulated under Art. 31 placed under chapter III of Bangladesh Constitution. The Court accepted the argument and extended the constitutional 'right to life' to a right to access to a safe and healthy environment. The Appellate Division remarked:

Articles 31 and 32 of our constitution protect right to life as a fundamental right. It encompasses within its ambit, the protection and preservation of environment, ecological balance free from pollution of air and water, sanitation without which life can hardly be enjoyed. Any act or omission contrary thereto will be violative of the said right to life.[129]

Besides, in *Dr. Mohiuddin Farooque vs. Bangladesh and others (1996)*, the High Court Division of Bangladesh Supreme Court further stated that 'right to life' extends to right to access to a kind of atmosphere in which one can expect normal longevity of life.[130] This may include right to access to fresh air or fresh water.

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[128]Dr. Mohiuddin Farooque v. Bangladesh, 49 DLR (AD) (1997) 1.

[129]Dr. M. Farooque v. Bangladesh et al. (1997), 49 Dhaka Law Reports, 1, at paragraph 101, cited in J. Razzaque, Public Interest Environmental Litigation in India, Pakistan and Bangladesh (Kluwer Law International, 2004) at 107. (Art. 31 of Bangladesh Constitution states : " To enjoy the protection of the law, and to be treated in accordance with law, and only in accordance with law, is the inalienable right of every citizen, wherever he may be, and of every other person for the time being within Bangladesh, and in particular no action detrimental to the life, liberty, body, reputation or property of any person shall be taken except in accordance with law." Art. 32 of Bangladesh Constituion states: "No person shall be deprived of life or personal liberty saves in accordance with law".

[130]Dr. Mohiuddin Farooque vs. Bangladesh & others (1996) 48 DLR 438. Habib E , 'Public interest Environmental Litigation: A Tool to Ensure compliance and Enforcement' presented on the Fifth International Conference Environmental Compliance and Enforcement]

In line with the just-mentioned two case references, the references to equity and sustainable development of the executive instruments or climate change related policy documents of Bangladesh may become judicially enforceable by way of establishing that assuring these principles resembles to 'the protection and preservation of environment, ecological balance free from pollution of air and water' as such amounts to 'right to life'.

As per recent interpretation as stated above, the material impact of the notion of 'right to life' goes beyond mere human's right of existence. The idea is broadened to even human's 'right to livelihood, as because without access to means of living it is not possible for living by human. For instance, if a number of homeless people take shelter in slums and somehow manage their livelihoods, widespread eviction of those people without any rehabilitation plan by government will also be deemed as an offence towards 'right to life' of those people.[131] Similarly, conferring value added taxes (VAT) on citizen's life –saving services for instance, any imposition of value added taxes (VAT) on 'receipts of medical and dental treatment, pathological laboratory and diagnostics centre and fees of specialists doctor' will also be deemed as '*ultra vires* of right to life'.[132] Even any kind of advertisement of Cigarette that may encourage people's smoking (which is injurious to human's health and life) deems to be a violation of 'right to life'.[133]

6. Conclusion

This study argues that being a Party to international legal agreements on climate change *e.g. UNFCCC, Paris Agreement*, Bangladesh requires integrating principles of equity and sustainable development with its own climate change related national laws and policies.

The study further demonstrates that concerned national laws and policies of Bangladesh are divided into two categories – judicially non-enforceable executive instruments and judicially-enforceable legislative instruments. Among executive instruments, almost all climate change related national plans, policies and program of action either explicitly or impliedly integrated principle of equity and sustainable development with their diverse provisions.

[131] Ain O Salish Kendra Vs Bangladesh, 1999 BLD 488.

[132] C.f. Advocate Zulhasuddin V Bangladesh, 2010 BLD 1.

[133] Prof. Nurul Islam V State, 2000, 52 DLR 413 .

Among executive climate change policies of Bangladesh, the National Adaptation Program of Action 2005 considers the principle of sustainable development as an important element of national adaptation plans. It does not explicitly mention about principle of equity. But some implicit reference to the principle of equity is found through its advocacy for the necessity of special care towards women, children, and elderly. It further reflects the principle of equity through adopting several capacity-building related projects. However, it lacks manifestation of equity in terms of assuring local women's participation in adaptation related decision-taking.

Another executive instrument the Bangladesh Climate Change Strategy and Action Plan 2009 observes 'inter-generational' approach of the principle of equity through adopting the aim of country's capacity building for resilience to climate change. Besides, it promotes 'intra-generational' approach of equity through setting priority development goals for eradication of poverty. In addition, this executive legal instrument of Bangladesh integrates social and economic development parts of sustainable development through six of its priority sectors *e.g. food security, social protection and health followed by comprehensive disaster management etc.*

The National Renewable Energy Policy adopted in 2009 also integrates sustainable development through its objective of substituting indigenous non-renewable energy supply with sustainable energy supply. It promotes intra-generational approach of equity through playing role in eradication of poverty.

The National Sustainable Development Strategy for 2010-2021 directly reflects the principle of equity through emphasizing on gender parity in diverse sectors of the country *e.g. education, forestry.*

Among the legislative instruments, this article shows that the Disaster Management Act 2012 of Bangladesh realizes the principle of equity through adopting provision for emergency humanitarian assistance to the most vulnerable people of the community. The Sustainable and Renewable Energy Development Authority Act 2012 realizes inter-generational approach of equity through ensuring protection of environment by reducing use of non-renewable energies. It facilitates intra-generational approach through playing role in eradication of poverty by creating new jobs in renewable energy sectors. The Climate Change Trust Fund Act 2010 of Bangladesh facilitates inter-generational approach of equity through assisting in capacity building in adaptation, mitigation and other essential climate change battling sectors. At the same time, it promotes intra-generational approach through its objective of assisting in eradication of poverty.

This study also finds that the principles of equity and sustainable development are explicitly or impliedly adopted as fundamental principles of Bangladesh constitution. But the fundamental principles of Bangladesh constitution are not judicially enforceable by domestic courts. Hence, judicial enforceability of equity and sustainable development depend on the scope and nature of explanation of these principles. If no constitutional amendment takes place making the fundamental principle of state policy of Bangladesh constitution judicially enforceable, judicial implementation of the principles of equity and sustainable development will depend on merely innovative and justifiable explanations of the principles, which must prove that shielding these principles are essential to protect 'right to life' of the citizens of Bangladesh. However, considering the changed socio-economic circumstances of the country, this study recommends for constitutional amendment ensuring judicial enforceability of the fundamental principles of Bangladesh constitution.

However, this article further denotes that although legislative instruments of the country are judicially enforceable, executive instruments are not judicially enforceable by domestic courts. For this reason, the study finally examines the possibility of legal enforceability of the principle of equity and sustainable development which has been integrated in national executive instruments. On the basis of some relevant case references, this study reveals that principle of equity and sustainable development of the climate change related executive instruments can be legally enforceable if applications of those principles can be included under scope and ambit of country's constitutional fundamental right - 'right to life'. In this connection, this study recommends that the High Court Division of Bangladesh Supreme Court should be more liberal to broaden the scope of 'right to life'.

SLAPP Auits in South Africa: A new Dawn or a Constitutional Quagmire?

Dr Abraham Klaasen[1]

[1]*North West University, South Africa, Braam.Klaasen@nwu.ac.za*

Abstract

Sustainable development is to a large extent dependent on environmental sustainability. This requires a balance between economic growth and the preservation of the natural ecosystem. The environmental activist can promote such policies by actively engaging with law makers to promote legislation regulating development or challenging corporations whose policies causes environmental damage. However, such environmental activism sometimes leads to counter action by corporations in the form of SLAPPs or Strategic Litigation Against Public Participation.

A SLAPP suit is defined as a meritless lawsuit initiated to discourage a party from exercising their right to free speech or other efforts directed at influencing matters of public concern. SLAPP suits are used by business entities or corporations to stop environmental activist from organizing to stop or bring attention to activities by such corporations that may be environmentally harmful. In some jurisdictions, such as Canada, the United States of America, Australia and Brazil, legislation has been enacted to protect activist and promote public participation. Usually the legislation provides for an early dismissal of the suit once it has been identified as a SLAPP.

SLAPP suits were relatively late recognized in South Africa although some academics have warned about the danger of SLAPPs in "chilling" freedom of speech and public participation in the environmental movements. In the case of Mineral Sands Resources (Pty) Ltd v Reddell [2021] ZAWCHC 22 the court identified the case before it as a SLAPP suit and allowed the defendants to bring a special plea (previously not recognized in South African law) to dismiss the case, before it was heard on the merits. This paper investigates the growth of SLAPP suits in South Africa and in selected other jurisdictions. The paper also discusses some of the countermeasures to SLAPPs instituted in other jurisdictions. Finally, the paper critically evaluates the Mineral Sands Resources case to determine whether the decision by the court is constitutionally viable

Keywords: SLAPP, environmental protection, special plea, sustainable development, environmental sustainability.

1. Introduction

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. There are four further dimensions to sustainable development, these are society, environment, culture and economy. These dimensions are intertwined and should be balanced in the pursuit of an improved quality of life (UNESCO, Sustainable Development https://en.unesco.org/themes/education-sustainabledevelopment/what-is-esd/sd). This paper focus on one of the pillars of sustainable development, that of environmental sustainability.

According to Gloppen, the weakness in political systems and the lack of responsiveness or inability to tackle social problems such as environmental challenges, have increased the importance of institutions such as courts to get relief. The fact that many counties have adopted rights-rich constitutions have enabled actors within civil society to fight battles, both on a national and international level that traditionally had been resolved in the political domain (Gloppen and Clair 2012). The court process is therefore often used by individuals, organisations and civil society to advance issues of social justice, including environmental protection.

2. Methods

The study comprises a critical review of relevant legislation and an examination of case law, electronic sources, textbooks and academic articles. The study employs a limited legal comparative approach to investigate how other jurisdictions dealt with the problem of SLAPP's.

3. Strategic litigation against public participation

When individuals and civil society groups try to advance issues of social justice as discussed above, they are often sued for exercising their constitutionally guaranteed rights, this includes groups or individuals advocating for environmental protection. Such lawsuits are used to stifle criticism and freedom of expression and places a 'chilling effect' on public participation. These suits are known as 'SLAPPs,' or 'Strategic Lawsuits Against Public Participation' (Pring and Canan, 1996).

Since the late 1980s, public concern over lawsuits aimed at punishing or silencing a party's exercise of free speech or right to petition the government has been slowly on the rise (Tebo, 2005). Pring and Canan reports how this practice struck at the very core of democracy and resulted in politically chilling thousands of potentially involved citizens, wreaking personal and financial havoc on targets as well as having troublesome 'ripple effects' on other citizens' willingness to participate in civic discourse (Dobson, 2000).

A SLAPP suit is a meritless lawsuit initiated to discourage a party from exercising its First Amendment right to petition the government or right of free speech. Pring and Canan describe the typical SLAPP suit as a civil suit that targets a non-government party for that party's communication or other efforts directed at influencing government action on a matter of public concern (Pring and Canan, 1996). A plaintiff bringing a SLAPP suit is not necessarily interested in winning the case (King, 2005). Rather, SLAPP suits are used to deter or to punish a party for exercising its political rights by forcing that party to waste time and resources defending its petitioning activity in court [Gordon v. Marrone, 1992, 590 N.Y.S.2d 649, 656 (N.Y. Sup. Ct)].

In the American case of Tosco Corporation v Communities for a Better Environment (CBE) 236 F 3d 495 (9th Cir 2001), the court found that the conceptual thread that binds SLAPPs is that they are suits without substantial merit that are brought by private interests to 'stop citizens from exercising their political rights or to punish them for having done so'. The longer the litigation can be stretched out, the more litigation that can be churned out, the greater the expense that is inflicted and the closer the SLAPP filer moves to success. The purpose of such gamesmanship ranges from simple retribution for past activism to discouraging future activism.

Claims that frequently appear in SLAPP litigation include defamation and invasion of privacy, abuse of process, malicious prosecution, conspiracy, and tortious interference with contract or business relationships.9 Pring and Canan describe the most common SLAPP scenarios as real estate development cases where a development company sues homeowners who have petitioned local government against a development project, public servants who sue the citizens for criticizing their conduct, commercial interests that sue environmental organizations for challenging their activities in regard to the way those activities impact the environment, and corporate interests that sue consumers or workers that have blown the whistle on illegal corporate practices (Pring and Canan, 1996).

In Gordon v. Marrone 1992 590 N.Y.S.2d 649, 656 (N.Y. Sup. Ct) the court declared that SLAPP suits are a national problem (in America) because of the effectiveness thereof. The court found that short of a gun to the head, a greater threat to First Amendment expression can scarcely be imagined. Even if a party that has been the target of a SLAPP suit ultimately wins in court, the party may have spent months or years defending the suit and accumulated significant legal fees. The court further states: "Those who lack the financial resources and emotional stamina to play out the 'game' face the difficult choice of defaulting despite meritorious defences or being brought to their knees to settle".

The threat of a major lawsuit is often more than enough to silence the participation activity of people who would otherwise seek to be actively involved environmental networks.

4. Position regarding SLAPPs in South Africa

Murombo and Valentine explored the impact of SLAPP suits on public interest environmental litigation in South Africa.10 They argue that SLAPP suits broadly show the need for a balance between competing individual rights such as freedom of expression, right to privacy, and the right to property. They state that it is precisely at this convergence of rights that the South African courts have had to adjudicate novel cases in which developers have taken environmental activists, lobbyists or interested parties to court because they claim that their vocal challenges to proposed developments (which often delay these developments) cause them financial and reputational harm (Murombo and Valentine, 2011).

These cases have prompted some individuals in the legal profession, environmental sector and media to question the impetus behind the litigation. They caution that, these cases may be attempts to silence those critical of the way unscrupulous developers ignore those with vested interests in the environmental impacts of proposed developments. Murombo and Valentine see SLAPP suits as an impediment to litigation to enforce compliance with socio-economic rights (Murombo and Valentine, 2011). Although not as numerous as in other jurisdictions, there has been cases in court identified as SLAPP suits in South Africa.

In Petro Props (Pty) Limited v Barlow and Another (29663/05,29663/05) [2006] ZAGPHC 46 (12 May 2006), the first respondent opposed a property development, maintaining that the construction was taking place on an ecologically sensitive wetland. The respondent sought to mobilise public opinion against the development and to challenge the approval process for the project. The mobilisation consisted of public meetings, the use of the media and submissions directed to various governmental levels. The respondent also made representations to SASOL,[1] a company involved in the development project. The applicant alleged that the campaign has been damaging to it with the final stages of the construction being brought to a halt and SASOL on the verge of withdrawing from the project. The applicant requested the court to interdict the defendant from continuing with the campaign.

Before an interdict can be issued by the court, an applicant must show that it has a clear right which is being unlawfully infringed. The applicant in the Petro Props-case contended that it had the right to the development and that the respondent had consistently harassed the applicant through the campaign and had therefore interfered with the applicant's exercise of that right.

The court, however, held that the respondent had conducted the campaign in an entirely candid manner. The interest and motivation of the applicant was selfless, to contribute to environmental protection. The campaign was geared towards public participation, information gathering and exchange and the production of community-based mandates. The court stated that such conduct earns the support of the Constitution of the Republic of South Africa, 1996 (hereafter the Constitution). The court dismissed the

[1] SASOL is a global chemicals and energy company headquartered in South Africa.

application referring to the constitutional rights held by the respondent (Section 16, the right to freedom of speech and section 24(a) the right to an environment that is not harmful to their health or well-being.)

In Wraypex (Pty) Ltd v Barnes 2011 (3) SA 205 (GNP) (11 February 2011), the plaintiff (a property developer) sued the defendant and three other conservationists over statements that allegedly defamed the company and thereby causing the company millions in damages. The plaintiff wanted to develop a luxury estate, golf course and hotel development on an environmentally sensitive conservation area. The plaintiff claimed damages to the amount of 40 – 50 million Rand from each defendant. Although the plaintiff had already obtained approval from the relevant government authorities for the project, the defendants appealed the decision. During the appeal process, the defendants published statements that the plaintiff claimed were intentionally wrongful and false. The publications were made before the appeal was finalised and the defendants were entitled in terms of legislation to file such objections. In argument the defendants held that the purpose of the action by the plaintiff was solely to intimidate the defendants to withdraw their appeal or to punish them for opposing the development. The court stated in judgment that the extraordinary amount claimed by the plaintiff was extravagant and prodigious. The statements by the defendants were also published only to one person during the administrative procedure. So, the defamatory value (if it was found to be defamatory) thereof, could not be high. Certainly not high enough to justify the amounts claimed. The court held that the plaintiff's claim lacked merits. The defendants should not have been called upon to contest the claim in a court of law. The court stated that the defendants were unnecessarily involved in heavy expenditure in defending the case brought against them. The court dismissed the case against the defendants and awarded a penalising cost order against the plaintiff.

The Wraypex-case have all the hallmarks of a SLAPP as described by Pring and Canan. The plaintiff's case was weak on merits and claimed extraordinary amounts of damages. The intention of the plaintiff (this can be deduced from the weak merits of the case) was not to win the litigation and recover real damages. The intention was to intimidate and force the defendants to stop their opposition to the development project of the plaintiff.

In the two cases discussed above the courts used existing court and civil procedure remedies to find for the environmental activists. However, the cost and effort to defend the actions must have been considerable. It is of course impossible to know how many times environmental activists have been bullied into abandoning their campaigns because of the threat of litigation. According to Chamberlain, the impact of SLAPPs on environmental defenders cannot be ignored. The 'chilling' effect of a SLAPP suit on activism have far reaching effects, creating a ripple effect for other would-be defenders observing the litigation (Chamberlain, 2020). SLAPP suits also leads to a wastage of resources; time, money and energy is spent on defending the suit, not on the environmental activism.

5. International Law and SLAPPs

The Office of the High Commissioner issued an info note on SLAPPs and the right to peaceful assembly and of association, drafted by Annalisa Ciampi (Available at:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjb06mdq3AhXYQUEAHVXLDDcQFnoECAgQAQ&url=https%3A%2F%2Fwww.ohchr.org%2FDocuments%2FIssues%2FFAssociation%2FInfoNoteSLAPPsFoAA.docx&usg=AOvVaw2g2D1CNNK3K_21z XVZbY3b)

In paragraph 1 of the note, the international trend of SLAPPs is recognised. The note mentions that some jurisdictions are fertile ground for SLAPPs. This is dependent on several factors, listed in paragraph 2 of the note, including how expensive legal costs are and the availability of legal aid, the elasticity of laws targeting speech (especially defamation) and the absence of any anti-SLAPP legislation.[2] Ciampi noted there are several international legal standards that can be influenced by SLAPPS. Articles 19 and 20 of the Universal Declaration of Human Rights (UDHR) and articles 19, 21 and 22 of the International Covenant on Civil and Political Rights (ICCPR) enshrine the rights to freedom of expression, of peaceful assembly and of association as essential human rights. These rights can be restricted only through laws necessary in a democratic society, in the interest of national security or public safety, public order, the protection of public health or morals or the protection of the rights and freedom of others (paragraph 3 of the Note). Ciampi also notes that both the UDHR and the ICCPR places a positive obligation on states to facilitate the exercise of the rights of freedom of expression, peaceful assembly and association by maintaining an enabling an environment for civil society to operate freely.

In a report by the Special Rapporteur on the situation of human rights defenders, (UN Doc. A/HRC/25/55, 23 December 2013, para 59), it is noted that: '…[t]he consolidation of more sophisticated forms of silencing their voices and impeding their work, including the application of legal and administrative provisions or the misuse of the judicial system to criminalize and stigmatise their activities. These patterns not only endanger the physical integrity and undermine the work of human rights defenders, but also impose a climate of fear and send an intimidating message to society at large.'

A report by the Special Rapporteur on the rights to freedom of peaceful assembly and of association (Joint report of the Special Rapporteur on the rights to freedom of peaceful assembly and of association and the Special Rapporteur on extrajudicial, summary or arbitrary executions on the proper management of assemblies, UN Doc. A/HRC/31/66, 4 February 2016, para. 84), stated that: 'Business entities commonly seek injunctions and other civil remedies against assembly organizers and participants on the basis, for example, of antiharassment, trespass or defamation laws, sometimes

[2] The note list Canada, Ecuador, India, the Philippines and South Africa as jurisdictions that have reported a rise in SLAPPs. The note lists the United States of America as a country where the trend has been particularly pronounced.

referred to as strategic lawsuits against public participation. States have an obligation to ensure due process and to protect people from civil actions that lack merit.'

In 2014, the Working Group on Business and Human Rights recommended that states enact ant-SLAPP legislation to ensure that human rights defenders are not subjected to civil liability for their activities (Guidance on National Action Plans on Business and Human Rights, United Nations Working Group on Business and Human Rights, December 2014, p. 37, UNGP 25\).

Interestingly the United Nations Guiding Principles on Business and Human Rights state that business and private actors have a responsibility to respect human rights, requiring of them to avoid infringing on the human rights of others and to address adverse human rights impacts if such occurred (Guiding Principles on Business and Human Rights, UN Doc. A/HRC/7/31, 21 March 2011, Pillar II). These corporate responsibilities exist independently of the responsibility of states to respect human rights.

Ciampi recommends that states should enact ant-SLAPP legislation to protect and facilitate the rights to freedom of expression, assembly and association so these rights can be enjoyed by everyone. Further recommendations include that state actors should work towards facilitating an environment where criticism is part of a healthy debate on issues of public or societal relevance and that private companies should refrain from the use of civil lawsuits as a means of shutting down public participation and critical advocacy (paragraph 2 and 4 of the Note).

6. Remedies to SLAPPS in some foreign jurisdictions

As discussed in paragraphs 3 and above, the United States of America is one of the countries where SLAPPs are finding fertile ground. The reasons for this are, according to Ciampi, exorbitant legal fees, the American rule of cost apportionment (each party is responsible for their own attorney's fees) and uncapped damages that can be claimed (Ciampi, paragraph 2 of the Note). Due to the prevalence of SLAPPs in the United States, twenty-eight states, along with the district of Columbia and Guam have enacted anti-SLAPP legislation.[3]

The European Union have indicated in April 2022 that it will take action to protect journalists and human right defenders from abusive court proceedings. The directive proposed by the European Commission will cover SLAPPS in civil matters allowing judges to swiftly dismiss unfounded lawsuits against journalists and human rights defenders. The directive will also include compensation for damages and penalties for launching abusive lawsuits (European Commission at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2652).

[3] The researcher could find a total of 13 countries that enacted anti-SLAPP legislation. Due to space constraints, it is not possible to discuss them all in this paper. Most of the legislation follow the same trend and seems to be largely based on the legislation enacted by the State of California, which will be discussed in this work.

The directive therefore includes:

- Early dismissal of a manifestly unfounded court proceedings.
- Procedural costs.
- Compensation of damages.
- Dissuasive penalties; and
- Protection against third-country judgments. This means that Member states should refuse to recognise a judgment issued in a non-EU country against a person domiciled in a Member State if the proceedings would be manifestly unfounded or abusive under the Member State's law.

The directive also contains recommendations for Member States. The recommendations encourage Member States to ensure that national legal frameworks provide the necessary safeguards against SLAPPs. That training is available for legal professionals and potential SLAPP targets to improve their knowledge and skills to be able to effectively deal with SLAPP court proceedings. To raise awareness and information campaigns. To ensure that targets of SLAPPS have access to individual and independent support and to collect data at a national level.[4] However, despite strong lobbying from interest groups, SLAPPs remains unrecognised by the EU.

The State of California have enacted strong ant-SLAPP legislation in Cal. Civ. Proc. Code § 425.16 (2019). Section (a) of the Code reads that it is in the public's interest to encourage continued in matters of public significance and that this participation should not be chilled through abuse of the judicial process. In its section (b)(1) the Code provides for an early motion to strike. This is dependent on the facts of the case. The motion to strike will be available when the cause of actions arose from any act of that person in furtherance of that person's right of petition or free speech under the State or Federal Constitutions. The motion to strike will not be successful if the courts finds that the plaintiff will prevail on the claim. In making this determination, the court must consider the pleadings, supporting and opposing affidavits stating the facts upon which the liability or defence is based.

The 'act in furtherance of a person's right of petition or free speech' in connection with

a public issue includes:

- Any written or oral statement or writing made before a legislative, executive, or judicial proceeding, or any other official proceeding authorized by law.

Any written or oral statement or writing made in connection with an issue under consideration or review by a legislative, executive, or judicial body, or any other official proceeding authorized by law.

- Any written or oral statement or writing made in a place open to the public or a public forum in connection with an issue of public interest; and

[4] The directive is available at: https://eur-lex.europa.eu/legacontent/EN/TXT/?uri=CELEX:52022PC0177.

Any other conduct in furtherance of the exercise of the constitutional right of petition or the constitutional right of free speech in connection with a public issue or an issue of public interest.

The California Code therefore casts a very wide net in matters where the anti-SLAPP motion will apply, however, any action brought by any one of the various State Attorneys of California is exempted from the motion. The special motion is also speedy, it must be filled within 60 day of the service of the complaint and all other proceedings in the actions is stayed upon the filling of the motion. The court will hear the motion within 30 days of filling. Although the California Code allows for speedy dismissal of an action where applicable, it still allows the plaintiff the opportunity to show that he or she will be successful in the case.

7. Mineral Sands Resources (PTY) Ltd v Reddell and Others

As held in paragraph 4, South African courts utilised existing court procedures and remedies to dismiss SLAPPs. However, no early dismissal remedy existed in South African civil procedure. In the case of Mineral Sands Resources (Pty) Ltd v Reddell and Others [2021] 2 All SA 183 (WCC), the defendants were environmental attorneys and community activists. The plaintiffs were two related mining companies, along with their directors, suing the defendants for defamation and damages to the amount of R14.25 million.

The plaintiff mining companies were involved in exploration and development of major mineral sand mining projects. The case against the defendants was based on e-books, radio interviews, YouTube post, appearance on a television show, online journalism articles and lectures at the University of Cape Town in which the defendants were actively engaged in criticising the plaintiffs' mining and excavating activities, and its environmental, ecological and economic impact on the development potential of the Wild Coast. The plaintiffs alleged that certain statements made by the defendants were wholly defamatory.

The defendants brought two novel special pleas in court. The second special plea did not stand to scrutiny and will not be discussed here. The first special plea stated as follows: The defendants plead that the plaintiffs' conduct in bringing each of the actions:

- is an abuse of process; and/or
- amounts to the use of court process to achieve an improper end and to use litigation to cause the defendants' financial and/or other prejudice to silence them; and/or
- violates the right to freedom of expression entrenched in section 162 of the Constitution of the Republic of South Africa, 1996.

The defendants further alleged that the mining companies' actions are brought for the

ulterior purpose of:

- discouraging, censoring, intimidating and silencing the defendants in relation to public criticism of the mining companies; and
- intimidating and silencing members of civil society, the public and the media in relation to public criticism of the mining companies.

The defendants therefore based their special plea on the fact that the case against them was a SLAPP suit and asked the court to dismiss the matter based on abuse of process doctrine. What is telling is that the defendants did not raise the issue that the plaintiffs' case was lacking in merits. The defendants focussed solely on the plaintiffs' motives in bringing the case against them. The defendants, however, emphasised the fact that the plaintiffs must know that there is no chance of them recovering the amount of the damages they seek.

The court referred with approval to existing case law, Company Secretary of Arcelormittal South Africa Ltd and Another v Vaal Environmental Justice Alliance 2015 (1) SA 515 (SCA) paragraph 71, emphasising the critical role played by the public in environmental debates, stating: 'It is clear, therefore, in accordance with international trends, and constitutional values and norms, that our legislature has recognised, in the field of environmental protection, inter alia the importance of consultations and interaction with the public. After all, environmental degradation affects us all. One might rightly speak of collaborative corporate governance in relation to the environment.'

The defendants relied on section 39(2) or 173 of the Constitution[5] that allows the court to amend the common law to allow for the special plea to continue. Section 39 requires the courts to develop the common law to be constitutionally compliant and section 173 vest in the courts the power to prevent any possible abuse of their process.

The court discussed the features of SLAPPs and did not deviate from the position set out in paragraph 2 of this presentation. The court also referred to current anti-SLAPP legislation in foreign jurisdictions. The court then discussed the protection of certain activities from legal action.[6] Here the court argued that competing policy considerations are involved in determining which activities should be protected. The court stated that a central feature of environmental activism is challenging activities with regards to the way they impact on the environment.

[5] When interpreting any legislation, and when developing the common law or customary law, every court, tribunal or forum must promote the spirit, purport and objects of the Bill of Rights. The Constitutional Court, Supreme Court of Appeal and High Courts have the inherent power to protect and regulate their own process, and to develop the common law, considering the interests of justice.

[6] The court mostly referred to legislation adopted in States within the USA, referring to Georgia, California, Washington and New York State. The court also investigated the European and Canadian position relating to SLAPPs.

The court further held that: 'Considering the nature of activism, it is inevitable that damaging information or claims are likely to emerge. Environmental activism is centred on providing critical information, even though such information may not always be correct.'

The court stated that the claim against the defendants stem from their activism in protecting environmental rights and that the strategy to target the group of activists together may have the effect of intimidating them to withdraw from further engagement. This may produce a 'chilling effect', not only on the defendants right to free speech, but also on others who may be involved in environmental activism. The court noted that entire communities and groups may be silenced out of fear of being dragged into a perpetual lawsuit.

The court also noted the exorbitant amounts of money claimed as damages, which cannot be realistically recovered from the defendants. Yet the plaintiffs instituted action fully aware that there is no prospect of recovering such damages from the defendants. The fact that the plaintiffs indicated that they would be satisfied with an apology was, for the court, one of the signature marks of a SLAPP suit.

The court noted that South African law does not have specific legislative measures to deal with SLAPPs and this could be exploited by companies and in the process render civil society vulnerable when involved in activism. The court held that the legal process is abused when it is used for a purpose other than that for what it has been intended for and that corporations should not be allowed to weaponise the system against citizens to intimidate and silence them. The court held that the case brought by the plaintiffs against the defendants match the DNA of a SLAPP suit. The court then upheld the special plea by the defendants and dismissed the claim of the plaintiffs.

8. Critique on Mineral Sands Resources (PTY) Ltd v Reddell and others

SLAPPs are an international problem and citizens and activists must be protected against vexatious litigation when they indulged in activism. In the Mineral Sands-case the court recognised a novel special plea that allowed the court to dismiss the claim based on the improper motive in which it was brought, considering the case an abuse of the legal process. A special plea is a plea which raises a special defence and is directed at an underlying legal problem in the plaintiff's case, rather than the merits of the case (Pete and Hulme, 2011). The special plea sets out the problem with the case of the plaintiff as set out in the particulars of claim and does not include affidavits or further evidence.

The special plea has limited effect in South African law and is used in certain limited circumstances. It is proposed that allowing the defendant to bring an anti-SLAPP defence would work better in practice if it is done by way of application, as set out in the California Code.

This would allow the defendant to set out the defence by way of affidavit and attach such evidence as is necessary to prove the defence. This would also allow the plaintiff to answer fully to the possible defence and allow the plaintiff the opportunity to show that the case should be considered on the merits. It is further

submitted that a special plea does not allow sufficient evidence to allow the court to come to a just decision. If the defence is brought by way of application, it would allow the court to consider the pleadings, and the supporting and opposing affidavits stating the facts upon which the liability or defence is based. This would also allow the plaintiff to establish a probability that the case would succeed on the merits.[7] This allows for a two-step process to be followed. The defendant satisfies her initial burden of proof by showing that the cause of action arose out of protected activities. The burden of proof then switches to the plaintiff to show that it is probable that the case would succeed on the merits.

In Mineral Sands the court relied on the fact that the defendants were environmental activists, that they were sued because of their actions and words while they were engaging in activism and that the plaintiffs sued them for very high amounts of damages. The conclusion of the court was that the defendants were unable to pay such high amounts of damages and that, therefore, the plaintiff's case were nor seriously inclined towards the recovering of damages. This is, with all due respect towards the court, not correct.

In South African law a party is entitled to the damages that he or she can prove. Whether or not the defendant is able to pay the damages is irrelevant, if a plaintiff chooses to litigate against a man of straw and is therefore unable to recover some or all of the damages, is the choice of the plaintiff. It must also be considered that the period of prescription of a judgment debt is 30 years (Prescription Act, 1969 section 11 (a)). This allows for a very long time for the debt to be collected.

Paragraph (b)(1) of the California Code sets out the circumstances in which the defendant may bring an inti-SLAPP defence. In Mineral Sands the court did not discuss the circumstances when the special plea would be available for a defendant. The court only looked for similarities between the current case and the basic hallmarks of a SLAPP. However, would the special plea be available for a defendant sue for defamation under circumstances not relating to environmental activism? If an applicant seeks to interdict a respondent from certain action, would the special plea be available? In current South African law, a special plea is only available to a defendant in action proceedings not to a respondent in application proceedings, although a point in limine may be raised if there are procedural defects in the application itself. The Mineral Sands-case was, with respect, decided wrongly.

9. Conclusion

SLAPPs are recognised as an international problem. As discussed in paragraph 4, SLAPPs are also recognised as a problem in South Africa. In some countries legislation has been enacted, giving rise to anti-SLAPP procedures to protect certain activities and speech from needless litigation. In the Mineral Sands-case the court developed the South African common law in terms of section 39(2) of the Constitution

[7] This allows the court to consider the plaintiff's right to access to court enshrined in section 34 of the Constitution.

to allow for a special plea against a SLAPP suit. However, such special plea is not the correct procedure for hearing a defence against a SLAPP. It is recommended that an anti-SLAPP defence should be available in South Africa, but that it is based on application and that the two-step approached as set out in the California Code be followed.

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Understanding the Economic and Environmental Impact of the COVID- 19 Pandemic through the UN Global Communication Using Computer- Assisted Text Analysis Tools

Ekaterina Bliznetskaya[1], Ekaterina Vasilenko[2]

[1]*Moscow State Institute of International Relations (MGIMO University), Moscow, Russian Federation,*
ekate.bliznetskaya@gmail.com
[2] *Centre for Sustainable Development and ESG transformation of the Moscow State Institute of International Relations (MCUR), Moscow, Russian Federation,*
ekaterina1278@gmail.com

Abstract

The coronavirus pandemic has created an environment in which decision-makers and policy-makers need to tackle multiple crises at once. First, the economic crisis caused by the lockdown. Second, the public health crisis. And thirdly, the climate crisis. The uniqueness of this situation is also added by the fact that so far, all these crises have practically been resolved separately from each other. This case raises the following question: Is there a shift in the discourse on coping strategies towards linking health, climate change and biodiversity loss? To answer this question, the authors consulted UN news stories published since the start of the pandemic (January 2020 to March 2021). To search for relationships between the selected topics in the UN materials, text mining was chosen as a research method, which allows not only to identify such relationships, but also to quantify them.

This research revealed that the link between climate change, biodiversity loss and the emergence and spread of disease has become a peripheral topic in UN news coverage during the COVID-19 pandemic. The number of news stories that link a pandemic, biodiversity or climate change is negligible compared to the total number of news stories published between January 13, 2020, and March 10, 2021. Despite this, the analysis revealed two types of relationships. First, the causal relationship: the emergence in discourse of ideas that environmental degradation and biodiversity loss create the conditions for the type of animal-to-human transmission, that has repeatedly resulted in vital epidemics. Second, pandemics, climate and biodiversity are linked in the context of post-crisis recovery: tackling climate change and biodiversity loss must be central to post-pandemic recovery plans.

Keywords: Climate change, Biodiversity, COVID-19, Text-mining, Framing

1. Introduction

The COVID-19 pandemic has every chance of fundamentally changing global environmental policy. It is difficult to define the corona crisis in one word - it is a public health crisis, a socio-economic crisis and an environmental crisis at the same time. It exacerbates systemic problems, including inefficient national environmental policies, social and economic inequalities, and weak health systems. Lack of understanding of the dynamics of the processes and consequences of policy change constitutes a significant obstacle to studying how policies are formed and developed in the face of a pandemic. (Hogan *et.al.* 2022).

It is still difficult to say whether the pandemic will lead to the emergence of new concepts for solving environmental problems, new international treaties, formal and informal organizations. For example, the financial crisis of 2008-2009 updated the concept of a green economy, and the debt crisis of 1982 had, albeit indirectly, an impact on the formation of the concept of sustainable development. The coronavirus pandemic may be the impetus for the development and institutionalization of the idea of "One Health" - the planet, animals and people. It can certainly be said that the pandemic has had and continues to have a significant impact on the development of existing areas of global environmental governance. Of particular interest is what post-COVID recovery strategies are being proposed by the various intergovernmental organizations involved in global environmental governance and whether they can provide better preparedness for the next infectious disease outbreaks.

2020 was supposed to be a very important year for global environmental policy. At the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), the Rules for Implementing the Paris Agreement were to be finalized. The Conference of the Parties to the United Nations Convention on Biodiversity (CBD) was to adopt the Post-2020 Global Biodiversity Framework. In 2020, negotiations on a new treaty on the conservation of marine biodiversity beyond national jurisdiction were to be completed. Due to the pandemic, all of these meetings have been rescheduled to 2021-2022. The postponement of the conferences could mean a halt in political dialogue and a rollback from previous agreements, which would lead to significant risks for environmental cooperation. To prevent this, interested states and international organizations used two strategies: the promotion of online diplomacy to maintain a dialogue between states and the active use of framing in communications.

The concept of framing is often used to analyze public communication. Framing is presented here as a process in which journalists define an event or a specific issue in such a way that news about it determines the reader's understanding (Hossain *et.al.* 2022). In the context of this work, framing refers to the actualization of key areas of the international environmental agenda in the context of responding to the COVID-19 pandemic. In practice, this is expressed not only in the way the press releases of international organizations and convention secretariats are formulated, but also in the “linking” of

problems that are usually solved separately from each other, and the intensification of interactions between IGOs with relevant competence.

It should be noted that the term "linking" does not mean the creation of an artificial link with any political goals, rather it is the identification of those causal relationships that exist in reality. For example, the COVID-19 outbreak has raised many questions about the relationship between emerging infections, the environment, climate change, and health (Barouki *et.al.* 2021). This is not to say that no one knew about these relationships before the pandemic, but it was during the COVID-19 pandemic that they began to be talked about relatively much. It cannot be said that before the pandemic, IGOs did not interact with each other in order to better understand the links between the reduction of biodiversity and the emergence of zoonoses, but it is in the last two years that attempts have been made to find acceptable forms of accounting for these relationships in international regulation. By examining how the links between different issues are being formed in response to the COVID-19 pandemic, one can better understand whether significant changes in global environmental policy should be expected.

2. Methods

Based on the research goal - to identify the presence / absence of the relationship between the problem of the pandemic and the problems of climate change, and the loss of biodiversity in the international discourse - the authors chose text-mining as a method for conducting the study.

This method is an automated process of obtaining information from unstructured text data by converting them into a set of structured data suitable for further work, presented in a form convenient for machine processing. Its use allows solving such research tasks as information search and identification of initial data; statistical analysis of the text; revealing meanings; identifying patterns; identification of cross-references; identification of relationships, facts and events; semantic analysis; quantitative analysis of the text. However, it should be noted that at the moment it is rather difficult to assess the effectiveness of this method, since there are no clear criteria for this. As a rule, scientists using this approach rely on the trial-and-error method (Kugo *et.al.* 2005).

And although the text mining method has not yet become so widespread in environmental policy and discourse studies, it is still possible to single out a number of studies in which this method was used. It is becoming popular in the study of public opinion regarding critical aspects of human impact on the natural environment, for example, in the disposal of high-level radioactive waste (Kugo *et.al.* 2005). This approach is also used to identify research narratives (Schober *et.al.* 2017) and to determine the context in which certain words characterizing environmental problems are used in policy (political) documents (van der Geest and Warner 2019).

Content analysis was an assisted method in this work. This method is an essential part of text mining.

This research method allows a systematic analysis of the content of different types of messages (Pashakhanlou 2017). Due to a number of characteristics, the content analysis method is considered the most effective among the methods used in discourse studies (Pashakhanlou 2017). Content analysis has found wide application in research on environmental policy and related discourse. For example, qualitative content analysis of materials is used to identify key themes within which the concept of degrowth has developed in the 21st century (Haapanen and Tapio 2016), as well as to describe the state of scientific knowledge regarding the sustainable development of small and medium-sized enterprises (Prashar and Sunder M 2020). In addition, the content analysis method is used to analyze various policy documents, such as climate change action plans (Tang *et.al.* 2013), environmental reports (Hooks and van Staden 2011), as well as documents from international organizations: UNEP publications (reports, protocols, guidelines, bulletins) (Mazzarino *et.al.* 2020) and resolutions of the UN General Assembly (Bliznetskaya and Vasilenko 2018).

A database compiled from news in English published in the "Coronavirus" section of the UN News portal between January 13, 2020 and March 10, 2021 was used in this study. A total of 750 news were included in the database, each of which was assigned to one of the tags:

- Climate Change
- Culture and Education
- Economic Development
- Health
- Human Rights
- Humanitarian Aid
- Law and Crime Prevention
- Migrants and Refugees
- Peace and Security
- SDGs
- UN Affairs
- Women

The choice of news posted on the UN News portal as research materials is primarily due to the relative political neutrality of this resource, as well as the wide coverage of topics on the international agenda, not limited to health, economics, climate, etc. At the same time, the data are freely available and their characteristics allow for quantitative, qualitative and retrospective analysis.

For the study, a research scheme was chosen, consisting of three stages:

1. Time and context definition for the keywords "climate" and "biodiversity" in the UN News database;
2. Creation of a data set consisting of fragments of news that contain either the keywords "climate" and "biodiversity", or both of these words at the same time;
3. Search in the created dataset for semantic relationships between the keywords and the topics "Health", "Pandemic", "COVID-19".

The study was conducted using qualitative data analysis software (QDA Miner / WordStat). Data from the database is loaded into this program, which automatically searches for matches in UN News stories with keywords selected for analysis.

However, the approach used in this work has a number of limitations. First of all, the study uses only one source of materials - the UN News portal. In addition, another limitation is directly related to the methods used. Despite the automated nature of data analysis, the use of QDA software cannot fully guarantee the identification and understanding of the entire context that the selected news items include. In this regard, it may be necessary to refer directly to the sources themselves (news).

3. Results and Discussion

The goal of the first stage of the study was to quantify the collected materials - news on the topic "coronavirus" posted on the UN News portal from January 13, 2020 to March 10, 2021, and to determine the presence of the keywords "climate" and "biodiversity" in them.

Throughout the period under review, the spread of the COVID-19 virus was the main topic of news coverage (see Appendix 1). The largest number of mentions was for such non-keywords as "COVID-19" (4023 mentions), "health" (3517 mentions), "pandemic" (2508 mentions), "world" (2357 mentions), "countries" (2480 mentions), "global" (1,772 mentions), "support" (1,071 mentions).

After dividing the time period under study into quarters (see Appendix 1), it becomes possible to see slight changes in the topics most often mentioned in the "Covonavirus" section of the UN News portal. In the first quarter of 2020, attention was focused on the emergence of a new virus in China and its rapid spread, as evidenced by the maximum number of mentions of keywords such as "COVID-19", "virus", "China", "outbreak". In January-March 2021, the number of mentions of keywords related to the topic of vaccination increased ("vaccine(s)", "COVAX", "doses"). It should be noted that among the leaders in terms of the number of mentions in the period from April to December 2020 were the keywords "children" (1034 mentions) and "women" (252 mentions in the 3rd quarter of 2020), thereby denoting the social and gender agenda, associated with the spread of the coronavirus pandemic.

However, it was not possible to detect the environmental agenda among the keywords with the highest frequency of mention at this stage of the study. Based on the results of the content analysis, it was revealed that the keyword "climate" appeared in news 291 times, and the keyword "biodiversity" - 40 times (fig. 1). At the same time, in the materials published at the beginning of the pandemic, from January to March 2020, these topics were not mentioned. The maximum number of mentions for climate issues falls on the period from April to June 2020 (140 mentions of the keyword "climate"), for issues related to biodiversity - July-September 2020 (23 mentions of the keyword "biodiversity"). Then the frequency of repetition of these keywords is gradually reduced.

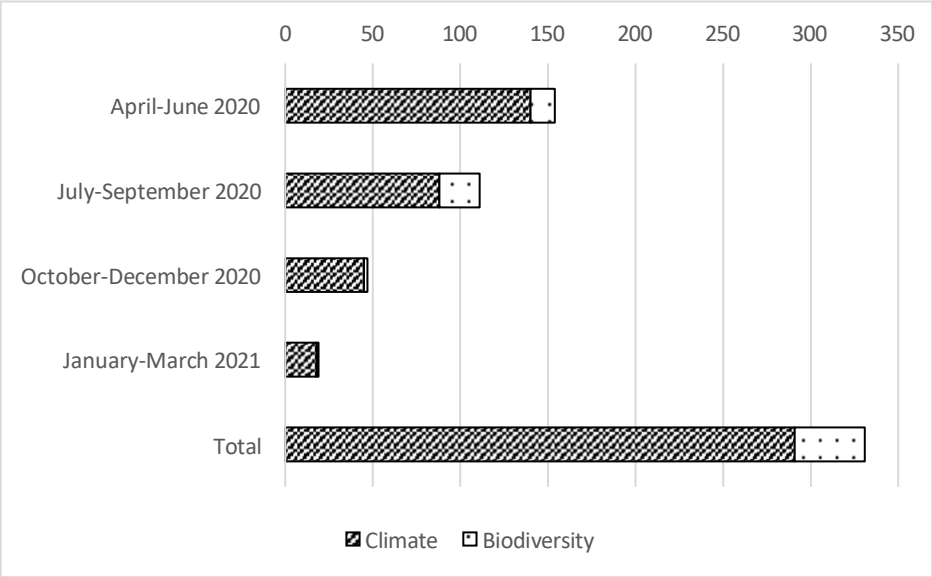

Figure 1. *Frequency of mentions of the keywords "climate" and "biodiversity" (January 2020-March 2021)*

Such a low frequency of mentions of the studied keywords makes it difficult to find links between them and other topics, including the topics of “health”, “pandemic”, “COVID-19”. In this regard, it was necessary to narrow the original database in order to exclude third-party topics that are not related to the subject of the study. At the same time, it should be noted that the keywords “climate” and “biodiversity” themselves can be found not only in the context related to the spread of coronavirus infection, since news materials in the “Covonavirus” section of the UN News portal are divided into several topics (tags), in including, for example, "Culture and Education", "Human Rights", "Women", etc.

The graph below shows (fig. 2), that the keyword “climate” is most often found in news with the tags “Climate change” and “Health” (108 and 93 mentions, respectively). A similar situation is with biodiversity - 20 mentions in the news with the tag "Health" and 12 with the tag "Climate change". Unlike “climate”, the context of the keyword “biodiversity” is less diverse. In addition to "Climate Change" and "Health", the topic of biodiversity is also found in news tagged "Economic Development", "Sustainable Development Goals", "Human Rights" and "UN Affairs". At the same time, both keywords are not found only in the news with the tag “Law and Crime Prevention”.

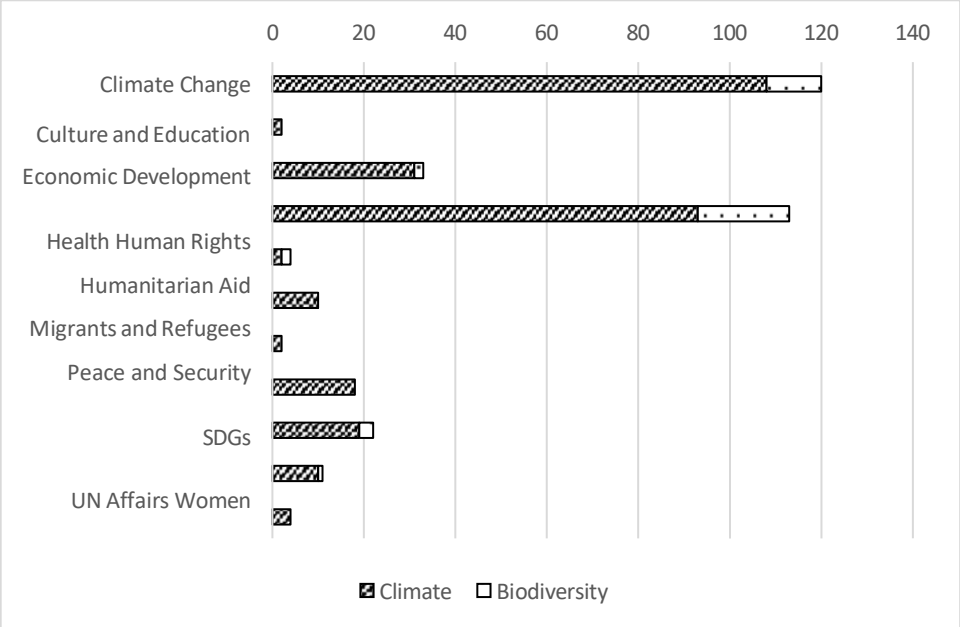

Figure 2. *Frequency of mentioning the keywords "climate" and "biodiversity" in news with different tags*

The result of the second stage of the study was a dataset consisting of fragments of news that contain either the keywords "climate" and "biodiversity" or both of these words at the same time and are related to the topics "health", "pandemic", "covid-19" ". Work with this data set continued in the third stage.

By narrowing down the original database, it was possible to identify links between climate change issues and biodiversity loss and the COVID-19 pandemic using text-mining analysis.

Most often, the keywords “climate” and “biodiversity” are found in the context together with the word “recovery” (38 and 6 mentions, respectively) (fig. 3). In this case, it is the recovery of countries and their economies after a pandemic. In particular, such restoration should include combating climate change and biodiversity loss[1]. Also, the term “green recovery” appears in some news materials[2].

The same number of times the words "climate" and "biodiversity" appear in conjunction with such words as "health" and "pandemic" (6 mentions each for "climate" and 4 mentions for "biodiversity"). In the case of the keyword “health”, the link to climate change and biodiversity is expressed in the so-called “One Health”[3] concept. For example, in February 2021, World Health Organization Director-General Tedros Adhanom Ghebreyesus reiterated that “we cannot protect human health without taking into account human activities that are destroying ecosystems and habitats and are increasingly exacerbating climate change.”[4]

[1] In Davos speech, UN chief highlights private sector role in pandemic recovery https://news.un.org/en/story/2021/01/1082862

[2] ‘Green recovery’ from COVID-19 can slow climate change: UN environment report https://news.un.org/en/story/2020/12/1079602

[3] https://www.who.int/news-room/questions-and-answers/item/one-health

[4] https://news.un.org/en/story/2021/02/1084982

At the same time, UN News back in April 2020 expressed views according to which "deforestation, industrial agriculture, illegal wildlife trade, climate change and environmental degradation increase the risk of a new pandemic"[5]. It should also be noted that the climate crisis and the decline in biodiversity were not mentioned in the materials under consideration as the causes of the current coronavirus pandemic.

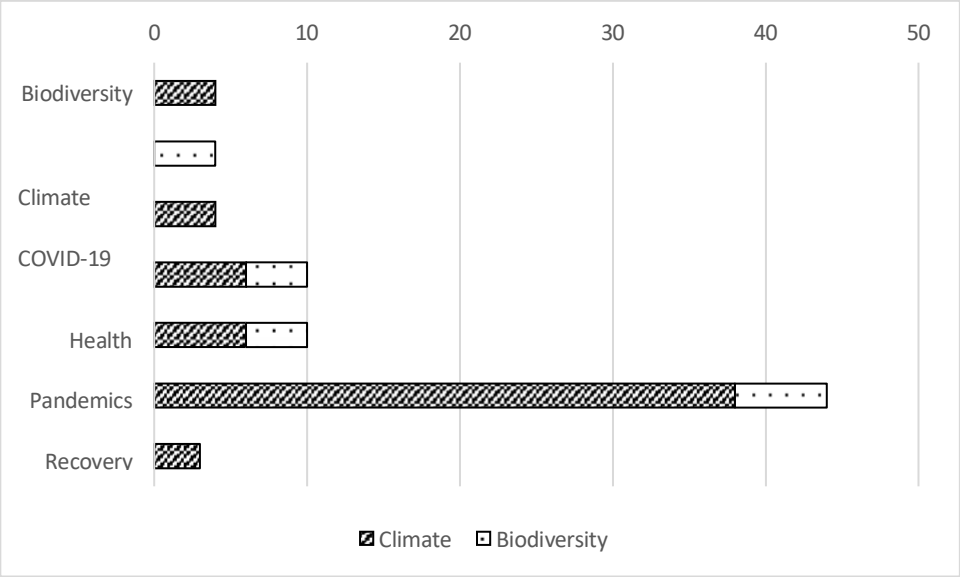

Figure 3. *Relationship of the keywords "climate" and "biodiversity" with the topic of the COVID-19 pandemic*

4. Conclusions

One way to study environmental issues and their relationship to other issues is to study their discourse. In this regard, the purpose of this study was to answer the question: is there a change in the discourse on the strategy to overcome the crisis caused by the coronavirus pandemic, towards the connection of health issues, climate change and biodiversity loss?

To achieve this goal, an approach was chosen that combines quantitative and qualitative methods, namely text-mining analysis and content analysis. The materials for the study were news in English published in the "Coronavirus" section of the UN News portal from January 13, 2020 to March 10, 2021.

First of all, the study shows that the relationship between climate change, biodiversity loss, and the emergence and spread of disease has become one of the peripheral topics of UN news coverage during the COVID-19 pandemic. The number of such news items compared to the total number of news items published between January 13, 2020 and March 10, 2021 is insignificant. In this regard, it is difficult to identify the relationship between climate change, biodiversity loss and the pandemic solely by machine analysis.

[5] https://news.un.org/en/story/2020/04/1061772

Summarizing the results of the analysis, the links between the keywords "climate" and "biodiversity" and the topic of the COVID-19 pandemic can be represented in three directions:

- The causal relationship between biodiversity loss and climate change and the emergence and spread of new diseases;
- The relationship between planetary health and human health;
- Recovering from the pandemic and the resulting economic crisis while conserving and restoring biodiversity and combating climate change.

Based on the above, it can be concluded that the connection between issues related to health and the spread of coronavirus infection in the world, and environmental problems in news is indicated, and it can be further updated at high-level events (next conferences under the UNFCCC and the UN Convention on Biodiversity).

At the same time, the environmental factors of public health have been known for a very long time. Thus, the pandemic has once again updated the concept of "One Health", well-known in the circles of public health specialists. The aim of the concept is to unite the health of people, animals and the environment. The One Health approach has already been recommended as a guiding principle for pandemic preparedness. In 2007, at the International Ministerial Conference on Avian Influenza, governments were asked to build links between human and animal health systems to ensure pandemic preparedness and human security.

The WHO Manifesto for a healthy recovery from COVID-19 states that public health and environmental protection should be the main motive for post-crisis recovery. It is proposed to perceive the protection and conservation of nature as a source of human health, *"… specifically plans to reduce the risk of future epidemics, need to go further upstream than early detection and control of disease outbreaks. They also need to lessen our impact on the environment, so as to reduce the risk at source."* (WHO 2020).

However, despite the fact that the call for a "green" recovery is heard in almost every intergovernmental forum, this topic has not yet received institutionalization in the UN. It can be attributed to the short-term nature of most national recovery strategies. As new vaccines and treatments for COVID-19 emerge, lockdown restrictions ease, and interest in the need for long-term strategies declines. Importantly, however, linkages between health and climate change have received political support, and this linking effect has emerged in response to the pandemic.

"Linking" the problems of environmental protection and climate change with the need to respond to a pandemic is not just one of the strategies that allows states to keep the attention of states on the need to develop environmental cooperation, but a natural attempt to overcome the fragmentation of the multilateral system in the face of the need to prevent biogenic threats.

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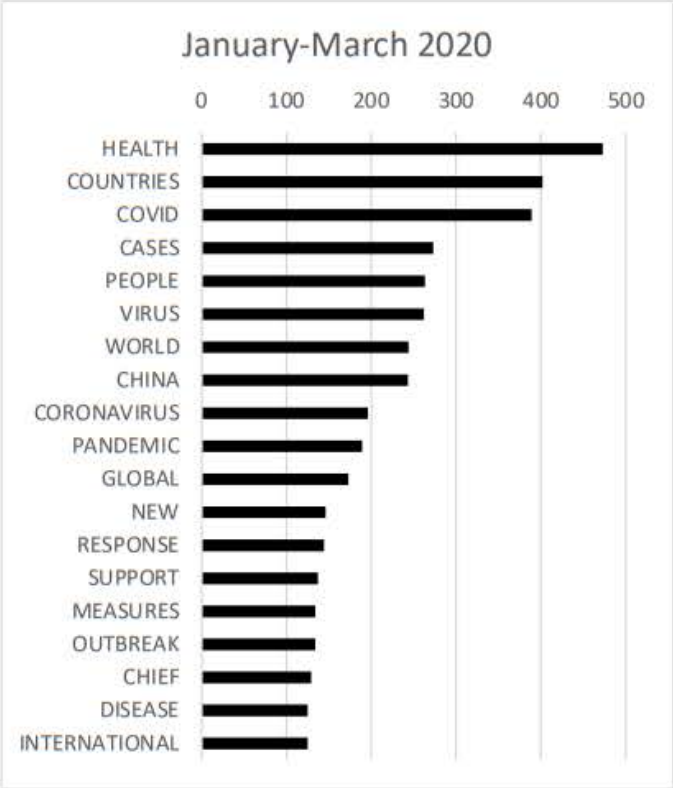
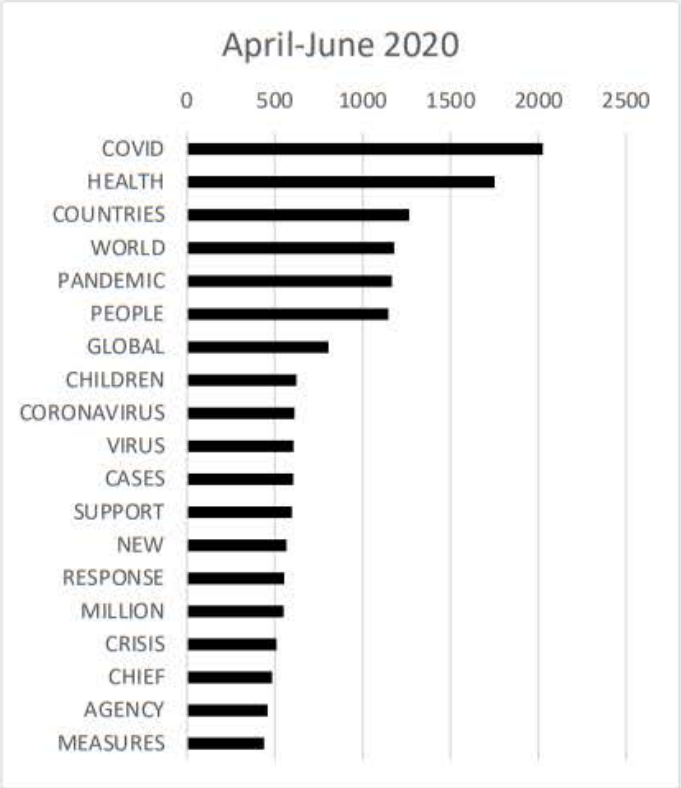
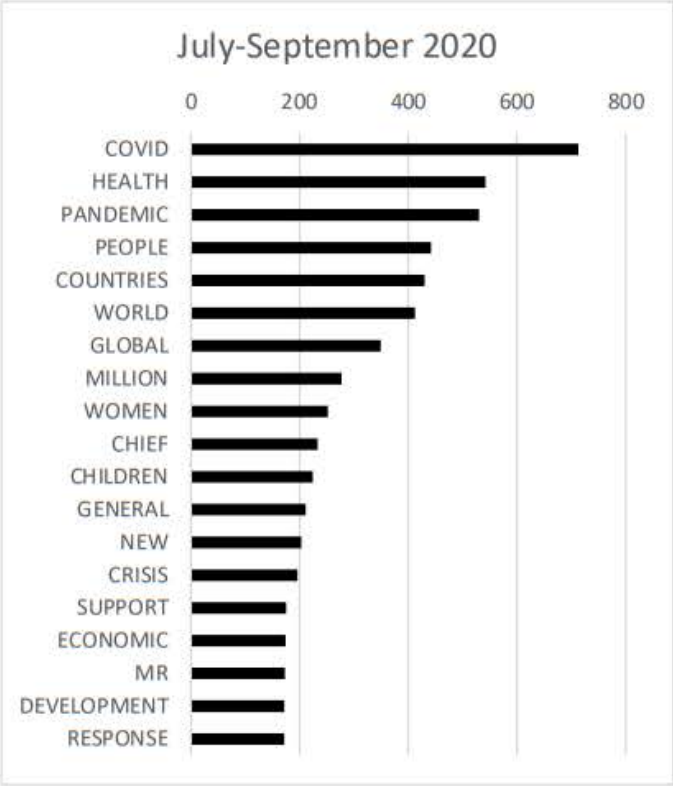
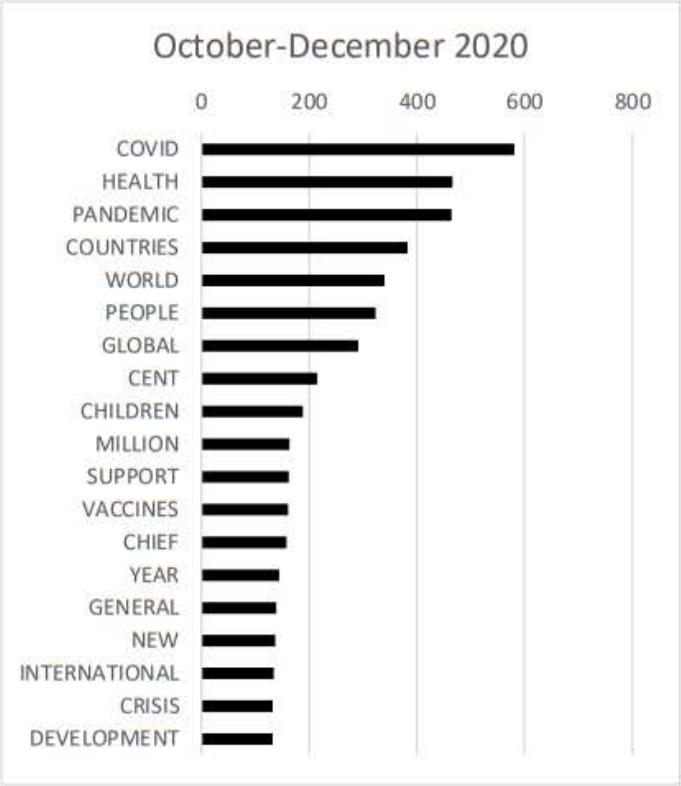
Appendix 1

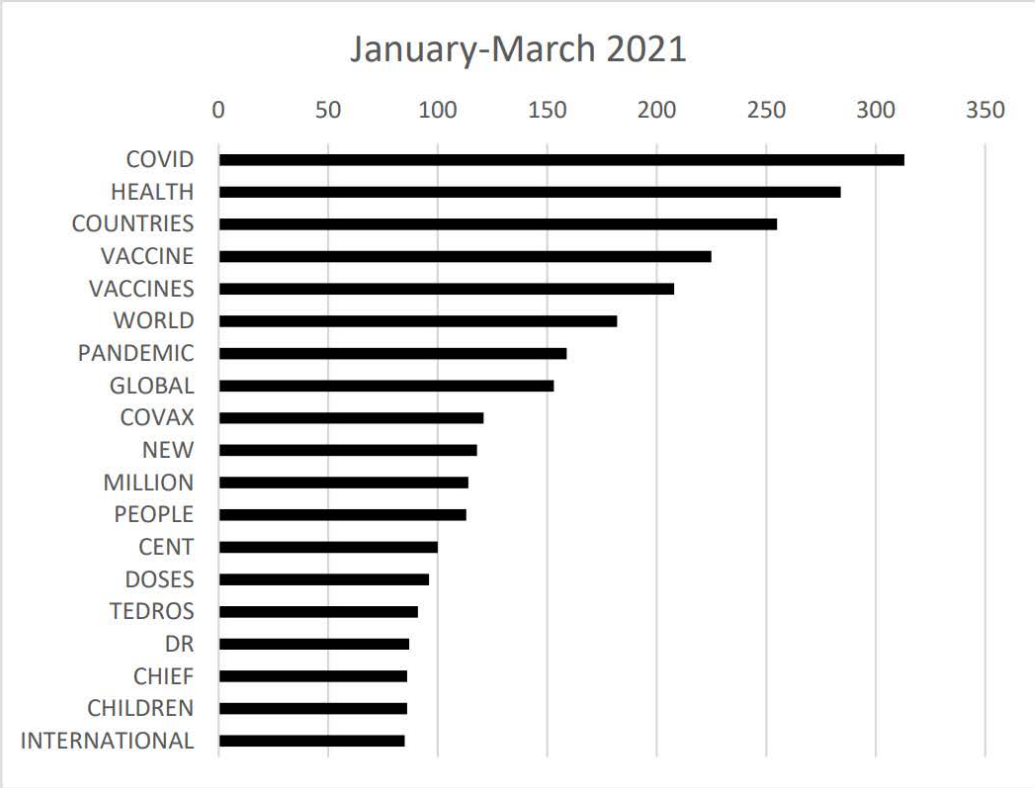
The results of the content analysis of news on the topic "coronavirus" posted on the UN News portal from January 13, 2020 to March 10, 2021










January-March 2021
0
50
100
150
200
250
300
350
COVID
HEALTH
COUNTRIES
VACCINE
VACCINES
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PANDEMIC
GLOBAL
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NEW
MILLION
PEOPLE
CENT
DOSES
TEDROS
DR
CHIEF
CHILDREN
INTERNATIONAL

Who Will Tie the Bell? Climate Change Policy Implementation Authority of Bangladesh

Nasrin Akter[1], Zelina Sultana[2]

[1]Lecturer, Department of Land Management and Law, Jagannath University, Bangladesh, nasrinakter@land.jnu.ac.bd

[2]Associate Professor, Department of Law, Jagannath University, Bangladesh, zelina@law.jnu.ac.bd

Abstract

Climate change has risen to the top of every country's priority list in terms of mitigating or adapting to impending climate crisis. Bangladesh has already ratified international agreements such as UNFCCC, Kyoto Protocol, the Paris agreements, SDGs and embraced the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in the national level, since it would be one of the most affected countries in the world due to the effects of climate change. A looming issue in Bangladesh is the non- implementation of policies and legislations, notably in the environmental sector. Since the BCCSAP implementation task have been assigned to the Ministry of Environment, Forest, and Climate Change, the purpose of this study is to examine the efficacy of that ministry in order to identify whether or not it is able to deal with the climate change challenge. This research blends doctrinal analysis with desk- based research of various policies and pieces of legislation. The authority in charge of implementing climate policies must be more competent, knowledgeable and inclusive as we might not have a second chance to remedy this 'crisis multiplier'. This article finds that MoEFCC is overburdened with their previous respective tasks due to various reasons. Climate change being the greatest threat to modern humanity, this article proposes creating a more responsive and effective body to implement climate change policy in Bangladesh and ensure appropriate climate change risk management and attaining related SDGs.

Keywords: Climate Change, Climate Policy, Implementing Authority, SDG, Bangladesh

1. Introduction

Bangladesh is severely affected with climate change disasters and slow-onset impacts of climate change such as: global warming, sea level rise, saline intrusions etc. (Nishat and Mukherjee, 2013). Both previous and recent research suggest that the intersection of current climate change crisis and the present vulnerability of Bangladesh need proactive strategies to mitigate the risk and adverse impact of climate change or adaptive plan or strategies that require a systematic evaluation of priorities and involvement of stakeholders (Huq & Golam, 2011, Downing et al., 1997). From the local authorities to the central authorities, which are responsible for taking different strategies for reducing climate change risk, has many limitations and practical challenges (Burch, 2010; Measham et al., 2011) and Bangladesh is not in exception. As a developing nations Bangladesh is always in dearth with addressing problems, investing funds and implementing policies for existing over populations, resource constrains, geographical location etc. (Nishat and Mukherjee, 2013).

Despites, the extant constrains, the unpredictable results of climate change are constant concerning issue to determine the human preparedness to face the forthcoming challenges of climate change (Nishat and Mukherjee, 2013). However, the affected issues such as: salinity intrusions, sudden tornado, severe cyclones, storm surges and severe floods, floods durability, early and late rainfall or excessive rainfall are becoming common over the years in Bangladesh (Hoque et al., 2022; Huq & Golam, 2011). Huq and Golam also argued that these all posing threat on human settling, agro-products, economy, life and livelihood, natural features and culture of country (Hoque et al., 2022; Huq & Golam, 2011). However, proactive role of the implementing authorities in collaboration with different stakeholders is crucial for Bangladesh with updated policies and plans for reducing climate change hazards and also to achieving the SDG 13 and also other SDGs and global goals. In revealing this fact, many developed countries have established independent and separate authority to tackle the impacts of climate change (Meadowcroft, 2009; Dubash, 2021). These authorities are functioning successfully to implement the climate change policies, plans for mitigating loss and adapting in climate change situations (Meadowcroft, 2009 Dubash, 2021).

Interestingly, Bangladesh has ratified the United Nation Framework Convention on Climate Change 1992 (UNFCCC) but has not enacted any comprehensive tool for preventing climate change impact until 2008 (Huq & Ayers, 2008). Now, Bangladesh have a climate policy named Bangladesh Climate Change Strategy and Action Plan (BCCSAP). The ever-known Ministry of Environment Forest and Climate Change (MoEFCC) has been delegated the power as prime authority to implement the policies and plans relating to climate change adaptation and mitigation with its other regular functions related to forest and environmental protection (Rahman, 2021). Over the last decades, like other policies, plans and environmental legislations, Bangladesh has enacted a wide variety of policies and plans to strategically reduce the negative effects of climate change, and is making significant investments in adaptation strategies (Rahman & Huang, 2019). In addition, climate change related activities are the

responsibility of MoEFCC which is previously named as Ministry of Environment and Forest. The Ministry is the leading administrative body of the government, for planning, co- ordination, promotion and supervision of the enforcement of environmental and forestry programmes as well as climate change related actions (Rahman & Huang, 2019). However, the implementation of this BCCSAP and climate change adaptation related plans policies are in dearth for many limitations of the implementing authority and has not been properly implemented yet (Rahman & Huang, 2019). With some distinct departments, the MoEFCC is broadly empowered to deal with environment and climate change in absence of accountability (Sarwar, 2021). Sarwar also contends that the ample and unfettered powers of executive authority without being accountable and ambiguous provision of law relating good faith clause hinder the institutional honesty (Sarwar, 2021). Thus, it is crucial to examine the competence, responsibilities, power, personnel and resources climate authority to control climate change challenges in Bangladesh.

It is important to explore the earlier scholarly work in this field before entering into the in-depth examination. Dubash contented that climate institutions should be examined with the same seriousness as climate politics and climate policy (Dubas, 2021). Previous studies have in scarce to focus on the capability of the MoEFCC in dealing with the climate change related challenges in Bangladesh but there exist budding literatures on adverse impacts of climate change in Bangladesh as well as climate policy attempts undertaken by the government (Sikder and Xiaoying, 2014; Rahman & Huang, 2019; Sarwar, 2021; Irfanullah, 2021; Dubas, 2021; Rahman, 2021). In Bangladesh, the institutional structure, people, expertise, purpose, vision, duties, and competency of state-level climate institutions in response to the problem of climate change remain little understood.

The aim of this paper is to examine the competence and effectiveness of the MoEFCC as the country's climate authority to implement climate related all policies, plans and to control climate change challenges. For this reason, we adopted doctrinal legal research approach with desk-based research of various climate policies and pieces of legislation and plans. Apart from extensive literature review, we looked through the Ministry's official website in order to learn more about its structure, staff, resources, current tasks, and yearly reports. We find that MoEFCC has many limitations like logistic supports, expert personnel, excessive work-load linked to environment and forest, lack of research on climate change impacts and strategies. We think that the climate change authority should implement climate policies in inclusive and knowledgeable manner as we might not get further chance to reduce 'crisis multiplier'. Thus, we propose to create a more responsive and effective authority for proper implementation of climate policies and plans in Bangladesh as well as attaining SDGs by 2030.

This paper is started with general introduction followed by the overview of regulatory instruments for climate change in Bangladesh. After that, we discuss the present institutional framework for climate policy implementation in Bangladesh, which clearly steps to us to focus on the necessity for

a responsive authority for implementing climate policy. Finally, we give a way forward for Bangladesh for a better policy implementation authority for reducing climate change risk, bolster efforts to adapt to and mitigate the effects of climate change through improved measures.

2. Regulatory Instruments for Climate Change in Bangladesh

In 2005, Bangladesh adopted the National Adaptation Programme of Action, marking the country's first step in combating the effects of climate change. Over the years, there were a number of noteworthy attempts made, including the adoption of multiple policies and the formulation of legislation. The Bangladesh Climate Change Strategy and Action Plan (BCCSAP), which was initially adopted in 2008 and updated in 2009, is the main instruments for combating climate change. On the other hand, the National Adaptation Plan of Bangladesh (Zero Draft, yet to be finalized), published in 2022, is the most recent addition to the country's efforts to deal with the effects of climate change. The progression of Bangladesh's legislative initiatives to tackle climate change is presented in the following figure (Figure 1) on a year-by-year basis.

Year	Climate Legislation of Bangladesh
2010	The Climate Change Trust Act
Year	**Climate Policies of Bangladesh**
2005	1st National Adaptation Programme of Action (NAPA)
2008	Bangladesh Climate Change Strategy and Action Plan (BCCSAP)
2009	Updated NAPA
2009	Updated BCCSAP
2013	Bangladesh Climate Change and Gender Action Plan
2015	Energy Efficiency and Conservation Master Plan up to 2030
2015	National Social Security Strategy (NSSS) of Bangladesh
2018	Delta Plan 2100
2018	Renewable Energy Policy
2019	National Action Plan for Clean Cooking 2020-2030
2020	8th Five Year Plans
2021	Mujib Climate Prosperity Plan up to 2030
2021	Nationally Determined Contributions (NDCs)
2022	National Adaptation Plan of Bangladesh (Zero Draft)

Figure 1: Climate Legislations and Policies of Bangladesh.

Note: Prepared by authors.

The BCCSAP provides an outline of the climate action strategy for the country. The National Adaptation Programme of Action of 2005 served as the knowledge foundation for the Bangladesh Climate Change Strategy and Action Plan. The BCCSAP was developed by Bangladeshi specialists with funding from the government following considerable interaction with stakeholders representing a variety of groups and individuals at the grassroots level (Huq, 2018). The fact that

the BCCSAP gives equal weight to mitigating the effects of climate change and preparing for those effects is one of the most prominent features of the strategy. The BCCSAP is constructed on a foundation of six pillars: "I. food security, social protection and health; II. comprehensive disaster management; III. infrastructure; IV. research and knowledge management; V. mitigation and low carbon development and VI. capacity building and institutional strengthening" (Ministry of Environment, Forest and Climate Change [MoEFCC], 2009). In accordance with these six pillars, a total of 44 programmes were developed, each of which had distinct objectives, anticipated actions, a schedule for their implementation, and the assigned authority. These programmes are scheduled to be carried out over the short, the medium, and the long terms. The BCCSAP was originally intended to be a living instrument that would be updated over time (MoEFCC, 2009); however, following the update in 2009, no more updates have been made.

To fund BCCSAP, Bangladesh established the Bangladesh Climate Change Trust Fund (BCCTF) and the Bangladesh Climate Change Resilience Fund (BCCRF) (Rahman and Huang, 2019). The BCCTF is financed entirely by the government, whereas development partners funded the BCCRF. After completing all of its projects, the BCCRF terminated operations in 2017 ("Global Climate Change Alliance Plus [GCCA+]," n.d.). The Climate Change Trust Fund Act 2010 (CCTFA) ensures that BCCTF-financed projects reach their intended beneficiaries. Section 10 (b) of the CCTFA requires 66% of its budget to be spent on BCCSAP-preferred projects (The Climate Change Trust Fund Act [CCTFA], 2010). The remainder of the funds would be set aside as a reserve in case of emergency and the project execution would be funded through deposit interest. In accordance with the provisions of section 9, the overall management and governance of the fund are entrusted to a board of trustees, which is presided over by the Minister of the Ministry of the Environment and Forests (CCTFA, 2010).

Despite the fact that Bangladesh has only enacted a single piece of legislation on the subject of climate change, the country has enacted a number of notable policies in addition to the BCCSAP, each of which focuses explicitly on issues linked to climate change or incorporates climate change concerns into the country's development strategies. For instance, the adoption of the Bangladesh Climate Change and Gender Action Plan (ccGAP) aims to include gender issues into four of the BCCSAP's six major pillars, ensuring gender-sensitive assessments as well as gender-responsive measures while tackling climate change (Ministry of Environment and Forest [MoEF], 2013). Three overarching national targets and six supplementary goals are laid forth in the Bangladesh Delta Plan (BDP) 2100. Goal 1 of the BDP explicitly refers to climate change, and more specifically to climate change related catastrophes, although all six particular goals might be linked to climate change in some way (General Economics Division [GED], 2018). Furthermore, the Bangladesh Country Investment Plan for Environment, Forestry, and Climate Change (CIP-EFCC) 2016-2021 was launched in 2017 to plan and coordinate not only national but also international investments in Bangladesh's environment, forestry, as well as climate change sectors. One of the four pillars that make up the CIP-EFCC is a

focus on adaptation, mitigation, and resilience in the face of climate change (Ministry of Environment and Forest [MoEF], 2017). The Mujib Climate Prosperity Plan (MCPP) is another crucial climate policy that attempts to move Bangladesh away from vulnerability and toward prosperity. When it comes to current climate policies, the MCPP doesn't aim to replace them but rather to serve as a connecting mechanism that may speed up and enhance their implementation (Irfanullah, 2021). The 8th Five Year Plan (2020-2025) and Perspective Plan (2021- 2041) are the country's another two most important development blueprints. Both of these plans have administrative improvements in mind, with the goal of improving environmental performance in order to advance green development strategy (General Economics Division [GED], 2020).

In addition to its efforts on the national level, Bangladesh is a signatory to a number of international climate agreements, including the UN Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and the Paris Agreement. An overarching international legal basis for global efforts to address climate concerns is ensured by the UNFCCC and following efforts such as the Kyoto Protocol and the Paris Agreement. Bangladesh's national legislation and policies are bolstered by these climate agreements as well. In 2015, Bangladesh presented its Intended Nationally Determined Contributions (I-NDC) with the goal of reducing its greenhouse gas emissions by the year 2030. Recently, Bangladesh submitted its updated Nationally Determined Contributions (NDC) as per requirements of the Paris Climate Agreement. Several areas have been incorporated in the updated NDC, including energy, industrial processes and product use (IPPU), agriculture, forestry, and other land use (AFOLU), and waste. By 2030, each sector's greenhouse gas (GHG) emissions will unconditionally be cut by 6.73% below business-as-usual (BAU) levels (MoEFCC, 2021). The energy sector will account for 95.4% of the total decrease in emissions, with the waste sector 2.2% and the agriculture, forestry, and other land use sectors contributing 2.3% excluding IPPU sector (MoEFCC, 2021). In addition to the unconditional reductions, GHG emissions would be 15.12% lower below BAU under the conditional scenario by 2030 (MoEFCC, 2021). If Bangladesh is provided with help from external resources, in the form of financial aid and technical assistance, only then the country will go on with the implementation of the conditional mitigation measures (MoEFCC, 2021).

3. Institutional Framework and Agency for Climate Policy implementation in Bangladesh

This section explores the institutional setting and the agency responsible for putting the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) into action, since BCCSAP serves as a blueprint for the country's climate action. When it comes to the establishment of climate institution, Bangladesh, like the vast majority of other countries, does not start with a blank sheet. Instead, the evolution of the country’s climate institution was heavily influenced by pre-existing institutional

structures (Dubash, 2021). The BCCSAP establishes four committees and units to carry out climate action plans, the highest of which is the National Environment Committee. The Prime Minister of Bangladesh is the person in charge of it. This committee is responsible for supervision and offers strategic direction. The following figure (Figure 2 below) depicts the climate change action plan organization of Bangladesh.

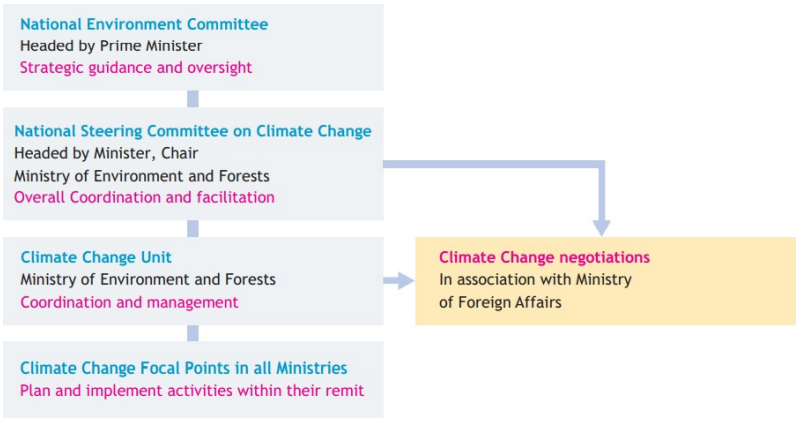
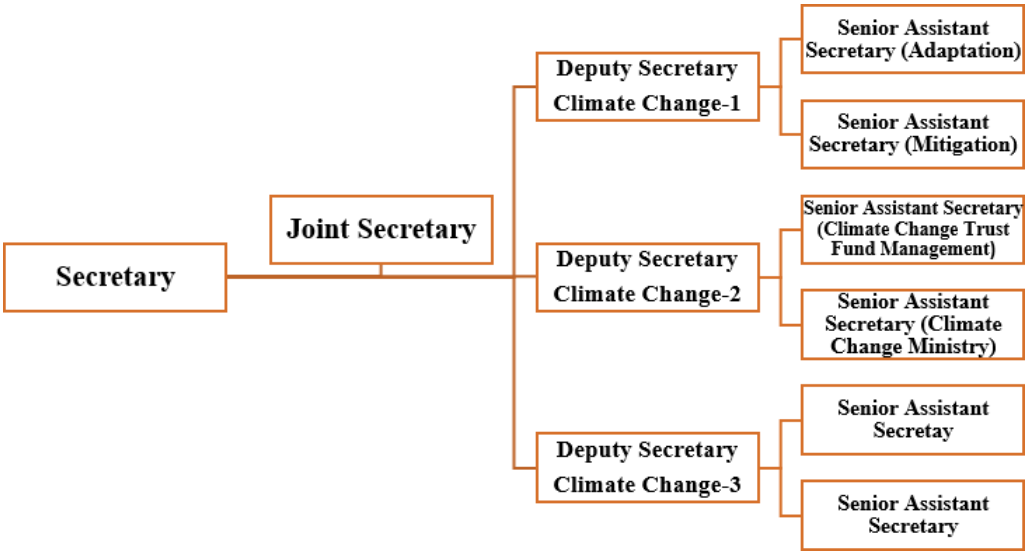


Figure 2: Climate Change Action Plan organization Chart

Note: Adapted from (MoEFCC, 2009).

The Ministry of Environment, Forests and Climate Change (MoEFCC), formerly known as the Ministry of Environment and Forest (MoEF), has been given more responsibility for putting the BCCSAP into action. In order to coordinate and make it easier for national actions to be taken on climate change, a National Steering Committee on Climate Change has been established. It is led by the Minister of the Ministry of Environment and Forests and Climate Change, who also serves as its Chairperson. Other members include secretaries of all climate-affected ministries and divisions, representatives from the business sector as well as the civil society. It is responsible for reporting to the National Environment Committee. In addition, the National Steering Committee on Climate Change guides international climate change discussions, including bilateral, multilateral, and regional initiatives for collaboration, research, information exchange, and development. Furthermore, the BCCSAP includes the establishment of a Climate Change Unit within the Ministry of Environment and Forests in 2010 in order to provide support for the National Steering Committee on Climate Change. It cooperates with the climate change focal points that are established in each ministry. Furthermore, the BCCSAP mandated establishment of a climate change focal point in every ministry. The following figure (figure 3) explains the Ministry of Environment, Forests, and Climate Change (MoEFCC)'s organizational structure to address concerns about climate change.

Figure 3: Organizational Structure within MoEFCC regarding Climate Change



Note: Prepared by the authors

The Ministry of Environment, Forest, and Climate Change (MoEFCC) in Bangladesh is in charge of carrying out the majority of the crucial aspects of Bangladesh's climate governance as mandated in the BCCSAP, whether it be on the national level or while representing the state on the international level (Rahman & Huang, 2019). Under the leadership of MoEFCC, the government of Bangladesh prepared a National Adaptation Programme of Action (NAPA) which was launched in 2005 and updated in 2009 (Bangladesh Country Investment Plan for Environment, Forestry and Climate Change [BCIPEFCC] 2016-2021, 2017 p. 26). The plan identifies priority activities to provide a response to urgent and immediate adaptation needs. Figure 4 below shows how the Ministry of Environment, Forests and Climate Change collaborates with the Department of Environment and the Climate Change Unit to implement NAPA and BCCSAP at the community level.

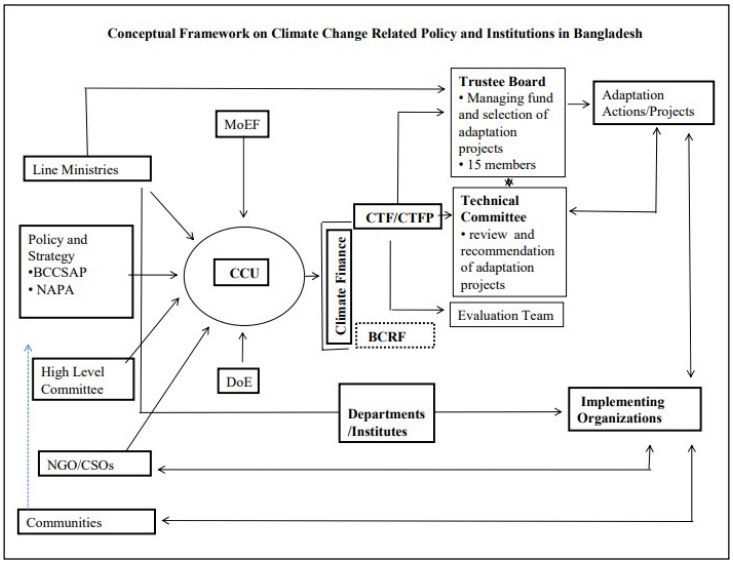


Figure 4: Conceptual Framework on Climate Change Related Policy and Institutions in Bangladesh

Note: Adapted from (Huq & Golam, 2011)

In order to achieve the country's climate strategic goal, it is necessary that this authority have the competence and resources to carry out its mandated responsibilities and provide the highest quality results possible. The next section of the article moves on to a more in-depth look at the MoEFCC and a critical analysis of its effectiveness in carrying out the climate actions.

4. The Effectiveness of Ministry of Environment, Forest and Climate Change

Whether or not a country is successful in meeting its climate goals is frequently dependent on the quality of its governance and the efficiency with which its climate institutions function. It is necessary to do a baseline study of the specifics of the MoEFCC as well as its climate change duties prior to diving into the analysis of the efficacy of the MoEFCC in meeting the country's climate goals. An overview of the MoEFCC is presented in Table 1 below.

Table 1: Specifications of the Ministry of Environment, Forest and Climate Change

Note: Prepared by the authors. Information used in this table is collected from the ministry's official website (http://www.moef.gov.bd/) as well as the Ministry of MoEFCC's most recent Annual Report 2020-21, published in June, 2022. https://moef.portal.gov.bd/sites/default/files/files/moef.portal.gov.bd/page/f68d9fbb_b5d3_4ea0_acaa_a4d96143a8b0/Report_2020-21_compressed.pdf

Ministry of Environment, Forest and Climate Change		
Mission	Sustainable environment and forest development	
Vision	Ensuring a sustainable living environment for the current and future population of the country through conservation of environment and biodiversity, control of environmental pollution, coping with the impact of climate change, development of forest resources and sustainable management of marine resources.	
Aims and objectives	Expansion of the total forest area, development of forests and forest resources, preservation and identification of biodiversity, poverty alleviation, environmental pollution, combating climate change and sustainable environmental development to ensure a suitable living environment for the current and future population of the country through the use of science-based and practical technology.	
Scope of work	• Environment and ecology • Matters related to environment pollution control • Conservation of forests and development of forest resources, forest inventory, grading and quality control of forest products • Afforestation and regeneration of forest extraction of forest produce • Plantation of exotic cinchona and rubber • Botanical gardens and botanical surveys • Tree plantation • Planning cell preparation of schemes coordination in respect of forest • Research and training in forestry • Mechanised forestry operations • Protection of wild birds and animals and establishment of sanctuaries • Matters related to marketing of forest products • Administration of BCS (forest) cadre • Liaison with international organization and matters related to treaties, agreements with other countries and world bodies relating to subjects allotted to the ministry • All laws on subjects allotted to the ministry • Inquiries and statistics on any of the subjects allotted to this ministry • Fees in respect of any of the subjects allotted to the ministry except court fees	
Departments and organizations under the Ministry of MoEFCC	• Department of Environment • Department of Forest • Bangladesh Climate Change Trust • Bangladesh Forestry Development Corporation • Bangladesh Forest Research Institute • Bangladesh National Herbarium • National Rubber Board	
Number of Employees	• According to the approved employee structure, the total manpower of the ministry is 184 people, currently working 106 and 78 vacancies. • 39 personnel in the Climate Change branch of the Ministry of MoEFCC. • 58 staffs are working in the Bangladesh Climate Change Trust	
Distribution of tasks (Climate Change section)	Climate Branch 1	• International conventions/ protocol/agreement including UNFCCC, Kyoto Protocol, Vienna Convention, CDM, IPCC, UNIDO, JCM, CCAC related activities • Bangladesh Climate Change Trust-approved projects related initiatives • Coordination and other tasks connected to the Climate Change Cell established by the Department of

		Environment • SCP related activities • Activities related to the observance of various international climate days • Nationally Appropriate Mitigation Action (NAMA) and BCCSAP related activities
	Climate Branch 2	• International conventions/ protocol/agreement including UNCCD, CBD, Nagoya Protocol related activities • Administrative management of Bangladesh Climate Change Trust (appointment, of officers, their leave and discipline) • Transport management of Bangladesh Climate Change Trust
	Climate Branch 3	• BCCSAP, NAP, NDC, GCF, GEF, LDC, G-77, CTCN related activities • International and bilateral cooperation activities
Special Achievement	• Preparation of Bangladesh Country investment Plan • Preparation of NDC implementation roadmap and action plan • Preparation of NAP (ongoing)	
Challenges	• Capacity constraints at the lead Ministry of Environment, Forest and Climate Change in terms of human resources as well as financial resources lead to limited implementation progress • Raising awareness of the industry and factory owners regarding environmental pollution • Court injunctions on enforcement actions to prevent environmental pollution • Lacking institutional capacity • Less manpower to handle all the assigned tasks	

Ensuring climate justice is contingent on the necessary development of climate governance along with appropriate legislation and policies in place. This climate governance must include professionally trained and knowledgeable personnel, access to information, transparency, inclusivity and accountability in decision making, effective management tools, and so on (Bangladesh Country Investment Plan 2016-2021, p. 1). Access to information and knowledge of the country's climate risk, together with appropriate monitoring and learning mechanism, could aid in mitigating the negative effects of climate change and environmental challenges by revealing the country's actions, learning from mistakes, and assessing the outcomes with prudence (Huq, 2018). Preparing policy papers on climate change is one of MoEFCC's crowning achievements so far. Nevertheless, the MoEFCC is up against multiple obstacles, each of which is preventing it from effectively carrying out the BCCSAP specified responsibilities that have been assigned to it as well as attaining the country's climate target. The main challenges found by the MoEFCC in functioning relating to climate action in Bangladesh are:

I. Lack of Defined Objectives and Climate Goal Oriented Responsibilities

After taking on the institutional responsibilities for climate change, the MoEFCC hasn't been changed anything else in terms of setting clear goals and taking on responsibilities based on those goals. Recent events saw Bangladesh submit its NDC in accordance with the Paris Agreement in an effort to reduce its carbon emissions. However, the primary body charged with overseeing climate-change issues has stayed in without being reorganized to better facilitate meeting the Paris commitment. The organization tasked with implementing BCCSAP must, however, have clearly articulated goals and a clear understanding of who is accountable for what in order to accomplish those goals. The Ministry of Environment, Forests, and Climatic Change (MoEFCC) is following a set of aims and objectives, however the nature of these aims and objectives is too broad which weakens the climate goal to be attained. The absence of climate-related research, climate risk assessment and a specific work progress annual report on the institution's efforts to accomplish climate objectives is even more concerning.

II. Lack of Professional and Technical Expertise

The institutional structure and the employees who work in the climate change sector of the MoEFCC were selected via a process (the BCS Examination) in which they were largely picked for administrative purposes. The Bangladesh Public Service Commission (BPSC) administers the Bangladesh Civil Service (BCS) examination, for recruitment into the several Bangladesh Civil Service cadres such as administration, taxation, audit & accounts, foreign affairs and so on. In this system, candidates are not chosen based on how knowledgeable and experienced they are in a certain field of study. Climate change governance personnel need go beyond just administrative prowess. It calls for a high level of professional and technical expertise on climate change and associated concerns as well as extensive background knowledge in the field. Therefore, the selection procedure of employees responsible for carrying out the climate branch in MoEFCC is not in alignment with the standards required for climate change governance. Experts in climate change science, physical climate change, building physics and environment, sustainable finance, climate risk analysis and management, climate resilience strategies, biodiversity, ecosystem are often part of the organizations that oversee climate change governance in other countries (Climate Change Committee, n.d.). In contrast, such a situation does not exist in Bangladesh. Furthermore, there isn't any other research facility or possibility of teaming up with other specialized institutions to assist MoEFCC.

III. Coordination of Activities

When there are more authorities and divisions involved in the process of policy implementation, there is a greater demand for coordination among those concerned (Steinebac, 2022). According to the BCCSAP, approximately forty ministries are involved in addressing concerns related to climate change, and MoEFCC is responsible for coordinating with those ministries. Literature

contended that having one implementing authority rather than numerous minimizes potential maladministration (Steinebac, 2022). One of MoEFCC's main issues is a lack of direct coordination between the MoEFCC and the other sectoral ministry on climate change and development initiatives. The regulatory scope, sectoral engagement, and ministerial stature of MoEFCC are generally constrained (Dubash, 2021). For example, Planning Commission oversees the country's sectoral development initiatives, including climate change projects, while MoEFCC also manages climate related projects from selection to execution (Haque, 2021). These two simultaneous project selection methods impair climate change and development programmes' coherence and create overlap and redundancy (Haque, 2021). This creates misalignment between climate change and development plans. Without first ensuring that the appropriate coordination mechanism is in place, the responsibility of coordination has been delegated to MoEFCC.

IV. Capacity

The specific capacity needs of an implementing authority are determined, in part, by the responsibilities that it is charged with (Steinebac, 2022). According to Steinebac, (2022) in order to carry out the functions for which they were initially constituted, authorities often require financial and personnel resources, in addition to professional and technical competence. Those criterion were completely neglected when imposing responsibility for climate action upon MoEFCC in addition to its previous responsibilities. The duty for addressing three significant environmental issues, namely the environment, management of forests resources, and the climate change concerns, has been assigned to a single ministry, namely to MoEFCC. The BCCSAP assigned a significant amount of responsibility to the MoEFCC to perform, including acting as an international climate negotiator, supervising the implementation of policy, and collaborating with other ministries. There are now 39 people working in the climate change section at the MoEFCC who lack the requisite professional and technical skills as well as adequate resources to deal with climate change and its associated challenges. As a matter of fact, there are no established standards for evaluating their ability to implement the climate policy (Meadowcroft, 2009). Prior scholarship confirmed that, the Ministry of Environment, Forestry, and Climate Change and the Department of Environment have not been able to demonstrate that they have the institutional competency necessary to meet environmental management and protection concerns (Islam, 2018).

V. Inclusivity

No single organization is competent enough to give comprehensive information on all the effects, implications, and adaptation measures associated with climate change (Bednar et al., 2018). Bednaret al. contended that for effective governance, it is critical to identify important partners early in the adaption process. Good climate governance begins with inclusive partnerships and representation to

increase non-state actors' (such as civil society, indigenous community, private sector) engagement and collaboration to fulfil the needs of those most susceptible to climate change (Cosentino, 2017). It should promote climate action development through cooperation, advocacy, research, knowledge sharing as well as building network. It is not guaranteed that every committee or unit formed under the BCCSAP would be inclusive, and it has not always been the mandatory practice in MoEFCC decision-making processes to take into account the voices and experiences of all relevant stakeholders.

VI. Knowledge Repository

One of the most important aspects of lowering expenses and implementing best practises is to learn from and even recreate previous experiences (Bednar et al., 2018). Understanding the climatic system and its impact on the local area is critical (Meadowcroft, 2009). MoEFCC's decision-making process lacked input from lower to upper levels, leading in an unsatisfactory representation of ground-level conditions in policies and systems (Islam, 2018). Furthermore, in the BCCSAP, pillar no. 4.6 includes “the establishment of a centre for research and knowledge management on climate change or a network of centres to ensure Bangladesh has access to the latest ideas and technologies from around the world and ensure that data is widely and freely available to researchers” (MoEFCC, 2009). Until now, there hasn't been a research centre of this kind.

VII. Accountability

Prior study found that the Ministry of the Environment, Forest and Climate Change and the Department of the Environment were lacking in their ability to properly care for environmental governance as a consequence of an inadequate level of transparency and accountability regarding the decision-making process (Islam, 2018; Sarwar, 2021). In the matter of climate policy, MoEFCC has been given a significant amount of authority without any accountability concerns being raised (Sarwar, 2021). In light of the fact that the nation is working toward accomplishing the SDGs, including those of the SDGs pertaining to climate change, by the year 2030, accountability is a crucial matter for addressing the misuse of power and function of the implementing authority. Table 2 shows that the MoEFCC has taken some initiative to attain goal-13 but many steps have yet to be done to achieve this particular goal. On the other hand, the Ministry could not take any remarkable activities for achieving the target 13.1, 13.2, 13.3 (Rahman, 2021).

Table 2: Activities by MoEFCC for Attaining SDG-13

Note: Adapted from (Rahman, 2021)

Targets	Activities undertaken by MoEFCC
T. 13.1	• Preparing a 'National Adaptation Plan' • 'Country Vulnerability Assessment' is going on • Updating 'Bangladesh Climate Change Strategy and Action Plan (BCCSAP)' • Establishing a green belt in the coastal areas
T. 13.2	• Updating 'Bangladesh Climate Change Strategy and Action Plan (BCCSAP)'

5. Rethinking for A Comprehensive Pro-active Climate Authority

When it comes to the establishment of climate institutions in Bangladesh, the layering of institutions strategy rather than the institutional displacement approach is being pursued (Dubash, 2021). As Bangladesh's climate institution is not founded anew, but by stacking additional duties on old organizations, namely on the Ministry of Environment and Forest (MoEF). In light of Bangladesh's climate change attempts so far, it is clear that the country has placed a lot of emphasis on policy and programs while completely ignoring the need for the establishment of a responsible authority supported by a strong legislation. The existing climate authority is underpinned by a policy (BCCSAP) that does not establish any kind of legal responsibility for the authorities.

According to previous research, both the central government ministries and their divisions as well as associated departments were previously found to have an "institutionally chaotic" network (Haque et al., 2017). Despite this, Bangladesh continues to rely on age-old bureaucratic structure to run its climate institutions. It has been acknowledged, beginning with the BCCSAP and continuing through the most recent development plan, the 8th Five year plan, that in order for the MoEFCC to fulfil its mandated role in environmental protection including climate change, it requires investment in its capacity as well as resources (MoEFCC, 2009; GED, 2020). The government aims to boost the budget so that it may expand capacity via improved personnel, including technical professional expertise, the establishment of a powerful digital information management system, regular monitoring and assessment of environmental compliance. If this occurs, the Ministry of Environment, Forest, and Climate Change (MoEFCC) may be able to temporarily better serve its climate duties.

Institutional frameworks are essential for all policies in order to concretize the intangible notions and objectives of climate policy into action (Steinebac, 2022). Due to their higher concentration on the problem at hand, it is commonly believed that more specialised agencies have a better track record for the efficient and effective execution of policy (Steinebac, 2022). Current Climate

governance structures and personnel in Bangladesh aren't optimal for managing climate change considering the ministry's track record of prior endeavours. The Ministry of Environment Forest and Climate Change (MoEFCC) was already struggling under the weight of its prior tasks on environment and forest resource management. A number of different jurisdictions have established sets of creative ways for the governance of climate change (Dubash, 2021). Among these measures was the establishment of brand-new institutions, comprehensive policy frameworks as well as climate change research facility (Meadowcroft, 2009). In this regard, a specialized agency would be better fit to carry out the climate actions in Bangladesh.

Meadowcroft, (2009) argues that the challenge brought on by climate change mandates more steps toward inventiveness and modification in governing methods. Climate change governance requires handling emerging issues of climate crisis including the mitigation and adaptation. It is desirable to get effective and timely response of such emerging concerns relating to climate change. It will be necessary to give careful thought to the design of institutions if the establishment of new institutions is to represent an innovative form of governance. New institutions need to be evaluated based on how much of a contribution they could make to the continued development of the climate regime in terms of mitigation as well as adaptation. Such institutions would need extremely specific mandates that are in line with its capacity to execute. The problem is to develop institutions that are trustworthy, transparent, and have a clear climate purpose, and to assess how well they are carrying out their mission. Having said that, the establishment of a competent and all-inclusive climate administration that is equipped with the following capabilities should be a top priority for Bangladesh: a) to effectively negotiate in global climate discussion; b) to conclude scientific, academic, social, economic evaluation of current as well as probable future domestic climate change vulnerabilities c) to keep track of the effects of climate change on local ecosystems d) to ensure various stakeholders active involvement from policy making to implementation and, e) to develop and implement climate change project while maintaining accountability (Meadowcroft, 2009). In addition to that, a legal framework determining the climate mandates, actors' rights and responsibilities, accountability, resources, power, information sharing and communication method and planning processes may boost institutional response capability (Romero-Lankao et al., 2013).

In order to properly respond to the immense difficulties posed by climate change, BCCSAP acknowledges that it may also need to construct and develop new institutions (MoEFCC, 2009). In light of MoEFCC's current shortcomings, it is necessary to re-evaluate the current climate change implementing agencies' degree of representativeness, authority, and responsibilities, accountability, professional and technical expertise. To that end, this article suggests that necessary steps should be taken in the immediate term to overcome the present weaknesses of the MoEFCC. In the long run, the establishment of a new body backed by legislation that is both more responsive and effective is essential in order to completely implement the climate action plan.

6. Concluding Remarks

The MoEFCC is nonetheless the highest and prime authority in Bangladesh working as the watchdog for all climate related policies, plans and activities. In this article, we argue that Bangladesh needs new climate institutions that can handle not only the current but also the future climate issues that the country will face. The paper tried to give an overall outline on the responsibility of the MoEFCC to draw an attention on the multifarious activities of this institution and reached its aim to focus how far the authority is able to deal with the current and forthcoming climate change issues of Bangladesh. It also dealt with the limitations of the MoEFCC in implementing BCCSAP for effective climate adaptation and mitigation as well as reducing climatic hazards loss. We found that lack of co- ordination, lack of professional and technical expertise, lack of inclusivity of climate functions in MoEFCC activities, lack of accountability etc. were the constrains of MoEFCC to act comprehensively for mitigating and adapting current climate change situation in Bangladesh. This incapacity of MoEFCC would detrimentally impact on socio-economic conditions of the country and hinder the achievement of climate goals under Paris Agreement as well as sustainable goals on climate change within 2030. Thus, the paper crucially addressed the issue and proposes to re-evaluate the functioning of the concern authority in regard to tackle the climate change challenges. Based on findings, we contended that Bangladesh is in need of a new proactive comprehensive and accountable authority for managing the current and forthcoming climate change events.

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10. Special themes

10a. Sustainability and Africa

Abstracts

Adsorption Study of Methylene Blue Dye and wastewater from local Textile Industry using Pennisteum pupureum (Elephant grass)

Miss Oluwadamilola Mustapha, Dr Temitope Osobamiro, Dr Nurudeen Sanyaolu, Mr Oluwatobi Alabi

Olabisi Onabanjo University, Ago-Iwoye, Nigeria

Abstract

Dye wastewater when released into the environment has negative impact on clean water and it's a potential source of toxic and carcinogenic substances. This study evaluates the adsorptive capacity of Elephant grass in removing Methylene blue (MB) dye from aqueous solution and wastewater gotten from two major local dyeing industries (A and B) in Abeokuta, Ogun State, Nigeria. Elephant grass with high tolerance which strives well on the study site was used as a low cost adsorbent to remediate contaminant in the dye wastewater. Dyeing business on the study sites is dominated by women of child bearing age and there is tendency of contamination of water source (well) by the wastewater which could result in adverse health challenges.

Batch adsorption method was used to determine the optimum adsorption conditions for the adsorption of standard MB dye by considering the effects of; solution pH (5–9), adsorbent dose (0.5 to 5.0 g), temperature (35, 40, 50 and 60oC) and contact time (180 minutes). The concentration of the dye was determined using UV-visible spectrophotometer (UV-2600) while characterization of the adsorbent was done using FTIR (Fourier transform infrared spectroscopy) and SEM (Scanning electron microscopy). The equilibrium isotherm data were analyzed using Langmuir, Freundlich and Temkin models. The optimum adsorption condition obtained was used for the adsorption study of the collected wastewater samples.

The optimum adsorption conditions of the standard MB dye were; pH 7, Temp 40 0C, contact time 180 minutes and adsorbent dosage 2.0 g. The SEM results revealed that the layered structure of the adsorbent was broken as adsorption occurs while the FT-IR results indicated the presence of O-H, S-C≡N, C=O, N-O and S=O functional groups. The results of some of the physio-chemical parameters (A and B) were; pH: 8.60, 10.6, Chemical Oxygen Demand (COD): 125.0, 115.0, Biochemical Oxygen Demand (BOD): 80.0, 62.0 and dissolved oxygen: 3.2, 3.8 and were above the WHO permissible limits indicating that the water samples are rich in organic pollutants. The adsorption data are well fitted into the three models but, was best fitted into Langmuir adsorption isotherm as indicated by their Qe (sample A- 379.75 mg/g and B is 323.0 mg/g) and (A regression values ($R2 \leq 0.98$).

This study revealed the phytofiltration and adsorptive properties of Elephant grass for the removal of contaminants in dye wastewater. The grass could be use to synthesize activated carbon or carbon nanoparticles for more efficient remediation.

Keywords: Elephant grass, Adsorption, Dye wastewater, adsorption isotherm, and Methylene Blue.

SDG+Target: 6.3 – Water quality and wastewater

This will help the local dyers in purifying their wastewater with cheap and readily available material making the process economical. This in turn improves the quality of water available for their daily use thereby enabling sustainable development and human right to clean water.

Track

Track 10a Sustainability and Africa

Agenda 2063 & SDGs Imperative of Transformed Economies in Africa in the Face of a Global Pandemic

Dr Banke Abejirin

None at present, Abuja, Nigeria

Abstract

Africa's Agenda 2030 aspires for Africa to have Transformed Economies. Specifically, this translates to: having sustainable and inclusive economic growth; having science, technology, and innovation (STI) driven manufacturing, industrialization, and value addition; and having economic diversification and resilience. Similarly, the Sustainable Development Goals 8 and 9, call for a promotion of sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all; and the building of resilient infrastructure, promoting inclusive and sustainable industrialization and foster innovation.

The need to achieve these aspirations and goals have become more glaring than ever for Africa in the face of COVID-19. The COVID-19 pandemic has impacted lives, livelihoods, businesses, and economies globally and in Africa in unprecedented ways. COVID-19 tested the readiness of countries to leverage industrial and technological response to the pandemic. African countries responded in different ways, with some sectors harder hit than others did. While the pandemic affected all sectors, the industry, and services sectors – pharmaceuticals, health, Information & Communication Technologies (ICTs) - were leading sectors in responding to the demand for medicines, medical equipment, PPEs, and the disrupted global and regional supply chains. Supply chain disruption was a major issue to address as shortages in medical equipment and medicine exposed the fragility and weakness of Africa's health and pharmaceutical sectors and fundamentally, the region's lack of industrial capabilities. Countries, that were more diversified, and had industries and firms with relatively deep technological and innovative capacities were better able to respond faster, mitigate and adapt to the negative impacts of the pandemic.

This paper seeks to align and highlight the necessity of Africa's Agenda 2063, with SDGs 8 and 9 in the call for transformed economies in Africa, using the impact of and response to the COVID-19 pandemic. It uses secondary data on human development, economic growth, industrial and technological indicators to provide a macro analysis of the readiness of and impact on countries of COVID-19. It then adopts a case study approach of select African countries to present country specific information and recommendations. We note that for African countries to achieve Transformed Economies, they would require leaders in government and industry that have the courage to push for this transformation and a recognition that it is in the interest of human rights that these changes must occur.

Track
Track 10a Sustainability and Africa

Comparative Study of Different Parameters for measuring the Performance of Improved Cook Stoves in Rwanda

Mr. Jean Baptiste RUTIBABARA

University for Development Studies, Tamale, Ghana. West African Centre for Water, Irrigation and Sustainable Agriculture (WACWISA), Tamale, Ghana

Abstract

Rwanda as one of developing countries is still dealing with the problem of using inefficient cook stoves that cause deforestation, and indoor pollution which lead to respiratory problems. The purpose of this paper is to make a comparison between the most popular Improved Cook stove (ICS) in Rwanda called Canamake and the new version ICS called Hishavuba. The parameters considered to compare these stoves were thermal efficiency, time and charcoal saving. This comparison helped to find out the best stove that can be recommended to Rwandans so that it can contribute to the health and environmental protection and to increase the family income. The methods used were water boiling test (WBT) and food cooking test to identify stove's thermal efficiency, time and charcoal saved. It was found that thermal efficiency varied substantially with stove design. The highest thermal efficiency measured was 60.15% of Hishavuba stove while Canamake has 25.49%. Furthermore Hishavuba stove can save charcoal over Canamake stove up to 57.47%. It can also save time over Canamake stove up to 30.21%. From these results, Authors suggest using Hishavuba cook stove instead of Canamake cook stove.

Keywords: Cook stove; Thermal efficiency; charcoal; water boiling test; Hishavuba stove.

Track
Track 10a Sustainability and Africa

Leveraging principles of economic geography and tourism climatology for sustainable tourism development in Egypt's New Administrative Capital

Dr. David Perkins

Missouri State University, Springfield, USA

Abstract

In 2015, The United Nations 70th General Assembly designated 2017 as the International Year of Sustainable Tourism for Development. The international year focused on several key areas including economic growth, employment, poverty reduction, climate change, resource efficiency, cultural heritage, and peace & security. With the exception of the COVID-19 pandemic shutdowns, sustainable tourism as applied in a development sense has had significant positive outcomes on a consistent yearly basis.

In this presentation, I review key aspects of how tourism is being used for development, and why current planning paradigms are in need of incorporating both economic geography and tourism climatology methods. I make the argument that, in order to fully encapsulate a sustainable development project with geographic assessment, data from social, environmental, and economic fields must be utilized in such a way that outcomes from one dataset inform inputs from another. This approach helps to achieve a 'sustainable circularity' within a project and creates needed co-dependence between traditional 'pillars' of sustainability, thus ensuring more tenable outcomes. To do so, in this project I will look at tourism in Egypt and contextualize the New Administrative Capital (NAC) as a tourism development hub within the region. The structure of the NAC will have significant impacts on the movement of labor and demand for services both in the NAC and beyond to Cairo. The ability to effectively manage increased populations, tourist numbers, and labor needs must be accounted for in light of resource demands and the changing employment landscape between Cairo and NAC. Through an analysis and overview of tourism climatology, I emphasize how global climate change, weather data, and environmental change interact with present and future initiative development within the tourism sector. Finally, I end with considerations and suggestions of how principles and tools from tourism climatology can be utilized in this field moving forward, hopefully providing insight for Egypt's New Administrative Capital.

Track

Track 10a Sustainability and Africa

Negotiating the Contours of Inequalities, State Power and Social Mobilisation for Sustainable Development in Africa

Mr Feyisitan Ijimakinwa

University of Ibadan, Ibadan, Nigeria. Institut Francais de Recherche en Afrique (IFRA-Nigeria), Ibadan, Nigeria

Abstract

Persistent and rising inequalities constitute one of the greatest challenges the world is facing. Corruption, injustice, inequalities in wealth and income and discriminations, amongst others, continue to frustrate poverty reduction and sustainable development in many African countries. At the same time, efforts to end discrimination and guarantee equal rights and opportunities for all, especially historically marginalized groups such as women and minorities, continue to experience backlashes in various places. These fractures are often catalysed by unyielding stranglehold of economic and political power by the elite class, a reinforcing process that compounds inequality. Africa Agenda 2063 and the 2030 Agenda for Sustainable Development seeks to overcome such disparities, aiming not to leave anyone behind. But, the bigger challenge is how to achieve this ambitious vision in the current climate in which those in power act to protect the status quo from which they benefit. In the past, progressive policy changes in Africa were often steered by broad cross-class coalitions between popular and middle classes that effectively pressured elites. Also, enlightened leaders and liberation movements played a similar role, especially under colonialism. Over the last three decades, there has been a continuous unraveling of this 20th century social contract—a bargain between the economic imperatives of growth and productivity, and the social imperatives of redistribution and social protection, as well as the political imperatives of structure and continuity. Those social and economic forces that underpinned progressive policy change of the past take a very different shape today, as economic systems have evolved, identities have shifted, new forms of politics have unfolded, and new conceptions of class have arisen. Several African countries are implementing innovative policy approaches and are moving in the direction of reforms with progressive outcomes, from the local to the national level, curbing inequalities, sharing costs and benefits of reforms more fairly, and making their societies more just and green. Strategically, non-state actors such as social movements, civil society organisations, social and solidarity economy actors and private businesses are now involved in activities that are promising an eco-social turn in different African countries. This is a qualitative study, with an exploratory research design, that interrogates the roles, activities and prospects of these non-state actors in driving the broader processes of change in their societies. The study concludes that these non-state actors are exerting influence on, and constraining, government of different African states to evolve processes of policy reforms and change that are leveling out social stratification and birthing positive results at transnational, national, subnational or local levels—to achieve social progress and sustainable development across board.

SDG+Target: 10.3, 16.3, 16.5, 16.6, 16.7, 16.10a

This contribution strengthens the premise that achieving sustainable development requires a hybrid of state and non-state actions. The non-state actors perform and function in diverse, linear and, sometimes, non-linear roles, through the deployment of necessary agencies and resources in driving actions and policies towards the achievement of the SDGs.

Track

Track 10a Sustainability and Africa

The augmented EKC and a new Measure of Water Pollution – An Investigation of Pollution in Africa

Nina Kupzig, Jenny Kupzig, Johanna Meier

Ruhr-University Bochum, Bochum, Germany

Abstract

The current climate crisis calls for substantial reductions in environmental degradation and pollution. While developing countries are often not amongst the major polluters, their projected growth paths will increase pressure on the environment while, in turn, environmental degradation threatens their growth paths. To enable developing countries to achieve both, their necessary growth and protection of the environment, it is essential to understand the underlying mechanisms causing environmental degradation in these regions. This study investigates how trade and institutional quality influence water pollution in Africa.

Using data from 2002 to 2016 for 42 African countries, this study employs fixed effects regression and the generalized method of moments to investigate an augmented Environmental Kuznets Curve that allows for heterogeneous effects of trade regarding institutional quality. We use the indicators from the World Governance Indicators and the International Country Risk Guide to measure institutional quality and employ a principle component analysis to reduce the dimensionality of institutional quality. For water pollution, a newly estimated water pollution indicator from the so-called WaterQual-Model of the WaterGAP3 Framework- a combined data and modelling approach - is investigated. The investigation of water pollution depicts a novel feature of our study as the determinants of water pollution have not been studied much in the African context due to limited data. Thus, we are the first to conduct such an extensive panel analysis on the determinants of water pollution for the region.

In the study, we find evidence for an EKC relationship using static estimation techniques, although this finding vanishes using dynamic estimation techniques. However, our results suggest institutional quality to be pollution-increasing. Moreover, we find that the interaction of institutional quality and trade is pollution-decreasing. Overall, for high levels of trade, an increase in institutional quality is associated with reduced water pollution, while at low levels of trade, an increase is associated with increased pollution. This finding is robust to static and dynamic estimation techniques as well as different assumptions on the form of the relationship between water pollution and GDP. Overall, the results emphasize the complexity of the multifaceted problem of environmental degradation and provide a basis for the development of strategies that enable Africa's growth while protecting the environment.

Track

Track 10a Sustainability and Africa

Posters

Deforestation in Ghana: Evidence from selected forest reserves across six ecological zones
John Tennyson Afele, Eunice Nimo, Basit Lawal and Kofi Ian Afele

Youth and transformative leadership
Pius Ekeopara

Perception of political corruption among local government employers of Oyo state
Ojuge L. E. Folorunsho

Deforestation in Ghana: Evidence from selected forest reserves across six ecological zones

1.0 Introduction

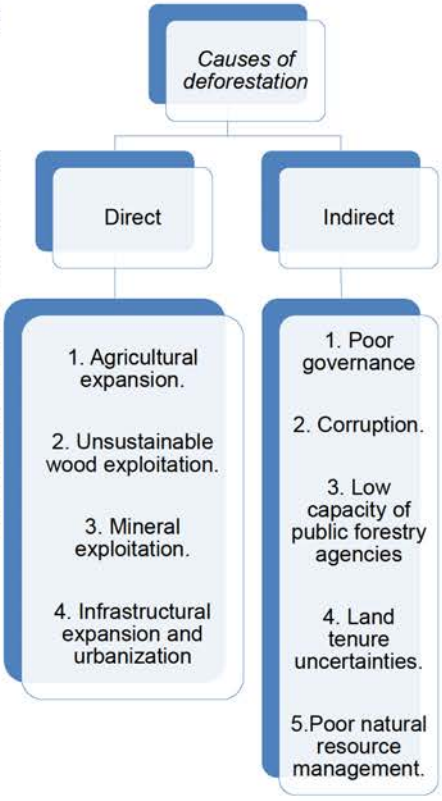
The tropical rainforest is home to diverse life forms, thus the nickname "lungs of the planet [1]. The destruction of trees or the permanent change in the use of the forest for other purposes is continually on the rise [2]. The forest cover in Ghana is an estimated 9.17 m ha, which is nearly 40% of the nation's total land cover [3]. Forest resources in Ghana are lost at a comparatively faster rate than other developing countries [4,5]. Amidst this, not much attention is given to issues of deforestation recently in Ghana [6].

2.0 Materials and Methods

The research took the form of a desk study, where relevant materials till the year 2021 relating to the topic in focus were reviewed to access the drivers, causes, as well as effect of deforestation in Ghana. Data for the various protected areas were derived from Landsat 5 and 8 images in 1990 and 2020. Supervised classification was used to analyze images. Images were classified into two, thus, forest and non-forested areas. In each ecological zone, one protected reserve was selected; Gbelle Game Reserve (Sudan Savannah), Mole National Park (Guinea Savannah), Digya National Park (Transitional Zone), Boin National Park (Semi-deciduous Forest Zone), Ankasa National Park (Rain Forest) and Kalapka Game Protection Reserve (Coastal Savannah).

3.0 Results

- ✓ *Effects of deforestation*
- ❑ Climate change
- ❑ Threat to biodiversity
- ❑ Food insecurity
- ❑ Threat to local people and their livelihoods
- ❑ Erosion



Processed images results reveal that, between the late 20th century and 2020, all ecological zones have seen significant depletion of forest cover.

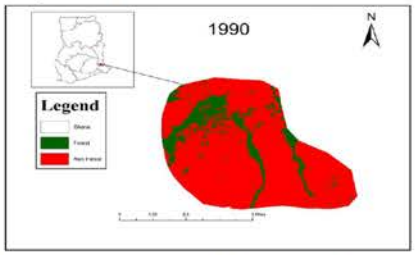


Figure 1: Image of Kalakpa Game Protection Reserve in the Coastal Savannah Zone of Ghana as at the year 1990.

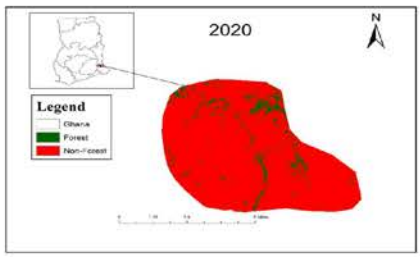


Figure 2: Image of Kalakpa Game Protection Reserve in the Coastal Savannah Zone of Ghana as at the year 2020.

4.0 Conclusion

Data processed of forest reserves suggest that deforestation in Ghana in on the rise and therefore more action by relevant authorities needs to be taken to curb the canker.

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Afele, John Tennyson ., Nimo, Eunice., Lawal, Basit. & Afele, Kofi Ian
Department of Agroforestry, KNUST – Ghana , School of Natural Sciences, Bangor University – Wales, Department of Silviculture

Youth and Transformative Leadership

The performance of any country, in seeking to achieve the Sustainable Development Goals (SDGs), to a large extent depends on its leadership. Effective leadership translates into prudent public policy formulation and implementation, as well as good public service delivery, to meet the needs and aspirations of citizens. Achieving the SDGs will require the concerted efforts of governments, the business sector, society, and individual citizens. Transformative and Innovative leadership and management will be essential for organizations in all sectors to integrate these SDGs into strategic plans and operational activities in service of realizing the 2030 aspirations and Agenda for Sustainable Development, including the SDGs as adopted At the UN Sustainable Development Summit on 25 September 2015, more than 150 world leaders present, which is the 17 SDGs, also known as the Global Goals, aim to end poverty, hunger and inequality, take action on climate change and the environment, improve access to health and education, build strong institutions and partnerships, and more. At this point, leaders should not only bring people together and encourage creative participation, but should help people to embrace a relationship with uncertainty, chaos and emergence. This emergence is the emergence of true, transformative and sound youth leaders. Leadership for achieving sustainable development is rooted in a living processes paradigm, rather than a mechanistic paradigm (Mckeown, 2002). Complex living processes demonstrate sustainable properties and patterns and can suggest important strategies for leadership. Considering that our world is inherently paradoxical, that multiple realities exist, and that living beings organize and adapt according to their environments, leadership must be "adaptive, flexible, self-renewing, resilient, learning, intelligent—attributes only found in living systems (Lai, 2011)". To achieve the SDGs, leadership at both the national and organizational levels would have to adopt leadership styles that engender a sense of shared responsibility toward the attainment of the Goals; one that is focused on the long-term, and thus would establish systems that persistently ensure the pursuance of this goal in the future; one that understands the need for collective effort (at both the national and organizational levels) toward the attainment of the SDGs; one that is willing to learn; and, finally, one that is in itself ethical, and thus would impress upon followers the need to behave in a like manner. the three basic indicators of sustainable development (improvement in economic efficiency, social cohesion and environmental responsibility) will be possible when Leadership reflects the characteristics of the transformational leadership style. Finally, strong leadership, a coherent implementation plan and, engagement of all government departments and diverse stakeholders are necessary to ensure that the Sustainable Development Goals are achieved at national and international levels.

Mr. Pius Ekeopara, Imo State university Owerri, Imo

4/8/2022

PERCEPTION OF POLITICAL CORRUPTION AMONG LOCAL GOVERNMENT EMPLOYEES OF OYO STATE

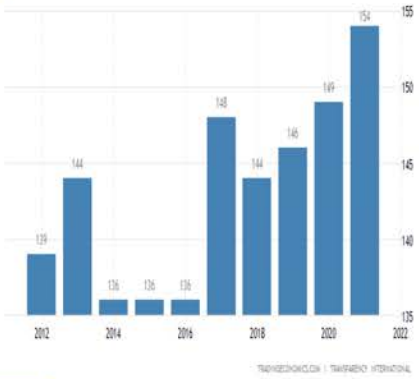
OJUGE L. E. FOLORUNSHO (Ph.D) - jobethfol@gmail.com

Introduction And Statement of The Problem

Globally, the political structure has become the chief determinant of the quality of leadership which shapes a nation's governance. Misuse of this governmental power has resulted in gross corruption which have grave effects on the political, economic and social environmental systems that promotes development

Political corruption has been defined as the use of power by government officials for illegitimate personal gain. This transcends to the use of power to repress political opponents, electoral frauds and gross violation of electoral promises.

For about a decade now, Nigeria has continuously declined in the corruption rating of Transparency International (T.I.);showing a non-improvement in corrupt practices in the country- (See below the patterns from 2012-2021 by T.I)



Political corruption retards development and growth processes and undermines democracy and good governance by flouting and subverting formal procedures. It influences accountability and distorts representation in policymaking; disregarding basic administrative principles. Government action or inaction in policies unimplemented by corrupt officials could be a big set back to human and physical development in a country

Literature Review And Theoretical Framework

Literature was reviewed based on the objectives of the study- (To investigate local government employees' understanding of the meaning of political corruption; To ascertain the extent to which political corruption affect Nigeria and Nigerians; To investigate whether there are departments in the local government most vulnerable to political corruption; To identify possible suggestion or policies that can reverse political corruption in Nigeria)

Emilie Durkheim's Anomie and Edwin Sutherland's Differential Association Theory were utilised for theoretical discussion. Emilie Durkheim's Anomie - Organic settings have much less provision of close moral guidance to individuals who could be constrained to resort to untoward behaviour and Edwin Sutherland's Differential Association Theory -different groups - families, friends, neighbours and subcultures); give us messages which make us conform or deviate from good behavior.

Methodology

Three local Government Councils (LGCs) were randomly selected from the 11 local Government Councils in Ibadan Metropolis. The Local Government Council mirrors the implementation of government policies in the grassroots. Two FGDs comprising of 12 participants were conducted in each LGCs with senior and Junior Staff separately. Two IDIs were also conducted in each of the LGCs with one senior and junior Staff each respectively

Findings And Conclusion:

Findings revealed among others that there is political corruption in Nigeria; and that the major causes of political corruption in Nigeria was generally, an enthroned culture of applauding those with money without investigating the source of their wealth and specifically, were identified as selfishness, poverty, greed, , ethnicity , societal influence, self-centeredness, protecting ill-gotten goods, lack of fear of God, poor moral upbringing, loss of moral values, desire to hold on to power perpetually , weak provisions in the constitution, impromptu leaders with no ideologies, financial demands in electoral procedures, corrupt leaders who go unpunished and so many others.

There should be a deliberate drive to reorientation of the populace, so as to regenerate the lost cultural values of honesty.

10. Special themes

10b. Sustainable development in Latin America: challenges and opportunities

Abstracts

A Decolonial approach to Socio-Environmental Justice and Indigenous Community-Based Eco-Tourism in Ecuador

Prof. Dr. Rickard Lalander

Södertörn University, Stockholm, Sweden

Abstract

Since a few decades, a growing number of Ecuadorian Indigenous communities have gradually modified their traditional livelihoods by providing tourism attraction in their localities. This paper argues that Indigenous Community-Based Ecotourism/CBET, initiated and controlled from below, may constitute a viable alternative livelihood model for rural indigenous communities beyond the parameters of neoliberal capitalism. Based on the understanding of CBET as a livelihood model aimed at achieving changes that are valuable to involved communities, this paper examines whether, how and why Indigenous CBET experiences yield outcomes that are locally perceived as socio-culturally and environmentally fair. Theoretically, a decolonial political ecology and socio-environmental justice framework helps to unveil underlying conditions and factors that link CBET to socio-environmental changes locally deemed as inclusive and equitable. From a bottom-up perspective, variations and challenges in CBET projects in rural Ecuadorian Indigenous communities are examined and problematized, drawing on initial ethnographic findings from Kichwa communities in the Ecuadorian highlands and the Amazon and Tsáchila communities of the tropical lowlands of north-western Ecuador. The paper concludes that Indigenous CBET ventures can be viewed as delinking projects, i.e., a disconnection from capitalist colonial structures and mechanisms of oppression and marginalization, thus altering the relative power relations of power between the community and surrounding actors. Accordingly, CBET in communities with a strong sense of agency can contribute to the assertion over their territorial claims and culture, in common struggles for formal recognition of ethno-territorial rights. While CBET activities may be viewed as a compromise with the logics of capitalism, the experiences of the communities examined in this paper indicate that it is more than ever before on local Indigenous terms. Moreover, the history of Indigenous struggle has always been characterized by both resistance and adaptation. This dual assertion unfolds as indigenous communities strengthen the control over their ancestral territory while also engaging in intercultural dialogues vis-à-vis tourists and other actors, simultaneously reshaping local perceptions of indigeneity and territoriality.

Track

Track 10b Sustainable development in Latin America

Community Action and the urgency around climate and health policy in the Caribbean: agency and shaping of local priorities

Dr. Michelle Scobie[1], Dr. Sonja Myhre[2], Dr. Unni Gopinathan[2], Prof. Ilan Kelman[3]

[1]The University of the West Indies, St. Augustine, Trinidad and Tobago. [2]Norwegian Institute of Public Health, Oslo, Norway. [3]University College London, London, United Kingdom

Abstract

Do the concerns of local actors coincide with global norms relating to sustainability, climate and health under SDGs 3 and 13? Important development partners like the Pan American Health Organisation in 2018 and the European Union in 2019 have supported and encouraged the development of Caribbean SIDS' action plans and targets and the strengthening regional and national policy on climate and health that coheres with the SDG 3 target relating to capacity strengthening for managing national and global health risks and the SDG 13 target relating to integrating climate measures into national policies, strategies and planning. These developments are part of larger global trends around prioritizing and sensitizing relevant actors on the urgency of mainstreaming climate change into national health policy. Despite community engagement in climate policy gaining prominence, how global norms on climate and health diffuse into and are interpreted in community contexts is poorly understood. The study, by investigating community groups' approaches to resolve the members' challenges, sought to contribute to a better understanding of community led action on health and climate change and its relationship with global agenda-setting and with norm diffusion in SIDS. The study is based on interviews undertaken between 2020-2022 with coastal community groups from one Caribbean SIDS and sought to give a space to local voices. The results of study contrasts dominant global narratives underlying recent regional and national policies and suggest that this area is still one of norm contestation between local development priorities and global norms on climate and health. The study contributes in the following ways. First, situated within norm diffusion debates, it develops a conceptual framework around scale, power and agency, and drivers of norm penetration in the context of health and climate change. Second, using regional and national policy documents, it tracks the recent historical trajectory related to the mainstreaming of climate into health regional and national policy in the anglophone Caribbean using the lenses of scale, contexts, power, and agency. Third, it registers the voices and views of coastal community groups on their development priorities in the context of climate change and health. Fourth, using the lens of norm diffusion, it highlights the disconnect between local voices and the global norms around the urgency and mainstreaming of climate change-health into regional and national climate policy. By pointing to the disconnect between community priorities and developing regional norms, the study can help development partners and national agencies to shape climate change and health policies in ways that are more inclusive of local needs. The study contributes to wider debates around norm penetration and contestation and around the power of external agents to shape local discourses and norms.

Track

Track 10b Sustainable development in Latin America

Intercultural learning through indigenous tourism: emerging spaces where decoloniality can be expressed and enacted

Dr. Juliana Porsani, Dr. Rickard Lalander, Dr. Kari Lehtilä

Södertörn University, Huddinge, Sweden

Abstract

This presentation focuses on an experience of indigenous tourism, i.e. the Pataxó Jaqueira Reserve in Bahia, Brazil. We content that indigenous' rhetoric in the realm of indigenous tourism can be understood as a decolonial instrument that illustrates how alternatives to modernity are being expressed and enacted in practice. Accordingly, the encounter with tourists in spaces where indigenous voices are protagonists allows indigenous people to retell and re-position themselves in the past and the present, and re-envision the future. The Pataxó experience shows that intercultural encounters within indigenous tourism can have epistemological but also political and economic implications. In other words, through these encounters people are invited to unlearn mainstream (i.e. colonial) versions of history and relearn from the lived experiences of oppressed groups. The decolonization of the mind in alternative learning spaces, as illustrated by indigenous tourism, can thus be instrumental against the systematic oppression of bodies, cultures, and nature, providing thus hope in our planet increasingly threatened by a socioecological crisis.

Track
Track 10b Sustainable development in Latin America

Posters

Reverse logistics as environmental practice in a Brazilian agroindustrial cooperative

Nora Marcon, Siva Johann and A. Alberton

REVERSE LOGISTICS AS ENVIRONMENTAL PRACTICE IN A BRAZILIAN AGROINDUSTRIAL COOPERATIVE

Introduction

The agricultural activity generates solid residues, among which pesticide packaging stands out. In this context, this work aims to analyze the process of reverse logistics of pesticide packaging. Organizations are in a period of great changes and technological innovations. Society exerts pressure on organizations to be environmentally responsible.

In Brazil, agricultural production has shown significant growth over the years, this is since new technologies have been implemented in the sector, meeting the increasing demand of the world consumer market. Agribusiness is one of the main driving sectors of the economy, the share of agribusiness in the Brazilian GDP in 2015 was 23%, compared to 21.4% in 2014, representing an increase over the previous year. This paper aims to analyze the reverse logistics process of pesticide packaging in a Brazilian agro-industrial cooperative.

Logistics involves the entire production chain, going from the raw material to the final consumer, so reverse logistics is the opposite process. The main purpose of reverse logistics is to reduce environmental pollution, waste, as well as promote the reuse and recycling of products.

The study has a qualitative nature, of a descriptive character, through a case study, in an agro-industrial cooperative. Data collection was carried out through semi-structured interviews and secondary data with the analysis of documents and internal controls, for later data triangulation.

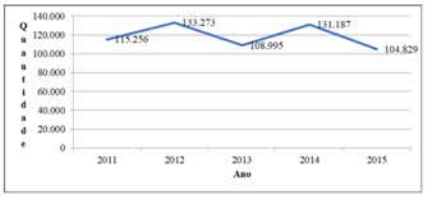
Development

Brazil is considered one of the largest consumers of pesticides in the world. Its market corresponds to almost a fifth of the world market in the volume of herbicide sales. Brazilian federal legislation divides responsibilities to all agents active in the country's agricultural sector. Under current federal law, all agents involved in the reverse logistics process are responsible for correctly disposing of pesticide packaging: i) consumers; ii) commercial establishments; iii) manufacturers; iv) public bodies. The National Solid Waste Policy, established by Law 12.305/2010, aims at the integrated management and environmentally appropriate management of solid waste.

Consumer	Responsibility for the triple washing and return of post-consumer packaging
Shops	Have a suitable place to receive the packages and indicate the return locations on the sales invoices
Manufacturer	Collect and dispose of packaging properly
Public Bodies	Responsibility to inspect and promote, together with manufacturers, environmental education and guidelines regarding the proper functioning of the system

Table 1 – Responsibilities of National Solid Waste Agents
Source: Adapted from Couto et al. (2011).

The industries manufacture the pesticides, which then go to the points of sale, either via distributors, cooperatives or direct sales by the industry. The point of receipt of packages must also be informed and must appear in the body of the sales invoice for the product.



Graphic 1 - Volume of environmentally correct pesticide packaging from 2011 to 2015
Source: Research data (2022).

After the purchase and use, the producer starts the reverse logistics process, carrying out the triple washing or pressure washing.

The Cooperative, in this case, then, prepares the packages to return them to the receiving stations, which can be made both at the stations and at the receiving centers. Finally, packaging is separated into recyclable and to be incinerated.

Conclusion

The main contribution of this study resides in the description of a flow which can be used by other cooperatives and agents of the reverse logistics process for pesticide packaging. For the success of the reverse logistics of empty pesticide packaging, it is essential that the responsibility is shared, and the destination of pesticide packaging is a complex procedure that requires the effective participation of all agents involved.

10. Special themes

10c. Quality Management and Sustainability

Abstracts

"Sticking power": Tracking employee well-being and organizational culture for insight into sustainability and quality

Kathryn Smith Rouse

Mid Sweden University, östersund, Sweden

Abstract

The purpose of this paper is to present the development of a survey tool designed to examine the culture of an organization through the "eyes" of the employees. Organizations are looking to retain existing employees with the intention to secure quality. The retention of employees is essential to the success of an organization with the retention of employees for longer periods being ideal for effective organizational success and quality (Dechawantanapaisal, 2018; Sanchez-Cardona et al., 2021). Research has demonstrated that highly engaged employees are more likely to stay with an organization due to the strong personal connections that in many cases become a mutually beneficial relationship for both the employee and organization (Fletcher et al., 2018; Rafiq et al., 2019; Thakur & Bhatnagar, 2017). Furthermore, employees who identify with an organizations values and behaviors are more likely to stay connected to that organization (Sinek, 2009; Steiner et al., 2020). An employee's strong sense of belonging creates a cultural safety net and supports the long-term interest of the organization (Sinek, 2009). A positive attitude towards the organization and its values by the employee adds to engagement (Fletcher et al., 2018). Research has also shown that the improvement of employee well-being and support can reduce turnover which may lead to greater overall business performance. Examining the culture and behavior of the employees within an organization may lead to understanding the organizations' ability to retain the "right" people as well as a producing high-quality product or service.

This study is based on the creation of a survey methodology in which a qualitative survey measuring employee ratings of educational quality, team quality, job satisfaction, belonging, collaboration, appreciation, agreement and trust, leadership strength will be created. The emergent design of the qualitative research process indicates that the first phase will have an initial plan but that this may shift or change as the research progresses and data collection begins (Creswell & Creswell, 2018). The qualitative survey is created as a test instrument to search for meaning and understanding in organizational culture and quality through the "eyes" of employees and extending this to the employees intention to stay. The survey parameters have been set using a prior conducted literature review focusing on "employee AND retention AND organizations AND intention to stay" which identified several areas as influencing the intention of employees to stay and on organizational quality. The analysis will present preliminary results from a test of a survey instrument. The conclusion of the analysis is still being developed at this time.

This presentation relates to SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all, target – 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value. For this conference the presentation directly relates to Track 10c, specifically organizational culture for sustainable quality and innovation.

KEYWORDS: Quality Management (QM), quality culture, qualitative, intention to stay, sustainable employment, sustainable quality, innovation.

Track

Track 10c Quality management and sustainability

Sustainable quality culture and characteristics of top management teams - Can it be measured?

PhD student Lilly-Mari Sten, Associate Professor Pernilla Ingelsson

Department of Quality Technology and Management, Mid Sweden University, Östersund, Sweden

Abstract

Today, Agenda 2030s Global Goals (SDGS.UN, 2021) focusing on sustainability is a major concern for organizations, and traditional financial measures are no longer adequate to determine an organization's performance. Now, organizations need to include ecological and social sustainability measures.

Sustainable Quality Management (SQM) and Sustainable Quality Culture (SQC) are important aspects for organizations in striving to become more sustainable and to create social, societal and environmental values. SQM is based on the existence of a number of core values within an organization that builds the culture that is needed to ensure sustainable quality (Bergman & Klefsjö, 2020).

Organizations worldwide have increasingly constructed their work around teams. This shift in the structure of work has made teams an organizational concern (Kozlowski & Ilgen, 2006). Teamwork can be seen "as part of a value creation process that encompasses internal and external actors and influences how an organisation's operations are structured" (Gremyr, Bergquist, & Elg, 2020, p. 111). Hackman (2002) stressed the importance of real teams for successful teamwork. A real team include following criteria: a team task, clear boundaries, specific authority to manage their own work processes and high membership stability (ibid.). Teams not meeting these criteria, are less efficient and less likely to realize the benefits derived from teamwork.

Previous research shows that leadership is the most crucial element of team effectiveness and performance (e.g. Hambrick, Humphrey, & Gupta, 2015) and that the top management team (TMT) is a key resource for an organization's sustainability (Xu et al., 2019). The current understanding of how the TMT influence organizational strategy and performance is mainly based on the Upper Echelons Theory (UET) by Hambrick and Mason (1984) and later updated by Hambrick (2007). This theory suggests that demographic characteristics like age, gender, work experience, and education are reasonable proxies for the underlying differences in executives' psychological attributes. In turn, these characteristics of top executives will ultimately manifest a firm's strategic decisions and performance. Studying TMT characteristics can therefore become important when to understand how TMT manage towards creating a SQC. Measuring is an important way for organizations to benchmark with other organizations but more importantly, to have a base for developing their own performance.

The aim of this study is to develop and evaluate an instrument, measuring SQC and characteristics of TMTs. This instrument, in form of a questionnaire, is a further developed version of a questionnaire about SQC, which has been tested in previous research (see for instance, Bäckström & Ingelsson, 2016). Adding perspectives about TMT can help widen the knowledge about how characteristics of TMT can affect how top management succeed in managing towards sustainable development and in creating a SQC.

This abstract relates mostly to the SDG target 8.1, which is in line with the track, Quality Management and Sustainability. Thus, this abstract contributes to new knowledge about how to measure SQC and characteristics of TMT.

Track
Track 10c Quality management and sustainability

The Journey to Strong Sustainability Starts With Understanding Organizational Culture

Mr James Demastus[1], Prof Nancy Landrum[2], Prof Brian Ohsowski[2]

[1]University of Deusto, Bilbao, Spain. [2]Loyola University Chicago, Chicago, USA

Abstract

Organizations and researchers have embraced corporate sustainability but the desired impacts of doing so are unrealized. This "Big Disconnect" stems from a business-as-usual integration of weak sustainability rather than an embracing of strong sustainability. This research approaches this problem by asking if organizational culture, is a component of corporate sustainability strength.

Too often, corporate sustainability is treated as a concept where organizations are assumed to be monolithically applying the intended principles of sustainability. Corporate sustainability strength is defined as a measure of organizations meeting the intentions of the concept, so that the goals of sustainability can be achieved. It is desired for organizations to be practitioners of strong sustainability, rather than weak, "greenwashed" sustainability.

Organizational culture is the repeated believe, values, and actions of an organization as it tries to achieve goals. The concept attempts to understand and explain why organizations differ in the way they choose to pursue their goals. Application of the concept can guide organizations in shifting culture to achieve desired results.

Documents from 197 organizations were text mined with standardized keywords to determine corporate sustainability strength on Landrum's Stages of Corporate Sustainability and organizational culture profile on the Competing Value Framework. Expectedly, organizations with a proclivity towards Hierarchy, and Market typologies were proponents of weak corporate sustainability. Surprisingly, Clan-oriented organizations were found to reduce weak sustainability while Adhocracy types had no relationship to corporate sustainability strength. This is among the first research to quantitatively measure the concept of sustainability and organizational culture. The methods will set precedence for future researchers to recreate and improve upon.

The findings demonstrate that organizational culture should be managed in practice and research to connect organizations to strong sustainability. Academia can confidently include OC as a factor in CS strength, and practitioners must consider changing OC as part of their management strategy in their journey towards strong sustainability.

Track
Track 10c Quality management and sustainability

UNIDO Good Governance Standards for Sustainable Business Practices: How much do Nigerian Entrepreneurs Know?

Prof. Adeyeye Adewole[1], Dr Ginah Ginah[2]

[1]Olusegun Agagu University of Science & Technology, Okitipupa, Ondo State, Nigeria. [2]Nigerian Content Development and Monitoring Board, Yenagoa, Bayelsa State, Nigeria

Abstract

In recent past, the Nigeria Business environment was introduced to United Nations Industrial Development Organisation (UNIDO) good governance standards as part of measures aimed at spurring businesses for enhanced competitiveness, efficiency, accountability, profitability and sustainability. The study examines the UNIDO good governance standards for sustainable business practices against the backdrop of its capacity to rapidly transform how business entrepreneurs run their businesses in order to attain desired profitability and growth. It evaluates how an average Nigerian entrepreneur has responded to this very important initiative in terms of knowledge and practice. Using randomly selected samples of entrepreneurs across South West Nigeria, It was discovered that the average Nigerian entrepreneur, even through conscious of good governance implications of business entity, his response in terms of practice is a function of various factors both within and outside of his control.

Track

Track 10c Quality management and sustainability

Full papers

Arts-based Interventions in Business

Understanding "value-added" for sustainable quality development

Kristen M. Snyder, Professor

Quality Technology and Management Mid Sweden University, kristen.snyder@miun.se

Abstract

This paper contributes to the exploration of culture as the fourth dimension in sustainable development, and its application in the business to support sustainable quality development. The past decade has witnessed a growing interest in arts-based innovation (ABI) to foster human capital as a value-added resource to achieve and sustain quality. As a co-creative process, arts-based practice stimulates out-of- the-box thinking and reflection, which is essential to leading organizations in complex times. Assessing the value of ABI is challenging since it doesn't fit into standard measures. At present, two models exist that examine value at distinct levels within an organization. Some suggest, however, the need for a more integrated view in which value is seen through the interdependence of levels. This has led to an interest to develop a multi-perspective approach to examine value from a systems perspective. The purpose of this paper is to apply the concept of the learning organization to explore further a framework for assessing the value of ABI in business from a systems perspective.

Keywords: culture, quality, sustainable development

1. Introduction

Culture, as defined by artistic practice, has been introduced into the UN Agenda 2030 as the fourth pillar of development toward sustainability. Artistic practice, both as artist and audience, contributes to the exploration, interrogation, and expression of critical ideas and voice. As part of the Creative Europe Programme (Culture Action Europe, 2018) culture is promoted to strengthen democracy by fostering participation and critical thinking. This evolution in sustainable development is exciting to many in the field of business who have been promoting the use of arts-based practices to foster participatory practice, innovation, and a sense of coherence toward sustainable quality development. As a co-creative process, arts-based practice (ABI) stimulates out-of-the-box thinking and reflection and fosters human capital as a value-added resource to achieve and sustain quality in complex times.

Including artistic practices as part of the solution to achieve sustainable development expands the very nature of conceptualizing what is sustainable development and what kind of sustainability practices are needed to sustain development. Early models represented sustainable development through one of three primary perspectives: economic, environmental, and social (Winter, 2008).

Separating such perspectives is now recognized by many as futile. As pointed out by the UN, creating the conditions for a sustainable planet necessarily involves everyone, including businesses as part of the solution (UNESCO, 2017).

Researchers in quality management suggests there is a paradigm conflict between current business forms based on models from the 20th century and what is needed to achieve sustainable development (Fundin, et al, 2021). At the forefront of the dialogue is a recognition that new systems and approaches are needed for organizations to become more adaptive and responsive to complexities in industry, service delivery and customer needs (Ulh-Bien & Arena, 2018). While it is perhaps easy to support sustainable development practices through statistical target goals (i.e. UN Global Compact and eco-metrics), many argue that this is all but one piece of the puzzle (Ramanathan, 2021). Developing sustainable practice requires a mind-shift within organisations to create conditions for participatory practice (Rill, 2016), and a recognition of the interlinkages between organisational practices and sustainable development (Mårtensson, et al 2019). Toward this end, the use of arts-based practices is explored as but one of the ways in which organizations can strengthen their work cultures to embrace and promote the kinds of business and social practices needed to create conditions necessary for sustainable development.

Examples of ABI are growing both in scope and application. Initially, ABIs focused on the arts as something external to organizational members (i.e. art on the walls). In more recent years, experiments have explored how the arts can be transferred into everyday situations, in which organizational members interact in their workplace through the arts. For example, Nissley (2002) studied the use of song as organizational discourse, in which members of the organization created or modified songs to express strategy and improve communication. Studies and reports now highlight important relationships between creativity, reflection, and critical examination of organizational practice and leadership approaches (Sköldberg, & Woodilla, 2014).

Taylor and Ladkin (2009) identified four distinct uses of ABI 1) support skill transfer, 2) reflect inner thoughts and experiences, 3) illustrate the essence of concepts and ideas, and 4) facilitate "making" as a form of self-expression through the production process. Interest is now moving beyond the application of ABIs to better understand the value-added nature of the practice. New questions are emerging about the "real" value of artistic interventions in organizations (Darsø, 2015). At present, two frameworks exist that examine value at distinct levels within an organization. Some suggest, however, the need for a more integrated view in which value is seen through the interdependence of levels. This has led to an interest to develop a multi-perspective approach to examine value from a systems perspective.

The purpose of this paper is to apply the concept of the learning organization to explore further a framework for assessing the value of ABI in business from a systems perspective. The learning

organization model (Senge, 1990) recognizes the interdependence of individuals and functions, which together stimulate learning and growth for the system. Deep learning and transformation occur through embodied knowledge, reflection, and conceptualization, which are supported by key organizational architectures. Value in the learning organization is identified by the interplay that exists between members and the architectures that foster deep learning. This theoretical model will be applied to an analysis of the ABI, "Resonance Listening". A comparative analysis is presented using the Learning Organisation model, the Arts-Based Matrix (Schiuma, 2009), and the Meta-Analysis conducted by Bertoin Antal and Strauss (2016) to provide a more in-depth picture and understanding of how to describe and assess the value of the ABI from a systems perspective. Implications will be discussed as they relate to the broader questions of quality and sustainable development in business.

Contextualizing ABI within sustainable quality management

There is a growing recognition of the importance of the "people dimension" to develop and sustain quality in organizations. Proponents of building human capital claim that organizational excellence is best achieved when knowledge and learning are stimulated and shared (Park-Dahlgaard & Dahlgaard, 2003); Senge, 1991). This perspective is crystalized within the current definition of quality articulated in the Emergence Paradigm (Fundin, et al, 2021; van Kemenade and Hardjono, 2019). Accordingly, "The emergence paradigm defines quality in a dialogue of all stakeholders… knowing quality can be different tomorrow" (p. 160). Among the characteristics, quality is seen as dynamic, not static, based on shared values, flexible, adaptable, dialog and communication oriented, participatory, shared leadership, strategic, and systems-oriented (ibid). However, researchers in quality management suggest, that there is a paradigm conflict between current business forms based on models from the 20th century and what is needed for meeting the complexity of society today (Fundin, et al, 2021).

Carlucci & Schiuma (2018) state that, "…in the new millennium, the creation of value in the organization no longer depends on a mere rationalistic and linear design and functioning of organization's components and processes. More and more it is tied to people's experiences, emotions, and energy in carrying out activities and developing new ideas" (p. 342). Creating the conditions for organizational transformation within complex systems, which are governed by deep cultural traditions and values may require leaders to think beyond the box (Rill, 2016). Schiuma (2009) claims that "the successful organizations of the 21st century will be those able to develop competencies to manage their energy and emotional states to govern their value creation dynamics" (p. 6).

According to Pink (2005), the paradigm shift will also require us to think differently about how we think and act. In his thesis, "A whole new mind", he suggests that right-brain thinking, such is used in artistic forms, will be a necessary balance to the current left-brain thinking orientation that is dominant in most organizations. Among the right-brain competencies that can help organizations foster and sustain quality in the new paradigm are storytelling, design, empathy, and play, each of

which is derived from arts-based approaches to organizational development.

Interest in the arts has developed as an approach to engaging organizational members in co- creative processes to enhance the strength of human capital as an essential resource for quality and innovation. The movement grew from a recognition that innovation through the arts can foster a process of developing solutions to problems through a systematic iterative method that invites exploration and exploitation of new ideas (Taylor and Ladkin, 2009). According to Schiuma (2009), "Arts-Based Initiative (ABI) can be defined as any organizational and management intervention using one or more art forms to enable people to undergo an art experience within an organizational context, as well as to embed the arts as a business asset." The power of the arts-based practice (ABI) as a co-creative process, lies in the ability of the arts to stimulate out-of-the-box thinking (KEA, 2011). ABIs are designed on the premise that the arts can help people experience the abstract, giving them a portal through which they can begin to talk about otherwise abstract phenomena. It is through the function and ability of art to challenge assumptions, perceptions, routines, and traditions that growth is stimulated.

The experiential nature of the arts stimulates learning in unique ways expanding the focus from cognitive knowledge to include embodied knowledge, which is fundamental to human and organizational communication and culture (Nissley, 2010). The Creative Clash (KEA, 2011) suggests that "culture-based creativity…is a driver of innovation, social well-being, and inclusion because it injects vision, values, emotional bonds, and contributes to disrupting routine and linear thinking in organizations." (ibid, P3). Carlucci & Schiuma (2018) demonstrate that arts-based experiences create an environment that frees workers from traditional ways of seeing and working by moving them out of their comfort zone, creating space for reflection, and making the invisible visible. They (ibid) suggest that "the arts can play a strategic management role to support organizational value creation mechanisms by stimulating learning dynamics among workers that transform human and organizational capital; a notion that connects well to Dahlgaard and Dahlgaard-Park (2006) 4Ps model of excellence for sustainable quality development that includes the integration of people, process, product, and performance. In business, the world of work is often centered around concrete structures and processes that are tangible and observable; easy to talk about. Meanwhile, the unseen dimensions of work found in the values, norms, and behaviors of organizational culture, are left untouched since they are too abstract to identify. The arts uniquely make visible these unseen dimensions providing workers with experiences and skills to identify and reflect upon the deeper dynamics of organizational life that impact their well-being and work processes.

Defining and Assessing the Value of ABI

At present, there is no agreed-upon approach or conceptual framework for measuring or assessing the value of ABI in organizations. Schiuma (2009) argues that studying ABI and determining value is complex. In general, ABIs are not directly linked to standard measures of success (i.e. productivity).

As he suggests, "Arts experiences are extremely difficult, if not impossible, to evaluate using money as a measurement unit. This is because any art experience tends to meet different needs which are subjective, idiosyncratic, context- and time-related " (ibid, P 10). The value, he contends, is found in the more subtle, abstract spaces of human attitude, which can be seen and understood through studying behaviors and other forms of cultural analysis such as linguistics. Berthoin Antal and Strauss (2016) suggest that measuring the value of arts-based initiatives on organizations is complex, and can be identified on many levels, including the individual, the team, and the organization. However, there remain significant questions about how to measure value from the individual to the organization, in which the individual is seen as an interdependent component of the organization.

Contributions from researchers, such as Schiuma (2009), Berthoin Antal and Strauss (2016), Sorsa et al. (2018), and Berthoin Antal (2018) reinforce the complexity of measuring the value of ABIs, as well as methodological challenges. What is emerging from these studies is an understanding that assessing the value of ABI requires a multi-perspective approach, both theoretically and methodologically. The abstract, subjective, nature of experience calls for a more comprehensive approach to defining value that is not often found in the fundamental measurement tools in the business. Moreover, value for the organization needs to be understood through the interplay of the individual and the collective.

Meynhardt et al., 2016 argue that "value" as an ontological construct requires a different approach where measurement is concerned. In their thesis, value is seen as a component of a system that is experienced and expressed in the interplay between the micro and the macro. In their proposed framework for studying value, they apply synergistic theory to explore "the dynamic interplay between individual and collective value" (p. 2983). Their framework draws from a similar principle of the Learning Organisation model (Senge, 1990) that recognizes the interdependence of individuals and functions, which together stimulate learning and growth for the system. Value in the learning organization is identified by the interplay that exists between members and the architectures that foster deep learning.

Existing Frameworks for Assessing the Value of ABI

Two frameworks for studying ABI in organizations are important to recognize. The Art-Matrix (see figure 1) is a framework designed by Schiuma (2009) to explore different aspects of value in arts-based initiatives that examine both the type of value as well as the inter-relationship between the individual and organization. Among the type of values are ABI for bonding, transformation, competence development, inspiration, and entertainment to name a few. The value can also be seen in different ways, which he classifies into four categories: Igniting, Intrinsic, Instrumental, and Artful. The igniting zone is an initial phase that is used to stimulate interest among staff, leaving little impact on the individual or the organization. The intrinsic zone has a high impact on individuals (i.e. personal pleasure and satisfaction), but a low impact on the organization. The instrumental zone has a high impact on the organization, but little on the individual. The artful zone has a high impact on both

people and the organization, encouraging new awareness, and energy that can stimulate change.

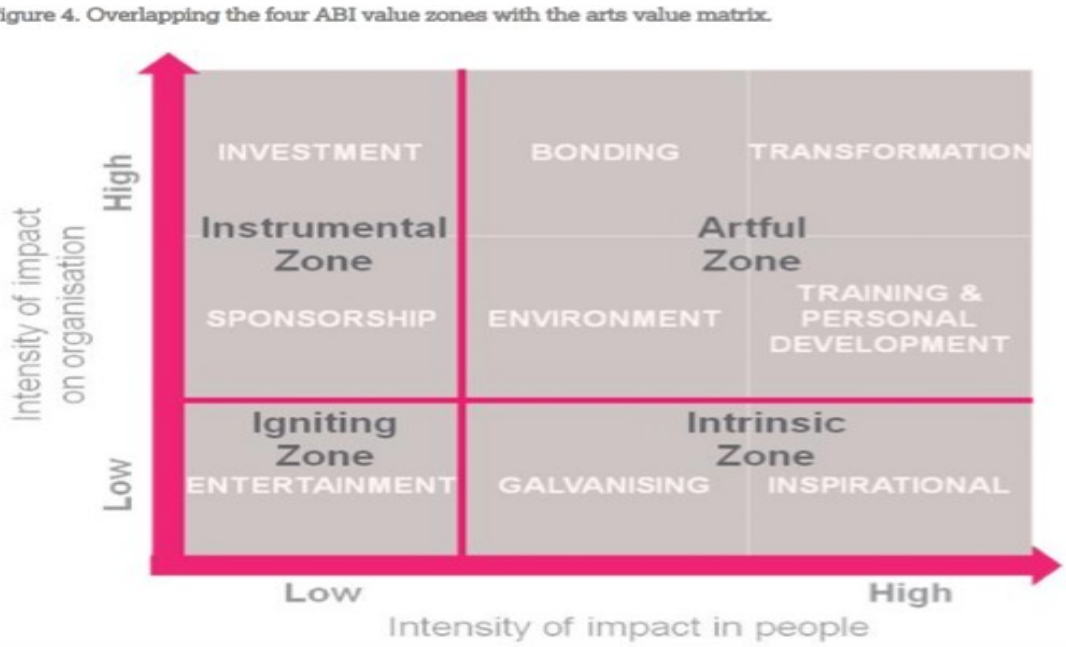


Figure 1: The Art-Matrix, Schiuma 2009

A second framework was developed by Berthoin Antal and Strauss (2016) in a meta-analysis in which value creation is documented at three different levels: the individual, the interpersonal, and the organizational (see figure 2). At the personal level, ABI focuses on personal development and can enhance the ability of individuals to see situations differently, At the interpersonal level ABI focus on relationships and contribute to collaborative ways of working. At the organizational level, ABI can add value through strategic operations that contribute to organizational development. The fourth category of value-added was also identified, which they labeled level-spanning effects. At this level, the focus was given to "artful ways of working"; an innovative practice that alters the standard routines found in an organization. The second component in this category was called "Activation", which they described as the igniting of energy that occurs during the meeting with artists. This meta-analysis provides a structural framework for beginning to organize the level at which the value of ABI might be explored. At the same time, it highlights the methodological challenge of defining value added that is often more subjective.

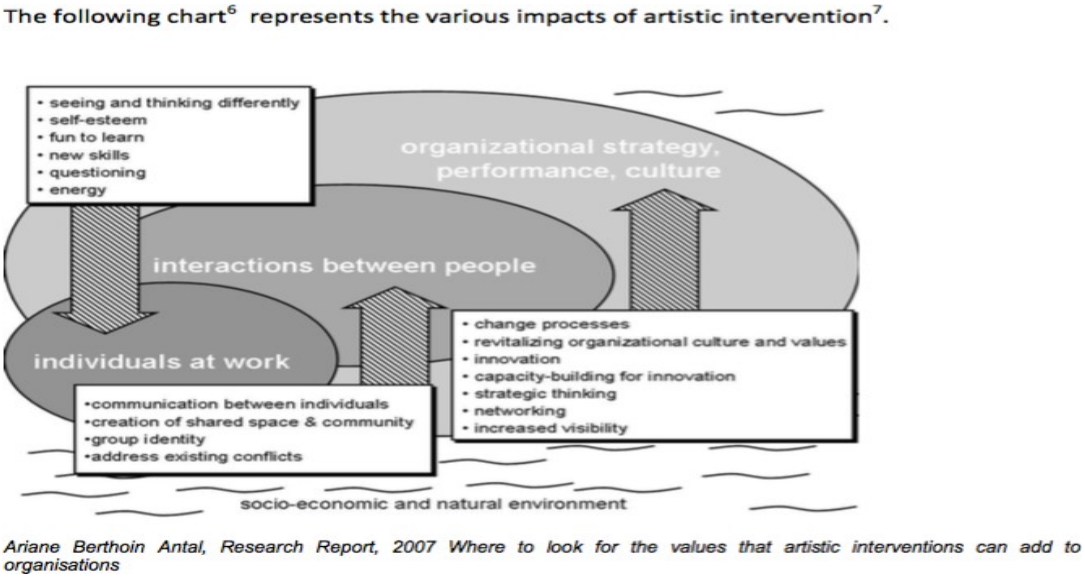


Figure 2: Berthoin Antal and Strauss (2016)

Both Berthoin Antal and Strauss (2016) and Schiuma's (2009) value-added frameworks provide a concrete gateway to studying and framing the value of ABIs for organizations. In particular, the Art-Matrix helps to categorize ABI into different types and categories that impact aspects of an organization at a more micro level. However, methodological questions remain about how to identify the value of an ABI at all levels from an integrated perspective. To address the ongoing challenge, Berthoin Antal, et al. (2018) applied multiple theoretical frameworks to explore and examine the complexity of the potential value and ABI on the meaning of work. This was necessary, they argued to examine "the non-instrumental management of work". Albeit, this was one focus within a work context "meaning of work", and did not address the impact on the organization as a whole.

Concerning the current frameworks, I would like to explore the potential that the Learning Organisational model can contribute to assessing the value of ABIs on organizations to support sustainable quality development. In particular, the architectures for deep learning may provide new insights into the value of ABIs.

The learning organization model (Senge, 1990) fosters interaction among stakeholders to build shared mental models, reflect, on knowledge, and develop a sense of personal mastery. The learning organization model is based on the premise that organizations grow and sustain by fostering deep learning cycles, which over time lead to renewal and growth of 1) new skills and capacities, 2) new awareness and sensibilities, and 3) new attitudes and beliefs. Igniting deep learning sets in motion collective learning based on experience, that guides the development of the organization from within. It is counter to external governance based on an expert model. Instead, the learning organization model values the individual and collective insights, experiences, perspectives, and skills of its members, which

are based on aspiration, reflection, dialogue, and conceptualization. Skill sets are not based on specialization, but rather on being open to learning to generate new awareness that "stimulates deep shifts in how we think and interact with one another".

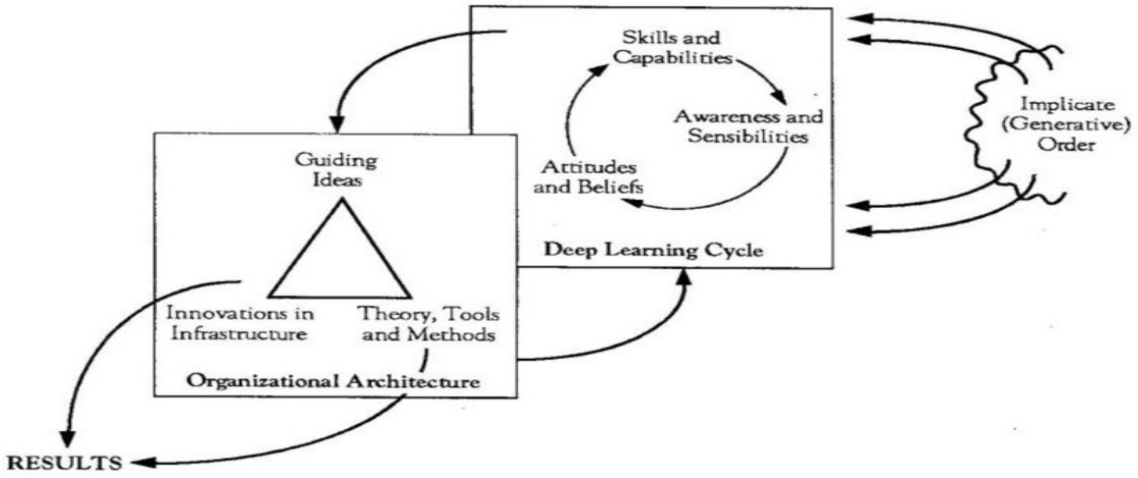


Figure 3 Deep Learning Cycle in the Learning Organisation. Senge, et al. 1994:

This kind of deep learning, Senge et al (1994) claim, takes place within a particular architecture that includes 1) guiding ideas, 2) innovation in infrastructure, and 3) theory, methods, and tools (see figure 3). The guiding principles include systems thinking that we are all a part of a larger system and we do not need to create inter-relationships for they already exist. The second principle is the "community nature of the self", which suggests that individuals are a part of a larger culture; when we talk about self, we are talking about the collective. The third principle is "the generative power of language", arguing that we co-create our realities through our understanding of experience. Innovations in infrastructure reflect the need for learning opportunities to take place in daily work, reducing the reliance on external training programs. As Senge writes, "until people can make their workspace a learning space, learning will always be a nice idea- peripheral, not central" (Senge et al., 1994, p. 35). The kinds of tools that foster deep learning in organizations build on reflection, aspiration, conversation, and conceptualization. Moreover, tools and methods should be grounded in a theory to stimulate deeper reflection and learning about the "why" behind the tools, not just the how and the what.

Using the learning organization model as a conceptual framework to examine and identify value-added in arts-based interventions may contribute to the dialogue and understanding about how to measure the importance and potential application of ABI to support organizational learning that starts with the individual. Considering Berthoin Antal and Strauss's (2016) analysis, there is a tendency to look for value-added at three different levels. However, the learning organization model would suggest that this is futile and in so doing, important evidence of value-added is overlooked. Dividing learning

into levels, in which the individual is singled out has been rejected by many organizational theorists who argue that there is an important "synergy" between organizational members, which adds value to knowledge creation (Schwandt and Marquardt, 2000). Measuring or assessing value cannot be achieved by adding the sum of the individuals to the organization. The value occurs through the interaction of individuals or is collectively larger than the sum of individuals.

Based on the "primacy of the whole" and the "community nature of the self" principles in the learning organization, exploring the value-added contributions of an ABI should include elements of deep learning. If evidence of deep learning can be identified at the individual level, and forums for reflection and conversation exist at the team and organizational level, then one could argue the ABI has the potential to add value at all three levels, even if the value is not yet visible. It is when value is given to skills and capacities that stimulate new awareness that the potential for new attitudes and beliefs has the potential to develop, stimulating growth and development in the organization as a holistic community.

Distinct from many theories of organizational development the learning organization model distinguishes between "development" as guided by planning, and "learning", which evolves from experience. This is an important point of departure that can influence how we think about determining the value of arts-based initiatives in organizations, which often take place at the individual level. In the Dance of Change Senge et al. (1994) highlight challenges to initiating and sustaining the learning organization. Several of these challenges are mentioned in this article to provide perspective about common roadblocks that may impact the degree to which ABI adds value to an organization. It is important to distinguish between the value of the ABI itself and the value of the ABI as a catalyst for change and growth. If roadblocks occur in the organization that prevents learning from occurring, it is fair to conclude that the value of the ABI cannot be fully measured. Among the common challenge to initiating deep learning are the following: 1) "time", 2) "lack of support", and 3) "walking the talk". Investing in change requires that time be made available for piloting new ideas, reflecting, and exploring the ideas. According to Senge, et al (ibid) "if time flexibility remains unchanged, and there is no additional time available for such initiatives…the initiative will be less effective, thereby undermining possible growth in learning capabilities, and it increases frustration and reduces people's willingness to commit" (p. 69).

Rooting change in the organization can require help to apply new ideas and knowledge in practice. Often change initiatives are implemented in smaller groups, leaving them without the support to inject their knowledge into other members of the organization. When institutional support for pilot projects is limited, people become frustrated because they are investing time with little payoff. The third challenge to initiating deep learning is for leaders to "walk the talk". Building cultures of trust, that new behaviors and actions are invited, is critical to fostering deep learning. Leaders who reflect openly, and engage in dialogue demonstrate to organizational members the value of learning. When

this value is not made visible, a trust gap emerges, challenging spaces for reflection and dialogue. The opportunity for arts-based interventions, I would contend, is thus dependent on the conditions of the organization to support deep learning, including dialogue, reflection, and conceptualization, as well as time to explore and a level of trust that demonstrates value in organizational learning.

Carlucci and Schiuma (2018) claim that the arts play an important role in stimulating the learning organization.

> *As "a learning platform" the arts have the power to spark and sustain learning dynamics that involve a transformation of human and organizational capital … the arts can be exploited to steer and strengthen the internal and external organizational relationships…This contributes to an increase in people's sense of belonging to an organization, supports the formation of a team-building culture, and can encourage intergroup cooperation and partnerships. " (p. 346)*

The role of the arts to foster shared learning and co-creation complements Senge's notion of the Learning Organisation and the importance of applying tools that invite and encourage reflection and conversation. Arts-based practices have an inherent nature that supports the learning organization by engaging people in the experience, through which they can reflect, dialogue, and conceptualize new understandings bringing to bear new awareness that can shape new behaviors. The co-creative nature of ABI builds naturally on the intersection of the individuals as part of a team as part of an organization, suggesting that if the conditions of the learning organization are present, the value of the ABI has the potential to impact the organization through the individual. Snyder et al (2017) in their work with value- based leadership found that utilizing artistic forms such as design thinking and storytelling opened space for dialogue and collective learning through which new values, processes, and innovation emerged, both individually, among team members, and at the organizational level as well. Moreover, that storytelling made visible values, attitudes, and behaviors that could be used to identify areas of improvement and harness opened spaces within the organization to ignite energy and creativity among employees. The arts-based practice stimulated a co-creative process for value-creation.

Arts-based Intervention: Resonance Listening

From 2012-2014, the arts-based concept, "Resonance Listening" was created through a Regional Development in Sweden initiative to pair artists and businesses to develop an innovative approach to address the challenges of communication and creativity in the workplace to enhance quality. The concept of Resonance Listening was born through a partnership between a Professor in Quality Management, two classically trained musicians, and a Yoga Instructor schooled in Medical Yoga. The guiding question was: "How can the application of the language of music to everyday life provide people with tools to comprehend and manage external stimuli and internal reactions as a way to reduce and improve work?" Listening and communication were chosen as the focal point for the intervention given that listening is claimed to be one of the most important skills for business leaders

today (Reichert, 2006) to create healthy quality-based work cultures. Listening is a key ability that contributes to participation and interaction, which can also provide increased well-being with harmonized and relaxing sounds (Leeds, 2010). It is also well known that listening is one of the most difficult aspects of human communication that requires practice to be refined.

The concept of resonance listening was developed by combining skills and language from music, breathing, and reflective practice from MediYoga (http://sv.mediyoga.com/om-mediyoga/varumarke/) and exploratory development techniques from Appreciative Inquiry (Cooperider and Whitney 2005) to teach individuals and groups how to be more aware of their way of listening and communicating. Resonance Listening transfers elements from the language of music, yogic breathing, and appreciative inquiry (ibid) to the workplace. The three dimensions provide theoretical perspectives and practical tools around which participants develop new skills in listening communication, and stress management. Application of the theoretical ideas and tools are carried out within an architectural framework of practice, reflection, dialogue, and feedback that provide the context for co-creation of value and continuous improvement for the individual and the team.

2. Methods

This paper is based on a comparative exploratory analysis of an arts-based intervention Resonance Listening, in which the three approaches to valuing ABI are compared. Methodologically, one could argue this is also an action research study. Action research is defined as "a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview which we believe is emerging at this historical moment" (Reason & Bradbury, 2002). It is intended to improve one's practice, improve one's understanding of the practice and produce knowledge about practice. Understanding the context and the situation in which the practice is carried out is central to the art of action research (Stringer, 1999).

As a co-designer of the ABI "Resonance Listening", I initiated the project as part of a call sponsored by the Regional Development Program in Sweden to pair artists and businesses to find innovative solutions to existing challenges. As both a professionally trained musician and Professor in Quality Management, I was well informed about challenges with organizations and the possibilities that combining arts and organizational development afforded innovation. The intervention was co-designed with two other professionals: a professional musician, and a licensed nurse who also worked as a yoga instructor. As a design team, we spent six months in co-creation during which the ABI was designed, training materials were developed, and the intervention was then tested in two pilot programs. In the current analytical phase, I am applying theoretical models as a researcher to both understand more fully the value of the ABI Resonance Leadership, as well as to explore new potentials for defining the value of ABI in business based on the Learning Organisation model.

In fall 2014 the ABI Resonance Listening was offered to 16 people from the staff at the same nursing home. Participants were divided into two groups (eight people per group). The selection of the participants was left to the management and the training took place at the workplace (three of the persons from the first pilot also participated in the second pilot). Participants met every two weeks for two hours during a series of five workshops. During each workshop participants were trained in the skills of yogic breathing and reflection, as well as concepts in music and the art of asking questions according to AI. Musical illustrations were performed by trained musicians who then transferred the skills to everyday situations in which people became musicians of their voice and body. Unique to Resonance Listening was that participants were actively engaged in shaping the music, rather than being passive recipients of music. Most studies on music and well-being focus on how people are stimulated by different types of music (see, for example, Leonard, 2006).

The first three workshops were used to introduce skills and concepts in the music of language: sound, melody, and harmony. In the third and fourth workshops participants were introduced to appreciative inquiry and worked with the tools for each of the four stages: dream, define, design, and discover. Medigap was offered during each of the workshops. Between workshops, participants were given a set of activities to perform to develop their skills and test them in a real-world setting. Participants were given workbooks including a theoretical presentation of the different tools and skills related to sound theory and music as medicine. As well they were given practice activities to explore and try new approaches in their daily life and work. Tips for also provided for the participants to develop a ”grab-bag” of solutions that could be applied to different scenarios and situations. The combination of theoretical background, practice activities, and tips were intended to give the participants the tools to both identify, comprehend, and managed external stimuli that could be seen as stressors or strengths.

Data were collected throughout the implementation phase of the ABI through a combination of stress inventory, reflective dialogue, and formal evaluations. During the first workshop participants completed a stress inventory (PSS-14). As well they completed a survey indicating noises that were perceived as negative and positive. Breathing rates were measured pre and post-workshop through yogic breathing and a reflective dialogue was held at the beginning of each workshop to understand how participants practiced and experienced the tools and knowledge from each of the workshops. After the last workshop participants completed a post-stress inventory (PSS-14) and a program evaluation, which was both written and verbal.

3. Results and Analysis

In this section of the paper, findings from the second pilot are presented to understand how the Resonance Listening ABI impacted the participants. Insights are provided from the reflective dialogues that took place throughout the workshops, as well as observations and results from different activities and the Stress Inventory.

Reflections from the dialogue indicated that participants were open to the concept of Resonance Listening but needed to develop routines to embrace it as a practice. From the initial stages, most of the participants didn't commit time to work with the concepts between sessions, even though it was an agreed-upon part of the project. The explanations given reflected high levels of stress at work and home making it difficult for participants to find time to work on something new. The most practiced technique from the beginning was breathing, which is not unexpected since it was the easiest skill to develop, and the one that gave the most immediate effect on well-being. During the first three sessions, reflections included comments such as, "I have thought about my breathing in different situations when I feel stressed, but I haven't practiced breathing at home", or "I am stuck…there is a lot to do at work and I just can't find the time both at work or at home to work on anything". Others who practiced the yoga breathing techniques, shared that they "listened to the yoga breathing technique CD (they were provided) and practiced the techniques in the evening after the kids went to bed". This same person also shared after the first session that they began to apply the technique in the workplace, taking time to breathe during stressful moments. One of the persons share that they applied the music skills with sound: "I have trained away the clicking of the clock (which is a disturbing sound), and it can hang on the wall again. I am working on the same technique with other sounds that I find disturbing at home and work".

By the third workshop, more reflections echoed changes that were beginning to occur in attitude and behavior. Participants were beginning to establish routines for breathing and listening through musical illustrations. For example, "I think more now when I breathe about how I breathe and what's going on around me and I feel calmer". Several other persons shared that in general, they were breathing more deeply after practicing yoga breathing. Moving from thought to action appeared to be the biggest obstacle for most. In almost all reflections, the same elements were heard in a variety of ways: "I think about breathing and the music, but I don't practice it so much. Perhaps it will happen more when I develop routines for doing so.

By the fourth session, a greater shift in behavior and attitude emerged that reflected an inner commitment and valuing of the ABI. One person shared, "At home it is peaceful, but at work it is stressful. I like to practice my breathing exercises when I cook because then it is peaceful. I also have music playing and have begun to think about how I choose my music to help me in my stress as you taught us to choose music that has the right frequency to match us." Another person shared that "I do too much for other people and don't think about myself. I am starting to take more time for breathing and I have also turned off the music around me so I can listen more to my surroundings. I am beginning to feel a difference".

By the fifth session, the type and tone of the reflections had changed dramatically as compared to the first two sessions. One person shared, "I have felt better these past few weeks. I feel more peaceful and less stress, more energy. I have turned off the music around and instead listen to the music that is in me.".

Another person echoed this indicating they "felt calmer since the last session, and when it gets stressful, I just begin to breathe. Even my children have learned from me and sometimes they say 'Mom, let's sit down for a minute and breath". A third person shared that "when I go home after a stressful day, I lie on my bed and listen to pleasant music for 30 minutes and then I get new energy." From another participant, "I feel more stable now. Just knowing that having breathing that can help is good. Also, music is a big part of my life and I have learned how to use it, even more, to help me feel grounded.

Findings from the stress inventory (N=5) indicated participants improved their ability to handle stressful situations during the course of the training program. Among the factors that all participants experience the most improvement in were the following:

- Improved ability to handle change and difficult situations
- Less frustrated when things didn't turn out as planned
- Less stressed and nervous and more in control

Findings from the evaluation indicated that participants develop tools that were useful to improve their listening and handle stress.

- Starting the workshop with a yoga pass made them feel calmer and in control
- Using the language of music helped strengthen their own and others' well-being
- They acquired tools to take charge of their health
- They developed skills to identify sounds and their impact and to neutralize the effect of negative sounds
- They felt that they have skills that can help them to improve their communication with others
- They experienced improvements in deeper breathing
- They experienced improved sleep

During various workshops participants often lifted scenarios in their work as they talked about issues related to sound, breathing, and listening, through which problem areas in the structure or process of work were articulated. Over time the dialogues shifted from mere complaints to articulated needs that could be used to develop the organization. Among some of the needs identified were:

- Routines in the workplace around mobile phones, breaks, and temporary work staff
- Special cleaning staff who only clean to free up the care staff to care for the residents
- More time to engage with residents for conversation, music listening, and walking
- When a resident is in danger of death, the regular staff will be alerted, and temporary staff will be replaced instead of the regular on schedule

Based on the findings from the pilot study, the value of the ABI is further explored using the following three models as presented in Table 1: 1) Berthoin Antal and Strauss's (2016) Meta-Analytical framework, 2) Schiuma's (2009) Arts-Value Matrix, and 3) The Learning Organisation (Senge, 1990). Table 1 highlights the dimensions from each of the models in which the value of ABI can be understood.

Table 1: Comparison of the theoretical frameworks for assessing the value of ABI

Meta-Analytical framework	Arts-Value Matrix	Learning Organisation Tools to foster Deep Learning
Individuals at work: Seeing and thinking differently Self-esteem Fun to learn New skills Questioning Energy	**Inspirational**: the main goal is self reflection, which can drive mindset and behavioural changes **Training and Personal Development**: the main goal is to develop specific skills, competencies and personal capacity **Bonding**: the main goal is to create a relational capital and common ground for conversation and collaboration **Transformation**: the main goal is to open up the organisation and its people to a new consciousness and devie organisaiton towards change	**New Skills and Capabilities that result in a mind shift, through:** **Aspiration**: the ability of individuals and teams to orient themselves toward what they truly care about **Reflection and conversation**: the ability to reflect on deep assumptions and patterns of behavior, both individually and collectively. . . .this requires an ability to listen and reflect on your own thinking, as distinct from "Ping-Pong" ball talking **Conceptualization**; the capacity to see larger systems and forces at play and to construct public, testable ways of expressing these views.
Interactions between people Communication between individuals Creation of shared space and community Group identity Addressing existing conflicts	**Instrumental:** high impact on the organisations infrastructure and little on the people (i.e. branding, aesthetically pleasing work environment **Artful:** High intensity on both people and organisational infrastructure. (i.e. change in attitude and behaviour is included in this category	**New awareness and sensibilities:** over time, as our new skills and capabilities develop, the world we "see" literarily shifts. Gain insights into how we reinforce behaviours making visible the tangible forces underlying a system that can serve as change drivers **New Attitudes and Beliefs** that result in an alignment of deep beliefs (embedded in the dialogue of the culture) and espoused values (outspoken values). This is evidenced in the stories that are told in the organisation
Organisational Strategy, performance and culture Change proesses Revitalizing organisational culture Innovation Capacity building for innovation Strategic thinking Networking Increased visibility	**Igniting:** low-level impact on the people and organisation. Used to stimulate energy and interest, without any lasting effect (i.e. entertainment **Intrinsic:** High impact on people, and low impact on the organisational infrastructure. ABIs leverage personal power, emotions, inner value	**Architecture:** guiding ideas innovation in infrastructure theory, methods and tools

Based on Berthoin Antal and Strauss's (2016) Meta-Analytical framework, Resonance Listening appeared to add value primarily at the individual level and team level. At the individual level, the impact was evident in the form of improved sleep, and a greater sense of calm, a finding that is in line with similar studies about the effect of yoga on sleep and stress (Anderzon-carlsson, et al 2014). Participants indicated that deep breathing was a powerful tool to deal with daily stress; a tool that could also be used in a group to help people address the stressful situation to eventually impact teams and the organization if it were developed into widespread practice. Evidence existed that the ABI enhanced communication in the group to both articulate areas of needed improvement in the workplace, as well as to share their own experiences with breathing and listening. Reflections shared during the later workshops demonstrated more open awareness for one another and listening with care to everyone's experience. Little evidence was found about the impact of the ABI on the organizational level. However, that is perhaps explained by the short-term nature of the project and the fact that the leadership was not present during the training.

Based on Schiuma's (2009) Arts-Value Matrix, findings indicate that Resonance Listening

demonstrated value primarily at the igniting and intrinsic zones with the participating groups. In the igniting phase, it is expected that interest is stimulated among participants, but that little to no impact is seen in the organization. In most of the cases, this was true of the pilot group. By the final sessions they demonstrated interest in the concepts, and many were beginning to apply the breathing and portions of the music at home. However, none of them integrated the concept in the workplace more than to help reduce their level of stress; an impact that has the potential with time to impact the organization. There was some indication among several participants that the ABI resulted in a value impact at the intrinsic level improving quality of sleep, sense of calm and stability, and greater satisfaction with previously uncomfortable situations.

The remaining two zones in Schiuma's model (ibid), instrumental (high impact on the organization, low impact on people) and artful zone (high impact on both people and organizations) did not witness an impact because of the pilot test. This can perhaps be explained by two factors, the first of which is individual and the second of which is organizational. Transformation of attitudes and behaviors takes time and begins with the individual (Schein, 2004). Given the short duration of the training program, it is only appropriate to expect change will necessarily take place in stages, and that the period for the change is individual. The second factor relates to leadership, and the importance of clear leadership to support organizational development; lack of leadership is shown to be destructive (Snyder, et al. 2017).

Applying the Learning Organisation model provides additional insights into the potential value of the ABI Resonant Listening from a long-term perspective that is important for sustainable development. The impact of the ABI was identified in all three areas of the deep learning cycles, 1) new skills and capacities, 2) new awareness and sensibilities, and 3) new attitudes and beliefs. According to Senge, this is an essential building block for renewal and growth over time. The presence of impact in these different phases has the potential to stimulate collective learning from the communal experience. There was strong evidence that learning and reflection were developed both among individuals and within the group. Also present in the ABI was an architecture-defined regular space for coming together, beginning with deep breathing and sharing reflections about experience and tools and methods for dialogue. The change in dialogue witnessed over time indicates the ABI added value to the group's collective knowledge. This is part of the third principle in Senge's model: the power of generative language. Finally, the application of the ABI in the daily work of the group provided pathways to continuous development, which in time has the potential to reach the organization on all levels.

4. Conclusions

This paper contributes to the conference theme to consider culture as a fourth dimension in sustainable development by exploring the application of arts-based practice in organizations. Incorporating the arts in organizations has developed as an innovative approach to engage organizational members in co- creative processes to enhance the strength of human capital as an essential resource for sustainable quality and innovation. As a co-creative process, arts-based practice stimulates out-of-the-box thinking and reflection, which is essential to leading organizations in complex times.

Determining the value of arts-based initiatives for innovation and transformation is complex. The traditions of performance measures and standardized bottom-lines limits how the impact of ABIs can and should be assessed. In the growing complexity of sustainable organizational development, it is argued by many that new paradigms are needed to determine value. In this paper, the Learning Organisation model has been applied to explore further how to assess the value of ABI for sustainable quality development in organizations. The theoretical model was chosen given the focus on deep learning and the recognition that sustainable organizational development occurs through an interaction between individuals and the community of stakeholders. Valuing ABIs from a Learning Organisation perspective offers deeper insights into the potential that any intervention has for long-term development. This is critical for helping organizations develop new mental models that can embrace the arts as part of the equation toward sustainable development in business and society.

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Teaming for Quality in the VUCA Landscape

Exploring key elements for a progressive leap in team-based practices to drive quality, sustainability, and regeneration

Johan Lilja[1], Kristen Snyder[2], Lilly-Mari Sten[3]

[1]Mid Sweden University, Johan.lilja@miun.se
[2]Mid Sweden University, Kristen.snyder@miun.se
[3]Mid Sweden University, lilly-mari.sten@miun.se

Abstract

The pandemic has impacted organisations in new and unprecedented ways, illustrating the landscape that organisations and their leadership are increasingly facing. A landscape that many organizations and leaders find exceptionally hard to navigate, characterized by tensions and increasing levels of volatility, uncertainty, complexity, and ambiguity (VUCA). This new landscape is strongly driven by the systemic, complex, and interconnected sustainability challenges now urgently facing humankind. It is simply no longer an option to lead, operate and design the quality of systems, organizations, or products based on an incomplete economic, reductionist and mechanistic logic. Instead, the world is clearly calling for a leap in leading and teaming for quality. This leap would be into more of a living logic; a dialogic mindset; an emergence paradigm; a regenerative culture; and an integral stage of consciousness, leading and organising. Collaboration will then increasingly replace autonomy, empowerment will replace power, teamwork will replace individualism, self-organisation will replace rigid structures, and team intelligence will replace individual intelligence.

The purpose of this paper is to identify, integrate, and advocate key elements for a progressive leap in team-based practices to achieve quality in the VUCA landscape. The paper is designed using a conceptual contribution framework. This framework includes making aware of what has been, or is missing, as well as pointing to aligned research areas that have failed to intersect. The paper presents conceptual findings concerning a progressive leap in team-based practices and what it might imply for how to team up for quality. In doing so, it advocates a leap into a practice of regenerative circles that transcends and includes fundamental principles and ideas from the team-based practices of quality control circles in the East by integrating insights from previous successful societal transformations within Nordic countries and the current Inner Development Goals initiative.

Keywords: Sustainable development, Quality management, Regenerative culture, Quality control circles, Inner development goals

1. Introduction

The pandemic has impacted organisations in new and unprecedented ways, illustrating the landscape that organisations and their leadership are increasingly facing. Many organisations and leaders have found this landscape exceptionally difficult to navigate, as it is characterised by tensions and increasing levels of volatility, uncertainty, complexity, and ambiguity (VUCA) (Bennett & Lemoine, 2014). This new landscape is strongly driven by the systemic, complex, and interconnected sustainability challenges now urgently facing humankind (Young et al., 2017). The pandemic has impacted organizations in new and unprecedented ways, illustrating the kind of landscape increasingly facing organizations and their leadership. A landscape that many organizations and leaders find exceptionally hard to navigate, characterized by tensions and increasing levels of Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) (Bennett & Lemoine, 2014). This new landscape is strongly driven by the systemic, complex and interconnected sustainability challenges now urgently facing humankind. It is simply no longer an option to lead, operate and design the quality of systems, organizations, or products based on an incomplete economic, reductionist and mechanistic logic (Hajer et al., 2015; Van Kemenade & Hardjono, 2019; Wahl, 2016; Reed, 2007; Capra and Luisi, 2014).

Such a world is clearly calling for a leap in leading and teaming for quality. Where teams enabled by distributed leadership are accentuated as alive and actively engaging in continual conversations and learning that accentuate the verb "teaming" in terms of "*a way of working that brings people together to generate new ideas, find answers, and solve problems,*" in accordance with Edmondson (2012, p. 24).

Specifically, the world is calling for a leap into more of a living logic (Hutchins & Storm, 2019); a dialogic mindset (Bushe & Marshak, 2015); an emergence paradigm (Van Kemenade & Hardjono, 2019); a regenerative culture (Wahl, 2016); and a more integral stage of consciousness, leading and organising (Laloux, 2014). Common to most elaborations about such a leap is the notion of a move towards approaching organisations as living systems, as complex ecosystems (Hutchins & Storm, 2019). Leading then becomes a matter of inquiry into the collective experience of the ecosystem in ways that catalyse the emergence of new ideas, processes, and solutions by aligning with and amplifying the untapped wisdom in the organisation. Rather than a "command-and-control" approach, leading successfully in complexity is about engaging all stakeholders to come up with multiple ideas, dynamically team up, and take them to action by experiments: fail or make progress—learn—amplify (Bushe & Marshak, 2015; Snowden & Boone, 2007). In this landscape Edmondson (2012) notes that collaboration replaces autonomy, empowerment replaces power, and teamwork replaces individualism. In addition, self-organisation increasingly replaces rigid structures (Bushe & Marshak 2015; 2016), and team intelligence trumps individual intelligence (Woolley et al., 2015).

The purpose of this paper is to identify, integrate, and advocate key elements for a progressive leap in team-based practices to achieve quality in the VUCA landscape.

2. Quality management and team-based practices evolving in response to the new landscape

This section provides a brief background and perspectives on the evolution and the new paradigm, era or mindset that is increasingly called for and evolving regarding quality management (QM) and team-based practices.

2.1 Quality Management on a journey towards sustainability, complexity and emergence

Research in QM argues that the field is entering a new era, Quality 5.0, in which society is recognised as a key customer (Deleryd & Fundin, 2020). QM thereby includes sustainability as both a goal and a way of organising. It also calls for a new, complementary emergence paradigm of QM that can help organisations cope with today's rapidly changing complex environment (van Kemenade & Hardjono, 2019). The emergence paradigm then builds on systems thinking and self-organising principles and relates to complex adaptive systems. Among the characteristics, QM is then characterized by: being dynamic, based on shared values, flexible, adaptable, dialog and communication oriented, participatory, and systems oriented (ibid.). Fundin et al. (2020) further identified research themes vital for future knowledge development in relation to QM, including 1) applied systems perspectives, 2) stability in change, and 3) smart self-organising models. In doing so, the authors identified a need for further research exploring how leaders within QM can combine and balance self-management with traditional leadership.

2.2 Team-based practices on a journey towards self-management, self-organisation and cross-organisational strategies

It is evident that effective leadership is more and more rarely about a single leader having the answers and giving orders as in "command-and-control" type of leadership. Chances are small that the manager or leader has the best idea or the most profound experience in relation to the contextual challenges in the VUCA landscape. Instead, the new type of practices is about team-based leadership as in "invite-and-inquire" - in order to invite the collective wisdom and connect people in the system to co-create so that new patterns can emerge (Snowden & Boone, 2007; Bushe & Marshak, 2015, Stacey, 2002).

Teams and team-based practices are also evolving beyond local colleagues to include inter- and intraorganisational teams. Such teams are often distributed and temporary and are designed to address complexities within the new landscape. Research in this area is evolving to explore of the role of networks for sustainable quality development (Snyder & Snyder, 2021). Many of the challenges in

relation to sustainable development apparently require such teams, where quality improvements are often driven at a systemic level, across organisational borders, and by cross-organisational teams and partnerships (Young et al. 2017). When it comes to management, Hajer et al. (2015) also stress that it is rather the bottom-up, non-confrontational, and stakeholder-oriented approaches, that relates to leading complexity, that will be a success factor for action in relation to sustainable development. In the VUCA landscape, self-managing teams and collective leadership (Lee & Edmondson, 2017) are hence expected increasingly to replace hierarchical organising, as generally argued by e.g Laloux (2014). Another argument for further exploring teaming is that collective action in problem solving has been shown to be more effective than individual actions, in accordance with the research on team intelligence (Woolley et al., 2015). Snyder et al. (2008) reported that "high performing companies have learned the power of teamwork for advancing their organisations towards their vision and mission (p. 249). In these organisations, leaders recognise the importance of empowering teams to self-manage to create work cultures that lead the organisations to become responsive and adaptive (ibid).

It has also become evident that "psychological safety", broadly defined as a climate in which people are comfortable expressing and being themselves (Edmondson, 2018), is a key factor for team performance and team-based quality development. Project Aristotle at Google, which studied 180 of their teams, showed, for instance, that psychological safety was the outstanding predictor of team performance (Duhigg, 2016). Furthermore, Nembhard & Edmondson (2006) found statistically significant relationships between psychological safety in the teams and quality improvement (the ability over time for teams to improve the quality of care). Han et al. (2019) further found that creativity in teams was impacted by psychological safety (Edmondson, 1999), which was also found to be highly correlated with shared leadership (Slobodnik & Wile, 1999).

3. Methods

This paper is designed using the conceptual contribution framework proposed by MacInnis (2011) with the conceptual goals of identifying, integrating and advocating. This includes making aware of what has been, or is, missing - as well as pointing to aligned research areas that have failed to intersect. The three general and specific conceptual goals of this paper—as well as their meaning, the metaphorical role of the researcher, and the metaphorical tool—are summarised in Table 1.

Table 1. *The goals of this paper defined. Each goal is connected to a metaphorical role of the researcher and a metaphorical tool in accordance with the framework for conceptual contributions developed by MacInnis (2011, p.138-139).*

Conceptual goals	**Meaning**	**Metaphorical role of the researcher**	**Metaphorical tool**
Envisioning by **Identifying**	"To see that something exists; to apprehend, notice, or behold"	**The astronomer**	The telescope
Relating by **Integrating**	"To see previously distinct pieces as similar, often in terms of a unified whole whose meaning is different from its constituent parts; to synthesize, amalgamate, or harmonize"	**The architect**	Architectural plans
Debating by **Advocating**	"[To] endorse a way of seeing; to support; justify or suggest an appropriate path"	**The guide**	The compass

Table 1 shows that a metaphor for a researcher whose contribution involves identification is that of an astronomer who uses a powerful telescope to identify previously unseen stars, planets, or galaxies. The subsequent integration then involves synthesis—that is, the creation of a whole from diverse parts. Integration leads to overarching ideas that can accommodate previous findings, resolve contradictions or puzzles, and produce novel perspectives. The metaphorical role of the researcher integrating concepts is that of an architect who creates a new building from a set of pipes, cement, steel, wiring, and windows. Finally, advocacy involves argumentation to justify or support a given conclusion. With advocacy, the researcher recommends or pushes for something or speaks in support of a particular view. The metaphorical role of the researcher is that of a guide who relies on a compass to direct the path forward (MacInnis, 2011).

4. Rediscovering and reimagining teaming for quality—accompanied by the astronomer and the architect

With the researcher playing the astronomer role, this section aims to provide a view of the starry sky and turn the telescope towards a set of very different stars and constellations that are central to a progressive leap in team-based practices for achieving quality in the VUCA landscape. Doing so involves reaching from the strong tradition of distributed leadership and quality circles found in the East (Ishikawa, 1985) to "the Nordic secret" of how to progress through major technological, economic and structural changes peacefully and successfully (Andersen & Björkman, 2017).

While doing so, we are also accompanied by the architect who has the capacity to relate, unify, and integrate those stellar observations into an architectural sketch or plan by pointing at underlying similar mindsets or drivers related to complexity and teaming.

4.1 Sustainability and creating regenerative cultures as a continuous learning and transformative journey

In this paper sustainability and regeneration are not seen as fixed states that can be achieved and then maintained forever after. It is rather Rather, they are learning processes, as described by Wahl (2016): "*Sustainability is a dynamic process of co-evolution and a community-based process of continuous conversation and learning how to participate appropriately in the constantly transforming life-sustaining processes that we are part of and that our future depends upon"* (p. 40). Learning with the intention of creating regenerative cultures then transcends and includes sustainability, in which regenerative cultures are "… *capable of continuous learning and transformation in response to, and anticipation of, inevitable change. Regenerative cultures safeguard and grow biocultural abundance for future generations of humanity and for life as a whole*" (Wahl, 2016, p. 46). This perspective suggests that sustainability is a conversation and a community-based learning process; therefore, it is not a task that an individual can perform alone. A broad spectrum of research increasingly highlights teams as key for such a process.

4.2 Inner Development Goals—transition towards sustainability and a regenerative culture through facilitating, enabling, and fostering inner development

Another constellation currently rising and worth our attention is known as Inner Development Goals (IDGs; https://www.innerdevelopmentgoals.org/). This effort is a not-for-profit and open-source initiative that researches, collects and communicates science-based skills and qualities that help us live purposeful, sustainable, and productive lives. It was initiated based on the notion that progress regarding the 17 Sustainable Development Goals (SDGs; UN, 2015) has thus far been disappointing. One reason being that we lack the inner capacity to deal with our increasingly complex environment and challenges. The IDG initiators then thought that the scholarly field of adult development research has accumulated a lot of relevant knowledge that is sorely needed for us to become more successful in working towards a more sustainable world such as Berger, 2011; Commons, 2008; Cook-Greuter, 1999; Dawson, 2004; Fischer, 1980; Kegan, 1998; King & Kitchener, 1994; Loevinger, 1976; Torbert et al., 2004)

The IDGs provide an open-source essential framework of transformative skills for sustainable development, i.e., a field-kit on how to develop these necessary skills. The current IDG framework represents 5 categories and 23 skills and qualities that are especially critical for leaders who address SDGs but fundamentally relevant to all, as seen in Table 2. The framework was developed by a team of international researchers after an extensive outreach consultation involving more than a thousand persons.

Table 2. *Overview of the Inner Development Goals (IDG) framework (https://www.innerdevelopmentgoals.org/).*

Being Relationship to Self	**Thinking** Cognitive Skills	**Relating** Caring for Others and the World	**Collaborating** Social Skills	**Acting** Driving Change
Inner compass	Critical thinking	Appreciation	Communication skills	Courage
Integrity and Authenticity	Complexity awareness	Connectedness	Co-creation skills	Creativity
Openness and Learning mindset	Perspective skills	Humility	Inclusive mindset and intercultural competence	Optimism
Self-awareness	Sense-making	Empathy and Compassion	Trust	Perseverance
Presence	Long-term orientation and visioning		Mobilization skills	

The five main categories are briefly elaborated below:

- **Being – Relationship to Self:** Cultivating our inner life and developing and deepening our relationship to our thoughts, feelings and body help us be present, intentional and non-reactive when we face complexity.
- **Thinking – Cognitive Skills:** Developing our cognitive skills by taking different perspectives, evaluating information and making sense of the world as an interconnected whole is essential for wise decision-making.
- **Relating – Caring for others and the world:** Appreciating, caring for and feeling connected to others, such as neighbours, future generations or the biosphere, helps us create more just and sustainable systems and societies for everyone.
- **Collaborating – Social skills:** To make progress on shared concerns, we need to develop our abilities to include, hold space and communicate with stakeholders with different values, skills and competencies.
- **Acting – Driving change:** Qualities such as courage and optimism help us acquire true agency, break old patterns, generate original ideas and act with persistence in uncertain times.

Given the VUCA landscape and the pressing need for a transition, there is apparently a need for a range of cognitive and emotional skills and other qualities that go beyond what most people normally learn in schools and higher education. A natural question then becomes how do we build and evolve those skills and qualities within our organisations and society.

It should be noted that during the course of the IDG project the team have also found and received suggestions from others of a number of more or less similar initiatives to formulate frameworks describing important skills and qualities. Some of them (e.g. Wamsler et al., 2020, 2021; Wamsler & Restoy, 2020; Wiek, Withycombe & Redman, 2011; Rimanoczy, 2020) also explore the skills needed in order to manage sustainability issues more effectively.

4.3 Learning circles and "bildung" as historically successful vehicles for societal transformation and development—learning from the Nordic secret

Given the challenges and increasing complexity at hand, a core question is how societies can progress peacefully through major technological, economic, and structural changes. How can societies evolve their capacity to handle new levels of complexity and thereby transition into a new paradigm?

In "The Nordic Secret", Andersen and Björkman (2017) highlight the unique and successful ways in which Denmark, Norway and Sweden were able to make a transition from feudal agricultural societies to industrialised, prosperous and progressive democracies by inventing a new kind of large-scale educational and developmental program. In relation to what we normally see as education, those programs had their roots in the German "bildung" philosophy which has a strong focus also on vertical development in terms of *"one's mental, spiritual and moral depth and aspirations"* (Andersen and Björkman, 2017, p.168). In doing so it is argued that they were a vital part of successfully expanding the Nordic people's ability to cope with the increasing complexity (by increasing mental complexity (as highlighted in adult development frameworks by e.g. Kegan (1982)) as well as expanding the moral complexity or circles of solidarity (from ego towards humanity and the planet as discussed by e.g. Welzel (2013)).

A core characteristic of this "building" or "folk-bildung" movement was that it was initiated at the top but then transformed the countries from the bottom and up. In Sweden, study circles allowed remote communities to be self-providers of bildung as of 1902. The tradition of learning circles or study circles remains in, e.g., Sweden, as a means for adult development and utilises the experience of ordinary people as a starting point for exploring socially relevant concepts (Larsson & Nordvall, 2010).

4.4 Team-based quality practices—the historical power of quality control circles

From a historical and global perspective, team-based practices and collective leadership in terms of quality circles or quality control (QC) circles have long been a highly valued and vital core of quality development in successful Asian companies such as Toyota, Nissan, and Honda. Bergman & Klefsjö (2010) highlight that the first quality circle was registered in Japan in 1962. These circles were small teams, with typically 6-10 people, who together discussed, originated, and realised suggestions for

quality improvements. In a further examination of the origins of these QC circles, Ellis et al. (2019) made three main findings: 1) that Sumitomo Electric Industries (SEI) first developed QC circles and won the 1962 Deming Prize based on QC-circles, 2) that SEI used societal and cultural conditions in Japan to encourage participation by the workers in improving quality, 3) that the most important method of participation for SEI was suggestion systems.

It is striking how this team-based practice relates closely to the "teaming" that Edmondson (2012) calls for to enable organisations to be more dynamic and adaptable, much like the systems found in nature. She highlights that organisations are alive and in an active process of continuous conversation and learning by accentuating the verb "teaming" in terms of "*a way of working that brings people together to generate new ideas, find answers, and solve problems*" (Edmondson, 2012, p. 24).

Since then, several of the major, more successful Japanese companies have organised and registered tens of thousands of such quality circles. Furthermore, it is common that circles are cross-organizational. What is also striking is the formulation of the actual aim of these circles and the order in which they are presented. At for example the Toyota Motor Corporation quality circles are applied with the following three stated aims according to Bergman & Klefsjö (2010):

1. to develop the abilities of individuals in the workforce and empower them to self-fulfilment,
2. to develop an attitude of mutual respect among staff members and creating a motivating environment, and
3. to contribute to corporate development by fostering continuous improvement of the workplace.

Despite the development of quality circles in the East and a wave of attempts to implement quality circles in the West during the 1970s and 1980s (Ishikawa, 1985), little evidence exists of their current application in Western-based companies, as argued by Bergman & Klefsjö (2010). This omission is even more striking as Ishikawa (1985) states that "*where there are no QC-circle activities, there can be no Total Quality Control activities*" (p. 137). This notion of a large gap between the East and the West as well as the QC circles being a core is also noted by Dahlgaard et al. (1998) when comparing QM practice in East and West. As a result, they state that *"the main observation is that in the Eastern countries the level of activity involved in motivating employees is higher than in the Western countries. In all three Eastern countries, involvement in quality circle activities is the main motivator. For example, 95 percent of the Japanese companies use quality circles compared with around 30 percent in the European countries" (*Dahlgaard et al. (1998, *p. 818).*

These circles in the East have always been based on voluntarism; they are not conducted at the command of a superior. Ishikawa (1985) cite ten items as a useful guide in conducting QC-circle activities: *"(1) self-development, (2) voluntarism, (3) group activity, (4) participation by all employees, (5) utilization of QC-techniques, (6) activities closely connected with the workplace, (7) vitality and*

continuity in QC activities, (8) mutual development, (9) originality and creativity, (19) awareness of quality, of problems, and of improvement" (p. 140). Once again, self-development is prioritised. Additionally, "mutual development" refers to the intention to give the employees broader perspectives, helping the employees see things from the standpoint of the whole and even ensuring employees have a worldwide perspective. The guide also includes the intention of exchanging ideas with others in other organisations and contexts.

5. Re-envisioning QC circles for regenerative transition and deliberately developmental organisations—accompanied by the guide

In company with the guide, the conceptual journey of this section highlights the compass and suggests an appropriate path for future practice and research into this area. Based on the previous identification and integration, several key elements can now be advocated for as part of a progressive leap in team-based practices for quality.

Key element 1: Provide a base of fundamental knowledge and inspiration—Improving quality will become increasingly equal to improving sustainability and regeneration

As the new measurement of quality becomes to achieve societal satisfaction and sustainable success (Deleryd and Fundin, 2020), quality improvements must become increasingly synergetic and equal to the improvements of sustainability and regeneration. Thus, a progressive leap in team-based practices for quality must be informed by knowledge about sustainability and regeneration. Just as it is seen as a must to initially educate people about quality in order to enable for them to take responsibility for improving quality. Similarly, an initial competence development must now take place regarding sustainability and regeneration as a foundation and inspiration for the progressive leap.

Key element 2: Invite into voluntary regenerative circles—Coping with the VUCA-landscape spells together

Both Wahl (2016) and Edmondson (2012) accentuate the continuous conversation as key to coping with the complexity and challenges at hand. Edmondson (2012) approaches organisations as alive and in an active process of continuous conversation and learning by accentuating the verb "teaming" in terms of "*a way of working that brings people together to generate new ideas, find answers, and solve problems*" (p. 24). Wahl (2016) states that *"Sustainability is a dynamic process of coevolution and a community-based process of continuous conversation and learning how to participate appropriately in the constantly transforming life-sustaining processes that we are part of and that our future depends upon"* (p. 40).

In addition, the team-based practice of QC circles has been a primary motivator of people and the main driver and enabler of quality improvement in the East. Therefore, the progressive leap in team-based

practices for quality should acknowledge many of the organising principles and ideas behind the QC circle activities of the East. Among them is the priority of designing these circles based on volunteerism and with the purpose of self-development and mutual development, in terms of maintaining the intention to give the employees broader perspectives, so they can see issues from the standpoint of the whole and even have a global perspective. This goal also includes the intention of exchanging ideas with those in other circles, organisations and contexts by connecting the circles into a national and/or global network nationally.

Key element 3: Go for a learning journey concerning skills and qualities that include and transcend the traditional focus of quality circles— Improving and transforming the world rise from developing and transforming people

The ability to improve quality, sustainability and regeneration in our increasingly complex environment (the VUCA landscape) requires us to build new capacity, skills and qualities. This point is obviously stressed in the Inner Development Goals initiative (https://www.innerdevelopmentgoals.org/) as well as in the top priority given to self-development within the historically successful QC circles in the East.

Given the 23 skills and qualities included in the IDGs and outlined in Table 2, one apparent way to start evolving QC capacity would be to train the circles in a new set of tools and practices in addition to the traditional ones. This possibility relates to what in the IDS report refers to as the development of thinking–cognitive skills: "*Developing our cognitive skills by taking different perspectives, evaluating information and making sense of the world as an interconnected whole is essential for wise decision-*making" (Jordan, 2021, p.15). Of special interest in relation to the VUCA landscape is the skill of complexity awareness that also relates to providing the circles with *"... actual skills in analyzing, synthesizing and developing and enacting strategies for managing complex issues ..."*(Jordan, 2021, p. 16). This particular field of theory and practice is growing, and the circles could then, for instance, be inspired by Snowden och Boone (2007), Laloux (2014), Hutchins and Storm (2019), and Bushe and Marshak (2015) as well as the tools suggested for the QM emergence paradigm by van Kemenade and Hardjono (2019).

By doing so, the skills, tools and qualities used and developed will include but also transcend the previous ones used in traditional QC circles. In relation to the four QM paradigms as suggested by van Kemenade and Hardjono (2019), the circles will have to build a higher level capacity of integration. The integration can then for example regard skills, tools and qualities needed to navigate in both simple, complicated, complex and chaotic contexts (Snowden and Boone, 2007). This capacity of integration can also, in accordance with the reasoning of van Kemenade and Hardjono (2019), be seen as a matter of epistemic fluency: "*the capacity to understand, switch between and combine different kinds of knowledge and different ways of knowing about the world*" (Markauskaite and Goodyear, 2016).

Related to the roots of QM, this capacity also relates to what Deming (1993) highlights as the need for the "theory of knowledge". These circles need to be able to integrate several different kinds of knowledge.

Key element 4: Make it a leap of courage and with global potential—Envisioning regenerative circles being a major force in the larger transition towards a sustainable and regenerative world

The interesting case of the "Nordic secret" may provide inspiration for how societies can deliberately evolve their capacity to handle new levels of complexity and thereby transition into a new paradigm of living sustainably and thriving together on this planet. In conclusion, Andersen and Björkman (2017) state that *"We need inner development to acquire the mental complexity that allows us to see our outer problems for what they are. We need to develop symbols, a collective language, shared narratives, and a common epistemology for a meta-modern future in all ten circles of belonging"* (p. 429). One lesson to be learned from "the Nordic secret" is that it then took a deliberate "bildung" effort for people to find the new realities of the world meaningful and safe. The question of our time is then how we might deliberately enable such a journey in today's society and world.

Using our organisations and team-based practices to enable setting and form would be the answer to that question and the vision, based on the idea of regenerative circles advocated here. Such a vision relates directly to creating what Kegan & Lahey (2016) call "Deliberately Developmental Organizations" (DDOs) and thereby societies. Kegan and Lahey further argue that in a VUCA world, they have found that these DDOs *"... are the most powerful settings in the world we have found for developing people's capabilities, precisely because they have created a safe enough and demanding enough culture that everyone comes out of hiding"* (2016, p. 2).

Redirecting and evolving the practice of quality circles into such regenerative circles can evidently be a powerful and valuable intervention to both the people involved as well as the progress of their organisations and society. Being inspired by the aims of the traditional quality circles in the East, regenerative circles might then be applied with the following three stated aims that transcend and include those of traditional QC circles:

1. to develop the abilities, skills and qualities of individuals in the circle and empower them to self-fulfilment, higher orders of mental complexity, and expanded circles of belonging;
2. to develop an attitude of mutual respect among the circle members in relation to all life and to create a motivating environment that enables learning, creativity, integrity and courage; and
3. to contribute to regenerative development by fostering continuous improvement and development of yourself, workplaces, society and the ecosystems on this planet.

The term regenerative circles—rather than, for instance, sustainability circles—was chosen to highlight the ambition of not only doing less harm but also as being conducive for life. This goal is in line with Hutchins and Storm (2019), who define regenerative in the context of leadership and organisational development as *"creating the conditions conducive for life to continuously renew itself, to transcend into new forms, and to flourish amid ever-changing life-conditions"* (p. 70). In this definition, the regenerative circles are also clearly connected to the critical transition into regenerative cultures, which are "*... capable of continuous learning and transformation in response to, and anticipation of, inevitable change. Regenerative cultures safeguard and grow biocultural abundance for future generations of humanity and for life as a whole*" (Wahl, 2016, p.46).

6. Conclusions

This paper identifies, integrates, and advocates the key elements for a progressive leap in team-based practices to achieve quality in the VUCA landscape. In doing so, it advocates a leap into a practice of regenerative circles that transcends and includes fundamental principles and ideas from the team-based practices of quality control circles in the East by integrating insights from previous successful societal transformations within Nordic countries and the current Inner Development Goals initiative.

The four key elements advocated for are:

- **Key element 1**: Provide a base of fundamental knowledge and inspiration—Improving quality will become increasingly equal to improving sustainability and regeneration
- **Key element 2**: Invite into voluntary regenerative circles—Coping with the VUCA-landscape spells together
- **Key element 3**: Go for a learning journey concerning skills and qualities that include and transcend the traditional focus of quality circles—Improving and transforming the world rise from developing and transforming people
- **Key element 4**: Make it a leap of courage and with global potential—Envisioning regenerative circles being a major force in the larger transition towards a sustainable and regenerative world

Regarding the implications, this paper will hopefully spark and create new regenerative ripples within the QM field as well as within the people, organisations and societies within which we live.

7. Discussion

The contribution of this paper is based on the selection of a few, but here argued as vital, pieces. The paper's value is then related to the readers' ability to see how those previously distinct pieces could constitute a unified whole whose meaning is different from its constituent parts: to synthesise, amalgamate, or harmonise. Societal change and inner development or "bildung" were previously synthesised by Andersen and Björkman (2017), but they did not specify how we could achieve the

"bildung" now needed to cope with our current transition and challenges. In relation to that question, this paper's most important contribution is that it advocates a potential answer in terms of the team-based quality practice of quality circles as practised in the East. In doing so, it also points to an appropriate and possible path for experimentation and further action research.

Regarding the new capacity, skills, and qualities needed to develop and use in regenerative circles, this paper has obviously only scratched the surface. It has, for instance, only highlighted and exemplified one of the 23 skills and qualities in the current IDG framework (Jordan, 2021) in terms of complexity awareness. The future research agenda in this area is extensive. For example, other specific practices with great potential for contributing to that skill, and others, are arts based (Carlucci & Schiuma, 2018; Snyder, 2019). Embodied knowledge can also serve to discover new ways of knowing, opening space for multiple perspectives and voices (Tanaka, 2011). In doing so, these practices may be fundamental in enabling and triggering the sought-after epistemic fluency within the regenerative circles in terms of "*the capacity to understand, switch between and combine different kinds of knowledge and different ways of knowing about the world*" (Markauskaite and Goodyear, 2016).

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The Role of the Main Customers and Key Stakeholders in Value Creation within a School System.

A Systematic Literature Review

Telma Largent

Mid Sweden University, telma.largent@miun.se

Abstract

Schools aim to increase the academic proficiency of students and give them the opportunity to expand their knowledge and skills through learning opportunities and research valued not only by the students, but also by parents and communities. To define value, organizations need to establish and prioritize the many stakeholders and understand how to balance their needs and wants. Customer focus is one of the main quality management principles. Organizations attempt to provide quality services and products by focusing on the customers' needs and expectations. Besides meeting the main customers' requirements, organizations should also consider the interests of other key stakeholders. Stakeholders may be defined as those who have a vested interest in how well the organization performs, while the customers may be the recipients of the output of the organization's product or service. Who are the schools' main customers and key stakeholders? This paper is part of a larger research study on the quality of mathematics education in K-12 schools. The purpose of this paper is to review the current literature on the phenomena of the customers and stakeholders in education. More specifically, the goal is to understand who the main customers and the key stakeholders are in a K-12 school setting. A systematic search of three databases, SCOPUS, Pro-Quest (Education Collection) and JSTOR, was performed with the publication date parameters from 2016 to 2021. Moreover, the snowball process was used, and the relevant literature found was examined along with the additional literature recommended by professionals from the quality management and educational fields. The following main themes were found: Customer Focus, Customer Identification, and Parents as Customers.

This abstract contributes to track 10c. Quality Management and Sustainability. The focus relates to the topic: Expanding the concept of value creation beyond the primary customer.

Keywords: Quality Management, Quality Education, Customer Focus, School Stakeholders

1 Introduction

"Education transforms lives and is at the heart of UNESCO's mission to build peace, eradicate poverty and drive sustainable development" (UNESCO, n.d.). The conventional definition of quality of education that relates to academic achievement is still important but addressing the social and other dimensions of learning is also necessary (Pigozzi, 2009, p. 237). "Education is expected to make a contribution to addressing sustainable human development, peace and security, universal values, informed decision-making, and the quality of life at individual, family, societal, and global levels" (Pigozzi, 2009, p.237).

Educational decisions have consequences for students and for society (NCTM, 2000) and these decisions may affect the quality of education. Bergman and Klefsjö (2004) stated that "improving continuously is an important element in a successful quality strategy" (p. 42). The understanding of what constitutes a quality education is evolving and the approach to understand the quality of education needs to take into consideration that in many instances the education that is offered is no longer pertinent to the societies in which it is offered (Pigozzi, 2009, p. 235). Pigozzi (2009) stated that "education must be placed and understood in terms of the larger context. A quality education must reflect learning in relation to the learner as individual, family and community member, and part of a world society" (p. 238). Quality of education is a dynamic concept that can change over time, and it varies depending on who asks the question, the nature of the circumstances and context, and what one views as the purpose of education. (Ingram, 2009, p. 246).

The current and widely accepted understanding of the concept of quality focuses on meeting or preferably exceeding customer needs and expectations (Martin, Elg, & Gremyr, 2020). According to Bergman and Klefsjö (2004) "focusing on customers must not be only a slogan, but requires systematic information about the needs, requirements, reactions, and opinions of customers" (p.36). The first step in quality is to identify who the customers are (Juran, 1989, p. 89). Quality should be directed towards the needs of present and future customers (Deming, 1986, p.5). Sustainability and digitalization require a perspective on quality that is inclusive of a broader range of stakeholders to serve current and future societal needs (Martin, et al., 2020). "Sustainability (environmental, financial, and social) has evolved into essential features in quality research" (Corbett & Cutler, 2000; Craig & Lemon, 2008; Isaksson & Garvare, 2003 as cited in Martin, et al., 2020). Moving from individual to collective can help identify aspects that are critical for either environmental or social sustainability (Martin, et al., 2020). Parviainen et al. (2017) explained that "digitalization has influenced society and organizations on all levels, from generating new types of jobs to allowing for digital tools as support in day-to-day activities" (as cited in Martin, et al., 2020).

Stone et al. (2007) argued that the basic framework of a quality education system is one that succeeds in meeting the individual school desired goals and outcomes; one that is relevant not only to the needs

of students, but also to the needs of communities and society; and one that fosters the ability of students to acquire knowledge and the needed 21st century skills (as cited in Cabardo, 2016). The purpose of schools is to increase the academic proficiency of all students and give them the opportunity to expand their knowledge and skills through learning opportunities and research valued by students, parents, and communities (Florida Department of Education).

Ingram (2009) discussed the possible desired outcomes from different stakeholders: students, parents, school leaders, and society in general: For the student, quality may be defined in terms of grades, subject matter engagement, or the usefulness of the schooling in finding a job. For the parent, quality may be defined in terms of alignment of values, or employment assurance for the child. For the school, quality may be defined in terms of graduation rates, or student scores on national achievement assessments. For the community, quality may be defined in terms of community values, ranking of a school determined by national tests, or the number of graduates adequately prepared to attract investment. For the nation, quality may be defined in terms of building a national unanimity around a political philosophy or religion, maintaining, or overcoming a perception of the nation's history, or making the country competitive in the global economy. At the international level, the purpose may be encouraging world peace and order and developing an appreciation for world community (page 246).

Identifying and prioritizing the main customers and key stakeholders, may be one of the first steps towards achieving quality education. The purpose of this paper is to review the current literature on the phenomena of the customers and stakeholders in education. More specifically, the goal is to understand who the main customers and the key stakeholders are in a K-12 school setting.

2. Methods

A systematic search of three databases was performed: SCOPUS, Pro-Quest (Education Collection) and JSTOR. At first, a predefined search string was used to search each database: customer AND education with publication date parameters from 2016 to 2021; scholarly/peer reviewed articles and English language publications. This search produced 16,460 articles (SCOPUS: 3,190; Pro-Quest: 7,314; JSTOR: 5,956). The search was refined by using customer AND ("K-12" OR "elementary schools" OR "middle schools" OR "high schools" OR "secondary schools"). SCOPUS produced 145 articles. For the Pro-Quest and JSTOR searches, yet another refinement was needed. The focus of the larger research study is on K-12 education, so the search was modified by adding the Boolean operator "AND NOT" to try to produce more narrow and productive results: customer AND ("K-12 schools" OR "elementary schools" OR "middle schools" OR "high schools" OR "secondary schools") AND NOT university. This last search produced 119 papers from Pro-Quest and 140 from JSTOR. All 404 articles (SCOPUS: 145; Pro-Quest: 119; JSTOR: 140) were screened. After reading the title and some of the abstract for each paper, 20 of them were read. Some of the papers were excluded because they

dealt with Customer Education: how to educate customers.

The topic of Customer Education will be part of the larger research, but for this paper the goal is to examine the phenomena of who the main customers and key stakeholders are in education. Out of the 20 papers that were read only 8 were found to be relevant (see Table 1). From the 8 papers retrieved, the snowball method was used to find additional relevant titles. The snowball method is a way of finding literature by using key documents as a starting point (Sayers, 2007). For this literature review these 8 papers were used as the starting point. The references of the 8 papers were examined to potentially find other relevant articles. The articles found were published before the 8 original articles. The snowball process could have also been implemented in reverse and used to find more contemporary articles. Reversed snowballing was not used for this literature review. Other resources recommended by professionals from the educational and quality management fields were also included in this review.

3. Results and Methods Discussion

For the first phase of this literature review, the author examined and assessed the phenomena of customers and stakeholders in education published between 2016 and 2021. Table 1 shows the results for the first phase of this systematic literature review and Table 2 shows all the articles included in this paper: the 8 articles from the first phase plus the ones retrieved from the snowball process and the ones recommended by professionals from the quality management and educational fields.

Table 1. *Systematic Literature Review*

	SCOPUS	PRO-QUEST (Education Collection: Education Database and Eric)	JSTOR
Identification	Records identified with search: customer AND education Date of Publication 2016-2021; English n=(3,190)	Records identified with search: customer AND education Date of Publication 2016-2021; English; Peer Reviewed n=(7,314)	Records identified with search: customer AND education Date of Publication 2016-2021; English; Journal n=(5,956)
	Records identified with keywords customer AND ("k-12" OR "elementary schools" OR "middle schools" OR "high schools" OR "secondary schools") Date of Publication 2016-2021; English n= (145)	Records identified with search: customer AND ("k-12 schools" OR "elementary schools" OR "middle schools" OR "secondary schools") Date of Publication 2016-2021; English; Peer Reviewed n=(1,864)	Records identified with keywords customer AND ("k-12" OR "elementary schools" OR "middle schools" OR "high schools" OR "secondary schools") Date of Publication 2016-2021; English; Journal n= 1,335
		Records identified with search: customer AND ("k-12 schools" OR "elementary schools" OR "middle schools" OR "secondary schools") AND NOT university Date of Publication 2016-2021; English; Peer Reviewed n=(119)	Records identified with search: customer AND ("k-12" OR "elementary schools" OR "middle schools" OR "secondary school") AND NOT university - Date of Publication 2016-2021; English; Peer Journal n=(140)
Screening	After reading title and some of the abstracts n=(3)	After reading title and some of the abstracts n=(17)	After reading title and some of the abstracts n=(0)
Included	After reading the articles n= (1)	After reading articles n= (7)	After reading the articles n= (0)

Table 2. *Articles included in the paper sorted by date*

Author	Date	Title	Overview
Arcaro, J. S.	1995	Quality in education: an implementation handbook. St. Lucie Press.	Inplementation Handbook designed to help education professionals implement principles of quality.
Bergman, B., & Klefsjö, B.	2004	Quality from Customer Needs to Customer Satisfaction.	Book on quality management
Breidenstein G, Krüger JO & Roch A	2020	Parents as 'customers'? The perspective of the 'providers' of school education.	The global establishing of school choice has often and convincingly been criticised in terms of social inequality because parents have very different access to resources to enforce their expectations and demands as 'costumers'.
Cabardo, J. R. O.	2016	Levels of Participation of the School Stakeholders to the Different School-Initiated Activities and the Implementation of School-Based Management.	This study aimed to evaluate the levels of participation of the school stakeholders to the different school-initiated activities and the implementation of school-based management (SBM) in selected schools in the Division of Davao del Sur for the school year 2014-2015
Carlbaum, S.	2016	Customers, partners and rights-holders: School evaluations on websites.	The dominant type of evaluation represented on websites is performance data used for accountability and informed school choice purposes. Parents are primarily positioned as customers who exert influence through choice and exit options, reinforcing the almost unquestioned norm of parental right to educational authority.
Cheng, A., & Peterson, P. E.	2017	How Satisfied Are Parents with Their Children's Schools? New Evidence from a U.S. Department of Education Survey.	All four sectors in K-12 education compete for the support of their customers--that is, the parents of their prospective students. Those parents have more choices today than in decades past: they may send their children to the public school automatically assigned to them by their school district, or opt for a private school, charter school, or district-run school of choice. These choices include a range of cost and convenience--and, not surprisingly, a range of customer satisfaction levels.
Deming, W. E.	2000	The new economics: For industry, government, education.	Deming details the system of transformation that underlies the 14 points for Management.
Doherty, G.D.	2008	"On quality in education"	This paper makes a contribution to the debate about quality in education in universities and schools and suggests that a clearer understanding across the education system of the scope and purpose of QA, the nature of TQM and the limitations of autonomy might lead to better embedded and more effective continuous improvement.
Đurišic, M., & Bunijevac, M.	2017	Parental Involvement as an Important Factor for Successful Education	To comply with the system of integrated support for their students', schools need to build partnership with parents and develop mutual responsibility for childrens' success in the educational system. I
Evans, R., & Thompson, M.	2021	Hopes and Fears. Working with Today's Independent	This book aspires to help teachers and administrators understand the sources of, and cope cosntructively with, the changing landscapr of the parent-school relationship.
Guilbault, M.	2016	Students as Customers in Higher Education: Reframing the Debate.	Even though marketing in higher education is well established, there is continued dabet about who the customer is.
Ingram, G.M.,	2009	Quality Education: What Is It, and Who Decides? Briefing Paper for a Policy Maker	Quality is a relative term. The goal of quality education involves a relentless pursuit of ever-improving learning. It is evolutionary and cannot be short-circuited. It can be hastened or retarded, but not leapfrogged. Quality of education is a dynamic concept that varies depending on who asks the question, the nature of the circumstances and context, and what one views as the purpose of education, and it can change over time.
Ishikawa, K.	1991	*Guide to Quality Control*	"The explanations of QC techniques and the practice problems which appeared in the magazine Quality control at the factory, during 1967, have been brought together in this book."
Juran, J. M.	2003	*Juran on Leadership for Quality*.	
Karakus, M., & Savas, A. C.	2012	The Effects of Parental Involvement, Trust in Parents, Trust in Students and Pupil Control Ideology on Conflict Management Strategies of Early in Students and Pupil Control Ideology on Conflict Management Strategies of Early Childhood Teachers.	This study was aimed to determine the effects of parental involvement, teachers' trust in parents and students, and teachers' pupil control ideology on the conflict management strategies used by teachers in classroom management.
LeMahieu, L. Nordstrum and P. Greco	2017	Lean for education	This paper is one of seven in this volume that aims to elaborate different approaches to quality improvement in education. It delineates a methodology called Lean for Education. Design/methodology/approach.
Martin, J., Elg, M., & Gremyr, I.	2020	The Many Meanings of Quality: Towards a Definition in Suport of Sustainable Operations	The concept of quality accommodates a range of perspectives. Over the years, various conceptual definitions of quality have reflected the evolution and trends marking the history and development of quality management. The current and widely accepted understanding of the concept of quality focuses on customer-centric notions, where meeting or preferably exceeding customer needs and expectations defines quality
McIntosh, S., & Hayden, M.	2021	Disrupting conventional conceptions of parental engagement: Insights from international schools	This paper approaches the problem through international school staff perceptions of issues relating to parents. Conditions in international education markets create conditions that tip the balance of power, conventionally with the school, towards already-privileged international school parents, raising important questions about the relationship between international schools and social inequalities perpetuated by education.
Pigozzi, M.J.,	2009	Quality Education: A UNESCO Perspective	A new approach to understanding the quality of education is needed because the current understanding is no longer functional. In addition, in many instances the education that is offered is no longer pertinent to the societies in which it is offered. Underpinning this wish to reconsider "what is quality" is a desire to focus on learning.
Sayers, A.	2007	Tips and tricks in performing a systematic review	Guidellines to perform a systematic literature review.
Wiley, A. L.	1995	The Quest for Quality	"The Quest for Quality" presents practical information about all aspects of a total quality strategy for technical communication.
Wood, M.	1997	The notion of the customer in total quality management.	This paper presents a critique of the notion of 'the customer' as a basis for total quality management (TQM). It argues that in practice the concept is often difficult to apply and likely to lead to confusion and misleading conclusions. It explicitly excludes the interests of many stakeholders-these include the workforce, shareholders, the community in general and environmental considerations.
NCTM	2000	Principles and standards for school mathematics.	Document updates the messages of NCTM's previous Standards and shows how students' learning should grow.

While reading the articles the relevant information related to customers in education was copied and pasted into a document. The information was reviewed with the intent to find similarities. The related ideas were grouped together and were categorized by themes. These themes were determined with the purpose of understanding the phenomena of the customers and stakeholders in education. The following are the main themes that were uncovered: Customer Focus, Customer Identification, and Parents as Customers.

Customer Focus:

Some dictionaries define a customer as a person or business that purchases a commodity or service. One of the Oxford English Dictionary's definitions of customer is: (someone) who gives business habitually to any seller or establishment (Doherty, 2008). Juran (1989), one of the foremost experts on quality who broadened the customer concept, stated that a customer is anyone who receives or is affected by the product or process (p. 17). Bergman and Klefsjö (2004) affirmed that customers are those that organizations want to create value for (p. 27). Wood (1997) stated that the most common use of the word 'customer' is in the context of a retail transaction, as a customer chooses the product or service, pays for it, and consumes/uses the product or service. In a retail transaction, the same person performs all three roles, however; Bergman and Klefsjö (2004) stated that "the person paying for a service may be a totally different person than the one from whom the service is intended to create value" (p.27).

Wood (1997) described a situation when these three roles may be split:

> When I take my son to the dentist I decide he has to go, the dentist decides on the precise treatment (presumably bearing in mind the wishes of the other parties involved), the government pays the money (treatment for children being free in the UK), and my son 'enjoys' the benefits of the treatment which it may only be sensible to evaluate in the long term, as in the short term there may be no benefits. Who is the customer here: the government, myself, or my son?

According to Bergman and Klefsjö (2004), Total Quality Management (TQM) means "a constant endeavor to fulfil, and preferably exceed, customer needs and expectations at the lowest cost, by continuous improvement work, to which all involved are committed, focusing on the processes in the organization" (p.34). TQM is defined as the method by which we achieve customer satisfaction (Wiley, 1995). Wood (1997) pointed out that "there is an increasingly widespread acceptance of the idea that the customer is an important, perhaps the most important, focus of a TQM strategy. Some argue that customers' needs should be satisfied, or, better, they should be delighted. Drucker (1954) stated that the only reason a company exists is to satisfy customers (as cited in Guilbault, 2016) and Kotler (1977) indicated that market-driven organizations focus is on satisfying customer needs (as cited in Guilbault, 2016).

The focus on the customers' needs means that certain stakeholders' interests are ignored (Wood,

1997). Wood critiqued the notion of the customer as a basis for Total Quality Management because it may exclude the interests of many stakeholders (1997). Deming (1986) stated that, "Quality should be aimed at the needs of the customer, present and future (p.5). Deming and Juran (as cited in Martin et al, 2020) hence established a perspective of quality as being required by customers, which was extended later to the idea of service quality.

The focus on the customer started because of the definition of quality which emphasized customer satisfaction over the purpose of the product or service being produced (Wood, 1997). The definition of quality in the early days of Quality Management was focused on the conformance and on the importance of reducing variation. However, Shewhart (1931) pinpointed that quality had a subjective side (1998, p. 420 as cited in Martin et al., 2020). It is challenging to define quality, since "quality", like "beauty", is subjective and a matter of personal judgment (Doherty, 2008).

Juran and Godfrey had a customer-oriented definition of quality as 'fitness for use' (Martin et al., 2020). Doherty (1994) questioned if a unified theory of quality is possible, exploring the difference between quality defined as "fitness to/for purpose" or the slightly more nuanced "fitness of purpose" and quality defined as "excellence" (as cited in Doherty, 2008). "Quality is defined as fully satisfying the requirements of customers, through conformance to specifications based on the requirement of customers" (Wiley, 1995). "The challenge with the customer focus approach is that customers may have different specifications, different views of fitness or even different purposes" (Wood, 1997).

More recent research on Quality Management, integrating sustainability, focuses on the need for a broader understanding of customer roles, also considering other stakeholder perspectives (Corbett & Cutler, 2000; Craig & Lemon, 2008; Isaksson & Garvare, 2003 as cited in Martin et al., 2020). In education it may be tricky to precisely identify the primary customer/user (LeMahieu, 2017). Educational organizations may have a diverse range of customers/stakeholders with diverse and sometimes conflicting expectations, but this does not mean that it is impossible to implement appropriate quality assurance methods in educational organizations (Doherty, 2008). Challenges are presented when the focus is to delight the customer. One of the challenges is that the oversimplified notion of customer is likely to lead to an unhelpful analysis of quality issues and ultimately lead to suboptimal decisions (Wood, 1997).

Wood (1997) suggested that TQM programs will be more successful when the focus is on activities that may serve a variety of purposes rather than simply "customer focus". A more complex analysis with the use of problem structuring techniques such as cognitive mapping may lead to better solutions to quality.

Wood (1997) stated that,

> "Following customers' requirements slavishly means that there is a danger that TQM will merely mirror the workings of the market instead of going beyond it to improve the workings of the market by, for example, consulting end-users rather than decision-makers, or by helping customers to achieve their `real' needs rather than what they think they want".

Customer Identification:

Bergman and Klefsjö (2004) posed the question of who the customer is in education: the students, who hopefully receive a good education, the parents, future employers, or the community at large? (p.28). In education, Doherty (2008) prefers the weasel word "stakeholder" as it causes less discomfort; however, he acknowledges that stakeholders and customers alike expect some means of ensuring the value of what they are paying for. Doherty (2008) considered the argument about who the customer is in education to be a dreary and fruitless argument. On the other hand, Juran (1989) stated that the first step in quality is to identify who the customers are (p. 89). Juran (1989) suggested the use of the flow diagram to help with the process of customer identification, which leads decision makers to identify customers who were previously neglected (p. 90).

Arcaro (1995) highlighted the importance of identifying every group that benefits from the educational enterprise, both internal and external (p. 112). It is important to go beyond the customer as someone who pays and consumes/uses the product or service. "The broadest definition is the person, department, or organizational unit that next receives the value-added product, service, or client" (Arcaro, 1995, p. 113). "There may be chains or hierarchies of customers – internal or external – or multiple customers receiving the same product or service" (Wood, 1997, p.184).

According to Arcaro (1995), educational organizations should agree on who is (are) the ultimate or primary customer(s) so their requirements and expectations may be determined (p.113). However, the notion of a customer leads to the implication that the goal of an organization would be to satisfy the customer (Wood, 1997, p.187). Wood (1997) noted that at times this is not feasible or desirable: health services, for example, should aim to decrease the demand for its services. Education faces the same challenges: should educational leaders aim to delight the students, or the parents, or other stakeholders? (p.187).

In Higher Education there is a continued debate over who the customer is (Guilbault, 2016). One could see the postsecondary student as the customer, but some are reluctant to accept this idea because there is a perception that if the students are viewed as customers, academic rigor disappears (Albanese, 1999; Bay & Daniel, 2001; Franz, 1998, as cited in Guilbault, 2016). Guilbault (2016) suggests that from a more contemporary view, there may be benefits in viewing postsecondary students as customers and co- producers of learning. Determining who precisely constitutes the customer in education can be challenging as many different stakeholders benefit from the provision of education (LeMahieu, et al., 2017). LeMahieu (2017) added that students, families, and society receive the benefits and each stakeholder group may see the value of education in a different way.

Parents as customers:

Research has indicated that great schools have effective partnerships with parents and that increased parental involvement has been shown to result in improved student success, enhanced parent and

teacher satisfaction, and overall better school climate (Davies, 1996, as cited in Đurišić & Bunijevac, 2017). Parent involvement has consistently shown a positive impact on students' school success (Karakus & Savas, 2012). Educators, parents, and community members may have different opinions on how each can contribute to the educational process (Đurišić & Bunijevac, 2017). Teachers and parents operate within a complex set of power relations: teachers simultaneously hold high and low status with parents (Brunnell, 2017 as cited in Mcintosh & Hayden, 2022). In the conventional conception of the school/parent relationship, schools dictate practices of parental engagement. Some argue that this is destabilized when parents are viewed as customers (Angus, 2015 as cited in Mcintosh & Hayden, 2022), while others believe that teachers will maintain the balance of power due to their professional status as educators (Breidenstein et al., 2020 as cited in Mcintosh & Hayden, 2022).

"Market competition forces schools to continuously improve their standards in order to attract parent customers of the educational "product" they are offering" (Angus, 2015, as cited in Breidenstein et al., 2020). There are four sectors in K–12 education that compete for the support of their customers: the assigned-school-district, private schools, choice, and charter. School choice "can be seen as part of the marketisation of education: parents take the role of 'customers' and schools take the role of 'providers' of education" (Breidenstein et al., 2020). In Sweden, parents have become more influential in both directly and indirectly governing education in terms of decisions, prioritizations, and policy action through 'choice and voice' channels (Englund, 2011, as cited in Carlbaum, 2016). There is an argument that school choice may negatively impact the school/parent relationship as parents are then viewed as customers (Angus, 2015, as cited in Mcintosh & Hayden, 2021). The private school sector has a strong disadvantage because most parents must pay tuition and are viewed as customers (Cheng & Peterson, 2017). "Parents are primarily positioned as customers who exert influence through choice and exit options, reinforcing the almost unquestioned norm of parental right to educational authority" (Carlbaum, 2016).

Breidenstein et al. (2020) conducted a case-study that is part of a larger, long-term research project on school-choice in primary education in Germany. They interviewed 33 parents and 8 school principals and aimed to analyze the relationship between parents and schools in elementary education in Germany. This study concluded that both public and private schools are sometimes affected by parental demands. In public schools, administrators have more flexibility on how to deal with parents, but parents still challenge the principal's position as professionals. Private schools' leaders cannot completely ignore the demands of the parents. The educational leaders express that parents' wishes and demands have to be considered. Leaders need to differentiate between demands that can be fulfilled from those that cannot. "Despite the differences, there seems to be a consensus across the interviews that the concept of parents as 'customers' in an 'educational market' is ultimately unacceptable from the perspective of a professional" (Breidenstein et al., 2020). Educators may be hesitant to defend their values and policies on what will best serve the students because they may lose their paying customers (Evans & Thompson, 202, p. 74).

Breidenstein et al. (2020) criticized the customer role in education because that role is unequal due to

parents having unequal financial resources and sources of information. They questioned if the power of parents increases towards schools when they are viewed as customers. They stated that in an ideal market, the power of the customers and pressure of competition lead to quality enhancement. That logic would assume that the customers are informed and rational and not parents with a partial perspective focused on their own child (Breidenstein et al., 2020). After all, "humans, like all mammals, are biologically programmed to be ferociously protective of their young" (Evans and Thompson, 2021 p.12).

Breidenstein et al. (2020) described that traditionally parents were the providers of supervision and emotional care, and the school had the role to convey "valid knowledge as well as socially positioning children and youth within a horizon of performance and talent". With the event of school choice, it seems that schools become dependent on parents' choices and decisions. "From the perspective of schools, a one-sided shift of power in favor of parents may be challenging because the parent-as-customer raises the question on how autonomy can be maintained" (Breidenstein et al., 2020). The Florida Council of Independent Schools (FCIS) code of ethics states that the basic criterion for all decisions in the school is the student's welfare. School education needs to focus on professional standards which cannot be subordinated to customers' preferences (Breidenstein et al., 2020).

School/parent goal alignment can foster parental engagement, but when parent goals do not align with the school's goals parents' desires may shape the school's agenda (McLntosh & Hayden, 2021). Many school heads like to speak of education as a journey, but "many parents want the school to help them prepare the path for their child instead of preparing the child for the path" (Evans & Thompson, 2021, p. 42).

Arcaro (1995) proposed that the beliefs and values of all stakeholders should be articulated, and a consensus should be reached (p.114). He argued that to be considered effective, organizations should focus on the customer, however, there are challenges in trying to agree on who the schools' customers are (p.112). Focusing solely on one group of customers would be inappropriate as when there are several customer categories, the various needs and expectations may not always coincide (Bergman & Klefsjö, 2004, p.28). It is important to identify possible conflicts in customer requests and make conscious prioritizations.

4. Conclusions

This paper is part of a larger research study on the quality of mathematics education in K-12 schools. The purpose of this paper was to review the current literature on the phenomena of the customers and stakeholders in education. More specifically, the goal was to understand who the main customers and the key stakeholders are in a K-12 school setting. A systematic search of three databases, SCOPUS, Pro-Quest (Education Collection) and JSTOR, was performed with the publication date parameters from 2016 to 2021. Moreover, the snowball process was used, and the relevant literature found was examined along with the additional literature recommended by professionals from the quality management and educational fields. The following main themes were found: Customer Focus,

Customer Identification, and Parents as Customers.

It can be concluded from the literature review that the definition of customer varies from someone who receives or pays for a product or service to a broader definition which states that a customer may be anyone who is affected by a product or service. While many authors point out that customer focus is one of the main principles, if not the most important principle, of Total Quality Management (TQM), some authors critique the notion of the customer as the basis for TQM. The argument against customer focus derives from the idea that the focus on the main customer may exclude the interests of many stakeholders. The customer focus approach started because of the definition of quality which emphasized customer satisfaction. However, quality may be subjective and may depend on whom defines it. Main customers and key stakeholders may perceive quality differently.

Customer identification is considered by many as the first step to quality. A question relating to customer in education arises: Should educational leaders aim to delight the students, or the parents, or other stakeholders? Determining who exactly is the main customer in education can be challenging as many different stakeholders benefit from the provision of education The partnership of schools and parents is an important aspect to improve student success. In K-12 education, public, private, and charter schools compete for the support of the parents. School choice led school leaders to often place the parents as main customers, especially in the private school sector. Some of the literature argue that viewing parents as customers is unacceptable as it may interfere with school leaders' professional autonomy. The answer to this conflict may be to focus on deliberately making prioritizations of the needs and wants of various interested groups, including the main customers and all key stakeholders.

Final Discussion

While this literature review did not unveil who exactly should be considered the schools' main customers, it brought to light the importance of identifying and prioritizing the different interested groups in education.

Identifying and prioritizing the main customers and key stakeholders may be one of the first steps towards achieving quality education. Educational organizations may have a diverse range of customers/stakeholders with diverse and sometimes conflicting expectations, but it is still possible to implement appropriate quality assurance methods in schools. The next step of this research will be to interview and survey school leaders, mathematics educators, parents, students, and other stakeholders. The customer/stakeholder phenomenon is one of the topics that will be explored further. How do school leaders identify the main customers and key stakeholders? Do school leaders use quality management tools to prioritize stakeholders?

Another topic that will be explored is how the different customers/stakeholders perceive quality in mathematics education. Continuous improvement is an important element of TQM. As indicated in

this literature review, quality of education is a dynamic concept, like other industries, education may be impacted by advances in technology and changes in society. An organization's long-term sustainability may depend on its capacity to adapt to changes and still provide quality services. Is the education being offered today still pertinent? In mathematics education, for example, the needs of society may now be different than they were years ago. To measure the quality and sustainability of a school, one may need to verify if the school's purpose is aligned with the main customers' and key stakeholders' purposes. Teaching mathematics for rote memorization may no longer be valued by all the main customers and key stakeholders. How do different stakeholders attribute value to mathematics education? What are the possible areas of conflict and trade-offs among stakeholder interests? How do school leaders deal with the possible conflicts? Are school leaders promoting stakeholder engagement, if so, how?

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Understanding Attractive and Sustainable Quality to Increase Customer Value in Education

Michael Johnson

Mid Sweden University, Michael.Johnson@miun.se

Abstract

The pandemic created a challenge for organizations and schools worldwide that raised fundamental questions about the degree to which they are sustainable. Schools and organizations around the world were put to the test on how responsive they could be to changes in their complex environments and this turbulent time in history. Educational leaders were forced to ask how schools could create more sustainable practices. Some schools struggled to adapt quickly to the needs of their stakeholders, while others saw an opportunity in the moment to create and innovate to generate new and unexpected value for their customers by increasing attractive quality (AQ) (Johnson, 2022).

The field of quality management continues to ask questions about sustainability and informed sustainable practices in organizations. When it comes to the quality of products and processes, sustainability is becoming more and more critical, and so too are quality management principles and methods (Desmond, 2021). However, the pandemic has shown a need to innovate and develop quality management tools to meet the sustainable development needs of the world today, especially in education. Sustainability can be defined as the responsiveness of a living system to change in its environment, and responsiveness can be defined as the quality of reacting quickly and positively (Snyder et al., 2000). Traditionally, Total Quality Management has focused on the negative effect of customer experience and promoted convergent thinking to solve problems. The theory of attractive quality, often described as the surprise and delight attributes when purchasing or experiencing a product or service, is a strong driver of loyalty, word-of-mouth, and saleability and offers new perspectives to examine sustainable quality development (Lilja & Wiklund, 2007).

This paper contributes to a body of research on developing attractive quality in schools by examining methodological tools that can be used to identify problems and areas of attractiveness as perceived by its customers. By empowering both public and private school leaders with the courage and the tools to increase delivered customer value, they may be able to contribute to a more sustainable future for their stakeholders and schools. This research relates to UN Sustainable Development Goal Four: To ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. It also connects to Goal Nine: To build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

This exploratory study was inspired by the problem and attraction detection study (ADS) methodology proposed by Lilja & Eriksson (2010) to capture and understand positive customer perceptions and motivations as well as negative perceptions and motivations. One-to-one interviews and focus groups accompanied the detection study to inform a value innovation system to drive the development of schools systematically based on what customers actually value. This paper aims to examine how the ADS methodology can be used as a possible way to analyze data, help school leaders develop an understanding of attractive quality, and begin to create a framework around how this new information has the potential to help schools become more sustainable. In the future, this research will contribute to the design and development of a new sustainable development framework for schools using quality management, attractive quality, appreciative inquiry, and customer value creation as its foundation.

Keywords: Quality Management, Sustainability, Attractive Quality, Responsiveness, Appreciative Inquiry, Customer Value

1. Introduction

The COVID-19 pandemic created challenges for organizations and schools worldwide to meet customer needs, raising fundamental questions about the degree to which they are sustainable. In many cases, these same challenges existed before the pandemic but were exacerbated by the unique set of fluid circumstances created by COVID-19. Schools in countries across the globe tried to be responsive to their stakeholders (students, parents, teachers, staff members, and board members) by adjusting and, in many cases, inventing new ways to deliver quality education. According to Miller and Sanger-Katz (2022), schools continue to face the fallout from remote learning, including burnout and shortages among teachers, staff, and students struggling with academics, social skills, and classroom behavior. In some cases, teachers have staged sickouts or asked for "wellness" or "school climate" days. COVID-19 shocked K-12 school enrollment overall in 2020/2021, but private schools were hit especially hard as enrollment declined for the first time in more than a decade (Gibbons, 2021).

Deficit thinking has plagued the decision-making of school leaders (Mahone, 2021). Few school leaders will report that what was accomplished throughout the pandemic is sustainable. The theory of attractive quality, often described as the surprise and delight attributes when purchasing or experiencing a product or service, offers new perspectives to increase perceived customer value, thereby creating the potential for a school to be more sustainable over time. If we look for and examine both the deficits (all the things customers identify as problematic) and the attractors (all the things customers deem high points), leaders have a unique opportunity to see a much fuller picture to find and reduce problem areas in schools while simultaneously finding and increasing the things that customers actually value.

This paper aims to understand how the concepts of attractive quality, appreciative inquiry, and the creation of positive customer affect using divergent thinking can enhance the organizational

sustainability of schools. This paper aims to explore the application of the ADS methodology as a leadership tool to better understand how to develop attractive quality for sustainable development in education. The backdrop for this exploration includes theoretical frames from attractive quality, total quality management, appreciative inquiry, and leadership responsiveness.

2. Theoretical Framework

The data show the pandemic has not been kind to private school enrollment as it is declining at a rate not seen in over a decade. The Florida Department of Education releases data concerning the enrollment of private school students and reports an 8.5% decrease between 2019-20 and 2020-21. The number of homeschooled students has seen a sharp rise since the pandemic's beginning, and the statewide online education system, Florida Virtual School (FLVS), has also seen massive growth as families have stayed home for safety reasons.

There exists a compelling argument for getting students back in-person in schools, for the long-term sustainability of quality education is at stake. For example, the RAND corporation conducted research on divergent and inequitable teaching and learning pathways, and the findings consistently indicated that remote schooling was associated with fewer instructional opportunities and potentially poorer student outcomes compared with in-person schooling (Kaufman & Diliberti, 2021).

Attractive Quality

The theory of attractive quality posits five dimensions of perceived quality; attractive quality, one-dimensional quality, must-be quality, indifferent quality, and reverse quality (Ingelsson, 2009; Kano et al., 1984). This model can be used to understand school customer satisfaction and the overall perceived quality of a customer's purchase and can be seen in figure 1 below.

Kano et al. (1984) proposed the theory of attractive quality as a method describing the relationship between two aspects, such as an objective aspect like physical sufficiency and a subjective aspect like customer satisfaction, from a two-dimensional viewpoint based on the philosophers' ideas such as Aristotle's and John Locke's. According to this theory, one can classify the relationship into attractive quality, one-dimensional quality, must-be quality, and indifferent quality (Kano, 2001). According to Lilja (2007), there are two fundamentally different mechanisms considered essential for the generation of attractive quality. Most attribute the meaning of attractive quality most closely to the concept of exceeding customer expectations and offering the feeling of delight. As central as this idea is to attractive quality, the second mechanism is the satisfaction of high-level needs such as reputation, prestige, and recognition from others.

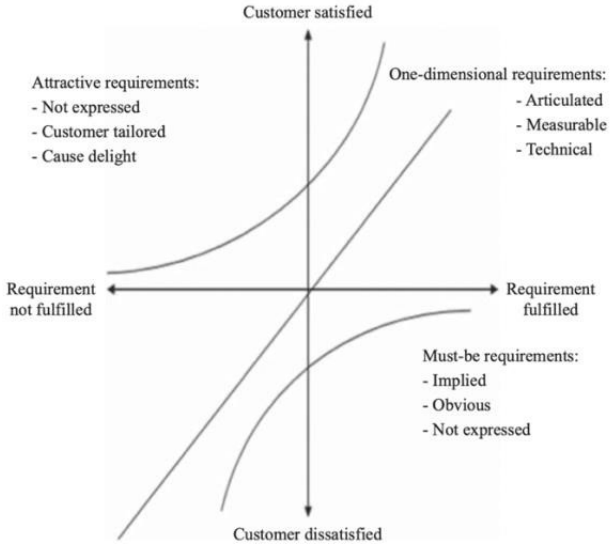

Figure 1: Kano's model of quality attributes (Adapted from Kano's model) (Berger et al., 1993)

The literature on quality management suggests that one of the ways organizations can be more responsive to changing conditions is to leverage attractive quality and perceived value as key elements for understanding how to build responsive systems (Johnson, 2021) Attractive quality is something customers do not expect. When organizations pre-define unconscious needs, they offer high value to their customers, and the number of loyal customers increases (Kano et al., 1984). A recurring question that came up often during this study is how can we use attractive quality as a concept to develop more sustainable systems in schools?

Detecting Attraction: A Methodological approach

This paper was inspired by the works of Lilja & Eriksson (2010) titled: "From Problem to Attraction Detection Study (ADS): Towards a New Methodology for Quality Practice." The authors argue that using the well-known problem detection study (PDS) methodology only paints half the picture. Used around the world for decades by many organizations, the PDS capitalizes on the psychological fact that humans are more inclined to identify deficiencies than make creative suggestions. It establishes the types and frequency of key customer problems, which, in turn, allows leaders to prioritize and find solutions to these problems.

Lilja & Eriksson designed a conceptual methodology, based on the shortcomings of the PDS (but also to complement it), called the attraction detection study (ADS). The ADS can be considered a counterweight to the PDS methodology, bringing a systematic focus on the positive and the negative. This new tool was inspired by appreciative inquiry (AI) methodology, which also focuses on stakeholders' positive motivations and experiences. The connection to AI is essential as many of the interviews completed during the data gathering process used the appreciative inquiry interview guide methodology, which focuses on the sharing of 'peak experiences' and "high points. This paper only

examined the ADS methodology as a possible way to help school leaders develop an understanding of attractive quality and how it can potentially help their schools become more sustainable.

When the PDS and ADS are implemented as complimenting methodologies, they unite to create a Value Innovation System (VIS) to drive the innovation of a school in a systematic way based on what students, teachers, staff, and parents actually value (Lilja & Eriksson, 2010). The PDS, ADS, and VIS model can be seen in figure 2 below.

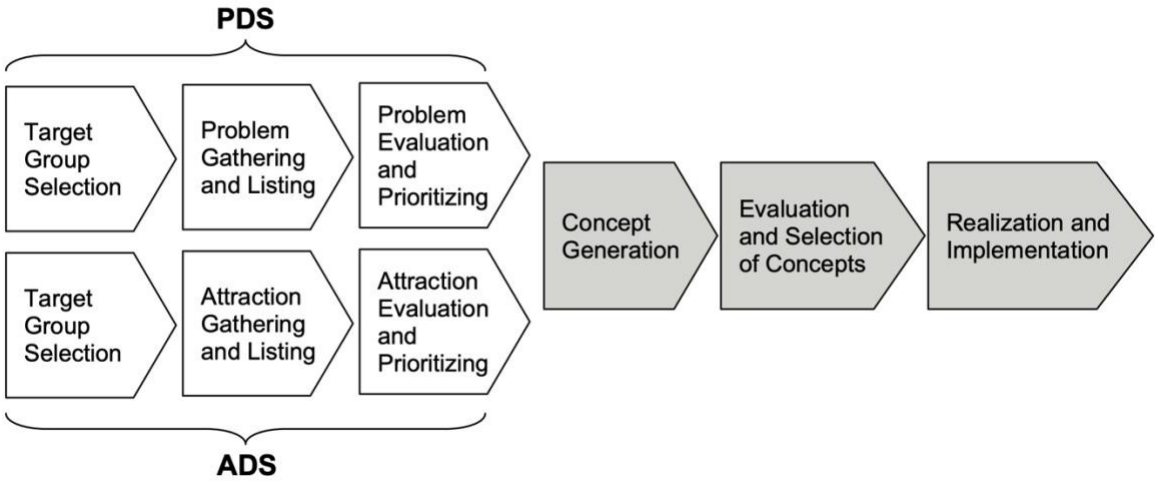

Figure 2: Problem Detection Study (PDS) and Attraction Detection Study (ADS) as two complementing methodologies for the early stages of a Value Innovation System (VIS) (Lilja & Eriksson, 2010)

Building Sustainable Systems

As people, we are trained to look for problems (Smith, 2016), but sustainability needs us to rethink how we can build on the things we want to sustain. Sustainability has become a business necessity, not just a differentiator. Sustainability concerns are an opportunity to bring to market products and services that meet new customer demands (Berdak, 2020). As part of an ongoing research study to address this question, the theory of attractive quality is explored to develop an understanding of how leaders can rethink designing and leading schools sustainably.

Evidence from earlier studies helps to focus the application of the theory of AQ at the next level. In the first paper (Johnson, 2021), the author collected data to understand how school leaders can ensure long-term sustainability for their schools from the literature on attractive quality and sustainability. In the second paper, the author gathered data on leadership responsiveness as a core capability and learned what these school leaders did to sustain attractive quality and develop sustainable quality in education throughout the pandemic. In this third paper, the author is curious about what would happen if the PDS/ADS method was applied, expanding it to address what tools leaders can use to rethink how they design and lead for sustainable school development. This paper presents findings from an action

research study in which the application of the ADS methodology is tested as a potential tool for educational leaders to understand and develop attractive quality in education.

3. Methods

The research presented in this paper is part of an ongoing qualitative study of schools in the United States to explore, examine, and understand the complexities of leading and developing quality in education. The methodology reflects the role and position of the author in the schools studied. The author is a school leader (at one of the four schools mentioned in this paper) and a doctoral student examining the phenomenon of attractive quality based on an action research method.

This paper aims to understand how attractive quality, appreciative inquiry, and the creation of positive customer affect using divergent thinking can enhance the organizational sustainability of schools. The qualitative methodology chosen to study this phenomenon was an exploratory case study. Yin (2009) posited three conditions for the use of a case study: the purpose must be to answer "how" or "why" questions, the investigator must have little control over events, and the focus of the research must be on a contemporary phenomenon within a real-life context, especially when boundaries between the phenomenon and context may not be evident. The exploratory case study is used when there is no pre-determined outcome.

Data were derived from three points in time. The first and second points in time were collected using a standard interview method at one particular school. Data were collected at a third point in time from four different schools using an appreciative inquiry interview methodology.

Case Description

Three out of the four schools selected for data collection for this case study are in the State of Florida. These schools were not selected randomly and instead specifically selected for this study because they actively demonstrate a bucking of the trends shown above. This method, which selects cases based on a known entity that meets specific criteria, is called purposive sampling. The leaders of these schools are busy not just running their schools, educating students, and supporting teachers; they are actively creating value for their students, teachers, staff, and parents. School leaders from four schools were selected for interview. School one is a PreK-3 through 8th grade private, non-sectarian independent school in Florida. The school is known as and dedicated to a hands-on, child-centered philosophy based on best practices in education and knowledge gained from leading-edge brain research to accelerate learning. School two is a PreK – 12th-grade private independent school in Florida well renowned for its modern pedagogical approaches to education. The third school leader interviewed is a high-level

district administrator in Florida county who oversees 103 schools, 4,790 teachers, and 77,125 students. The fourth school leader is a middle school principal at a Kindergarten through 8th-grade public school in Illinois, USA.

Data Collection

Findings in this paper were derived from interviews and focus groups. Respondents were selected based on their role in the school and availability. Two focus groups were conducted at school one, including four division leaders from the elementary school, one early-childhood teacher, and the middle school principal. A second focus group was conducted with four teachers from the middle school and the principal of the middle school. Two one-to-one interviews were conducted with a preschool teacher and a science teacher from the middle school. Four one-to-one interviews were conducted with school leaders from four different schools; two from private independent schools in Florida, one from a Florida county public school system, and one from a public school in the Chicago area.

Data collected for the third point in time in this study used the data collection method of appreciative inquiry (AI) to design an interview guide. By design, AI focuses on stakeholders' positive motivations and experiences, including the sharing of 'peak experiences' and 'high points.' As each statement made by school leaders was analyzed and evaluated using the methods mentioned above, it quickly became apparent that something different was happening in these schools. The perceived customer value experienced in the selected schools appeared to be greater than other schools of the same size due to the 'bucking of the trend' of decreased student enrollment.

The data collected from the interviews and focus groups were triangulated using the VIS conceptual framework. First, data transcribed from each data source was mapped out using an online visual digital collaboration tool called Mural.com. Next, the PDS/ADS/VIS framework called for the detected problems and detected attractors to be reduced as much as possible into specific statements. Each statement could be ranked on a four-point scale, from zero to three points. The ranking is decided according to two indicators:

1. How significant the problem or attraction is
2. How frequently the problem/attraction occurs

There existed the possibility of some subjective bias during this evaluative task. However, the author (a school leader familiar with most of the problems and attractors shared) used the best judgment based on how the interviewees shared the information to place each problem or attractor within the PDS or ADS matrix. Each statement was analyzed and matrix location calculated by asking these same five questions for each identified statement:

1. Who is the customer in this statement (Teachers, students, parents, staff members)?

What is the size of the problem or attraction?

2. What is the frequency of the problem or attraction?
3. For problems, was reverse quality experienced?
4. For attractions, was 'surprise and delight' experienced?

4. Results and Discussion

It is important to note that this analysis is based on the author of this paper employing the action research methodology as a researcher but also as a school leader and practitioner testing this approach in the field. From a leadership perspective, testing this potential methodology to see what happens when we apply the ADS and PDS may help school leaders to identify not only the problems but also the strains, determining where gaps may exist while simultaneously identifying possibilities to build on attractive quality.

As data was placed into the matrix, it became evident early on that these leaders reported far more positive experiences and examples of attractive quality than problems. Figure 3 below displays the frequency and size of problems identified by school leaders. Note: The color of each individual data point signifies to the author from which interview or focus group it originated from.

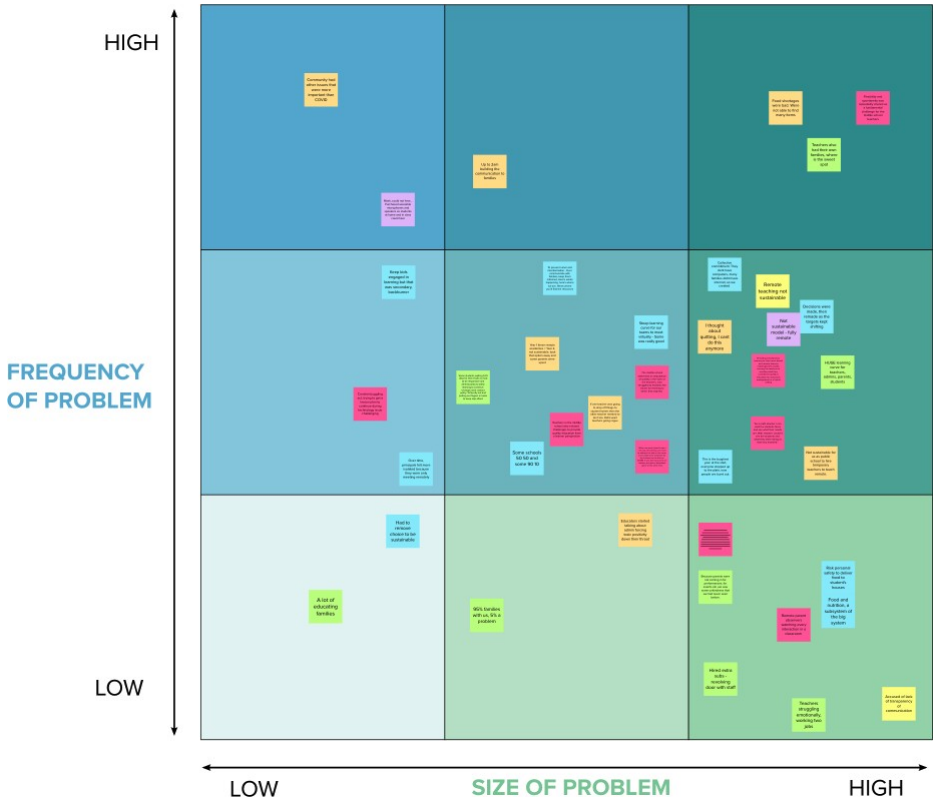

Figure 3: Frequency Vs. Size of Problem

Some significant problems were acknowledged and explained during the appreciative interview process. However, in many cases, school leaders described a particular problem, then quickly explained how they jumped into 'solution seeking' mode, who they included in those decisions, and how they created customer value by solving these problems. Overall, it was evident that these particular schools were very responsive to issues and challenges, keeping a close ear to the ground and pouncing on each opportunity to solve a problem or improve a situation that needed to be better. For example, one school prides itself on employing positive phrasing in all communications, both internally and externally, on paper, by email, in person, and within all student lessons.

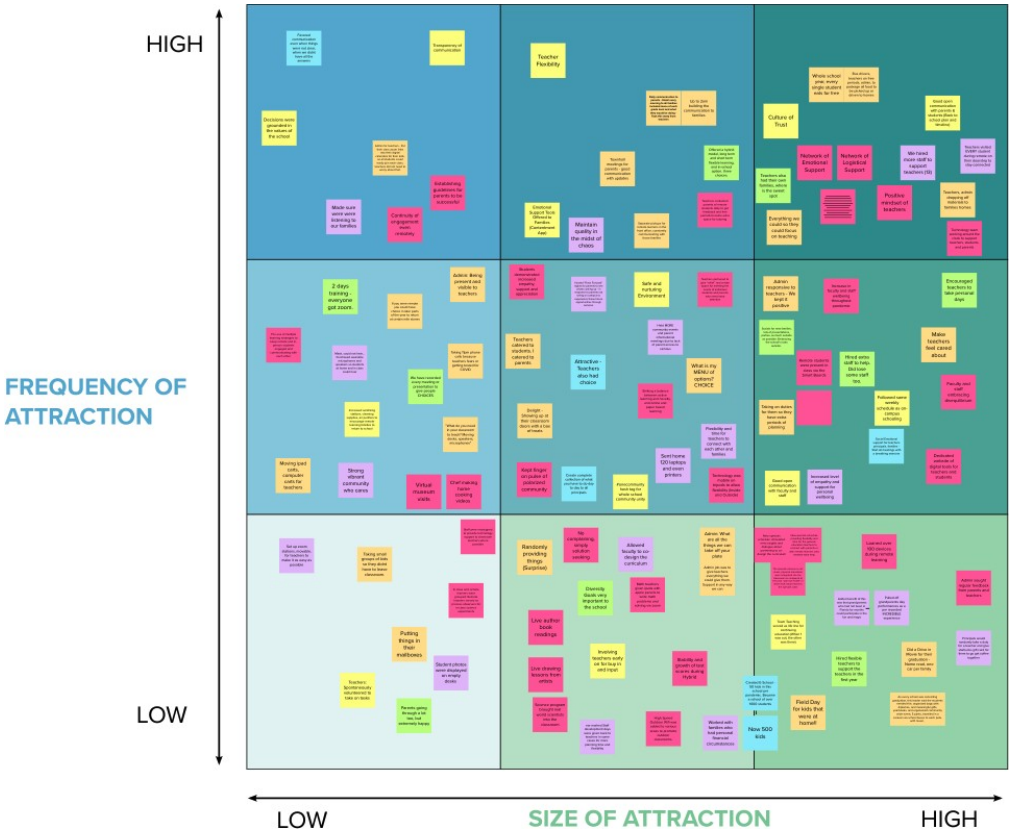

Figure 4: Frequency Vs. Size of Attraction

Figure 4 displays the reported attraction points from school leaders. Calculations show that 382 individual statements were collected from interviews and focus groups. 152, or approximately 40% of these statements, were identified as a problem or an attraction point. 40 of these statements identified problems, whereas 112 were identified as attractors, approximately 35% and 65%, respectively. What was immediately noticeable was the frequency of positive attractive quality statements compared to the problems reported. Of particular interest are the high-value problems and attractions, namely, the statements identified as both high frequency and of a large size comparatively. Table 1 below lists the problems and attractions which appeared in the +3 frequency and +3 size box on both the PDS and ADS (darkest blue/green box in the upper right corner of the matrix.)

Table 1. *Highest Frequency and Size of Problem & Attraction*

Major Problems Identified	**Major Attractions Identified**
"Food shortages were bad. Our school was unable to find many items."	*"Decision was made that every single student will eat for free for the whole school year."*
"Flexibility and spontaneity were repeatedly shared as a fundamental challenge for the middle school teachers"	*"Bus drivers, teachers on free periods, and admin packaged up food to be picked up or driven to homes."*
"Teachers also had their own families. Where is the sweet spot?"	*"Good open communication with parents & students (Back to school plan and timeline)"*
	"Teachers visited EVERY student during remote on their doorstep to stay connected."
	"We hired more staff to support teachers (13)."
	"When the pandemic began, parents were rightfully worried about the effects COVID would have on their children's academic, social, and emotional growth. These same parents were surprised and delighted to learn that not only did their children experience a year full of joy, but their academics did not suffer."
	"Technology team working around the clock to support teachers, students, and parents"
	"Teachers, admin dropping off materials to families homes."
	"Administrators did everything they could so [teachers] could focus on teaching."
	"Positive mindset of teachers"
	"Network of emotional and logistical support"
	"Leadership recognition that teachers also had their own families. Important to identify where was the sweet spot."

It may be assumed that these high-value problems and attractions should be the most critical areas for school leaders to focus their attention on. The most significant problems need to be prioritized for solutions, and the most important attractors need to be prioritized for perhaps increasing these positive experiences. Schools that employ this approach now have a much more accurate representation of what

their students, parents, faculty, and staff actually value instead of assuming what they value. One school leader reported, "these high-value reminders are the post-it notes I need to have stuck next to my computer screen," meaning it was important for this leader to be reminded of the challenges and high points this school's stakeholders value.

The next logical step in this larger body of research is to include more people in the process of analyzing the data. Involving key stakeholders in a school-wide process to analyze and detect problems and attractions will outline a blueprint for a value innovation system for school leaders to create more sustainable systems in their schools. The application of the PDS and ADS to inform a value innovation system has never before been completed in a school context.

5. Conclusion

This paper aims to test the use of an ADS methodology as a tool for leaders to identify and develop attractive quality in schools. Applying the ADS in a school context, it can be argued, provides vital insights and ideas to school leaders, which paints the other half of the picture, but in actuality, paints an entirely different and often overlooked perspective.

This research has the potential to move schools towards the goals of ensuring inclusive and equitable quality education, promoting more lifelong learning opportunities, building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. These United Nations sustainable development goals (four and nine) move us closer to the overarching goal of ensuring that by 2030, all people enjoy peace and prosperity.

This research contribution raises fundamental questions about how we can use attractive quality as a concept to develop more sustainable systems in education. School leaders make decisions for their schools' long-term prosperity and sustainability based on the data streams they have available to them. Most commonly, these leaders rely upon standardized assessment data, parent surveys, enrollment data, per-student spending, student-teacher ratios, and their previous experiences as a leader, often at other schools. Many also rely on their 'gut feeling' to make decisions, often assuming they understand what their customers value. The ADS and PDS are simply two more data streams critical to creating a theoretical framework of attractive quality for educators and school leaders worldwide. Involving more stakeholders to create these new data streams happens at the problem/attraction gathering stage and the problem/attraction evaluation stage. Attractive quality is, in itself, complex because leading schools is complex. Quality management has tools for sustaining attractive quality in schools, such as weaponizing complex adaptive systems to identify system-wide patterns.

It is of particular interest to the author as to what came of the richness of dialogue between the participants and the interviewer. As the literature on quality management suggests, dialogue is an

integral part of the process and journey of identifying areas of challenge and attractiveness. Involving more stakeholders such as teachers, parents, and even students in this practice can create value alongside the data contained in the end products of the PDS, ADS, and VIS. The appreciative inquiry methodology is designed to foster organizational growth by tapping into the core motivations, strengths, and values that inspire and energize individuals and provide an impetus for change (Cooperrider, 1985). The use of an appreciative inquiry interview guide sought positive dialogue about each leader's high points and peak experiences. Choosing this methodology contributed to the richness of dialogue between researcher and participant, offering additional opportunities for the attraction points to be identified and celebrated.

Future Research

This study and the prior studies have led the author to open the doors of attractive quality to the world of education. From a methodological perspective, we have only peeled back one layer of the proverbial attractive quality onion as we unpack the possibilities AQ has to offer for the long-term sustainability of schools. The next step is to examine more closely attractive quality in schools using the ADS.

Another area of interest is how to involve key stakeholders in the process through the strategic use of design thinking methodology. What might happen if a group of teachers, staff members, parents, and even students elevate the empathy stage of design thinking. The subsequent study aims to apply this concept in a prototype format, designed around leveraging attractive quality for customer value creation and greater long-term sustainability of schools worldwide.

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Using a Process Based System Model (PBSM) for sensemaking - the case of sustainable building blocks in Sub Saharan Africa

Raine Isaksson

Uppsala University, Department of Civil and Industrial Engineering, raine.isaksson@angstrom.uu.se

Abstract

One of the challenges with sustainable development seems to be that we often do not have a common understanding of what we mean by sustainability and sustainable development. Sustainability issues are complex and transdisciplinary which creates problems both for academics and practitioners to understand the system worked with and its main sustainability impacts. Most of us want to have a sustainable working place, but what does it mean? What we cannot understand we cannot define and measure. Not being able to measure core sustainability performance makes work with sustainable development less effective. Visualisation for better sense making could be one way to facilitate defining and measuring sustainability to enable better leadership of sustainable development. Based on previous work with Process Based System Models and the logical sequence of Understanding-Defining-Measuring-Communicating-Leading this paper tries to improve sensemaking for sustainable development generally. This is done by applying the current theory and understanding on an ongoing multinational and multi-disciplinary research project with alternative binders for building blocks in Sub Saharan Africa. The issue to be tested is, if the proposed system models can highlight overall opportunities that then can be related to operational goals in different contexts. The proposed visualisation will be later tested in a series of common workshops for verifying the sense making strength of the visualisation.

Keywords: Sustainability, sustainable development, process, sensemaking, PBSM.

1. Introduction

Many of us are action oriented and when problems surface somebody is already thinking of a solution. This is a good ability when the problem is clear but could be a liability when we are confronted with complex problems where neither the problem nor the solution is obvious. Positively charged words like Quality and Sustainability often make it difficult to establish simple and clear definitions. Research on Quality and how to define Quality and Quality Development has been around for close to 100 years. In the height of the Quality Movement in the mid of 1990s Quality and particularly Total Quality

Management aspired to cover all areas of doing things better. That role has today largely being taken over by Sustainability which seems to be in every activity. We are all for Quality and Sustainability but often perceive what these are, or at least what we should do about them, differently. It could be of importance to take the time to find a common understanding and a definition based on this. Both Quality and Sustainability are contextual and generic definitions need to be understood in the context.

When comparing Quality Development and Sustainable Development there is an obvious difference. Quality Management consists of theory building which relies on successful examples where often the Japanese success in building a globally leading car industry after the Second World War is mentioned. Sustainable Development deals more with the necessity to change the current way of doing things for humanity to avoid getting into problems. There are no commonly shared success stories of how countries or companies have changed their modus operandi and become truly sustainable leaders. Sustainability and Sustainable Development are largely about what we would need to do, presenting goals and road maps but not presenting a coherent theory of improvement. Sustainable Development could largely be seen as freestyle improvement. Here, systematic quality improvement could provide support.

Quality Management provides a variety of principles, practices, and tools to improve performance. It therefore is logical to look for inspiration from Quality Management and how it can support Sustainable Development. Particularly the principle of Process Focus can be of use in setting the context for where sustainability can be studied, understood, and defined. Isaksson (2006) proposes in a paper based on a PhD thesis from 2004, called "Total Quality Management for Sustainable Development - focus on processes", the use of process-based system models to understand quality and sustainability in systems. The process model from 2006 is later presented as the Process Based System Model (PBSM) which can be used to describe both steady state and change (Isaksson, 2019). Process models can be used to describe value adding in a company, in a value chain and in a system. The logic is based on the observation that all value is created in processes and that these always exist, irrespectively if they have been identified, mapped, and established. The PBSM can therefore be used to propose visualisations of systems where the system itself might not be aware of how elements interact or how good management is. The PBSM provides a snapshot of the system as it is with all possible deficiencies. At a yet more simple level the value generation can be described as a flow that can be used to delimit a studied system. A flow chart consists of input, activities, output, and a purpose. We could study delivering education in University A, providing meals in restaurant B, or producing blocks in Sub Saharan Africa describing them as flows. This sets the context and leads to questions such as what is the mission and how is performance assessed and how does it look like compared to targets? At this level we could start discussing what is Quality and Sustainability for the studied system?

As researchers and consultants, we can study any process and set the context using process models. Processes always exist but the system maturity in understanding itself could vary hugely. One way of

doing a qualitative assessment of the maturity would be to use the stagewise model described by Isaksson and Hallencreutz (2008) with the stages Understanding-Defining-Measuring-Communicating-Leading. For any issue or process we could imagine that a person or an organisation goes through these stages. If we would focus on sustainability in delivering university education, we would expect to find some activities for all these stages. These might be far from best system sustainability performance, but could still by the actors in the system be perceived to be perfect. The common saying is that at system does not understand itself. Even if organisations generally could be expected to understand what they are doing this could be more difficult with complex issues such as quality and sustainability. There might not exist any agreed definitions of what perfect Quality and Sustainability are for a university or for any other business. This is work that every organisation needs to do themselves. The complication here is that a good portion of humility and change willingness is needed in a continuous reassessment of what constitutes vital Quality and Sustainability for the mission chosen. Transparency is needed and in addition welcoming an external review of how Quality and Sustainability have been interpreted.

There is another difference between Quality and Sustainability which is important. For at least private organisations it could be argued that it is up to them if they want to work with Quality and customer focus needs or not. They can decide not to and then take the consequences with lost business and possible bankruptcy. Sustainability could be seen as a requirement for all organisations that want to retain their license to operate. This means that for researchers it would be legitimate to study the level of organisational sustainability without the direct consent of the organisation. Reviewing sustainability in the organisational value chain and in the entire value chain from cradle to grave that the organisation is part of could be done without including those that are studied, at least in the beginning. This requires a systemic approach and some good theory ground to be able to define what constitutes sustainability in a value chain which could conflict with what participating organisations themselves present.

We could try to bring some objective help into deciding what should be included by starting from the perfect process which delivers the right thing, in the right way continuously over time. The right thing would be defined by the user. The user-based perspective is one of Garvin's (1984) five quality perspectives and the one that constitutes the core of Total Quality Management (TQM) (Bergman and Klefsjö, 2010). The customer, the user of the product - any combination of goods or services- decides if the thing is right. Doing the thing right means making no errors and delivering the product exactly according to design. Joseph Juran, states that the cost of poor quality is zero when products and processes are perfect. Combining this with time means that the product and process change continuously over time in such a way which always delivers the perfect product. In any chosen system this could be used to set a virtual benchmark that can be used as a reference when comparing current performance.

Going from Quality to Sustainability could theoretically be relatively simple. The user-based perspective is retained but the customer is expanded to a group of stakeholders. Also, focus now is primarily on stakeholder needs. Companies still need to focus on customer wants but the sustainability of the system would be defined based on how well it provides stakeholder needs value. Here, a second of Garvin's Quality Perspectives is needed, the value based. This perspective describes customer value in comparison to what it costs. When translating from Quality to Sustainability, cost becomes part of the generic stakeholder harm (Isaksson et al. 2015). The value-based perspective would in any system measure the total stakeholder value created and compare it with the total harm done for all stakeholders. The user-based perspective is needed in parallel. In any system there are limits to harm that different stakeholders can be subjected to. To keep things manageable, the focus on the vital few or the Pareto approach is applied. This means that main stakeholder and stakeholder needs are put into focus. On an overall level the two main stakeholders on a global level could be seen as humanity and nature (Isaksson et al. 2015). Using the outside in approach, based on a Pareto approach, singles out climate change, loss of biodiversity and poverty as particularly important needs (Isaksson, 2021). These are challenges that always need to be contrasted with the value produced. In addition, there will be other impacts that are specific, but important in the context. To understand sustainability in a process we need to have an idea of the mission of the process and what the main value and harm consist of. This logic has been used to describe the mission, to understand, define and measure performance in some common global value chains and is presented in Table 1 (Isaksson et al. 2021). The work done in Table 1 relates to work doing a Sustainability Opportunity Study which is a further development from an Opportunity Study (Isaksson, 2015). The challenge with sustainability is often that there are no agreed and relevant performance indicators. This means that preliminary work must be done in proposing how to understand, define and measure sustainability in the studied process. The purpose of an Opportunity Study is to use the visualisation of an improvement potential as driver for change. The interpretations in Table 1 have not been generally validated. However, all the interpretations present missions that are both common and needed. The interpretations lead to short and simple definitions, where the content intuitively is something that feels as mandatory content in a definition. The correct wording should be e.g., Sustainable Building is at least affordable and carbon free. That is, there will obviously be a long list of other criteria that need to be included in a comprehensive sustainability definition. This is the list that in old Quality Management jargon used to be called trivial many, but which these days would be called useful many.

The outside in perspective with focus on main people and planet needs enables a necessary simplification that makes it possible for the researcher to propose sustainability indicators and goals and based on these assess the sustainability improvement potential in the studied value chain and processes in the value chain.

Table 1. Understanding, defining, and measuring for some chosen value chains, based on Isaksson et al, 2021.

Mission	Understanding sustainability	Defining sustainability	Measuring sustainability (value/harm)
Building	Main values are shelter and infrastructure and main harm is climate effect	Affordable with zero-carbon footprint	Living space per price and carbon footprint (Infrastructure per price and carbon footprint)
Providing education	Main value is the right to learn and main harm the cost of learning	Inclusive quality education and lifelong learning opportunities for all	Realising educational potential and employability
Providing health care	Main value is the right to health and main harm the cost of it	Healthy lives and equitable well-being for all at all ages	Life expectancy at birth compared to yearly costs
Providing tourism	Main values are reducing poverty, preserving nature and culture, and increasing biodiversity with the main harms being the climate effect and loss of biodiversity	Tourism that reduces poverty, respects cultural heritage, and maintains or increases biodiversity with a zero net carbon footprint	Tourism revenues compared to footprints Revenue going to poverty alleviation.

The Process Based System Model (PBSM) together with the Principles Practices Tools Model (PPTM) have been suggested as ways for visualising systems on different levels from local to global (Isaksson, 2019). The PBSM which is based on basic process theory with management, main and support processes supported by resources forms a system model that includes all important elements needed to understand the system. An example is presented in Figure 1 where the process of providing sandcrete blocks is presented. Sandcrete blocks are building blocks made from sand, cement and water and are common in many countries in Sub Saharan Africa. A good part of all residential buildings is made by some type of block made materials that enable building over extended periods of times. Block sustainability in Sub Saharan Africa has a significant impact on building sustainability in the region.

There is an ongoing research project involving the author of this paper that works with building block sustainability. In this research participants from African and European Universities take part in research that studies alternative binders to Portland Cement that could be used for producing blocks. The research is interdisciplinary and involves researchers deeply immersed in what could be described as technical details of cement performance. The current networking research should identify important areas for new research and lead to research proposals. This comes with an important sensemaking challenge. To release the creative capacities of all participating researchers it would be good with a common understanding of the mission and jointly defining sustainability and how it should be measured. In the current research the

PBSM has been mentioned but it has not been tested for its potential sensemaking capability.

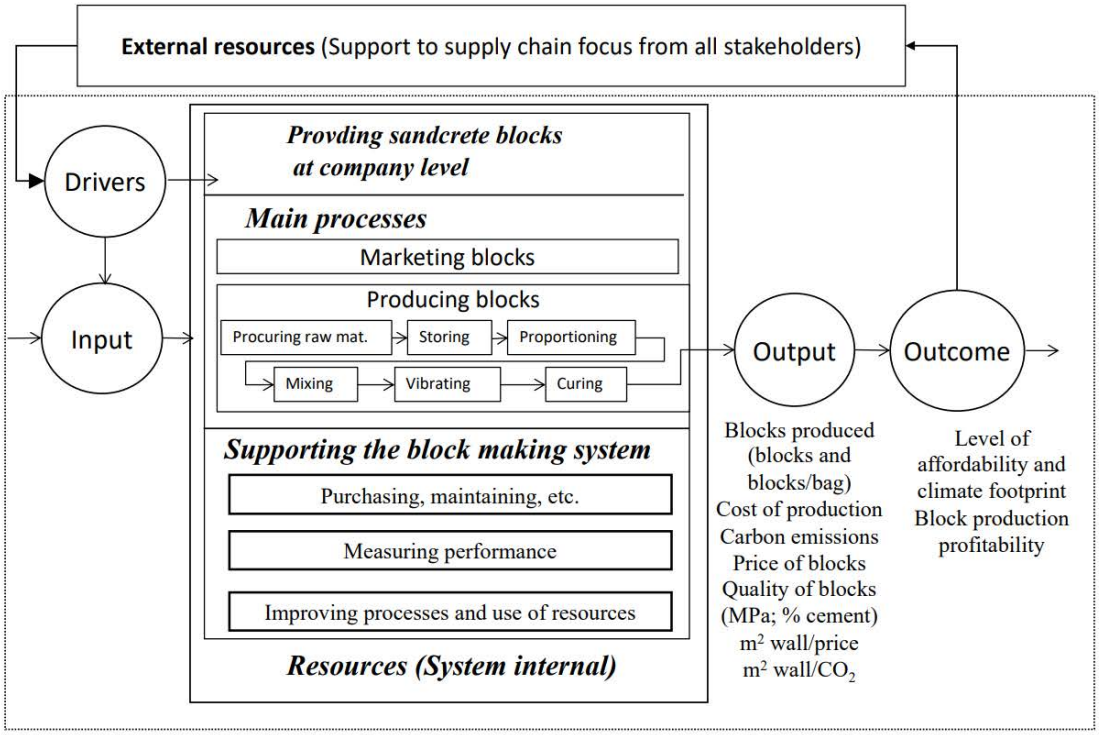

Figure 1. *The Process Based System Model (PBSM) applied on sandcrete production in Africa, (Isaksson, 2019).*

The Principles, Practice and Tools Model (PPTM) proposed by Isaksson (2019) can be used as a condensed management system and includes the elements of purpose, principles, practices, tools and the two processes of introducing and managing the system. In Figure 2 the PPTM has been used to set a vision and goals for how sustainable sand production could be managed in Dar es Salaam, Tanzania. This model can serve as a benchmark when comparing with the real system. Detected gaps can be identified as opportunities and can become drivers for change.

The PPTM can be seen to be included in the PBSM as a Method resource in the system. The question is if the PBSM and the PPTM can be used to make sense of the currently studied system of "Producing Sustainable Building Blocks in Sub Saharan Africa" in such a way that it increases the creativity and productivity of participating researchers? Block production is here limited to production with using alternative binders partly or fully to replace Portland Cement. The reason is that cement drives both the carbon footprint and the price of blocks (Isaksson and Buregyeya, 2020). Here, the introduction process is in focus. How could interest be created? One way could possibly be to confront the participants in the research group with an interpretation of the sequence of understanding, defining, measuring, and communicating and leading change (Isaksson and Hallencreutz, 2008) in the process of sustainable block production. This stage based sequence is believed to be important in sensemaking. For the PPTM to be complete it should also include the PBSM as a tool for visualisation. There should probably be

a practice that involves members of the guiding coalition in a discussion of how to understand the system studied including the scope of the value chain. Further, the entire process from understanding block sustainability to leading sustainable block use should be agreed upon.

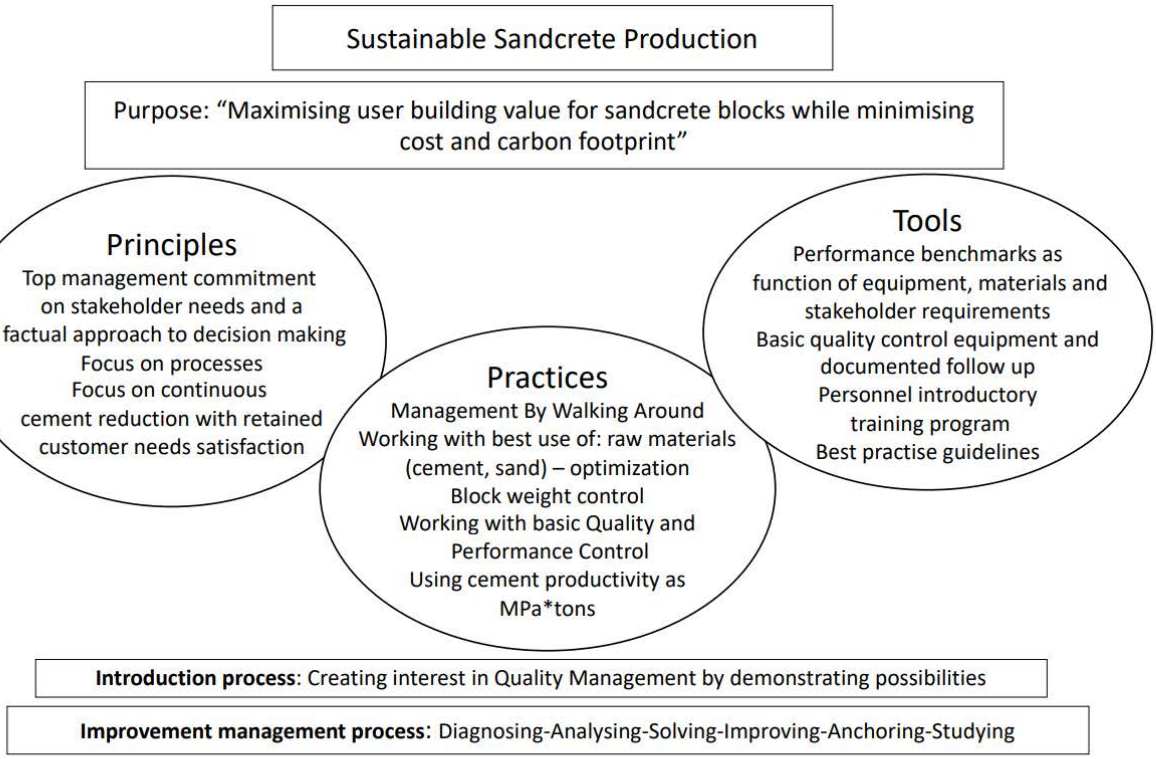

Figure 2*. The Principles, Practices, Tools Model applied on a vision for sustainable sandcrete production in Dar es Salaam, Tanzania (Isaksson, 2019).*

This paper discusses how the previously presented system models PBSM and PPTM (Isaksson, 2019) in connection with the sensemaking logic of understanding, defining, measuring, communicating and leading (Isaksson and Hallencreutz, 2008) could be used for creating a common understanding. The work is done in an ongoing research project for sustainable building blocks in Sub Saharan Africa. This is research within research with the purpose of understanding the possible value adding in using the process models. The resulting models and visualisations are intended as input in a series of workshops to be held with students and researchers connected to the research project.

2. Methods

This conceptual paper has a deductive approach where chosen models are further developed in an action research setting. The driver for the research is the sustainability implied need of using existing resources in the best way. Action research contributes both to those being researched and to the research society. In addition, Innovation Action Research Kaplan (1998) creates new practices that seem to be missing while doing the iterative research. The PBSM, describing block making in Sub Saharan Africa, will be prepared based on the knowledge that that the author has from more than 10 years of work in the region. Similarly, the interpretation of a PPTM and of the introduction process using the sensemaking sequence, will be based on previous knowledge and understanding of the context and the technical field.

3. Results and Discussion

The results are presented in three different parts. The first part - 3.1 - contains the PBSM for the overall process for SSA with comments. The PBSM presents the interpreted current state of the system and identifies elements which are important. The PPTM model is exemplified 3.2. The model can be seen as a resource being part of the Method, one of 10 resources categorised with the 10M checklist and part of the PBSM (Isaksson, 2016). In 3.3 the introduction process is presented in the form of a maturity grid identifying benchmarks and comparing these with the current maturity.

3.1 The PBSM for sustainable block production

The process studied has focus on using alternative binders. This means that the production of those binders, which is currently not taking place, needs to be included. The input is defined as needs and raw materials for alternative binders. When these binders have been produced, they are transported to a block making plant. These are small and technically simple units often placed quite close to where the blocks are used. The end performance of the blocks is set to when the blocks are used in a building and more specifically when they are used as walling material. Using a m^2 wall as the functional value enables comparing between different products for those parameters that are important (Isaksson and Buregyeya, 2020). In Figure 3 a proposed PBSM for providing blocks in SSA is presented. The picture is not complete but includes those elements which at first site appear important for understanding the system.

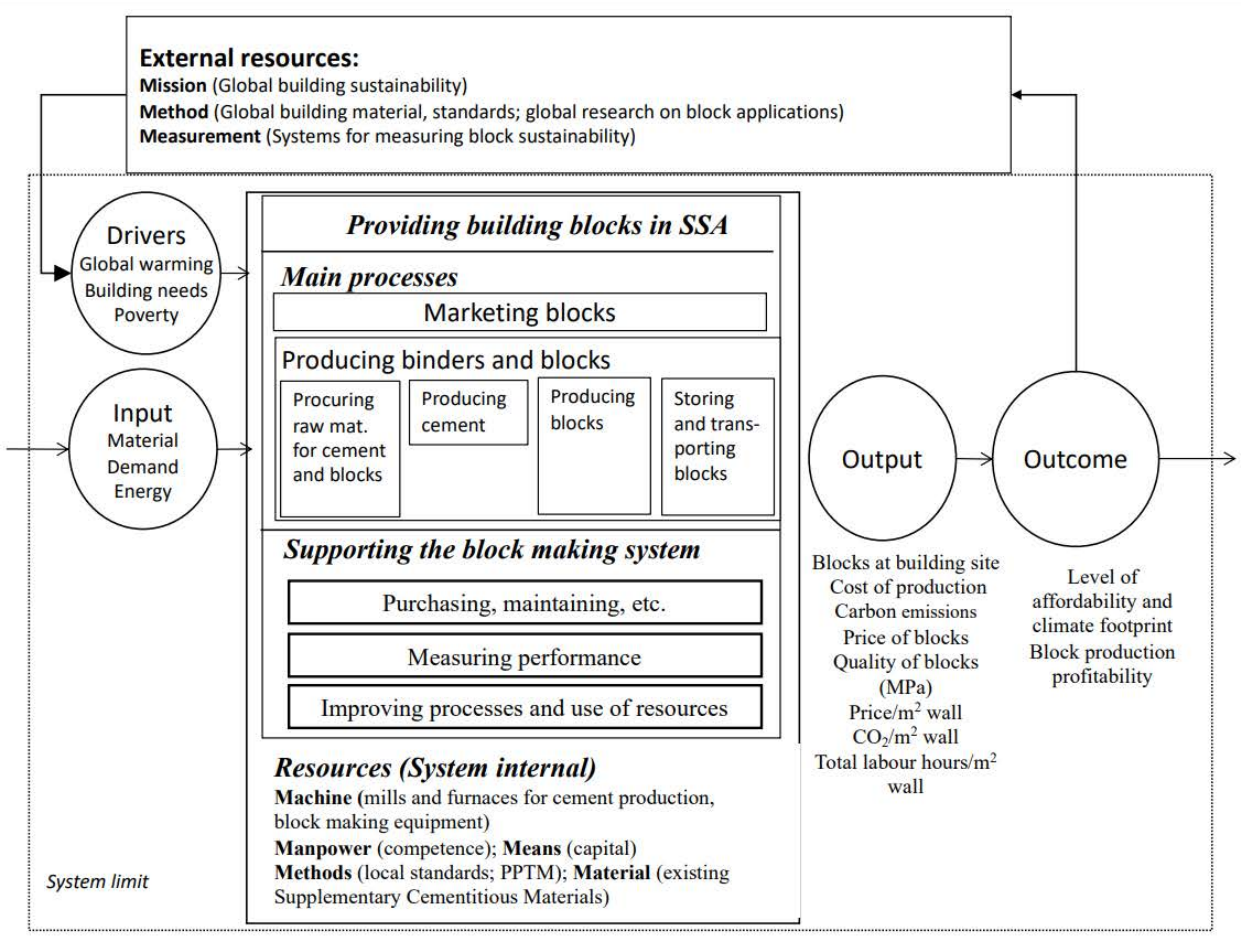

***Figure 3**. The Process Based System Model (PBSM) applied on building blocks production in SSA.*

Both the internal and external resources can be described using a checklist called the 10M. This generic list can be adapted for the area studied (Isaksson, 2016). External resources would be the global resources that support sustainable block production. Since the blocks used in SSA are rather simple concrete applications, which are not used in the same way in developing countries, there seems to be little relevant research. There seems to no clearly proclaimed missions on block sustainability in SSA highlighting the importance of affordability and low carbon footprints. Similarly, the system internal resources for the studied value chain seem poor. Existing modern equipment in the value chain is that of cement manufacturing. The plants often belong to international cement companies which are those producing Portland Cement (PC). Since alternative binders constitute competition to the use of PC in blocks, support from the cement industry cannot be counted with. The Manpower competence on Supplementary Cementitious Materials (SMCs) resides mainly in some universities. With block producers in most cases being small economic units employing some 5-20 persons the access to Means is limited. This means that even if there would be materials that could be used to substitute PC the hurdles are many in taking the theory to practice.

3.2 The PPTM for sustainable block production

As part of the 10 M internal resources in Figure 3 there is the Method resource. One part of this is the proposed PPTM in Figure 4. This minimised management system defines the main principles, practices and tools as well as suggests an introduction and a management process. This work will not deal with the management process but will only study the introduction process in more detail in 3.3.

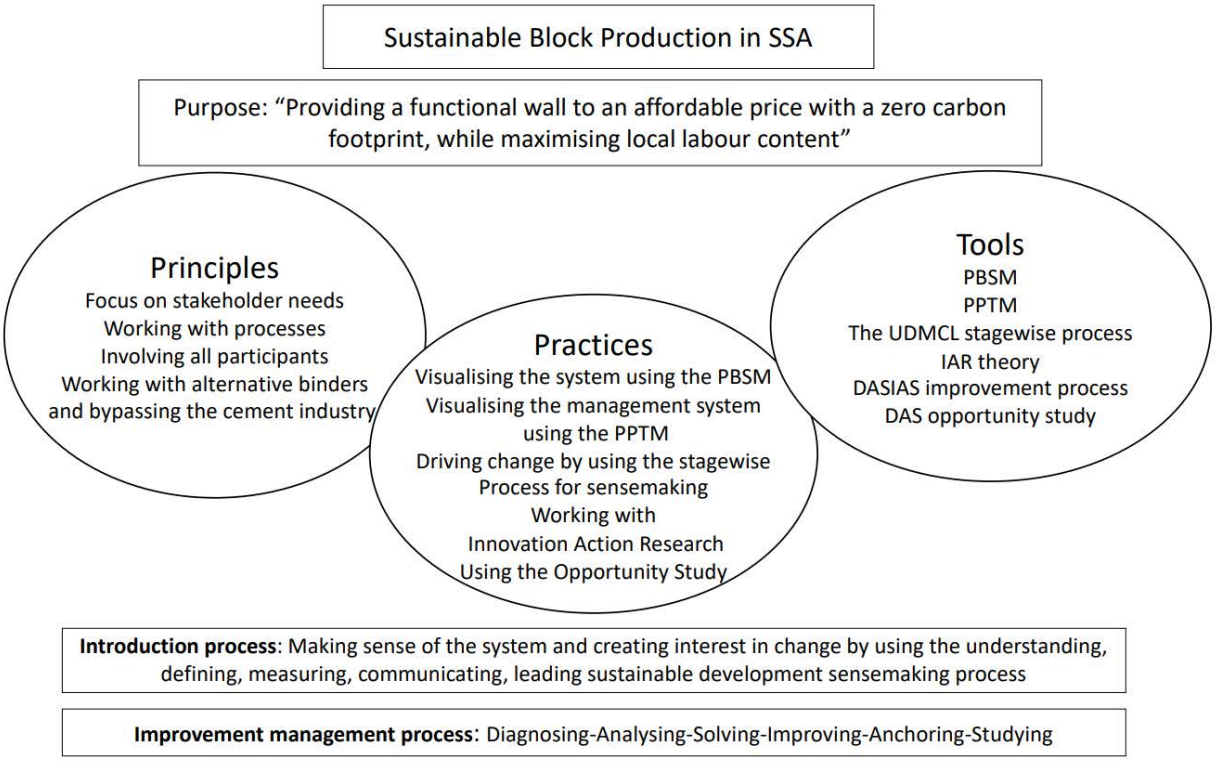

Figure 4*. The Principles, Practices, Tools Model applied on a vision for sustainable block production in SSA.*

The PPTM in Figure 4 should be seen as a first iteration where I have tried to catch the most essential elements for the management system. The "Principles" content has been simplified to the three quality principles of focus on customers - modified and extended to focus on stakeholder needs - work with processes and letting everybody be committed by involving them. Work with processes often includes making decisions on facts and improving continuously. The management commitment is currently the commitment of the research group. Practices are how things are done whereas tools are nouns, things used within practices.

3.3 The introduction process as Understand-Define-Measure-Communicate-Lead

The sensemaking logic has been divided into the four identified sub-processes. Understanding parts of the process, should also provide understanding of the entire process and acceptance of what is input and output.

Table 2. Understanding, defining, measuring, communicating for the SSA block production process.

Process	Understand success	Define sustainability	Measure performance	Communicate performance	Leading sustainable block production
Procuring raw materials	Costs, quantities, environmental footprint, alternative use and pozzolanic performance of materials - theoretical cement substitution potential in blocks and in cement costs avoided Creation of decent employment	Material production with decent work that minimises ecological footprint while maximising building value generated	Working hours Tons produced Costs	Rate and change of rate of using existing non-renewable SCMs Percentage of use of agricultural ashes and how this rate changes	Not analysed
Producing cement	Technology needed, costs and complexity, minimum viable size Achieved cement substitution potential at block site	Acceptable working conditions, Good product quality, good productivity, Minimised waste	Lost working hours due to injuries Target MPa*ton in blocks at 14 days from alternative binders, MPa*ton/cost MPa*ton/kg CO2 MPa*ton/hours of work	Employee safety CO2-savings Employment created Market share and growth of market share	Not analysed SWOT analysis?
Storing and transporting blocks	Costs and breakage		Storing cost Yield %		
Using blocks in walling	Usability, variation		Yield% average and variation	m^2 wall built CO2-savings	

Describing the different sub-processes was not very easy. How to divide a process in sub-processes could always be discussed. It could be that a detailed work would need dividing the process further. As a way of presenting the field of research Table 2 should work. For a researcher being deep down in SCM chemistry it should be OK to look at the entire process and to understand what the probability of making any impact is. Sustainable Development like Quality Development is an applied field. We as researchers should take responsibility in identifying where real impact can be created. To use the Table as a comparative grid, benchmarks need to be set for the performance. With this we can start identifying opportunities which could help us focus our research.

4. Conclusions

The main conclusion is that the process approach and the models PBSM, PPTM and UDMCL seem to be a viable way of increasing sensemaking in a complex system. The proposals presented in chapter 3 will be further developed and then presented to persons involved in the ongoing research on alternative binders. Workshops are planned for this, and the feedback will be used for further developing the models. The work done should also form part of validating the sensemaking ability of the process approach.

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Value Creation through Educational Partnerships Focused on Preparing Students for Citizenry in a Sustainable Global Society

Cynthia Whitney[1]

[1]*Mid Sweden University, Cynthia.Whitney@miun.se*

Abstract

This paper marks the start of a larger research project focusing on the value created for all stakeholders in sustainable partnerships in primary and secondary education. These stakeholders are defined as the primary or secondary school, the partnership organization, the teachers, the students, and the parents of the students. The purpose of this paper is to investigate the value created by organizations who enter into these educational partnerships with schools. The primary focus of the partnerships in this study is on preparing students for citizenry in a sustainable global society. This study consists of qualitative appreciative inquiry interviews conducted with leaders of organizations who intentionally enter into partnerships with primary and secondary schools focusing on developing students as global citizens who will be prepared to create a sustainable global society. This research will provide insights regarding: 1) the type of value created for each stakeholder from the perspective of the organizational leaders through the establishment of the partnership; and 2) who or what receives the value created by the partnership from the perspective of the organizational leaders. Partnerships in education with a global focus provide a platform for primary and secondary students to practice creative problem-solving skills, team building through collaboration, and to develop real-world global connections through true- to-life, meaningful experiences in their community, their state, their country, and internationally. Organizations with a global educational focus provide an attractive quality for primary and secondary schools in that these schools are searching for ways to meet parental and societal demand of a cutting- edge education. This study follows the United Nations Sustainable Development Goal (UN SDG) Quality Education, Target 4.7, which calls for ensuring "all learners acquire the knowledge and skills to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development." This research also supports the UN SDG Partnerships for the Goals, Target 17.16, which calls for enhancing "the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries (United Nations, 2022)."

Keywords: Quality Management (QM), Global Society, Sustainability, Partnerships, Education

1. Introduction

The world has entered into an age of crisis and conflict. Since 1880, our earth has heated up 1.1 degrees Celsius (GISTEMP Team, 2022; Lenssen et al., 2019) and is expected to continue to warm another 1.6 degrees Celsius by the end of the century (UNEP, 2021). Sea levels are rising, towns are flooding (Sweet et al., 2022), the number of natural disasters has increased fivefold over the past fifty years (WMO, 2021), and climates are warming at different rates all around the globe (GISTEMP Team, 2022; Lenssen et al., 2019). Global warming is affecting crop yields, livestock production (Hatfield et al., 2008), water resources (Lettenmaier et al., 2008), and as such, are creating critical food insecurity issues around the world (FAO et al., 2021). The COVID-19 virus took just under 15 million lives between 2020 and 2021 (WHO, 2022), and climate change has been identified as a "risk factor for armed conflict (Mach, 2019)."

As a direct result of recognizing that the world is in crisis, the United Nations adopted the universally applicable Sustainable Development Goals (SDGs) which could "create a new global energy and atmosphere of problem solving (Sachs, 2015)." This study follows the United Nations SDG Quality Education, Target 4.7, which calls for ensuring "all learners acquire the knowledge and skills to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development." This research also supports SDG Partnerships for the Goals, Target 17.16, which calls for enhancing the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the SDGs in all countries, in particular developing countries (The 17 Goals: Sustainable Development (un.org)).

There is also a call to action amongst experts in Quality Management (QM) and global issues to modernize the educational system in an effort to create a populace that will grow into adults who can advocate for and create solutions involving peace and sustainability in a global society (Senge and Kim, 2013; Sachs, 2015). They argue that business and the demands of the future will not be sustainable (Senge, 2003; Senge and Kim, 2013) and that changes in education involving innovative schooling needs to be implemented in order to prepare the children adequately (Helmold, 2021; Senge, 2003; Senge and Kim, 2013).

One form of innovative schooling is the establishment of partnerships in education. Partnerships are "collaboration networks" that foster student exchange programs and professional development opportunities for administrators and teachers (Snyder et al., 2000). School partnerships expand their global reach through a QM and systems theory perspective (Snyder et al., 2000). These partnerships can "bring perspectives and capabilities to educators seeking to produce fundamental change" (Senge, 2003) in order to create "global system citizens" who can "create a workable sustainable, and prosperous global civilization (Senge, 2012)."

The purpose of this paper is to investigate the value created by organizations who enter into educational partnerships with primary and secondary schools. The focus of the partnerships in this study is on preparing students for citizenry in a sustainable global society.

2. Methods

This study investigates the value of partnerships in education that are designed specifically to prepare students as global citizens. This set of six interviews involves participants who are current or former leaders of organizations that partner with schools in order to prepare students as global citizens. The first study involved interviewing participants who were current or former leaders of a school which partnered with organizations and schools from other countries in order to prepare their students as global citizens. The third study will involve interviewing participants who are teachers and staff of schools who are set with the task of implementing and sustaining the partnerships between the schools and the organizations.

The Appreciative Inquiry (AI) interview process was chosen as the qualitative method to be used for data collection. AI is an open-ended questioning technique that prompts the participants to focus their stories around positive thoughts and reflections. Questions are focused on high points, strengths, values, and the ideal future (Cooperrider and Whitney, 2005: Cooperrider et al., 2008; Whitney and Trosten-Bloom, 2010). The questions for these interviews were designed to prompt the participants to produce their answers in a storytelling format, in which they controlled the amount of detail given.

The interviews for this study were conducted with leaders of organizations who enter into and sustain partnerships with schools in order to provide resources that will help students become global citizens. The interview questions were designed to have the participants describe what they thought the values were that the partnerships created.

Participants were interviewed about their position, background and how long they worked at the organization. Participants J, L, N, and O all previously worked in the school system as administrators (J, N, and O), teachers (N and O), or as a staff member (L). The other two participants (K and M) started their organizations without having a professional background in education. Four participants (J, K, N, and O) have their doctorates and three participants (J, N, and O) have been identified as professors at universities in the United States. Five of the participants were born in the United States (J, K, L, N, and O), and one participant was born in South Africa. Three of the participants were founders of their organizations, (J, K, and M). Participant L is a leader at Participant K's organization. Participants N and O are leaders at Participant J's organization. The interviews from six participants were reviewed, broken up and sorted under value codes.

3. Results

The purpose of this paper is to investigate the value created by organizations who enter into educational partnerships with schools with a focus on preparing students for citizenry in a sustainable global society. The value codes that were used for sorting the data are: "school", "students", "teachers", and "parents". These codes and key ideas are in Figures 1-4.

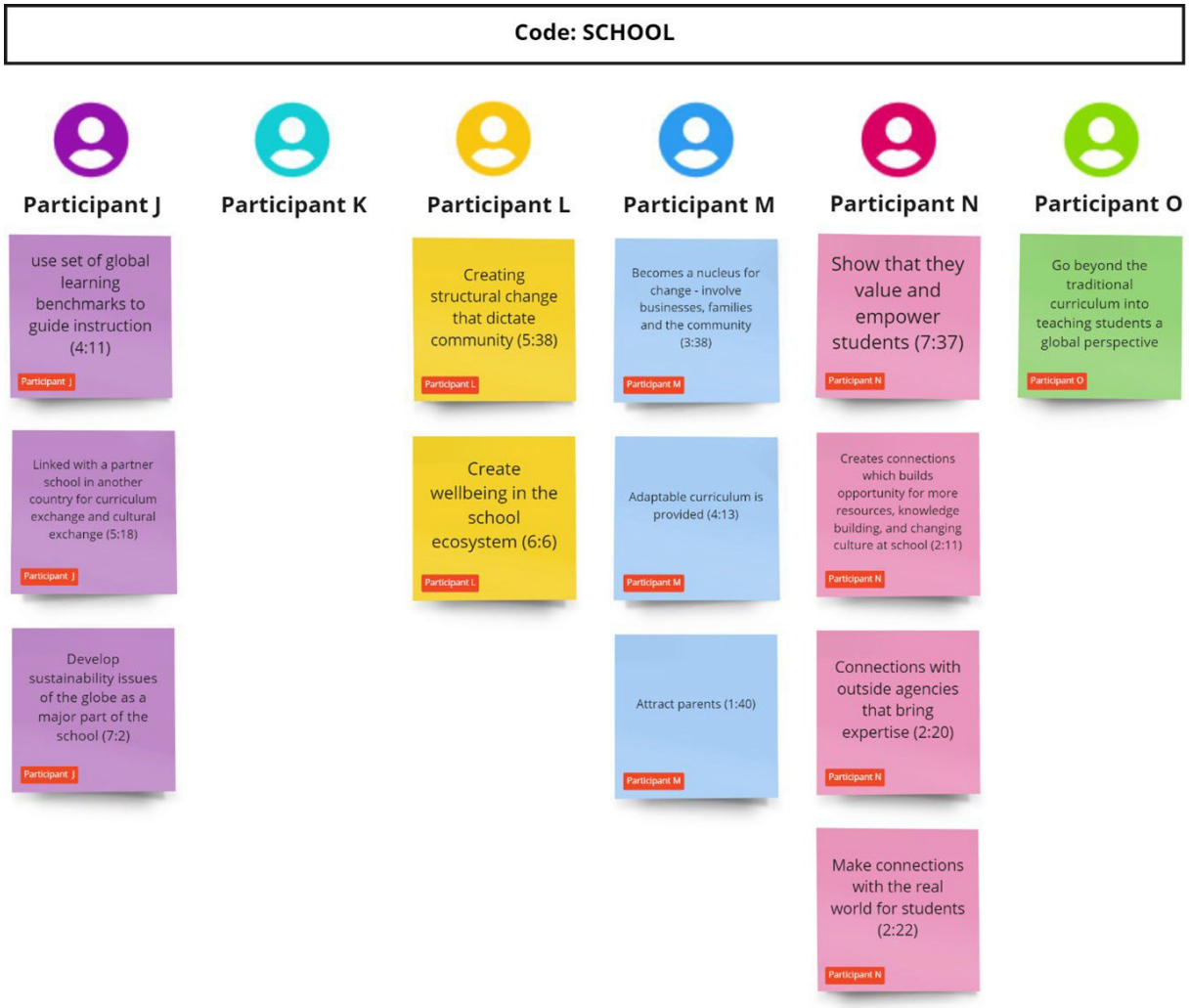

Figure 1. *Excerpts from Participants J-O grouped under the code "School" (Miro, 2022).*

In Figure 1, organizational leaders stated that partnerships provided value to the school by providing a curriculum or benchmarks (Participants J, M, and O), create change involving community (Participants L, M and N), attract parents (Participant M), Make connections to the real world (Participant N), address global sustainability issues (Participant J), create wellbeing (Participant L), bringing in expertise from outside agencies (Participant N), show they value and empower students (Participant N). Participant K was without mentioning value brought to the school.

Figure 2. *Excerpts from Participants J-O grouped under the code "Students" (Miro, 2022).*

In Figure 2, organizational leaders stated that partnerships provided value to the students by creating connections with students from other countries which accentuated their similarities and/or differences (Participants J and N), becoming global thinkers or global citizens (Participants J, N, and O), developing awareness of global concerns of students from other countries (Participants J and N), learning from each other (Participant J), collaborating with students from other countries on projects (Participant J), thinking about what they can offer society and/or taking steps to act (Participants K and M), developing compassion and empathy for others or think beyond themselves (Participant K, L, and N), creating awareness of the needs of larger social group or ecosystem or the global impact of their actions (Participants K and M), creating change or solutions for change or working with others for change (Participant K, and M), wanting to create wellness in a global community (Participant L), work with or make connections with professionals outside of the school (Participants M and N), becoming leaders in driving the curriculum or the connections (Participant N), receiving and retaining information from engaging and relevant lessons (Participant O), having a social contract with the world (Participant O).

Figure 3. *Excerpts from Participants J-O grouped under the code "Teachers" (Miro, 2022).*

In Figure 3, organizational leaders stated that partnerships provided value to the teachers by providing access to travel to other countries and making connections worldwide with teachers and students (Participants J, N, and O), giving them power in the decision-making process and/or giving feedback regarding the implementation and improvement process (Participants J, L, N and O), providing globally focused curriculum or benchmarks to guide instruction (Participant J, M, N, and O), providing tools for students to practice wellbeing (Participant L), providing tools for teachers to practice wellbeing (Participant L), attending training sessions (Participant N), changing thinking based on global connections made with teachers and students (Participant N), and creating lessons that are meaningful for their students (Participant O). Participant K was without mentioning value brought to the teachers.

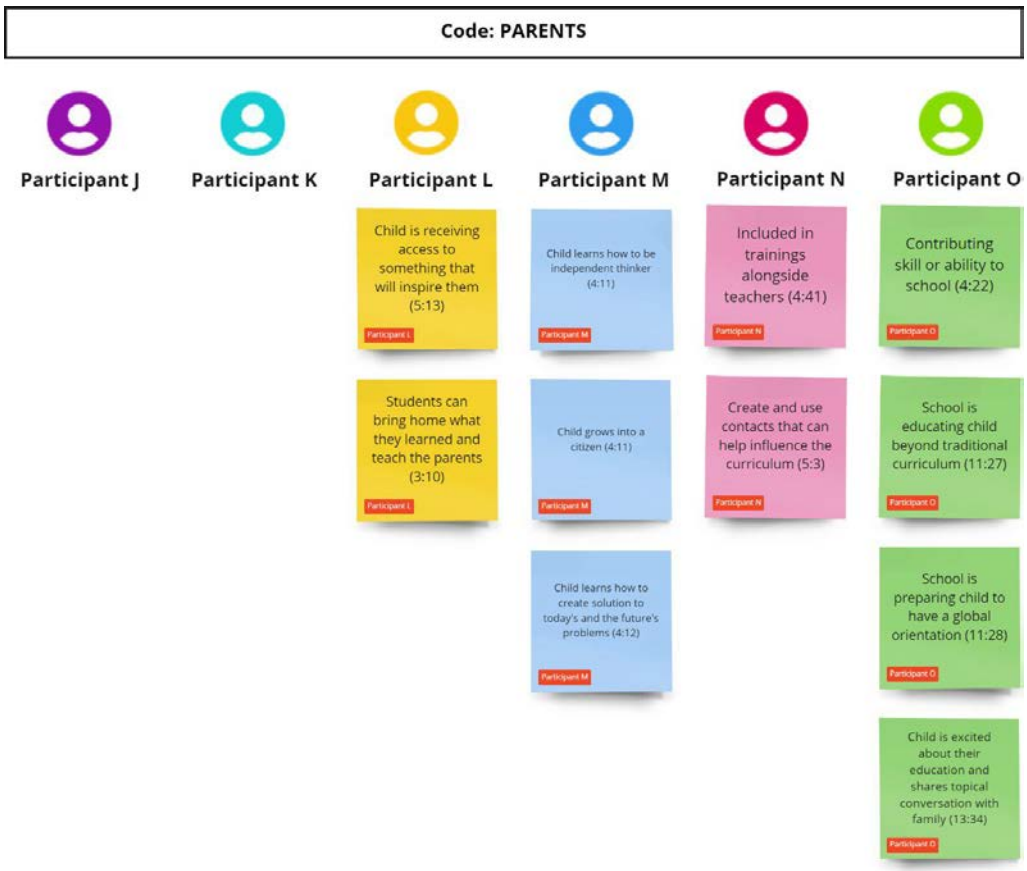

Figure 4*. Excerpts from Participants J-O grouped under the code "Parents" (Miro, 2022).*

In Figure 4, organizational leaders stated that partnerships provided value to the parents by providing access to inspiring or topical lessons to their child (Participant L and O), exciting their children enough that they bring home what they learned in school (Participant L and O), teaching their child how to be an independent thinker that creates solutions to today's and the future's problems (Participant M), teaching their child how to be a citizen or have a global orientation (Participants M and O), participating

in trainings alongside teachers (Participant N), using them to help influence the curriculum or contribute their skill to the school (Participants N and O), educating their children beyond the traditional curriculum (Participant O). Participants J and K were without mentioning value brought to the parents.

Prevalent themes of value emerged from the data collected from the interviews. The themes included creating connections to the real world regarding global impact and creating global thinkers and global citizens (Participants J, K, M, N, and O); access to a globally-focused curriculum that contained engaging, relevant lessons that were beyond what was offered in traditional curriculums (Participants J, M, N, and O); creating independent thinkers and empowering students to drive the curriculum and create change in their community (Participants K, L, M, and N); involve teachers in the decision making and implementation of the curriculum (Participants J, L, N, and O); creating a sense of wellbeing, including compassion and empathy (Participants K, L, and N); creating global connections with teachers and students (Participants J, N, and O). In contrast, Participant K only mentioned the value created for students in the partnership between the organization and the school, and didn't mention any value created for the school, teachers, and parents. Similarly, Participant J did not mention any value created for the parents in the partnership between the organization and the school, but did mention value created for the school, students, and teachers.

4. Discussion

The results of the interviews indicate that leaders of these organizations that partner with schools are primarily concerned with developing the global mindset of students, with all six participants mentioning multiple examples of value created. The values that students receive from the school partnership are stated by organizational leaders as developing independent thinking, driving change, taking ownership of their education, creating global connections, and practicing wellness through expressing empathy and compassion toward themselves and others. These organizational leaders view teachers as essential for implementing their program and sustaining the partnership through weaving the organization's curriculum through the lessons taught in the classroom. The organizational leaders also welcome critique and feedback from the teachers regarding the success or failure of curriculum implementation.

Organizational leaders state that schools receive value from their partnership through the reputation that they will have in offering a non-traditional curriculum, creating connections within the community, empowering the students, teaching students a global perspective through real world experiences, and creating wellness in their school community. These values that the partnership brings to the school, in turn, creates a larger value in attracting parents for the purposes of enrolling their children in the school.

None of the organizational leaders mentioned any values that the partnership brought to their organization. Their focus was primarily on the value that the partnership brought to the students in creating global citizens. The concern for the state of the world in crisis sparked the creation of these organization by their founders. They sought an innovative way to supplement the traditional curriculum

that schools had expertise in delivering with curriculum that would help students grow up into global citizens that could help guide and motivate others to create a more sustainable world. In order for these partnerships to exist and be sustained there have to be at least two committed primary parties: the school and the organization. One could argue that schools have a vested interest in increasing their students' local and national test scores; however, it is intriguing that this "value" is not mentioned in any of the interviews conducted for this paper. The values that are mentioned in the organizational interviews encompass traits of teaching the tools used in advocacy for change and in standards of humanity – compassion, care, and wellness for oneself, others, and the global environment. For the schools to enter into partnerships with these organizations, the schools must not only feel like there is a need to develop these global values in their student populace, but they must also feel that the partnership will contain an attractive quality that will increase enrolment. For administrators to invest time and resources in marketing a partnership and implementing a curriculum that develops global citizens to the community, the demand from the community in desiring this type of education for their children must be prevalent and large enough for the schools to take note. As long as communities foster increasing enrolment at schools with innovative curriculums with a focus on creating global citizens, these types of educational partnerships should continue to grow and thrive. This in turn, could spark an increase in other schools seeking out these types of partnerships with organizations, which would increase demand and grow the organizations' customer base of schools. This increase in the number of partnerships that an organization creates with schools should create more funding, resources, and marketability options for the organizations. The increase in partnerships would mean that more students would be educated with the tools that they need to become global citizens, which helps to positively support SDG 4, Quality in Education and SDG 17, Partnerships for the Goals.

5. Conclusions

This study is part of an ongoing research project that contains three sets of interviews. The three sets of interviews are with leaders of organizations, leaders from international schools, and the teachers and staff who maintain the day-to-day sustainability of the partnership within the school setting. All sets of interviews are with individuals who have the common purpose of educating students to have a global mindset to become global citizens who are prepared to solve sustainability issues in a time of global crisis. The data in this set of interviews show that although the main focus of the conversation centred around the value brought to the student, that value that was brought to the student was dependent upon the support of the other three entities receiving value – the school, the teachers, and the parents. The school supports the value received by the student through entering into the partnership with the organization and supplying the teachers with the materials and support needed to implement the program. The teachers support the value received by the student through implementing the curriculum in the classroom with fidelity and giving feedback or critique regarding the curriculum's

implementation in the classroom to the school administrators and the organizational leaders. The parents support the value received by the student by enrolling their student into the school that has the partnership with the organization and by volunteering their services with implementation or creating connections of support within the community for the organization. All these value support systems set in place for students to become global citizens indicates that there may be a system, formal or informal, that is set in place for the support to be successful. Also, even though the leaders of the organizations did not mention value received for their organization regarding the partnerships with schools, the organizations' purpose is clearly to support schools and teachers in giving students the tools to become global citizens, and that the value brought to the organization is that they are able to stay in business conducting these partnerships and that they see the growth in the students' mindsets. In order to confirm or refute this assumption, more data needs to be collected.

Regarding the levels of data collected for each category of school, students, teachers and parents, it was possibly more challenging for the organizational leaders to think in terms of creating value for parents, as their primary focus is creating a partnership that benefits students. A follow up, open-ended question survey will be created and sent to all the participants to obtain clarification on 1) the value created for the school, students, teachers, parents, and the organization; 2) what characteristics create a sustainable partnership so their mission of educating students with a global mindset can be successful; and 3) how the organization knows that value is actually being created for the students, since students are their primary focus for value creation.

To overcome the now seemingly mountainous hurdle of the sustainable goals of Target 4.7, the data from this interview group seems to suggest that establishing partnerships with innovative international and globally minded organizations will provide students with the tools that they need to become global citizens. Innovative sustainable partnerships between schools and organizations with a global focus provides value for all groups involved in the process.

The data collected from this interview group of leaders from organizations will be compared with the data from the interview group of leaders of schools and with the data from the interview group of teachers and staff who are in charge of sustaining the partnership at the school level. The data regarding the perspective of received value in each of the three groups will be analysed in order to discover patterns of commonly recognized values and divergent perceived values. This analysis will be conducted for the larger research project that is forthcoming.

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Posters

District nurses' use of a decision support and assessment tool to improve the quality and safety of medication use in older adults

Annica Lagerin

District nurses' use of a decision support and assessment tool to improve the quality and safety of medication use in older adults

Annica Lagerin Senior Lecturer RN

Conclusion:

With the support of the CDSS and the SMA tool, the district nurses(DNs) could identify several factors related to inappropriate or unsafe medication, and the patients were positive toward the assessments. Thus, this method may be useful in promoting better and safer medication use in older patients.

Polypharmacy and adverse drug reactions were common, and at both baseline and follow-up, DNs needed to intervene to improve medication use for the majority of patients. These findings underscore the importance of DNs' role in regularly following up older patients' drug treatment in collaboration with other health care professionals.

Introduction:

According to WHO, all countries in Europe need to adapt their health care systems to prepare for an aging population. DNs in Region Stockholm have the opportunity to establish special units at primary health care centers for patients 75 years and older. The units conduct drug utilization reviews and create care plans for older adults.

Purpose:

To investigate whether DNs can identify factors related to the quality and safety of medication use among older patients via a clinical decision support system (CDSS) for medication and an instrument for assessing the safety of drug use (SMA-tool).

A secondary aim was to describe patients' experiences of the assessment.

Method:

Nine DNs at seven primary health care centers in Stockholm used the tools with 45 patients 75 years and older who used one or more drugs. Outcome measure were the number of drugs, potential drug-related problems, nursing interventions, and patient satisfaction. Prevalences of drug-related problems and nursing interventions were calculated. Eleven patients answered a telephone questionnaire on their experiences of the assessment.

Resultat:

DNs identified factors indicative of drug-related problems, including polypharmacy (9.8 drugs per person), potential drug-drug interactions (prevalence 40%), potential adverse drug reactions (2.7 per person), and prescribers from more than two medical units (60%). DNs used several nursing interventions to improve the safety of medication use (e.g., patient education, initiating a pharmaceutical review).

The patients thought it was meaningful to receive information about their drug use and important to identify potential drug-related problems. With the support of the clinical decision support system and the SMA tool, the DNs could identify several factors related to inappropriate or unsafe medication and initiated a number of interventions to improve medication use. The patients were positive toward the assessments.

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"By using the tools, DNs gained information that form the basis for discussion with GPs about older adults' medication use. By giving the DNs a clearer picture and more information about the patient's problems and needs, the tools helped clarify the DNs' work. This, in turn, helped the DNs gain a feeling of security in their professional role".

Avdeling/Avsändare MCHS
Namn: Annica Lagerin Senior Lecturer RN
Avdelning: Department of Health Care Sciences
Adress: Stigbergsgatan 30 Stockholm

E-post annica.lagerin@esh.se
Telefon: +46 73 914 52 01
Webbsida: www.mchs.se

MARIE CEDERSCHIÖLD HÖGSKOLA

10. Special themes

10d. One Health, SDGs and ethical conflicts

Abstracts

Assessing risk and building resilience to facilitate the transition towards circular food systems

Dr. Rebecca E. Nordquist[1], Dr. Brian Dermody[2], Dr. Jorke Kamstra[1], Dr. Lapo Mughini-Gras[1,3], Prof. Dr. Hens Runhaar[2], Dr. René Verburg[2], Prof. Dr. Sybe de Vries[4]

[1]Department of Population Health Sciences, Veterinary Medicine, Utrecht University, the Netherlands, Utrecht, Netherlands. [2]Copernicus Institute of Sustainable Development, Geoscience faculty, Utrecht University, Utrecht, Netherlands. [3]RIVM Dutch National Institute for Public Health and Environment, Utrecht, Netherlands. [4]School of Law, Faculty of Law, Economics and Governance, Utrecht University, Utrecht, Netherlands

Abstract

There is potential for circular food systems to improve quality of life for humans, farmed animals, and ecosystems. However, increasing circularity in the food system brings with it novel risks that should be managed to avoid negative unintended consequences. Under circularity, the interconnectivity of food subsystems is likely to increase. For example, waste streams are proposed to be used as feed or fertilizer. Creating such loops brings novel risks that may become reinforcing. Risk is interdependent across system scales and may related to animal welfare, pollution, spread of disease, or international trade. If these risks are not identified, managed, and regulated, the project of transition to circular food systems may be undermined.

We propose a new, multidisciplinary framework for managing and governing risk within circular food systems, more specifically within the EU including the context of the Green Deal. Our framework places an emphasis on building resilience of food subsystems as a pathway to managing risk. We explore how the current movement toward restructuring of interconnections within the food system to increase circularity may introduce novel and unintended risk factors, and how this connectivity can be managed to mitigate these risks. We outline how risk owners can be identified and connected to improve governance across food system scales. Finally, we explain how resilience principles can be applied to manage changing risk associated with transition to a circular food system.

Relationship of the contribution to SDGs:

SDG 2: Zero hunger: target 2.4 and target 2.5

SDG 12: Responsible consumption and production: target 12.8 By 2030

SDG 15: Life on land: target 15.5, target 15.8, target 15.9

Relationship of the contribution to the theme of the Conference – "Sustainable Development and Courage. Culture, Art and Human Rights":

Transition in food systems, including a potential transition to circular agriculture, is a wicked problem that requires input and insight from many different disciplines in order to oversee the possible effects of changes, and to mitigate the inevitable issues that will arise during transition. The consortium involved in our contribution is specifically selected to include academics from (veterinary) health sciences, environmental sciences, and law; we are very open to collaboration with all disciplines.

Track
Track 10d One Health, SDGs and ethical conflicts

How to solve ethical conflicts in One Health approaches

Henrik Lerner

Department of Health Care Sciences, Marie Cederschiöld University, Stockholm, Sweden

Abstract

One Health approaches, such as One Health, EcoHealth and Planetary Health, are interdisciplinary or transdisciplinary to promote health in more than humans. In wide One Health approaches, health in humans, animals, plants and ecosystems is recognized and valued and intra-disciplinary ethical discussions in public health or veterinary ethics might be too narrow. Expanding ethics used in human or veterinary healthcare is not enough to solve ethical conflicts in One Health approaches. An ethic for such approaches needs to bridge the gap between anthropocentric, zoocentric, biocentric and ecocentric ethical theories. This calls for a pluralistic ethics which must be able to solve conflicts across ethical theories. In pluralistic ethics, other issues are at stake than in a single ethical theory, such as considering what counts as moral standing, what values should be considered and how should one balance and compare different ethical claims. Several possible methods exist that aim for solving ethical conflicts or dilemmas. In this presentation I will analyse three, namely principlism, wide reflective equilibrium and the map method. These will be analysed with two example dilemmas, one based on scientific discussions of the role of parasites in tropical ecosystems and one based on the need for an interspecies ethics to evaluate animal-assisted interventions. The results from analysing these dilemmas pinpoint shortcomings and strengths with these three methods and give insights how a method for solving ethical dilemmas across ethical theories in One Health approaches needs to be developed.

This presentation will address two of the concepts in the conference theme, culture and human rights. First, the future pluralistic method developed must be able to include and balance different culturally bound ethical systems or perspectives. Second, one needs to address human rights in relation to other rights proposed within zoocentrism, biocentrism and ecocentrism for animals or ecosystems.

This presentation focus on how to deal with possible conflicts that might arise when aiming for SDG 3, 13, 14 and 15 at the same time.

Track
Track 10d One Health, SDGs and ethical conflicts

One Health *Praxis* as an Ethos for the Sustainable Development Goals

Dr. Jake Keyel[1], Dr. Patricia Mooney Nickel[1,2]

[1]Colorado State University, Fort Collins, CO, USA. [2]Victoria University of Wellington, Wellington, New Zealand

Abstract

The Sustainable Development Goals (SDGs) seek to provide a "shared blueprint for peace and prosperity for people and the planet." Similar to the SDGs, in 2021 the One Health High-Level Expert Panel proposed a new operational definition of the concept built around an "integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems." Protecting the ecosystems that sustain all life on the planet calls for an approach to reaching these goals that can also integrate the social, ethical, and political complexities of the work to be done. One Health, if conceived as an ethos engaged by practitioners, activists, and scholars, is such an approach.

In this context, we consider the question posed by the conference track chairs: "If humans, animals, plants, and ecosystems all count, what ethical framework could be used to think about fulfilling the SDGs?" As an ideal, One Health is already a potential ethical framework through which to achieve the SDGs. In the following paper, we examine the ways in which recent One Health discourses are based on a narrow epistemological lens (Bardosh, 2016). In Section 2 we establish praxis as a methodological approach that could broaden this lens. In Section 3 we explore the tensions of sectoral thinking in One Health and especially the ways in which the operationalization of these ideals may occlude their emancipatory potential. We conclude that understanding One Health as praxis and the SDGs as a potential effort towards One Health would potentiate a "thicker" dialogue that resists the tendency to depoliticize the ethical challenges encountered by both frameworks.

Track
Track 10d One Health, SDGs and ethical conflicts

Overview of ethics, One Health and sustainability goals

Henrik Lerner[1], Charlotte Berg[2]

[1]Department of Health Care Sciences, Marie Cederschiöld University, Stockholm, Sweden.
[2]Department of Animal Environment and Health, Swedish University of Agricultural Sciences, Skara, Sweden

Abstract

This presentation is an introduction to the track 'One Health, SDGs and ethical conflicts'. One way to reach the UN Sustainable Development Goals (SDGs) is to follow One Health approaches. One Health approaches have a strong multispecies and multi- or interdisciplinary scope, both scientifically and societally. Much emphasis in research has been put on medical, biological and veterinary aspects of various One Health approaches, and substantially less on ethical aspects. However, during later years, aspects such as the ethics of trying to eradicate one species (e.g. a parasite) to improve the health of another species (e.g. humans or a farm animal species) or the ethics and rights aspect of the use of interventions and substances based on indigenous people's knowledge in conventional medicine have been brought up within the One Health community. This presentation provides an overview and a review of potential ethical issues that arise in multispecies and interdisciplinary approaches on health for humans, animals and the environment. It also summarizes a selection of attempts made within an ethics of One Health approach. This presentation can be seen as a starting point for the workshop later in the track.

This presentation will address the courage aspect of the conference. In a world where there is at the moment a strong emphasis on eradicating severely diseases such as Covid-19 one needs courage to include other sustainability goals and ethics than only survival, health and well-being. One of the strands of ethics, the idea of human rights, will be an important issue to discuss in this track in relation to other claims of rights when it comes to animal suffering or depletion of species.

This presentation focuses especially on SDG 3, but as a result of its review character it will also focus on goals such as SDG 10, 13, 14 and 15.

Track
Track 10d One Health, SDGs and ethical conflicts

Solidarity and One Health in The Age of Covid-19

Dr. Zohar Lederman

Rambam Healthcare Campus, Haifa, Israel

Abstract

The ongoing Covid-19 pandemic presents numerous instances of inter-human solidarity, of humans standing together and carrying costs to assist other humans with whom they share relevant similarities. Solidarity among fellow humans is not, however, the only kind of solidarity to be considered. More-than-human solidarity means empathy and care by humans towards animals, including pets, farm animals and wild animals.

The OH literature discusses notions such as shared risks and benefits to express the idea that both animals and humans may be susceptible to similar environmental risks such as toxicants and zoonotic diseases. Consequently, public health and biomedical interventions such as vaccinations originally aimed at humans may end up benefiting animals and vice versa. Normatively then, policies and interventions that may have the added value of benefiting multiple species in a OH spirit should be prioritized over those that stand to benefit only one species, namely humans.

Using the language of solidarity as understood in bioethics, these notions of shared risks and benefits reflect a descriptive understanding that humans and animals may identify with one another (obviously only moral agents can actually 'identify' with anyone in the sense meant here; the term may be understood metaphorically in the case of non-moral agents). If that is the case, then these notions plausibly entail a normative commitment to carry a potentially heavier burden on oneself or one's own species to benefit other species rather than one's own (again, only moral agents can make and act upon such commitments).

This paper will first review instances where Covid-19 negatively affected animal species, thus making a case for a relevant similarity between human and non-human species. It will next defend a substantive account of more-than-human solidarity that, if persuasive, would compel humans to carry burdens or costs to assist animal species.

Inter-human solidarity implicitly grounds many if not all of the SDGs. Using a OH language allows us to link the SGD to More-than-human solidarity. This potentially may mean much greater responsibility towards animals, constituting a vulnerable population. This theoretical reframing might have corresponding duties, for instance by committing to provide clean water to both human and animal populations, or by assuring sustainable environs in which both humans and animals dwell.

One understanding of solidarity in bioethics has been understood as 'standing with' someone in the face of obstacles. Solidarity defined as agreeing to carry a burden for someone then means at least having the courage to face significant potential harms. Individuals and stakeholders need courage to engage the SGDs in solidarity with the vulnerable populations.

Track
Track 10d One Health, SDGs and ethical conflicts

Workshop on 'One Health, SDGs and ethical conflicts' – creating a roadmap

Henrik Lerner[1], Charlotte Berg[2]

[1]Department of Health Care Sciences, Marie Cederschiöld University, Stockholm, Sweden.
[2]Department of Animal Environment and Health, Swedish University of Agricultural Sciences, Skara, Sweden

Abstract

This workshop finalizes the track 'One Health, SDGs and ethical conflicts', with the aim to find consensus – or at least a generally agreed roadmap – of what an ethics of One Health should aim for. Expanding ethics from traditionally intra-disciplinary ethical discussions in medicine, nursing science, public health and veterinary medicine will not be sufficient for all aspects of ethics within the wide scope of various One Health approaches. The type of ethic standpoint aimed for here needs to be a very broad version of bioethics, dealing with conflicts between anthropocentrism, zoocentrism, biocentrism and ecocentrism. To us, it is obvious that although many species and ecosystems can sometimes benefit from the same intervention there are inevitably cases where, on the contrary, different species or ecosystems may be protected or receive improved health at the cost of other species or ecosystems. It also needs to balance ethical standpoints from various cultures and ethical traditions. The aim of the workshop is to prepare a declaration on these matters or at least a road map on how ethics can be incorporated in the core of One Health approaches, as well as identifying the areas where further developments are most urgently needed. The declaration or roadmap will also indicate areas worth considering in future research and policy making regarding ethics in relation to the SDGs. The input for this will be the discussions from the workshop as well as earlier presentations within this track.

This workshop will address the theme of the conference in the aspects of courage and culture as well as human rights. In the search for an ethics that could be applicable in One Health approaches one will need to have the courage to include humans, animals, plants and ecosystems. Similarly, one also needs to discuss human rights in relation to animals, plants and ecosystems.

This workshop focus on SDG 3 in relation to other SDGs, especially SDG 10, 13, 14 and 15.

Track
Track 10d One Health, SDGs and ethical conflicts

Posters

One health dilemmas in the Peruvian Amazon: Off-label ivermectin use and COVID-19

Verónica Ormea

One Health Dilemmas in the Peruvian Amazon: off-label ivermectin use and COVID-19

INTRODUCTION

-Place: Iquitos, area with the largest number of Peruvian Amazon Indigenous communities. **70% seroprevalence** of anti-SARS-CoV-2 IgG and IgM antibodies (1) by July 2020.

-COVID-19: Pan-Amazonian region: highest total number of cases and deaths throughout South America (3.3 M SARS-CoV-2 infections and 121,000 deaths) (6).

-Health inequities (7).

-An already fragile health system

-misinformation / *infodemics*

-Ivermectin as pre/post exposure prophylaxis (4)

OBJECTIVE

This is a case report study. It describes events that occurred during the first COVID-19 wave in the Peruvian Amazon and the off-label use of ivermectin.

METHODOLOGY

Information was gathered from scientific papers, case reports and newspapers to detail the use the of ivermectin during COVID-19.

***Track 10: One Health, Sustainable Developing Goals (SDGs), ethics conflict*:**

The proposed work relates to the following Sustainable Developing Goals (SDGs):
SDG3: Good health and Well-being
SDG6: Clean water and sanitation
SDG10: Reduce inequality
SDG11: Sustainable cities and communities
SDG12: Responsible consumption and production
SDG14:Life below water
SDG15: Life on land
SDG16: Peace and justice strong institutions
SDG17: Partnerships to achieve the goals

https://sdgs.un.org/goals

RESULTS

Table 1. An overview of newspapers describing the veterinary ivermectin off-label use in the Peruvian Amazon.

Place		year 2020	Stakeholder involved		Amount donated	Sources (PRESS)	Cited by
			donation	reception			
AMAZON JUNGLE	Loreto	May-11	veterinarian	local medical college	6,000 doses in 2 weeks	Panamerica televisión (2020)	(Chamie-Quintero et al., 2021)
		June 18	medical doctor	General public	15,000 doses	Diario Ahora (2020)	
	Nauta, Loreto region	june 19	A mayor, evangelical group	General public	Delivering 500 doses plus a donation of 1,000 additional supplies	El Comercio, 2020	(Fowks, 2020)
	Ucayali	April	Political parties, government authorities	local authorities and health centers	Using radio stations promoted the application of veterinary ivermectin to 5,000 people aprox.	El Pais (2020)	(Chamie-Quintero et al., 2021)

Table 2. A published case report on the subcutaneous application of veterinary ivermectin as COVID treatment

Amazon Jungle	Loreto	not date report, published on 06/12/2020	2 patients with skin ulcers after ivermectin subcutaneous application as prophylaxis	Source: scientific report: Ramal-Asayag et al., 2020

CONCLUSIONS

- Ivermectin is an example, where the (governmentally recommended) application of a medicine withouth health professionals advice may result in environmental impacts.
- Similar off-label use of veterinary drugs did not occur with steroidal anti-inflammatory drugs (recommended by the WHO during COVID-19).
- Fragile health systems needs to become more resilient. Some obstacles for resilience include regulatory boundaries.
- Integrating Traditional Amazonian medicine in the health system could add to better resilience.

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Verónica Ormea
Universidad Peruana de Ciencias Aplicadas, Peru
veronica.ormea@upc.edu.pe

UPC Universidad Peruana | University of | University of Massachusetts

5/17/2022

10. Special themes

10e. Handbook of Sustainable Development Goals

Abstracts

Chances and Challenges In Implementing Sustainable Development Goals in Disaster Risk Management and Post-Catastrophic Crisis Management – Case Study on the German Ahr Valley Region

Dipl.-Ing. Sandra Reinstädtler

Independent Scientist as University of Technology (TU) Dresden - Alumna, Dresden, Germany. Former External Doctoral Researcher and former Scientific Associate, Lecturer and Doctoral Researcher, Brandenburg University of Technology (BTU) Cottbus-Senftenberg, Department of Environmental Planning, Cottbus, Germany. Former Visiting Lecturer, University Brunei Darussalam (UBD), Gadong, Brunei Darussalam

Abstract

Severe flood events in the German Ahr Valley Region, such as historically happened on 21st July 1804, 13th June 1910, and the actual natural disaster in the night from 14th to 15th July 2021, all with many deaths, severe devastations, destructions, are calling for more Sustainable Development (SD), resilience building. Especially in disaster risk, post-catastrophic crisis management, Sustainable Development Goals (SDGs) might be a potential transmitter in planning, policy, or practice (3Ps) to enhance courageous but morally binding SD processes. This case study on Ahr valley wants to evaluate chances and challenges in 3Ps engagements for successfully implementing SD and SDGs into this strongly by the flood disaster, and COVID-19 pandemics threatened area.

The case study and short-termed action research started directly after the 2021 flood disaster in Ahr valley with observations three weeks after the flood. The main methodological contribution lies within a conceptual framework for Lusatia Region developed sustainability screening, named "INASTAREC-Sustainability Screening". Its long-term research result of a screening procedure inhabits a pre-assessment for diverse worldwide regions to receive initial sustainability data and information about a specific region, here for the German Ahr Valley Region.

The findings of INASTAREC-Sustainability Screening are twofold: on the perimeter of Ahr Valley Regions` watershed, results are shown by excerpts of the eight topically different screening steps and an assessment on the existing main five at least European to German common spatial planning levels from international (I), national (NA), state (STA), regional (RE) and communal (C) planning level. The exemplarily shown excerpt of screening processes was fulfilled to highlight synergistic sustainability effects and strengthen SD and SDGs in different land use forms on landscape scale. It was further gained to build solutions for supporting resilience structures through SDGs, general SD initiatives. Establishing first incentives for guiding SD and transforming found sustainability-chances into activating opportunities gives the further important finding of making regions such as Ahr Valley fit for the future and strengthening against existing crises in case of climate change, COVID-19 pandemics, natural hazard predestinations, or happened natural disasters.

The effectiveness of SDGs, SD targets is a severe challenge with many stressors, especially in post-catastrophic crisis management where survival, existential needs, or simply quickness in rebuilding a devastated area has to be secured urgently and timely. Time, finance, and other factors hinder the implementation of SD or SDG processes. However, the strongest network exchange, courage combined with cultural-artistic, natural, and human rights backgrounds, is necessary.

How to accelerate chances and minimize challenges in implementing SDGs or SD procedures into a disaster-threatened region such as Ahr valley are some of the results of having created an SDG-related „Emergency Take-Away". Flagship-SDGs processing does not have to end up in privileged areas but can and must contribute to 3Ps good processing and finalizing Agenda 2030 against several crisis-related priorities successfully.

Keywords: Ahr Valley Region, SDGs stressors and chances, Policy+Planning+Practice (3Ps), Disaster Risk Management, Crisis Management, Cultural Landscapes, Sustainable Development Implementation

Track
Track 10e Handbooks of sustainable development goals

Co-Design and Regenerative approaches towards SDGs Territorialisation for the Communities in Transition. A pilot project for the implementation of Agenda2030 in the Metropolitan City of Reggio Calabria

Arch. PhD Giuseppe Mangano

ABITAlab, Department of Architecture and Territory-dArTe, Mediterranean University of Reggio Calabria, Reggio Calabria, Italy

Abstract

In order to trigger sustainable transformations and mitigate possible inconsistencies between the Agenda2030 and sustainability policies, the UN has encouraged national governments to build their own National Sustainable Development Strategy, capable of "territorializing" the SDGs at local level. If, on one hand, global initiatives "in the context of policies for Climate Change and Sustainable Development, change the paradigms of the transition to economic and social, as well as environmental scenarios of the Fourth Industrial Revolution", on the other hand, it seems necessary to adopt an integrated approach to generate programs and projects for the "[...] dissemination of urban and territorial issues, experimenting best practices [...], pursuing processes of involvement of communities and engaging public investments"[1].

It means applying in a "transdisciplinary" way methodologies and operational tools of co-design in multi-level and multi-actor project experiences[2], in order to co-implement actions in which the aspects related to environmental, social and economic sustainability are closely related to the ability to transfer them to the communities, preparing the necessary field of knowledge and skills on contemporary scenarios for sustainable development and digital and ecological transition, according to "fair and equitable" mechanisms[3].

This trajectory is currently being experimented at local level with the project *RCMetro Citizens in Transition*[4], aimed at the construction of the "Metropolitan Agenda in implementation of the National Strategy for Sustainable Development". Through knowledge transfer and capacity building actions "Knowledge MetroCity" (seminars and co-design workshops on sustainability, innovation and enabling technologies), which have involved an open "Civic Ecosystem" (professionals, university and high school students, institutions, associations, citizens...), it has been possibile to act on the targets of the SDGs 4-"Quality education", 7-"Clean and accessible energy", 9-"Business, innovation and infrastructure", 11-"Sustainable Communities and Cities", 12-"Responsible production and consumption", 13-"Climate action" and activate monitoring processes of the projects in accordance with the set of the 43 indicators shared by the National SD Table for the "Planet" and "Prosperity" areas of the SNSvS.

The results obtained in the medium term and the creation of a "community" educated on the issues of transition, have the ambition to project themselves on identified integrated trajectories of the Metropolitan Strategic Plan, with particular reference to the possibility of launching innovative experimentations with high regenerative rate in territorial areas such as the inner areas of metropolitan city of Reggio Calabria, in implementation of the provisions of the RRP-Missions.

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Track
Track 10e Handbooks of sustainable development goals

Conserving Water Resources for Achieving Sustainable Development Goals in Bangladesh: A Legal Analysis

Ms Zelina Sultana[1], Ms Nasrin Akter[2]

[1]Department of law, Jagannath University, Dhaka, Bangladesh. [2]Department of Land Management and Law,Jagannath University, Dhaka, Bangladesh

Abstract

Protection of water resource and maintaining quality of that can pave the way to attain sustainable development goals (SDGs) by 2030 for the countries. Bangladesh has already taken many initiatives to achieve the SDG targets but many efforts have yet to be done to meet the commitment of no one left behind. Water, a vital natural resource, is becoming scarce and contaminated in Bangladesh due to many anthropogenic reasons as well as climate change increased salinity instruction. Water resources should be conserved and maintained in order to accomplish the Sustainable Development Goals (SDGs), notably target 6 linked to clean water and indirectly to the other eight goals. The extant plans, policies and the institutional protection mechanisms for water resource conservation and management in Bangladesh prove weaken and tend to exhausted ecosystems, human health and accelerate poverty rate. This research attempted to analyze Bangladesh's existing legislation and policies for the conservation and management of water resources for balancing environment and attaining SDGs as well as regulated by its environmental and development related policies and plans. It also focuses on the limitations of existing instruments to find out the robust solution for water resources conservation. In doing so, we will rely on policy analysis methodology by which we can analyze the extant policies and plans. However, we find that excessive pollution, demand for fresh water, lack of synergy between multiple institutions, and lack of coordination with other SDGs remained a persistent concern for Bangladesh. This is surely detrimental to maintain environmental equilibrium and in achieving the SDGs. Thus, on the basis of findings, we contend that SDGs and other relevant national targets might not be achieved if just water resource conservation, regulation, and management actions are carried out independently without coordination with other relevant SDGs goals and activities.

Track

Track 10e Handbooks of sustainable development goals

Exploring Agenda 2030 through the 5Ps lens

MSc Matheus Gobbato Leichtweis[1], MSc Raiana Schirmer Soares[2]

[1]Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. [2]Universidade de São Paulo, São Paulo, Brazil

Abstract

In the preamble of 'Transforming our World', the 5Ps ['People', 'Planet', Prosperity', 'Peace' and 'Partnership'] are presented as 'areas of critical importance for humanity and the planet'. Many argue that the 5Ps are a key to emphasise the synergies and trade-offs between the 17 goals, given that they combine core values and principles of the Agenda 2030 for Sustainable Development. In a sense, the 5Ps can be read as a continuation of the tripod society, economy, environment (the three-dimensional understanding of sustainable development), now translated, respectively, to people, prosperity and planet, with the addition of Peace and Prosperity.

In this study we investigate the role of the 5Ps in Agenda 2030, and the nature of their relationship with the SDGs. We aim to identify and problematise mainstream interpretations of this relationship, seeking to understand how the 5Ps could be better used to guide action towards the implementation of the SDGs, overcoming the Agenda´s fragmentation by strengthening the link between the SDGs (detecting synergies and trade-offs). According to what we identify as the mainstream approach, each SDG is categorised in one [exclusive] dimension' of the 5Ps. We argue that this interpretation reinforces the compartmentalisation and fragmentation of the SDGs, creating clusters, or silos that still reproduce 5 isolated Ps instead of 17 isolated goals.

Instead, by interpreting the 5Ps as 'core values' of Agenda 2030 and by emphasising the role of values in international legal making, governance and policy development, we propose a new a approach, a new 'lens' design which accounts for a value-based, integrated, multidimensional and holistic way of reading the interplay between Ps and SDGs. We claim that the Agenda and SDGs should be interpreted as synergically related to all the Ps, and vice-versa. Thus, instead of 5 segregated lenses (each P as an independent lens), we suggest the use of a single, integrated lens, whereby Ps themselves are seen as deeply interconnected and each of the SDGs as multidimensional.

We use the lens as a metaphorical tool to suggest that through the use of this integrated approach one would be able to see each and every SDG, or the Agenda 2030 altogether, as a three-dimensional array in which society, environment and economy are assessed as in relation to each particular conjuncture, with socio-political contexts also considered. We claim that our lens approach is capable of delivering a context-based three-dimensional understanding of the Agenda 2030, whereby people-planet-prosperity represent the substance of the agenda and of sustainable development; while the peace-partnership axis represents the transversal, cross-sectional elements that frame and regulate the actions and procedures of states, private actors, and stakeholders in general. Ultimately, our 'lens' is a critical exercise that allows us to rethink the internal and external connections between the goals and the legal-political environment that structures them.

Track
Track 10e Handbooks of sustainable development goals

Operationalization of an Innovative Theoretical Research Approach for Spatially Determining SDGs – Implementing Spree Forest and Lusatia Regions Land and Environmental Systems Model into the flood disaster-damaged Ahr Valley Region in Germany

Dipl.-Ing. Sandra Reinstädtler

Independent Scientist as University of Technology (TU) Dresden - Alumna, Dresden, Germany. Former External Doctoral Researcher and former Scientific Associate, Lecturer and Doctoral Researcher, Brandenburg University of Technology (BTU) Cottbus-Senftenberg, Department of Environmental Planning, Cottbus, Germany. Former Visiting Lecturer, University Brunei Darussalam (UBD), Gadong, Brunei Darussalam

Abstract

Half-way through Agenda 2030, the question about effective 17 Sustainable Development Goals (SDGs), combined sustainability, land-environmental systems, transformative science, and SDGs successful operationalization on the ground must be critically evaluated. Catalyst of this research was the flood disaster in mid-July 2021 and simultaneously threatening COVID-19 pandemics in Ahr valley and surrounding regions in Germany. Topical entrance into this case study was a (short-termed) initiative action research about sustainable development and courage, together with culture, art, and human rights, leading to constructive solution transferors against devastating natural hazards for disaster risk-, post-catastrophic crisis management.

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 into the flood-destroyed Ahr Valley Region. SDGs were validated to be spatially determined through the regional planning level, landscape scale with the planning instrument of landscape units, and by the help of the operationally implanting „Climate Adaptive Land Use within Landscape Units and Drought and Water Management" ($CA(LU)^2WA$) proactive landscape meta-model. The incrementally worked out theoretical framework with applied research parts was examined in exemplary form within a comparative study alongside Ahr valley and Lusatia Region. Assessment excerpts were selected throughout the main driving forces for enabling a sustainable, timely reconstruction of Ahr river landscapes.

The first results of the short-termed action research being based on past, long-termed theoretical combined applied research pillars show that the framework is not only specialized on ideal „prototype region" of Lusatia and inhabited Spree Forest. Instead, it is generalized enough, transferable for even abiotically, biotically, socio-culturally different, and diverse regions. Therefore, it is a possible transmitter to enable transformative research and practice processes in the Ahr Valley Region. Moreover, SDGs implementation, $CA(LU)^2WA$ model and its applied instrumentations help guide land-use concerns into "Climate Smart Planning" and an "Integrated Drought and Water Management".

A critical area within discussions of transferability and implementation ability of SDGs is the status of the strongly flood-destroyed, pandemic-affected Ahr valley. However, the region transferable framework secures lighthouse guidance, possibly decision support, and at least structured, transparent data and processing forms. Nevertheless, reconstruction pressures for quick functioning (blue-green) infrastructures, basic existential needs of the inhabitants are giving rare timeframes for long-termed, sustainable solutions in general. Therefore, a functioning, practicable, pragmatic conceptual model is important while quickly determining sustainable solutions in spatial planning spheres throughout UN SDGs.

Gaining regional (land) resilience in the flood disaster-, COVID-19-impacted Ahr valley and flourishing culture, combined nature, art, human rights require greatest amounts of courage, communication, and hope. Global SDGs and the CA(LU)^{2}WA framework is coupled with innovative and well-known assessment methodologies to rebuild a destroyed region, reconstructing it in a high-ranged, sustainable, resilient future-saving, capacity-building flagship way. This research supports processes around the fourth cultural pillar in sustainable development transformations. At the same time, re-unifying culture and nature as a synergetic functioning system can enhance interdisciplinary sustainability science, sustainable development goals research, and buffer future climate change-, disaster-, crisis-related pressures.

Track
Track 10e Handbooks of sustainable development goals

The core values and drivers for building future businesses – How born-sustainable and sustainability-driven companies contribute to the SDGs

Svenja Damberg[1], Ulla Saari[2], Morgane Fritz[3]

[1]Hamburg University of Technology, Hamburg, Germany. [2]Tampere University, Tampere, Finland. [3]Excelia Business School, La Rochelle, France

Abstract

The principal values and drivers of born-sustainable and sustainability-driven companies are built in the core of the companies' business models. These sustainable business model elements are crucial for achieving some of the critical SDGs in the business context. The emphasis given to sustainability values in born-sustainable companies, and their impact on the sustainable business model development of the companies from the very start, can help in creating more positive impact to society and the environment. Previously, the 3P's (People, Planet, Profit) approach has given some general guidance to companies on how to consider social and environmental aspects, instead of too much focus on the financial success of a company. However, this is clearly insufficient, as the corporate social responsibility activities in many companies have not been incorporated tightly enough into their respective business models. In fact, we argue that those businesses focusing mainly on the profit side of their business will not be able to provide anymore safe solutions to society and the environment.

The theoretical background in this research is based on the ecopreneurship and sustainable business literature. We apply a case study methodology with case companies from the textile industry, cosmetics industry and food sector, i.e. companies developing consumer products in large volumes with a strong social and environmental impact with their business activities. For this purpose, we use secondary data sources, such as public information on the case companies and their websites, and previous research on the companies. The case companies include, for example, Patagonia and The Body Shop.

We analyze how born-sustainable companies present themselves, including how they have built their business by focusing on their business history and core values. Some case companies have already been established before 2012 when the SDGs were formed and published in the UN conference in Rio de Janeiro. Therefore, we also assess to what extent these companies that are considered "born-sustainable" are living up to the SDGs, focusing on the goals that are relevant to the sector in which the company operates in. Based on our analyses, we address the topic of "building blocks for the post-SDG 2030 agenda" that could help in transforming the business context and address the key elements in the sustainable business models that future born-sustainable companies and start-ups need to already consider from their early entrepreneurship and innovation journeys. Moreover, these components could offer some guidance for incumbent companies that need to update and develop their business models in order to become more sustainable and aligned with the SDGs.

Based on our findings, we present a conceptual model on how born-sustainable companies initially build their business models on a sustainable foundation that promotes the key SDGs. This will help to build more sustainable business ecosystems, i.e. ecosystems that focus on sustainable eco-quality and social practices as well as promoting sustainable consumption behavior that does not support overconsumption among consumers. Thus, born-sustainable companies with future-oriented sustainable business models and practices could help to ensure overall well-being in society and have a positive impact on the natural environment.

Track
Track 10e Handbooks of sustainable development goals

10. Special themes

10f. Religion, Courage and Sustainable Development

Abstracts

Catholic Green Social Teaching -The Devil in the Details

Associate Professor Johan Gärde

Marie Cederschiöld University, Stockholm, Sweden

Abstract

Catholic Social Teaching (CST) is a normative tool to promote the Social dimension of the Christian Faith by the Pope and central authority, the Church extended on the national and local levels. Combined, this authority plays a central role with a more conservative/traditional role focusing on dogma or, as in the case with the latest pope Francis, a progressive courageous voice for Social Justice, Human Rights and Sustainable Development. The current pope has shown that a comprehensive change is needed on all levels, an approach which has been welcomed by the Secularized world, but very much questioned within major circles in the Catholic Church.

This paper will treat CST and perspectives on Sustainable Development, through Critical Discourse Analysis. At the focus will be the two Social Encyclical Letters written by the current Pontiff, with an examination of his core policy statements on sustainability in relation to Agenda 2030 and the call for participation/dialogue in the global synodal process, launched in 2021.

In order to understand the context of these texts, the concept of central and local authority in the Catholic Church needs to be examined, using system theory and in van der Ven's words, "social system, systemic equilibrium, systemic limit, environment and systemic pluralism." Parsons' theory of culture and religion is also a relevant analytical tool in this regard, where the green elements of Catholic Social Teachings could be understood in different dimensions, such as "ultimate reality, ultimate order, spheres of life and activities."

The two CST-documents that were published by Pope Francis were:

1. The first Green Encyclical Letter "Laudato Si" (2015) on Environmental issues and Climate Change.
2. The Encyclical Letter "Fratelli tutti" (2020), which proposes "fraternity and social friendship as the ways indicated to build a better, more just and peaceful world, with the commitment of all: people, institutions, the economic world, international organizations, civil society."

The authority within the Catholic church is both centralised/hierarchical but also decentralised since the reforms of the Vatican Council II (1962-65), where structures on the national and local levels were enhanced, such as National Bishop Conferences, the 2 248 Dioceses around the world and Orders, Congregations and Lay Movements. The Systemic Pluralism of the Catholic Church is her strength and weakness, especially in a more globalised, polarised and fragmented world. The way the current Pope has promoted social and green policies shouldn't be underestimated, but the question is whether this agenda of change can be sustained over time in a complex environment with systemic limits. Van der Ven suggests a process-oriented method of reciprocal exchange, understanding of the basis of reciprocal exchange of perspectives, and the formation of consensus.

The assumption is that there is no consensus on a Green Catholic Social Teaching when it comes to concrete measures (spheres of life and activities) but possibly more viable (and/or vague?) in the spheres of ultimate reality and ultimate order. The Devil is probably in the details.

Track
Track 10f Religion, Courage and Sustainable Development

Political Socialisation, Enrolment Process and Ideology Building of College Youth

Ms Kokila Shetty

Tata Institute of Social Sciences, Mumbai, India

Abstract

Political socialisation is a continuous unconscious process by which political cultures are maintained and changed whereby the individuals are inducted into the political culture and their orientations are formed. Thus, it is a process by which the ethos and behaviour of a political system are communicated from one generation to another. The essence of this study is the process by which an individual or a group of people acquire political values which is not only through their active political participation but also through their continuous exposure for a period before they engage in political activity.

Children have a natural tendency to imitate their parents which diminishes over a period and a child learns a lot from outside the family. Nevertheless, the influence of the parents is never completely wiped off from the mind. Family as a unit is conservative and is also the main hurdle in social and political change wherein the child learns about political change and participates in them. After family and peer group, the individual comes in contact of educational institutions. It is not an exaggeration to say that the influence of educational institutions upon political socialisation is more than that of the family, which is evident today wherein the governments of most of the countries of the world try to control the educational institutions. Educational institutions are the biggest means of propagating political ideas, values and patterns of behaviour. Economic and moral aids to universities through political parties, typical changes in curriculum and specific ideology holding teachers are some of many ways of political socialisation.

Whatever maybe the present political bent in a country the function of political socialisation is to maintain the present patterns of polity. Higher education is often an important site for youth activism, and it also provides an opportunity for young people to engage in a social critique. Different political parties have often liquidated these opportunities and opened their student wing.

The proposed abstract relates to sustainable development goals SDG4 Quality Education. The study is an exploratory one and has employed a qualitative research approach. Looking at the sensitivity of the field the researcher decided to take the in-depth interviews of college youth and participant observation as tools to collect data. Data has mainly been collected from 50 respondents belonging to two colleges and one university in the city of Mangalore in Karnataka, India. The richness of the data findings indicates that student are politically socialised or has been influenced by the family, peer group, school and another social group from their childhood.

The paper aims to explore the political socialisation of a youth before they make a choice to join the student's organisation and their engagement with it. With the help of this study, the researcher further aims to bring out the undercurrents and motives of the relationship between the youth organisation and political parties. These political organisation for their own vested political and communal interest have appropriated the education structure and resources leading to displacement of educational goals.

Track

Track 10f Religion, Courage and Sustainable Development

The Political Economy of Faith and Coexistence in a Failed State in West Asia and North Africa (WANA)

Professor Eugene Sensenig

Notre Dame University-Louaize, Zouk Mosbeh, Lebanon

Abstract

This paper builds on the ongoing discussion concerning sectarianism and coexistence in West Asia and North Africa (WANA) using a base-superstructure approach. It asks which role organized religion and person faith currently play in societies in which the power elite is intentionally promoting state failure and a collapsing economy for personal gain. This study will focus primarily on the proverbial 'Lebanese situation', but will draw conclusions concerning the impasse faced by faith-based politics and social activism, dealing primarily with the role of progressive Christianity in the WANA. The data collected for this paper is part of two ongoing studies being carried out by the Gender, Communications and Global Mobility (GCGM) studies unit in the Faculty of Law and Political Science (FLPS) at Notre Dame University (NDU). The first, "The Legacy of Christian Social Activists and Social Justice in the Middle East" is ongoing since 2016. The second, "The Political Economy of Sectarianism and Coexistence" is being carried out with support of the UN's OHCHR as of 2019 and intersects with the collapse of the Lebanese political system and economy as of that year.

An attempt will be made to demonstrate that the integration of religious institutions within the political and economic elites, dating back to the Ottoman Tanzimat reform period between 1839 and 1876, went hand-in-hand with an integration of the WANA region in the global cash-crop economy, thus destabilizing and eventually undermining the foundations of coexistence, as argued by Ussama Makdisi (2000 & 2019). It will further argue that as progressive Catholic and Protestant social justice movements spread from the imperial centers to the colonies in the 20th century, this did not take place in the WANA because of the lack of a socio-economic base for such faith-based superstructure movements. Finally, it will deal with concrete examples of ongoing struggles of marginalized groups to confront the impact of state failure and a collapsed economy on people with disabilities, refugees and migrant workers. It attempts to understand why progressive movements are rarely faith-based and faith-based groups and individuals are seldom progressive. A comparison will be drawn with Latin America, Sub-Sahara Africa, and the Philippines to look for the roots of the crisis of Leftist Christianity in the WANA.

Finally, this paper will deal with 'local heroes', i.e. individual Christian activists and initiatives who are struggling against the pervasive cultural of impunity and structural injustice and evil in the region. It will juxtapose this courageous behavior with the complacent and/or complicit actions and positions taken by the religious elites. Reference will be made to SDGs 1 (poverty), 2 (food security), 6 (water & sanitation), and 7 (energy), all linked to the intentional overall collapse of Lebanese infrastructure. Special emphasis will be placed on SDG 16.3, 16.5, 16.7 and 16.10.b, linking the rule-of-law, anti-corruption, social justice agendas to Christian social theory in the WANA.

Makdisi, Ussama (2019). Age of Coexistence, Univ of California Press: Oakland CA

Makdisi, Ussama (2000). Culture of Sectarian, Univ of California Press: Oakland CA

Track

Track 10f Religion, Courage and Sustainable Development

Tracing the history of Bangalore's Infant Jesus Church through oral history and memory

Mr Pramod P Harle

St. Joseph's College (Autonomous), Bangalore, India

Abstract

The city of Bangalore in the state of Karnataka in Southern India is known around the world for being a hub of Information technology organisations. But in recent years the city and the state it belongs to has been in the news for religious persecution. The minority Christian and Muslim citizens are increasing made to feel like second-class citizens. In this challenging environment one can find Bangalore's relatively young Infant Jesus Church being a defiant site of syncretism. The church that started out as a 'tent' in 1971 is now an integral part of the urban religious landscape of the city and attracts thousands of devotees. The city's newspapers too would be complete without the numerous 'Thanksgiving' advertisements directed to Infant Jesus placed in them every Thursday.

This paper traces the history of Infant Jesus Church, Bangalore using oral history interviews with devotees who live around the church and people who frequent the church. These personal interviews collect stories and through these stories the paper highlights collective memories, myths and legends that can be connected to the larger volume history of the church. The paper also points to historical practices of the church and links it to other practices in the city and in other parts of the world.

The paper additionally shows the different foci of the 'official' history and the history pieced together through memory. It also shows how the church and the venerated image of Infant Jesus bring people of different faiths together to form a community of worshipers.

The proposed abstract relates to the sustainable development goals - SDG 10: Reduce inequality within and among countries, target 10.12 and SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable, target 11.4.

The proposed abstract relates to the theme of the Conference – "Sustainable Development and Courage. Culture, Art and Human Rights" especially track 10f (Religion, Courage and Sustainable Development). As Christian and other minority communities are increasingly being targeted by the state for political gains this paper serves as a reminder of the time before divisive politics poisoned the minds of people. The paper also serves as a repository of the community's stories and memories in a time when the state is overwriting history by suppressing minority voices.

Track

Track 10f Religion, Courage and Sustainable Development

Full papers

Laudato Sì and Sustainability

Paul O'Hara[1]

[1]*Istituto Universitario Sophia, Figline e Incisa Valdarno, Italy, paul.ohara@sophiauniversity.org*

Abstract

On reading *Laudato Sì*, one cannot but be impressed by the anthropological approach it takes to the whole of the creative process and the way it characterizes the human person not only as the apex of creation but also as made in the image and likeness of God. This tying together God and creation through the vocation of man is one of the distinctive characteristics of the encyclical. It aims not only to be a social commentary on the state of today's world but does so by bearing in mind the dichotomy (dialectic) between the teleological end of creation foreseen as the new heavens and new earth of St. Paul and the current tragic situation of a world falling apart both ecologically, socially, politically, economically, and morally speaking. On the one hand there is the vison of faith and the greatness of the human vocation and on the other, there is a world of human creation that if it is not held in check risks destroying itself. Many people of faith undoubtedly see God's love in the current situation, whereby we are being called to recognize our human limitations and ask His help in overcoming the obstacles, while in contrast there is also a materialistic approach which sees the answer as lying only with science. And although, the two approaches do not have to be in opposition and should work together to solve problems, unfortunately, it is not always so. One needs to be realistic and recognize that for many today, God has been cut out of the equation. Man-made climate changed induced by chemical imbalance has become the only permissible explanation as to why we have so many hurricanes and destructive tropical storms. Rarely, if ever does one hear the suggestion that nature's rebellion might be an expression of human rebellion against God and consequently a breakdown in the human mediation between God and his creation. It takes courage to speak the truth, it takes courage to face the truth about oneself, and to recognize that without religious values, sustainability is not realistic. In this presentation, we will try to explore this more in depth in relation to *Laudato Sì.*

Keywords: Sustainability, Bottom-up versus Top-down, Methodology, Cybernetics

1. Introduction

In any scientific conference, it is best to begin with some definition of the terms. Unlike mathematics, definitions in the social sciences tend to be more of a heuristic nature and presuppose a philosophical position. For the purpose of this article we will use the definition of "sustainability science" formulated

by Jian-Guo Wu et al. which states that "Sustainability science is the study of the dynamic relationship between humans and the environment, particularly focusing on the vulnerability, robustness, resilience, and stability of the coupled human-environment system. It is a transdisciplinary science that integrates natural sciences with humanities and social sciences" (Wu et al., 2014). On reading this the first word that came to mind was "holistic" as a way of understanding the "coupled human-environment system" that is both "transdisciplinary" and "that integrates the natural with the humanities and the social science." However, having said that it is not clear what is meant by the term "integration" in the above context. The fact that the authors are Chinese suggests that Catholic theology was not on their minds when referring to a "transdisciplinary science" although one cannot exclude the influence of Confucian thought in their understanding.

Regardless, one must be aware that Pope Francis, in virtue of who he is, offers a Catholic theological perspective when speaking of the integration of the natural and social sciences. With that said, on reading *Laudato Sì* [LS], one cannot but be impressed by the historical anthropological approach it takes to the whole of the creative process and the way it characterizes the human person not only as the apex of creation but also as made in the image and likeness of God (Bible, Genesis 1:26). This tying together God and creation through the human vocation is one of the distinctive characteristics of the encyclical. It aims not only to be a social commentary on the state of today's world but does so by bearing in mind the dichotomy between the teleological end of creation foreseen as the new heavens and new earth of St. Paul and the current tragic situation of a world falling apart both ecologically, socially, politically, economically, and morally speaking. On the one hand there is the vison of faith and the greatness of the human vocation and on the other, there is a world of human creation that if it is not held in check risks destroying itself (LS, 79):

> In this universe, shaped by open and intercommunicating systems, we can discern countless forms of relationship and participation. This leads us to think of the whole as open to God's transcendence, within which it develops. Faith allows us to interpret the meaning and the mysterious beauty of what is unfolding. We are free to apply our intelligence towards things evolving positively, or towards adding new ills, new causes of suffering and real setbacks. This is what makes for the excitement and drama of human history, in which freedom, growth, salvation and love can blossom, or lead towards decadence and mutual destruction. The work of the Church seeks not only to remind everyone of the duty to care for nature, but at the same time "she must above all protect mankind from self-destruction".

When *Laudato Sì* was written Covid-19 had not yet appeared on the scene but nevertheless one can deduce, from the encyclical, that Pope Francis would have used the pandemic (as he has already done) to call us to conversion (LS, 216-221; O'Connell, 2020) not in some abstract way but in a way where "realities are more important than ideas," (Pope Francis, *Evangelii Gaudium*, 231-233, 2013) emphasizing a twofold approach that involves a return to the subject characterized by an inner union

with both creator and with one another (LS, 220). Our need to be loved and respected also requires that we need to love and respect each other, which also requires working together to solve the current planetary crisis. Ironically, it is the same crisis that seems to widen the dichotomy on both sides. On the one hand, many people of faith undoubtedly see God's love in in the current situation, whereby we are being called to recognize our human limitations and ask his help in overcoming the obstacles, while on the other hand, there is also a materialistic approach which sees the answer as lying only with science. And although, the two approaches do not have to be in opposition and should work together to solve our difficulties unfortunately, one has to be realistic and recognize that for many, God has been cut out of the equation. Human made climate change induced by chemical imbalance has become the only permissible explanation of why we have so many hurricanes and destructive tropical storms. Rarely, if ever does one hear the suggestion that nature's rebellion might be an expression of human rebellion against God and consequently a breakdown in human mediation between God and his creation that "ends up provoking a rebellion on the part of nature" (LS 117). For example, earthquakes, tsunamis and volcanoes cannot be explained by climate change, no more than they explain social unrest (which seems to be on the increase) and economic breakdown. Yet there tends to be an ideological conviction that the only problem is climate change and that other factors are secondary if not unrelated.[1] On the contrary, within the context of Christian theology, the divisions within our hearts are the prime cause of all rebellion, and this division also impacts nature as noted by Francis in par. 2 of *Laudato Sì*:

> The violence present in our hearts, wounded by sin, is also reflected in the symptoms of sickness evident in the soil, in the water, in the air and in all forms of life. This is why the earth herself, burdened and laid waste, is among the most abandoned and maltreated of our poor; she "groans in travail" (Rom 8:22). We have forgotten that we ourselves are dust of the earth (cf. Gen 2:7); our very bodies are made up of her elements, we breathe her air and we receive life and refreshment from her waters.

In addition to have forgotten that "we ourselves are dust of the earth," we seem to have also forgotten that we are made in the image and likeness of God. God intended us to be mediators while at the same time respecting our right to say "no" to that mediation, but that "no" has consequences. If the mediation is broken, then nature rebels on all levels. Perhaps that is the real remote cause of climate change. Consequently, putting our faith in science alone (and putting God on the back burner by ignoring him) is ironically for people of faith a form of practical atheism that contributes to both many human-made and natural disasters. So, the dilemma is real and the choices are two: to fall on our knees and implore God's imminent and immanent help whereby we recognize we are mere creatures who need His guidance in making scientific decisions in a way that respects our being co-creators (and co-redemptive)

[1] LS 23 recognizes the key role of the greenhouse gases in promoting global warming and climate change. However, nowhere in the encyclical does Pope Francis suggest that it alone is the cause of the social breakdown that we are witnessing today. The call to ecological conversion is primarily an inner call that requires a correct relationship with God and one another and consequently with nature: [LS, 220].

with Christ or to find an expedient political solution that appeals only to scientific method but forgets that we are mere mortals with limited capabilities who more often than not fail to see the bigger picture. To quote from *Laudato Si* (LS 199):

> It cannot be maintained that empirical science provides a complete explanation of life, the interplay of all creatures and the whole of reality. This would be to breach the limits imposed by its own methodology. If we reason only within the confines of the latter, little room would be left for aesthetic sensibility, poetry, or even reason's ability to grasp the ultimate meaning and purpose of things.

Unfortunately, science by being associated with a "technocratic paradigm" risks being the new ideology of our day (LS, 107-109) and like all ideologies it is doomed to bring about its own failure and eventual reversal[2] (Lonergan, *Insight*, 1957). The order of being, can be ignored but it cannot be eliminated no matter how much we try but what is the way back?

2. Method: A bottom-up versus a top-down approach to the unity of the Cosmos

Anyone familiar with Christian anthropology is aware that God's presence is immanent in all of creation and that there was only one act of creation extended over time and history. It is the ultimate expression of Pope Francis' precept "Time is greater than space" (Pope Francis, *Evangelii Gaudium*, 222-225, LS 178). Indeed, God's continuous immanence is what makes us exist in the present moment. As *Laudato Si`* (LS 233) points out the Universe (creation) is one and everything in it is dependent upon everything else.

The universe unfolds in God, who fills it completely. Hence, there is a mystical meaning to be found in a leaf, in a mountain trail, in a dewdrop, in a poor person's face. The ideal is not only to pass from the exterior to the interior to discover the action of God in the soul, but also to discover God in all things. Saint Bonaventure teaches us that "contemplation deepens the more we feel the working of God's grace within our hearts, and the better we learn to encounter God in creatures outside ourselves".

Again , in par. 236, of *Laudato Si*, Pope Francis writes

> The Eucharist joins heaven and earth; it embraces and penetrates all creation. The world which came forth from God's hands returns to him in blessed and undivided adoration: in the bread of the Eucharist, "creation is projected towards divinization, towards the holy wedding feast, towards unification with the Creator himself". Thus, the Eucharist is also a source of light and motivation for our concerns for the environment, directing us to be stewards of all creation.

[2] Lawrence Krauss, *Ideology Subsumes Empiricism in Pope's Climate Encyclical* Scientific American (Celebrating 175 Years), Guest Blog. This ideological dilemma is captured very well in an article by Lawrence Krause (in Scientific America) who comments somewhat favourably on the encyclical but also is apt to condemn the Pope for what Krauss perceives as his ideological adherence to Catholic religious doctrine. For Krause climate change can ultimately be brought under control by limiting human population (which means more contraceptives and abortions) which is in contrast with Pope Francis outreach to the plight of the poor and the injustice towards them. It should also be pointed out that Francis explicitly condemns abortion in the encyclical (cf par 120 but also there are implicit condemnations in par. 50,117,136). It is ironic that Krause acknowledges the ideological divide but sees science as in favour of truth and catholic theology as ideological. This contrasts with Pope Francis rebuke of the one-sided scientific paradigm which demeans both people and nature. (LS: par. 106, 107, 199).

The smallest molecule of hydrogen is linked to us not only through the stardust formed from the nuclear furnaces of the stars but through the fact that without hydrogen (or any element for that matter) there would be no life or anything else. "It cannot be emphasized enough how everything is interconnected. Time and space are not independent of one another, and not even atoms or subatomic particles can be considered in isolation. Just as the different aspects of the planet – physical, chemical and biological – are interrelated, so too living species are part of a network which we will never fully explore and understand" (LS,138). In other words, by way of an inner dynamism, there is an upward movement from below that allows us to exist and be formed by the physical laws of the universe. The smallest elements of existence project themselves into our lives through space and time to allow the possibility of our existence. However, our existence is more than atoms and molecules, more than the ensuing biochemical and biological laws, more than sentient and psychological principles. The unity from below, by means of an upward thrust, is also completed by a downward movement that gives meaning to the mystery of existence through the very mystery of our own existence. To understand this unity requires not only a bottom-up methodology but also a top-down one. Herein lies the mystery of our mediation between matter and God. We are both matter and spirit, and the spirit comes from above. All creation (including ourselves) acquires meaning through our mediation with our Creator. The non-human aspect of creation is dependent upon us to give it meaning, it is dependent upon us to systematize what could otherwise seem meaningless and without direction, it is dependent upon us for the new heavens and the new earth to emerge. This mediation sees God's continuous creative act at work in evolution and been guided by him towards the new creation by means of our cooperation and rebellion. The transformative act at the end of history will be an act of the Holy Spirit who as a masterful artist will take the state of the universe as he finds it, and as we have left it, and moulds it into a transcendent design beyond our grasp while using us and all that surrounds us as the raw material for this transformation. Herein, we have a top-down approach to the act of creation.

On the other hand, there are those, who see matter as having eternally existed and perceive in Darwinian evolution a chance explanation of how we came to be (natural selection) while ironically, undermining our true worth. In this model the meaning of life becomes meaningless. From a Darwinian perspective, we exist through a collection of random forces that have come together in accordance with some principle of natural selection. Our existence is a mere possible and pragmatic solution to the problem of survival and human existence and is seen as an epiphenomenon on the tree of life. Higher meaningful questions are suspended and prohibited as not been "scientifically" valid. "Our number came up by accident," as Jacques Monod (1971) maintains or at best, we can move beyond the strict interpretation of the randomness associated with natural selection and take history in our own hands by constituting our own meaning in accordance with some type of Hegelian dialectic or Nietzschian notion of the *übermensch*, whereby we are the instigators of our own meaning and create God in our own image and likeness in accordance with some robotic blueprint that we have developed or 5G technology that is

expected to become the panacea of a *Brave New World* (Huxley, 1932). Instead, these ideologies have brought about and are bringing about a great cultural collapse. When Nietzsche cried out "God is dead" and realized the consequences of evolution, he pushed social evolution to its logical conclusion[3] (Nietzsche*, Gay Science*, Book 5, para 349). The *übermensch* meant that since God was dead (and we Christians had killed him) we could now make God in our image and likeness (Wiener, *God & Golem*, 1973), with history becoming the laboratory to realize this brave new world in accordance with "the will to power." But in our day, as we watch the collapse of ideologies which have in more ways than one brought about a *Thanatos syndrome* so aptly captured by Walker Percy in his novel of the same title (Percy, *Thanatos Syndrome*), we also have, in my opinion, a succinct confirmation of Lonergan's analysis of the General Bias of Common sense (Lonergan, *Insight*, Chap 7, Sect. 8). The social surd is as much alive today as it has ever been and in spite of our intellectual and moral conversions there is still no escape from the collapse.

In this regard the encyclical of Pope Francis on the environment risks, in my opinion, being misinterpreted and reduced to a mere sociological vision guided by our futuristic dreams or fatalistic meanings. One can easily read it and overlook the novelty of the Gospel and the Christian message of hope. Indeed, it can also be a source of division among us, in the sense that there are those who will only focus on the reference to global warming in paragraphs 20- 26 and seek a more scientific and political response to climate change and those who will focus on the social injustice (including abortion) aspect of the document and feel that the emphasis is in the wrong place. Finally, there will be those who are in denial because they fear their Christian vision is threatened or their economic status undermined by the teachings of Pope Francis. Knowing how to lose does not come easy. "Regrettably," as Francis notes (LS, 14) "many efforts to seek concrete solutions to the environmental crisis have proved ineffective, not only because of powerful opposition but also because of a more general lack of interest. Obstructionist attitudes, even on the part of believers, can range from denial of the problem to indifference, nonchalant resignation or blind confidence in technical solutions."

[3] Although Nietzsche believed in evolution, he was strongly opposed to Darwin's theory of natural selection and "with its unbelievably one-sided doctrine of the 'struggle for existence'. Instead for Nietzsche evolution "resolves around supremacy, around growth and expansion, around power, in accordance with the will to power, which is precisely the will to life" (ibid. par 349). In other words, for Nietzsche "the will to power" is a guiding principle intrinsic to evolution which gives it vitality. In contrast Darwin's natural selection is guided only by a process of random selections often subsumed under the catchall phrase "the survival of the fittest," and without any other sense of purpose.

We usually can accept losses only if they are forced upon us by natural disasters, economic collapse, war, tyranny and so on, unless we perceive a Divine calling and collaborate with it. However, this presupposes an anthropology that is attuned to the Gospels, to the signs of our times, to the purity of our heart and more specifically it will be the domain of those who have a specific vocation to live for the unity that Christ prayed for when he beseeched the Father "that all may be one" (Bible, John 17), only to be followed a few hours later with the cry "My God, My God why have you forsaken me" (Bible, Matthew 27:46), as he laid dying on the cross. For the chosen ones, called to live unity, it is a noble vocation but not easy and not without its conflicts. This is one of the reasons, that Chiara Lubich compared unity to a coin with two faces, with "that all may be one," (not de pluribus unum) written on one side and "My God, My God, why have you forsaken me," written on the other (Lubich, *Essential Writings*, pp 16-26). We could say that Lubich brings together order and chaos in a new vision of unity, in accordance with the vision of Pope Francis where "unity prevails over conflict" (Pope Francis, *Evangelii Gaudium*, para 226-230). This conflict is all the more chilling because of the cry "My God, My God why have you forsaken me." For Lubich and her followers, unity is achieved not despite the cry but precisely because of it (by means of what Lonergan would call an inverse insight). Herein lies the great Christian mystery. The Holy Spirit unifies Heaven and Hell, life and death, through the cry of abandonment. Failure and sinfulness, conflict and disaster have become the cornerstone of a new creation. Apart from Chiara Lubich, perhaps no one among her followers has had a better understanding of this in a scientific setting than Piero Pasolini. For this reason and within the context of the definition given in the first paragraph, I will focus on Pasolini's use of the language of cybernetics to narrow the gap between a secular and Christian (that of Pope Francis) understanding of a transdisciplinary approach to sustainability based on a methodology that allows simultaneously for both a top-down and bottom-up approach intrinsic to the encyclical *Laudato Sì*.

3. Results and Discussion

The Charism of unity as the reconciler of the two points of view: A winner of the Marconi prize in 1942 for the best thesis in physics, written at the University of Bologna, Piero Pasolini[4] (dell'Eva, 2020) as a follower of Chiara Lubich, was inspired by her mystical writings (especially of 1949) and his own vocation to live in "focolare," to embrace a Christian view of the cosmos in which all collaborates for the glory of God. In many ways, he was ahead of his time and strived to break new ground in the dialogue between science and faith. His vision is in line with the cosmology of Pope Francis, although his language is different. However, to better appreciate this, we need to say something about their respective methodologies. Both in *Evangelii Gaudium* and *Laudatò Sì*, Pope Francis delineates a

[4] Pasolini died on 26 September 1981.

fourfold hermeneutical method for interpreting the current socio-anthropological status of the world which can be summarized as follows:

(1) Time is greater than space

(2) Unity prevails over conflict

(3) Realities are more than ideas

(4) The whole is greater than the part

In the context of his writing, Francis interprets these primarily from a socio-economic perspective. The whole is greater than the part is used to help us understand the relationship between globalization and the local scene. Time is greater than space recognizes that processes are more important than current economic schemes and that affronting social injustice is more important than ideological theories. It is also important to note that the four principles are intertwined. For example, if we remove number (3) or reverse its order then the other three principles could be used to foster an ideology. In reference to (2), if unity does not prevail over conflict, then (4) has no sense and (1) means that history will become only more chaotic (long cycle of decline) and the dominant reality is anarchy. If (1) is neglected, then we have a utopia and if (4) is put aside then we have pure reductionism.

Numerous interpreters of these four principles apply them to the social-political problems of our times, as does Pope Francis in *Evangelii Gaudium* but also in *Amoris Laetitia* and *Laudato Sì*. However, it seems to me that these precepts also serve as heuristics for understanding the whole evolutionary process from a *Big Bang to Big Mystery* (Purcell, 2011) or Big Crunch depending on your point of view), which when combined with Lubich's and Pasolini's understanding of Jesus forsaken become further enriched and better understood. Pope Francis dynamic historical analysis of the world situation is outlined in *L'amore Laetizia*, *Laudato Sì*, *Evangeli Gaudium*, *Lumen Fidei* (Time is greater than space). Although for the many interpreters of Francis, *Laudato Sì* describes a Christian anthropology of creation in an immediate setting of our current times and problems, its prophetic openness to end-times and the future (ours is not an epoch of change but a change of epoch[5]) cannot be overlooked. Within this latter context, Piero Pasolini's use of cybernetics as an interpretative key for understanding both our current historical situation and our cosmic journey towards a new heaven and a new earth can add a new dimensional to how we interpret Francis' four principles from the perspective of a top-down approach in a language that is also more compatible with science.

For anyone studying the life of Piero Pasolini, it should be clear that although he put aside his formal scientific studies of physics to help Chiara Lubich and her first companions built the newly nascent

[5] Pope Francis,(2015, 10 November). Florence: non viviamo un'epoca di cambiamento quanto un cambiamento d'epoca

Focolare Movement, he did not put aside his intellect. Indeed, by living the ideal of unity in accordance with Lubich's charism his intellectual passion comes to the fore in a new way, as he attempted to reinterpret the evolutionary process for the secular post-modern world through the eyes of faith, using a type of journalistic style that gives new and dynamic meaning as to how we live. As we shall see, Pasolini's quest for meaning can be summarized through his use of the cybernetic principle to explain that unity brought about through our love of Jesus forsaken. This principle, rooted to our being at peace with ourselves and one another (unity prevails over conflict), serves as both the hermeneutical key and heuristic notion to resolving conflict. He touches on many of the topics mentioned by Pope Francis in his *Laudato Sì* but does so by combining science and spirituality.

Piero Pasolini and Cybernetics: As mentioned, the Christian perspective of creation implies a quest for meaning which sees the unity of the cosmos as essentially coming from a top-down principle, while embracing an inner spiritual impulse that is bottom-up. Polkinghorn (2000) for example takes this approach[6] as does Piero Pasolini[7] (1985) who tries to explain this using the language of cybernetics, much of which can be reinterpreted in the light of Pope Francis' four principles:

(Translation from *L'Unità del Cosmo*): In this way the absolute, instead of being postulated as a deus ex macchina only for some transcendent jumps, is presented as a true Deus in natura rerum, distinct and immanent at the same time, intimately adhering to actions of beings, to their creation and being created by way of transcendent cybernetic acts.

First a few words on the meaning of cybernetics. Cybernetics was a word coined by Norbert Wiener (1948/1967) to describe the science of feedback systems. The original Greek meaning refers to the "steersman" at the helm of a ship which as he points out was probably one of the first uses of feedback in human technology. The direction that a ship takes is constantly self-corrected through the steersman. Wiener himself first used the principle to develop heat seeking missiles. Later he (and others) developed a theory of cybernetics to embrace any technological system based on feedback systems. For Wiener (and others) the feedback systems are controlled by merely mathematical laws. Nowadays, although still used by some in the social and economic sciences, the word is used primarily in the context of robotics and computer systems. Indeed, this symbiosis between robotics and the social sciences reflects the fact that most people in the field have a reductionist approach to the subject grounded in some form of neo-Darwinism or Nietzsche's *übermensch*. This is reflected in the distinction between Wiener's

[6] John Polkinghorn (2002): ... it illustrates a necessary degree of interplay between a bottom-up approach to divine agency (arising from scientifically motivated conjecture about the causal joint by which it might be exercised) and top-down theological constraint (arising from a controlling belief concerning the nature of divine love). All valid theological discourse must make some use of both approaches. It is in striking a balance between them that the best hope of achieving insight is likely to be found.

[7] Piero Pasolini, (1985). *L'Unita' Del Cosmo*: Cosi' l'assoluto, invece di essere postulato come deus ex macchina solo in alcuni salti di trascendenza, si presenterebbe come un vero Deus in natura rerum, distinto e immanente nello stesso tempo, infinitamente aderente alle azioni degli essere, al loro creare ed creati negli atti cibernetici di trascendenza.

God and Golem (1973) and also within the current debate on the distinction between human and transhuman. In fact, apart from Piero Pasolini, no one (that I know of) in the field of cybernetics, includes a top-down approach to the subject, not to mention a Christian teleological vision. There are some essays related to Christianity and cybernetics but substantially they are also quite different to Pasolini's use of the term. For example, there is Vanessa May Gradwell's article,[8] entitled *Cybernetics and Christianity, the Pattern that connects* in which parallels between cybernetics and Christianity are compared and (correctly) contrasted as two different paradigms. Pasolini, although he shares something in common with the original reductionist meaning, nevertheless gives his own unique interpretation to the cybernetic principle.

First Pasolini's use of the term is distinctively top-down. He is aware that there is only One reality, that it resides in God, that no human being possesses the fullness truth (apart from Christ) and that there are many different perspectives to this One truth. Here we see all four of Pope Francis principles at work. Specifically, in common with general principles of cybernetics, Pasolini would emphasize that "the whole is more than the sum of its parts," and indeed is his guiding principle to help us understand the hierarchical relationship within nature. Secondly the whole concept of feedback and inter-relatedness for him would be reformulated in terms of a Trinitarian paradigm, which would resonate with Pope Francis vision in Laudato Sì(LS, para 238-240). In other words, he fully agrees with the unifying cybernetic approach that places emphasis on feedback as constitutive of any system or whole, while in contrast he would take this one step further and see feedback and inter-relatedness as a creative reflection of Trinitarian footprints at work in nature. Thirdly in keeping with the spirit of cybernetics, he would see it as a science that can explain evolving systems and as an instrument for explaining human development and history but not in terms of some Hegelian dialectic or *übermensch* (both of which he is aware of) but rather in terms of human beings who as co-creators with God bring about (by means of the Holy Spirit) the transcendent transformation of the cosmos into the new heaven and new earth of revelation and not some type of imminent historical process grounded in ideology. And finally, he reconciles the theology of the cross with the immanent process operative within history. Indeed, in accordance with the principle that "unity prevails over conflict", Pasolini recognizes that each one of us is co-creator so to speak with God to the extent that we not only embrace the cross, embrace Jesus Forsaken (as he would call it) but simultaneously live the resurrection here and now through that embrace of the cross.[9] For Pasolini as for saint Paul we complete in ourselves that which is lacking in

[8] There is also an article entitled *Ecclesial Cybernetics* by Patrick Granfield O.S.B that is applied to office management within the context of the local church and diocese.

[9] Piero Pasolini (23 settembre 1981, (unpublished): talk to focolarini in Nairobi): Gesù Abbandonato io lo chiamavo la chiave cibernetica per mutare la morte in vita, cioè per far la ripresa positiva dell'organizzazione sociale, dell'organizzazione del Corpo Mistico che deve diventare Cristo. Per diventare Cristo bisogna che il mondo capisca il principio di Gesù

the suffering of Christ (Bible, Colossians 1:24-26), precisely because through the action of the Holy Spirit each one of us both individually and collectively make up the cosmic Christ, which is the Church, and in so doing brings about the new heavens and the new earth. This undoubtedly is something he learned from Chiara Lubich who was his spiritual mentor.

Francis Four Principles and Cybernetics: Within the context of Pasolini's understanding of cybernetics, let us move beyond Pope Francis strict use of the principles and consider them as heuristics for the whole of the creative process implied in *Laudato Sì*. From the perspective of cybernetics, the principle that time is greater than space resounds in two aspects. The first is that in living fully the present moment of time through a constant embrace of Jesus forsaken, we are in a certain way already living in eternity while dynamically moving through history towards "the new heavens and the new earth" (Rev 21:1). All is in God both because of his simultaneous immanence and transcendence. It means transcending the physicist notion of space-time to arrive at a real historical time that is itself one instance in eternity. It requires not just the virtue of patience but knowing how to lose. It is an ongoing mediation between God and creation that characterizes human beings as co-redemptory with Christ.

The second is that unity prevails over conflict. Here, as already noted, Pasolini finds in his law of the Cross the means to implement this axiom. Unity is the fruit of embracing Jesus forsaken, unity prevails when we love Jesus Forsaken, unity and Jesus forsaken because they are both expressions of the Trinity are expressions of love and transcend any conflict. The saints live this heroically. The rest of us get perhaps an occasional glimpse of it. Moreover, the subdivision of the dialectical process of entropy and syntropy are for Pasolini an entwined process that helps creation evolve and move forward. Quoting Teilhard de Chardin, Pasolini (1982) reminds his readers that "the best is yet to come and the future is always better than the past."

This brings us to the third point: there is only one reality in God, although within time and history it is also self-constituting but at the same time limited by our physical-chemical-biological-psychological-sociological-theological condition and despite our best attempts can only be transformed (through faith, hope and love) by Divine action. We are not full masters of our own destiny because we are not God but creatures. This divine reality in the end is the one and only reality and our various ideas and thoughts while constructive and useful are always limited. We cannot change the order of being regardless of the numerous gnostic attempts to do so. Therefore, both Pope Francis and Pasolini in their own subtle ways affirm the one reality of God-Creator (albeit from different perspectives) and not different realities from one perspective. It this sense reality is more important than ideas, the ideal of supernatural love is the only valid reality of the present moment and not the many contemporary ideologies that attempt to

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Abbandonato…[Translation: I call "Jesus Forsaken" the cybernetic key to change death into life, that which enables the positive recovery of the social organization, of the Mystical Body that is becoming Christ. To become Christ it is necessary for the world to grasp the principle of "Jesus Forsaken"…]

destroy it. Our calling is to reflect that we are creatures made in God's image and not to create a Golem, whereby God is made in our image. In this sense, reality is more important than ideas. Piero Pasolini holds this dialectical tension together through love of Jesus forsaken. Pope Francis captures this reality in paragraphs 238-240 where he dwells on the Trinity and the relationship between creatures.

The fourth principle is a bit more ambiguous. If by stating that the whole is greater than the part, we mean the whole is more than the sum of its parts as expressed by Aristotelian metaphysics (although neither the Pope nor his interpreters seem to note this) then it can be identified with Pasolini's use of his cybernetic principle. He likes to give the example of water as H_2O as being more than the hydrogen and oxygen that constitutes it. Water also includes the laws of chemical bonding and feedback relationships. In a similar way, human beings by being united in and through the Risen Christ discover that the whole is more than each individual but in a Trinitarian way. Our identity is not destroyed but enriched by being part of the whole. Pope Francis distinguishes between the polyhedron and the sphere, Pasolini on the other hand borrows directly from chemistry and notes that the water molecule is more than the hydrogen and oxygen atoms that are part of its constituents, but that water also includes the laws involving chemical bonding and feedback relationships. Moreover, if a molecule of water is more than the sum of its parts then, a fortiori, life in all its stages is a hierarchy of interrelated beings formed from stardust but yet more than stardust, formed from the physical and chemical laws of atoms and molecules and yet more than atoms and molecules, formed from a myriad of biochemical and biological interactions but yet more than biochemistry and biology, formed from animal sensitivity and psychology and yet more that our animal and psychological instincts, all formed and moulded by God's grace to define the mystery of who I am, the mystery of one made the image and likeness of God. Unlike Aristotelian metaphysics, the whole is constituted by a dynamic process that takes on ever greater meaning as history goes forward. This whole for Piero Pasolini (and Francis) is the lived reality of the one Church rooted in the cosmic Christ characteristic of the third principle, although perceived differently by each one (the reality is more important than ideas). It constitutes the second principle in that this one whole manifested as the risen Christ in each one of us (at least for Christians), is by definition a unity and identity held together in a dialectic tension, expressed as a simultaneous kenosis of Jesus forsaken and the fullness of love. Each one has his place in this whole, freely chosen, uniting heaven and hell in a continuous embrace of the divine love. Here the spirituality of Chiara Lubich is key. And finally, the first principle that "time is greater than space" is in itself, a reflection that the whole is more than the sum of its parts in that the whole of cosmic history from the "big bang" to the "new heavens and new earth" (or to the "big crunch" if one is an atheist) is just one instance in the eternity of God and the risen Lord who is all in all,[10] explained very well by Pasolini (1992, pp. 257-

[10] Chiara Lubich, Paradiso '49, cpv 1169 (unpublished).

265) in his essay *L'evoluzione dell'uomo è diventare Cristo* (the evolution of Man is to become Christ). Indeed, the title says everything.

The polyhedron image is not so clear. It affirms that life is more than can be grasped by looking at it locally. A sphere although a global object can be fully grasped mathematically by knowing its local properties. Its sphericity is the same locally no matter how you view it. In contrast a polyhedron is much more nuanced especially if it is irregular. Looking at a small part of it does not allow us to construct the entire picture. Indeed, we need to assemble the whole object before we can grasp what it is.

4. Conclusions

In this article we have scratched the surface of Pope Francis methodological principles for discerning world process and the underlying causes of the sustainability crisis. While Pope Francis certainly acknowledges that air pollution, deforestation, the depletion of natural resources and disrespect for the earth are immediate issues, nevertheless in *Laudato Sì* he asks the deeper questions as to their causes and concludes that at the heart of the matter there is a profound spiritual crisis, and until this crisis is addressed, immediate political and social solutions function only as band aids for wounds that run much deeper. Keeping this in mind, we have attempted in this article to get to the roots of this spiritual crisis by using Francis own fourfold methodology but adapted to the language of cybernetics to help bridge the divide between the secular and the Christian approach to the problem. We have tried to move beyond the usual current sociological interpretations of these principles to show that they can be extended to understanding the whole cosmological process from the big bang to the end times. For a person of faith like Piero Pasolini, it is possible to harmonize the four principles with his understanding of cybernetics. For people of faith, creation takes on meaning through being united with Christ in the present moment. We are made to know, to love and serve God both in the drama of this life and the next, and time and world history define the stage on which it plays out. For those without faith the four principles can also be applied but the conclusions will be quite different, and instead of anticipating a new heaven and new earth, one will probably either anticipate a "big crunch" at the end of time or hope that human evolution will evolve to the level of allowing us to come to grips with the mystery of existence by conquering death and overcoming social and political unrest. Ultimately, it might anticipate a future, where in the words of Jacques Monod (1970, p143) the human person "is immersed by chance" «è immerse per caso» and consequently to him and her remain "the choice between the Kingdom and the darkness" (a lui la scelta tra il Regno e le tenebre). Two paradigms but one reality, two mysteries but one reality, two understandings but one reality, two strands of one dialectical reality which for a Christian like Pope Francis defines a Trinitarian model held together through our love of the cross and which, through human mediation, is still active in history. On a person-to-person level this mediation is brought about

by dialogue, a word repeatedly emphasized by Pope Francis in many of his writings.[11] Indeed, understanding this human mediation and the need for dialogue enriches our understanding of Pope Francis' four methodological principles and sustainable ecology. As long as there is dialogue, human relations are sustainable but when dialogue breaks down, conflict and war follow and as a consequence of this the environment too is denigrated.

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[11] In LS the word dialogue is used 25 times. In "Fratelli Tutti" it is used 51 times.

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Religious Systems in Transition

How Social Systems Theory Can Illuminate Democratic Procedures in the Uniting Church of Sweden and Saint Paul's Letter to the Galatians

Linda Joelsson[1]

[1]*University of Oslo, l.k.joelsson@teologi.uio.no*

Abstract

In situations characterized by mobility, climate change and security threats, today's religious communities act as significant resources, as well as potential threats, to cooperation in diversity. While educational efforts are made on many levels to disseminate knowledge about religious texts and religious practices (e.g., Sunday services, youth groups, open lunches, study groups), societal transition as described in the central religious texts and rites deserves further attention. The motivations for adapting to greater diversity are dependent upon each community, nation, or region's characterization or construct of collective identity. This paper adopts social systems theory (Bowen) as a lens through which religious and other discourses can be investigated.

The fundamental concept in social systems theory is that a change in one part of the system is followed by compensatory change in other parts. Compared to social systems with a low level of differentiation, social systems with a high level of diversity react with less severe symptoms and need less time for recovery, in times of hardships and stress. In other words, openness to individual variation is central to the development of *societal resilience*. On the other hand, when experiencing a crisis, systems with a low level of differentiation commonly face problems with *reactive emotions*. The system then focuses mainly on the emotion—and tries to get rid of that emotion—rather than trying to solve the problem that caused the emotion.

In the Uniting Church of Sweden (*Equmeniakyrkan*), the religious congregations involve a high percentage of their members in boards, councils and committees. How are the democratic processes introduced to new members? Are the democratic methods that are employed motivated in some way by religious discourse and, in that case, how? To investigate those questions, four religious leaders (two senior pastors, two associate pastors) and one trainee from two local congregations were interviewed and the results indicated high motivations for introducing new members to the congregation's democratic processes and subsequently involving them in those processes. The leaders could offer numerous examples of how the assembly dealt with processes of decision-making and they emphasized the effort devoted to communicating relevant dates and meetings, while also describing the issues that were to be brought up in advance.

However, in those interviews, the Christian tradition, sacred texts, and rites were not described as an important resource for the respondents' commitment to democratic processes. One of the interviewees even described how the religious tradition could be perceived as non- supportive to the congregation's strong commitment to democratic values. In this setting, therefore, the paper takes Galatians—one of the letters of the apostle Paul that belongs to the religious heritage—as an example of a religious text that could be taken as having a bearing on issues relating to diversity, democracy, and resilience. While noting that the early Christ-loyal communities appear as social systems in transition toward a higher level of differentiation, the reader may wonder why this aspect of the texts has not gained stronger momentum in the minds of those who turn to these texts for spiritual guidance. In this setting, interpretive traditions, translations and the structure that the texts are given by means of headings and subheadings all offer a partial explanation.

Keywords: Resilience, Diversity, Uniting Church of Sweden, Social Systems, Democracy, Galatians

1. Introduction

The fundamental concept in social systems theory (Bowen, 1976/2004) is that a change in one part of the system is followed by compensatory changes in other parts. Moreover, in times of hardships and stress, social systems with a high level of diversity react with less severe symptoms, and need less time for recovery, compared to social systems with low levels of differentiation. In other words, social systems with a high level of differentiation are more resilient. Differentiation is here the extent of individual variation in the system. Lars Laird Iversen (2014) notes that the fundamental characteristic in a democratic society is not that people think the same, but the way in which participants do *not* think the same. Similarly, Sylvia Chan (2002:10) suggests that a minimalist definition of democracy requires "the provision for participation of all adult members of a society, freedom to formulate and advocate political alternatives, and the credible availability of political alternatives." In a democratic society, people are given the opportunity to formulate alternatives and to participate actively in decision-making.

This paper investigates how individuals in leadership roles in local congregations describe the democratic and decision-making processes in congregations within the Uniting Church of Sweden (Swe. *Equmeniakyrkan*). Historically speaking, this particular church tradition has placed a strong emphasis on religious heritage and religious texts. It has also endorsed democratic structures for decision-making; indeed, the foundational denominations were among the first societies in Sweden to apply the principle of equally distributed votes among men and woman. Each adult member had one vote. Hence, the connection between religious tradition and commitment to democratic decision-making merits attention. Are the current democratic processes motivated by religious discourse? If so,

how—and if not, why not? In addition to investigating those questions, the paper takes Galatians, which is one of the central, religious texts within this particular religious movement, and investigates the attitudes to diversity and inclusion as expressed in this text. Both the interviews with church leaders and Galatians, as a central religious text, are examined through the lens of Bowen's social systems theory (Bowen, 1976/1994). Based on clinical observation and the use of a clearly defined terminology, aspects of diversity, inclusion, and resilience are central to Bowen's theory.

Historical Background: The Uniting Church of Sweden

The Uniting Church of Sweden (*Equmeniakyrkan*) was founded in 2011 as three denominations joined together, namely: the Baptist Union of Sweden (founded in 1857); the Methodist Church in Sweden (founded in 1868), and the Mission Covenant Church of Sweden (founded in 1878). The three original denominations included much variation, both locally and between regions. There were also differences between the denominations, for example, with regard to organization, liturgy, and understanding of the sacraments. Uniting them was a shared commitment to democratic practices and values. When those denominations were established in Sweden, they had the effect of increasing the level of diversity in the broader society. Moreover, as these religious movements found themselves in conversation with religious movements in other countries, they were sometimes met with suspicion and even hostility from other groups in the Swedish society, where the Lutheran Church of Sweden was dominant. Several of the leaders in the early Baptist movement were exiled (Vägmärken, 2016; Bergsten, 1990:64–72). The Methodist Church in Sweden acquired permission from civic authorities. The Mission Covenant Church of Sweden was established during a time when society was gradually becoming more open to new religious movements. In other words, the Swedish society was eventually more open to an increased level of *diversity*—but it came at a cost, paid particularly by the Baptists.

Furthermore, it should be noted that the Baptist Union of Sweden was the first movement in Sweden to adopt democratic decision-making procedures (according to the principle of one voice per person) that included women (Halldorf, 2020:38–39). However, both the Baptist Union of Sweden and the Mission Covenant Church of Sweden adopted practices that allowed members to be excluded from the local congregation in rather unregulated fashion (Kennerberg, 1996). Needless to say, this practice resulted in a decrease in the internal level of differentiation. However, the practice of exclusion could be implemented in different ways in different congregations. In other words, while the church's democratic rights were strong compared to other parts of the society, these rights could be removed in ways that left individuals, particularly women, quite vulnerable.

With regard to the variety of theological and philosophical convictions in the Mission Covenant Church, it can be noted that the first person elected as secretary general (Swe: *missionsföreståndare*), E.J. Ekman did not believe in eternal punishments, which was a religious conviction commonly

endorsed at the time of the denomination being established. In the monograph *Evangelii fullhet och de ändlösa straffen* (1903), Ekman developed and shared his views. Similarly, the second secretary general, P.P. Waldenström held theological views in opposition with the views officially endorsed by the Church of Sweden. Hence, the freedom of formulating theological alternatives was exercised both internally —in opposition to the majority within the movement—and in relation to convictions supported by the Church of Sweden and most likely endorsed in society at large (Dahlén, 1999; Halvardsson, 2004:43–63).

To summarize, the movements that later formed the Uniting Church of Sweden contributed to increasing the level of differentiation in the Swedish society by establishing and developing alternatives both in terms of convictions and organizations. Furthermore, the denominations forming the Uniting Church of Sweden (i.e., the Baptist Union of Sweden, the Methodist Church in Sweden, and the Mission Covenant Church of Sweden) developed more democratically oriented processes for decision-making, which promoted the development of democracy in Sweden.

Religious Heritage: Paul's Letter to the Galatians

Galatians is a text dealing with a situation of transition, namely a community moving toward a higher level of diversity in the social system. Surviving from antiquity, this letter is endorsed as a spiritually significant text and read regularly in late-modern churches (especially at Sunday services and in religious education). With its origin nearly contemporary with Jesus, it has been important to the self-understanding and spiritual orientation of the movement (that later became Christianity) for almost two-thousand years— even if Paul, the author, did not have those subsequent audiences in mind. When the text was written as a letter to the Christ-believing assemblies in Galatia, those assemblies were in fact part of Judaism, or perceived themselves as being adopted among the children of Abraham. Paul strongly advocated the latter conceptualization, since he believed that Abraham would be the "father of *many* nations," thus indicating that adherents from other nations would not be assimilated into Judaism (Campbell, 2008; Ehrensperger, 2004). When the text was translated into German during the 16th century (and soon several official translations into other languages emerged), the ideological paradigm presupposed that Jews were excluded and replaced by Christianity. Notwithstanding, the text itself substantiates no such replacement paradigm as it was written before the so-called "parting of the ways" (Dunn, 1991).

In Galatians, Paul describes the open-table fellowship as the "truth of the Gospel" (Gal. 2:5, 14; 5:6–7, in context). Here, the key to inclusion and systemic functioning —resilience—is faithfulness, rather than signs of an exclusive collective identity or physical identity markers. As the letter indicates, this is an issue under discussion, but Paul makes his opinion clear: the identity markers avail nothing, though they do not have to be erased or eradicated. The call for assimilation and adaptation is explicitly described as a non-gospel that would impede the full inclusion already provided by Christ. As Paul

describes the transition toward a higher level of diversity, the text seems to support the subsequent development of democratic processes in decision-making.

2. Methods

The paper is divided into two parts. First, the attitudes expressed among present-day local church leaders toward democratic processes in local assemblies in the Uniting Church of Sweden are explored by means of interviews (two senior pastors, two associate pastors and one trainee). The study focuses on congregations that have received many new members during the past then years, and it asks how the process of democratic decision-making have been introduced to these new members. The results of the interviews are analyzed using social systems theory (Bowen, 1966/2004; 1976/2004). Secondly, as one of the texts belonging to the religious heritage of Christianity, Galatians, is analyzed from the same perspective with regard to attitudes toward diversity and inclusion.

Theoretical Perspective: Social Systems Theory (Bowen)

Murray Bowen's social systems theory illuminates the aspect of resilience in human interaction by describing the systemic functioning in societal and social life. The theory has the advantage of being applicable to a variety of social systems—ranging from family and workplace up to the region and nation—while also acknowledging the prevalence of overlapping social systems. When already existing terms (e.g. from biology) are employed, the same definition is kept as the term is used in another setting. For instance, the systemic perspective implies that "a change in one part of the system is followed by compensatory change in other parts of the system" (Bowen, 1966/2004:147–81). The level of differentiation describes the extent of individual variation within the system. Clinical observation shows that social systems with a high level of differentiation are more resilient than systems with lower levels of differentiation. Resilience is here the capacity to deal with problems and changes without changing basic structures and over-all functioning (Bowen, 1966/2004:147–81; Walker and Salt, 2006:37–38). It can be noted that when life goes as normally or without any particular complications, systems with low level of differentiation can function without problems. Nevertheless, in situations of hardships and strain, these systems develop *reactive emotions* which results in a collective shift in attention, where the emotional state—and how to change it—takes center stage, but the underlying cause of the stress goes largely unexamined and thus is unresolved (Bowen, 1976/2004:367).

In such situations, the strategies to change the emotional state can be described by three main categories: 1) emotional and/or geographical distance; 2) conflict/harassment; 3) over- and under-functioning. These strategies are not mutually exclusive and can be combined (Bowen, 1976/2004: 337–87). The first category suggests, for example, that a sensitive topic is not mentioned. The second

may describe when a particular group or individual is targeted with accusations for a situation what they had no possibility to control. The third category could describe when democratic decision-making is suddenly abandoned in an experienced crisis while both time and competence are available for a more informed assessment of the problems. In this setting, anti-immigrant attitude could be described in connection to the emerging climate crisis. The nation would not benefit from having a more homogenous population, but on the contrary, a higher level of differentiation would strengthen the resilience in the social system. Still voices are raised to restrict the level of differentiation in the system and, by implication, suggesting obstacles to the development of more diverse competencies. Hence, precisely when diversity and differentiation are most vital, the construct of a collective identity based on an idea of *sameness* is most likely to be suggested (Bowen, 1976/2004).

Systems with a high level of differentiation allow their members to develop diverse competencies and skills—without this being perceived as a threat to the unity of the group. Moreover, the emotional reaction in a member can be endured without the whole system becoming emotionally ill. Collective identity can be described as *being oneself* rather than being the same (Ricoeur, 1992). The fusion of egos into an *undifferentiated ego mass* is avoided and more solid self-identities can be developed, that is, a sense of self that is less dependent upon the opinions of others (Bowen, 1966/2004:159–166). When the members of a system can stand emotionally in contact without being caught up in reactive emotions, they are also more likely to support each other in situations of turmoil and stress. Attention can be focused on the situation and possible problems, instead of being diverted to the symptoms or signs (Bowen, 1976/2004:367). Unsurprisingly, strategies to handle reactive emotions, distance, conflict and over- and under-functioning are usually ineffective, whereas co-agency, the appreciation of a variety of competences, and long-term commitments tend to be valuable resources. The systemic perspective implies that, as reactive emotion can become a burden to the whole system, the development of a more solid self in one member can be to the benefit of the whole system.

3. Results and Discussion

In the local congregations of the Uniting Church, a high percentage of the members are involved in boards, councils, and committees. The highest governing body is the congregational assembly (*församlingsmöte*) and the annual meeting is where decisions are made for the coming year's programs, activities, and budget, and the last year's results are reported. At this meeting, every member has the right to vote and make proposals. In some congregations, there is a special youth council which makes decisions about the activities for youth and for children. According to the first interview, the congregation placed strong emphasis on establishing democratic decision-making among the youth. Every child and youth who regularly participated in activities was invited to the youth councils, held two or three times per semester. These councils were planned in connection to regular meetings and activities in order to

make participation as easy as possible. In other meetings, the council was referred to as the place to make decisions and consider suggestions about Christmas activities, summer camps, and so on.

As most of the children were first-generation immigrants, there were sometimes a language gap between them and their parents. The care-taking days, held once per semester to fix things and tend to the yard, were felt to be important occasions for getting to know each other. During the interview, the senior pastor mentioned a disagreement she had with a senior Swedish-speaking participant who perceived that she should only speak Swedish. The pastor noted the disagreement but did not intend to change her habit of shifting language now and then. At the board of the congregation, however, a problem was identified in relation to language and the need for introduction. Newly involved members were elected to the board but did not participate as expected at the board meetings. Some were overwhelmed with busy and quite strenuous lives that included worries about visas, temporary citizenship, and family members abroad in dangerous situations. Moreover, the board dealt with issues that required a specialized vocabulary (such as maintenance of the buildings, heating, and so on) and some background knowledge. As the need for personal introductions was noted, the trainee who participated in the interview noted that new members may find it easier and more motivating to contribute to the program committee. In this setting, an immigrant background and languages competences beyond Swedish could be more valuable than in the board meetings. Decisions about programs and activities may be felt to be more relevant, the trainee suggested, and the senior pastor agreed.

As the need for introduction to the decision-making of the board had been identified earlier, a newsletter had been gradually developed and was frequently distributed. Some time ago, a member had suggested that the decisions could be described more explicitly in the letter, together with the dates of the coming board meetings. This suggestion was implemented.

In another congregation, three local church leaders were interviewed separately (two pastors and a senior pastor). As the pastors described, worship services were held every Sunday in three languages. Since regular services were held separately, efforts were made to strengthen fellowship between the language groups. As the senior pastor noted, “we cannot always talk but we can always eat together.” On two occasions every semester, joint services gathered all three language groups, and people from all groups were actively participating in leadership roles, and measures were taken that communication should be accessible in at least three languages. There were always a meal or snacks after.

Moreover, measures were taken to include everyone in decision-making and to encourage active participation among members in all three language groups: English, Swedish and Pashto—together with some Urdu, Hindi, Punjabi and Spanish. The basic idea was that the board included two members from each group, but the English language group had one extra since they were proportionally the largest subgroup. In order to give both groups and individual members time to develop their own ideas and suggestions for activities, programs and budget, the introduction of the board’s suggestions for

budget and the annual meeting, where the decisions were made, were split on two occasions several months apart. The "budget festivity" was held in November—with much food—and the annual council was held in March. For the sake of clarity and accessibility, the budget itself was divided into three parts: recurring expenses, new investments, extra important. Every document was available in advance in all three languages and, naturally, discussions and negotiation were translated too.

It was noted that every language group had its own ways of communicating the purpose and plans for such events and occasions. One group depended mainly upon written communication in a newsletter, while another group repeated information orally when it was assembled. A third group communicated mainly by texts to cell phones; this may not be surprising given that this group also has a YouTube channel, which is listed on the church's webpage. Within these groups, attitudes to written communication seem to vary. In the Swedish speaking group, strong emphasis was placed on written documents. As the pastor in one group expressed concern for the democratic procedures in another group, the lack of written documents was noted. It was feared that the pastor would make many decisions himself without involving the committee of that language group, or that the committee was reduced to merely a role of consultation rather than decision-making. On the other hand, it was expressed that some members in this group were delighted and "shocked" that they had so much influence over activities and organization, which was more than they had anticipated.

In another language group, the documents were orderly. In the social structure, emphasis was placed on families and measures could therefore be taken to secure the right and encourage the *perceived* opportunity for individual to formulate and promote alternatives.

To summarize, as described by local leaders, in both congregations measures were taken to involve new members in the democratic processes of decision-making. As new members arrived, efforts were increased to encourage their active involvement in decision-making. Communication was adapted to the habits of various groups and the organization of councils, board meetings, and annual meetings was adapted in order to strengthen the opportunities for members to participate actively. In both settings, there was a willingness to develop structures in order to meet the needs of particular groups (such as providing time to formulate alternatives, time for translation and discussion, and time to develop habits of democratic decision-making). However, concern was expressed that democratic decision-making takes time and not every member had that time available. Moreover, when the opportunity to have influence on congregational matters was given to a particular group, measures may be necessary to ensure that the opportunity to formulate and promote alternatives also extended to the individuals within that group. The risk was identified that power would accumulate in the hands of a few individuals when the intention was to disseminate power to groups that might otherwise have less influence over congregational matters.

As described in these congregations, measures were taken to develop bonds of friendship and

commensality (e.g., volunteer days, meals, and joint worship services). As seen through the lens of Bowen's social systems theory, distance was actively bridged and conflicts in the form of harassment were kept at a minimum. On the other hand, conflict in the orderly form of negotiation was encouraged. Members were actively encouraged to formulate alternatives and to make propositions—both in youth councils, in board meetings, and annual meetings. Moreover, the suggestion that new members be elected to the program committee may provide the opportunity to further adapt the organization and activities in ways that would meet the needs and interests of new members in the congregation. In both congregations, the right to formulate and promote alternatives was highly valued which could be described as an indication of a willingness to increase the level of differentiation. In both congregations, new members were actively invited and welcomed.

When the persons in local leadership roles were also asked about the connection between their religious heritage and their commitment to democratic decision-making, none of them quoted directly from religious texts. In this particular religious tradition, which has been characterized by discussion over theological and ideological matters and even strife, this reluctance to refer to religious texts appears as noteworthy (see Safstrom, 2016; Dahlén, 1999, for accounts of the so-called "war on reconciliation," *försoningsstriden*). The development indicated here could be the result of a general cultural and religious influence, possibly as exercised by the welcoming of new members with other theological and ideological backgrounds. It could also be a result of internal reflection over the past; discussions over congregational matters in which references to religious texts were adopted as proofs could be quite unforgiving and inclement. As an anonymous speaker noted: "It is uncertain if there were more truth, but it certainly was less grace." As there might be a movement away from using religious texts as proof in argumentation, they are still used in worship and religious education. In other words, the religious texts may be perceived as belonging to liturgical contexts and personal spirituality rather than to the political and other types of decision-making.

Given that the religious tradition includes texts that could be seen as promoting democratic decision-making and supporting increased levels of diversity, it may seem strange that none of the persons who were interviewed quoted from such texts. As the question was asked specifically if they would like to make mention of a text that supported the perception of the importance of the democratic processes—which they were all highly committed to—none of them did. The two senior pastors, both of whom were women, referred somewhat vaguely to every person being created by God. As indicated above, the reason for this situation could be manifold and would be an area for further investigation. As one of the texts that has been deemed as important within this religious tradition, Galatians is described and analyzed from the perspective of social systems theory below.

Religious Heritage: Paul's Letter to the Galatians

In the reception history of religious texts, some texts are given more attention than others and some aspects of the texts are placed more in focus rather than others. We now turn to one of the texts that is treasured as part of the religious and cultural heritage of this denomination. Paul's letter to the Galatians deals with the inclusion of the neighbor without requiring assimilation. In Galatians, as emphasized throughout the discourse, the markers of collective identity are devalued as tools for creating fellowship bonds. The markers of identity are described as "nothing." On the other hand, the open-table fellowship which includes people from every nation, is described as "the truth of the Gospel" (Gal 2:5, 14; 4:16; 5:7). Opening for an intersectional approach, Paul suggests that the borders between Jews/Greeks; enslaved, free-born, or freed; and male/female are all removed. Critically, however, Galatians supports the right to have disparate identity markers. The markers and signs do not provide occasion for harassment or exclusion, but the members of the assembly are not required to assimilate. On the contrary, their full inclusion as "themselves" is the original errand of the historical letter, which suggests that certain were asked to assimilate and that Paul opposed such requests (Campbell, 2008; Ehrensperger, 2004).

It should also be noted that the text in the manuscripts is not divided into paragraphs and lacks even spaces between words. Thus, the division into subparagraphs could also be made differently. Moreover, as such redactional work has been done to make the text more accessible and readable, translators or editors sometimes add subheadings to the text. Since the headings and subheadings do not belong to the original manuscripts, they may also be an indication of the interpretive paradigm in which the translation has been made.

Naturally, headings are short phrases that can be open to several interpretations. Below is a table with possible headings from Galatians, beginning at chapter 3. The brief descriptions given here do not aim to be exhaustive of all interpretive possibilities. Rather, a few examples can be given to indicate possible patterns that deserve further attention. Nevertheless, a quick glance—which is most often what a heading gets—seems to indicate that the text is about replacement, superiority/subordination and the moving of borders from one place to another—rather than about embracing an increased level of differentiation.

The first column includes the subheadings from the translation Bibel2000, which is used regularly in several large denominations in Sweden, including the Uniting Church of Sweden; the second column is my own translation of these subheadings into English. The third column is an attempt at a brief description of the approach suggested in these subheadings. In the fourth column, alternative subheadings are suggested in a very tentative manner.

Table 1. *Subheadings in Galatians 3:1–6:10.*

Bibel2000 (Swe)	**Translation (mine)**	**Description**	**Alternative**
Inte lag, utan tro	Not law, but faith	replacement	Full inclusion
Löftet står över lagen	Promise superior to the law	superiority/ subordination	The promise is valid
Lagens uppgift	Purpose of the law	-	-
Inte längre slavar, utan söner	No longer enslaved but sons	gender-exclusive	Full inclusion regardless of collective identity
Ingen väg tillbaka	No way back	-	Do not fear exclusion
Två förbund: lagen och löftet	Two covenants: the law and the promise	distance	Do not become enslaved
Rättfärdighet utan omskärelse	Righteousness without circumcision	replacement	Inclusion without adaptation
Låt er ande leda er	Let your spirit guide you	replacement	Let God's Spirit guide you
Vad man sår får man skörda	What someone sows s/he will also reap	-	Do good to everyone

As placed over paragraphs, in which the text embraces the inclusion of the Galatian addressees, some subheadings suggest that the "law" is replaced. However, if increasing the level of diversity, someone can be included without someone else being excluded. Besides, the text notes that the addressees have attained the status of "sons" and "heirs," but in the subparagraph, the border between male and female is also removed (Gal 3:24–29). Therefore, the exclusively male character of "sons" does not correspond very well to the content of the text. Moreover, the letter describes the transition from being *under* the law to living *by* the law, but there is no indication that the law as such would be surpassed or obsolete. That being said, not every commandment is applicable to everyone. The Jewish group keeps to the custom of male circumcision, but the Galatians are not required to assimilate into this practice. As "circumcision" or "foreskin" is regarded as nothing, a proto-feminist approach is substantiated and as is the inclusion of the non-citizen (Ehrensperger, 2004; Campbell, 2008). It is even suggested that the demands for conformity pose an obstacle to the development of the fruit of the Spirit (i.e. love, joy, peace, and so on; Gal 5:11–24). Notably, the text does not describe that the addressees must follow the guidance of their *own* spirit (cf. "let your spirit guide you"), but, being a religious discourse, it is rather the Spirit of Christ or the Spirit of God. The Spirit of God transcends the borders of constructed collective identities. As the metaphor of adoption is used instead of that of adaptation, the covenant can be described as renewed rather than *new*.

As seen from the perspective of Bowen's social systems theory, Galatians is a text emerging from a situation in which the social system faces the opportunity of increasing the level of differentiation. As Jae Won Lee describes, the notion of a universalist collective identity can be deceptive, since it can just be imperialism in disguise (Lee 2015). But Galatians does not suggest such purportedly neutral collective identity. On the contrary, the open-table fellowship is described as the truth of the Gospel, but such openness requires that any demand for conformity with regard to identity markers is refuted. Obviously, Peter as one of the main leaders in the early Christ-loyal movement was not excluded, but he was challenged (Gal 2:11–21). The text describes how Paul, as a role model, formulated and promoted a political alternative to assimilation and fear of exclusion (cf. Gal 4:17).

To summarize, as belonging to the religious and cultural heritage, Galatians provides a fascinating historical document, offering a glimpse from what seems to be a process of transition toward a higher level of differentiation. There is, as far as I am aware, no other document that indicates how the letter was received. Nevertheless, the text describes systemic movements that are similar to the ones Bowen and his research team observed in modern times—and to those experienced by the pastors interviewed in this study. The text, as it has been transmitted as religious heritage, raises certain questions—suggesting certain practices and discouraging others—for the sake of spiritual development and systemic functioning (resilience), and it is part of a larger conversation in liturgy, religious education, and art.

4. Conclusions

In conclusion, on the societal level, particularly in a secular society such as Sweden, religious assemblies contribute to increasing of the level of diversity. Especially when the assemblies perceive themselves—and are perceived by other groups—as firmly integrated into the fabric of society, congregations and assemblies can be expected to contribute to the resilience of that society. The openness to the development of specific competencies strengthens the social system's capacity to meet new situations and perhaps solve new and old problems in a new way.

On the level of the local assembly, the commitment and capacity to organize decision-making by means of democratic processes can be expected to strengthen the aspect of resilience in that particular community. As members of the congregation are given the possibility to listen to each other and to formulate alternatives, the activities and programs of the congregation are more likely to meet the needs and the interests of the members. In interviews with persons in leadership roles in local congregations, communication was identified as a vital aspect in the local assembly structures and the habits in communication varied. Furthermore, the time aspect in the democratic processes was essential to the active participation of the members: it should be easy to participate in democratic meetings (i.e., scheduled around other meetings that regularly gathered many people, such as Sunday

services and youth activities). Moreover, there should be time to discuss and formulate alternatives (e.g. providing information in advance through accessible channels, scheduling time between the budget being suggested by the board and actual decision-making, and so on).

Moreover, democratic processes take time. Illness or heavy responsibilities in other settings were circumstances that could be impediments to active participation in decision-making. Social activities were valuable for establishing friendships, which also made it easier for members to participate in decision-making through democratic processes. In one congregation, fellowship bonds were strengthened by meals and festivities. In the another, the taking-care days were such opportunities for fellowship bonds to develop. In relation to such occasions, language was not spoken of in terms of barriers, but instead a variety of approaches could be noted. Communication was clearly not easy. Not every member had the capacity or commitment to learn several languages —which is a question of time and resources too—but to some this was a possibility.

Finally, it can be noted that not every religious assembly has the capacity to receive and involve new members in decision-making the way that the two congregations investigated here described. However, within these assemblies, it can be noted that their commitment to democratic processes seems to be integral to their flourishing. New members were not only welcomed as passive members, but their involvement in decision-making was actively sought.

Turning to one of the texts from the religious heritage, Galatians describes the open-table fellowship as essential to their in-group identity. Being perhaps a contested version of their collective identity, the identity markers are described as availing nothing. In fact, the focus on their belonging to separate collective identities is described as an impediment to their "walking in the Spirit." In Galatians, the identity markers are described as insignificant ("nothing") and protected ("do not conform to the demands of other people"). Adaptation is replaced by adoption as the ruling metaphor. In this way, identity can be spelled out as being *oneself* rather than being the *same.*

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