Global challenges – local: responses: Scaling up local sustainability innovations and business models to address the SDGs



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CONFERENCE PROCEEDINGS

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Contents

WORDS OF WELCOME 1

CONFERENCE THEMES AND TRACKS..... 2

1. EXPLORING THE SYSTEM LEVEL..... 3

1.1 Innovative business models and ecosystems for sustainability transition: perspectives from global north and global south..... 3

1.2 Ecosystems in support of sustainability 4

1.3 Business Models for Transition. Empirical observations and theoretical foundations of existing or emerging business models fostering societal transformation and transition..... 5

2. EXPLORING THE SECTORAL AND ORGANISATIONAL LEVEL..... 6

2.1 Innovation through artificial intelligence and data-driven business models for sustainable transformation..... 6

2.2 Community-led and community-based business models for sustainable development 7

2.3 Business model experimentation for circular economy: close, slow, narrow, regenerate.... 8

3. EXPLORING THE ORGANISATIONAL IMPACT 9

3.1 Management, governance and accountability for sustainable business models 9

3.2 New business models in times of crisis: scaling resilient and sustainable local solutions for global challenges..... 9

3.3 Measuring and managing the sustainability effects of business models 10

4. EXPLORING THEORETICAL AND METHODOLOGICAL FOUNDATIONS . 12

4.1 New theoretical foundations of business models for sustainability 12

4.2 Transitioning business models towards sustainability through finances 13

4.3 Actor engagement in sustainable (circular) business model innovation through design thinking and other practices 14

5. CONFERENCE WORKSHOPS 15

Incorporating paradoxes into my research on business models for sustainability: insights from the case of the fashion industry 15

Building Climate Solutions: En-ROADS workshop for Global Action.....15

Interdisciplinary dialogues on new business models: recognizing the value of nature and people 16

Co-Creating a New Research Agenda: A Cross-Cultural Dialogue on Business Model Innovation to Solve Global Challenges 17

CONFERENCE PROGRAMME..... 18

CONFERENCE TRACKS AND ABSTRACTS 19
EXPLORING THE SYSTEM LEVEL 21
EXPLORING THE SECTORAL AND ORGANIZATIONAL LEVEL 389
EXPLORING THE ORGANISATIONAL IMPACT 625
EXPLORING THEORETICAL AND METHODOLOGICAL FOUNDATIONS 952
EPILOUGE 1126
ABOUT UNIVERSITY OF ICELAND 1129
SCHOOL OF BUSINESS ADMINISTRATION 1147
ABOUT REYKJAVÍK 1149

WORDS OF WELCOME

In today's academic world, the International Conference on New Business Models (NBM) is a leading platform for discussing sustainable business models. As we embark on its 10th edition, the NBM conference is more than just a milestone; it is a committed effort to advance knowledge and solutions in sustainable business practices. This conference brings together academics, researchers, and practitioners to tackle urgent issues and encourage innovative research in the evolving field of sustainable business models. NBM2025 is set against a backdrop of new socio-economic complexities and uncertainties, making sustainable business models increasingly challenging to design and adopt. Global trends like climate change, resource scarcity, demographic shifts, and the technological revolution are driving significant transitions that demand radical and transformative changes, supported by various forms of innovation. Sustainable business models are crucial for achieving digital, green, and inclusive transitions.

The technological and digital revolution is transforming all industrial sectors, altering goods, services, and processes in both public and private organizations. New business models are emerging, driven by digitalization, automation, and the adoption of flexible technologies like artificial intelligence, connectivity, big data, robotics, and additive manufacturing. These technology-driven innovations are not only disrupting industries but also changing our way of life. It is essential to integrate values such as human dignity, equality, security, and basic rights into business model designs. The climate crisis has heightened the need for rapid and extensive systemic change to achieve carbon neutrality by 2050. This goal requires moving away from traditional business practices to sustainable business models. The green transition necessitates business models that support the circular economy, eco-innovation, and the creation of green jobs.

The digital and green transitions must be inclusive and fair, prioritizing people and ensuring no one is left behind. Organizations need to develop business models that address intergenerational challenges, promote diversity in all its forms (gender, race, class, etc.), encourage cooperation, create shared social value, and foster a culture that empowers individuals to contribute to social transformations. Over the years, this conference has built a robust and expanding academic community focused on sustainable business models. We are dedicated to making NBM2025 a platform for those aiming to develop sustainable business models that integrate technological, energy, climate, and social transitions with a holistic approach to sustainability. Our goal is to unite science, technology, innovation, and society to create more resilient, green, and inclusive business models for a fairer, more prosperous, and sustainable future.

We look forward to seeing you at the School of Business Administration of University of Iceland for another unforgettable New Business Models Conference!

Dr. Lára Jóhannsdóttir

Conference chair

Environment and Natural Resources

School of Business Administration

CONFERENCE THEMES AND TRACKS

The NBM2025 aims to be a forum for reflection and academic debate in the field of sustainable business models for the digital, green, and inclusive transition through different levels of analysis: system level, sectoral and organisational level, organisational impact level and theoretical and methodological foundations.

Along with the parallel tracks of academic papers, the program will include plenary talks and debates on how we can better enable impactful business models for sustainability in practice.

Themes and topics

The 10th International Conference on New Business Models will continue to explore relevant themes and topics building on the insights from previous conferences:

At the system level, we invite scholars working on topics such as collaborative business models for inclusive transitions, ecosystem thinking in support of sustainability, empirical observations and theoretical foundations of business models for transitions; and collaborative and circular business models emerging in the global south.

At the sectoral and organisational levels, we will address topics on data-driven business models for sustainable transformation, business model experimentation for circular economy, and rural community-led business models.

At the organisational impact level, topics will deal with the design, functioning and impacts of sharing economy business models; management and accountability for sustainable business models; new business models in times of crisis; and assessing and managing sustainability performance of business models (which includes a special subsection on Business Models & Life Cycle Assessment).

We will also explore the theoretical and methodological foundations of business model research, including new theoretical views, business models for sustainability, and the role of design thinking practices during sustainable business model innovation. Additionally, the session, Bring Your Own Tool, provides the opportunity to present practice-based experiences using tools to develop sustainable, circular, and inclusive business models.

Topics in each one of the four themes are presented below.

1. EXPLORING THE SYSTEM LEVEL

1.1 Innovative business models and ecosystems for sustainability transition: perspectives from global north and global south

Track chairs: Annukka Näyhä & Irene Kuhmonen, Jyväskylä University School of Business and Economics, Finland; Timber Haaker Saxion, University of Applied Sciences, The Netherlands; Nguyen Hong Quan, Institute for Circular Economy Development, Vietnam National University - Ho Chi Minh City, Vietnam; Nguyen Cong Thanh, National Economics University, Hanoi, Vietnam; Milou Derks, Orange Corners and Eindhoven University of Technology, Netherlands

It is widely agreed that diverse organizations, instead of seeking purely economic profits attained through innovations, should increasingly pursue sustainability-oriented innovations which promote environmental and/or social sustainability (e.g. Boons and Lüdeke-Freund, 2013; Adams et al., 2016; Bocken et al. 2019). Further, aligned collaborative efforts by a diverse range of value network actors and stakeholders are needed for sustainable value creation and successful innovation diffusion. For example, circular business models and innovations with networked nature are key levers for implementation of circular economy principles (Antinkainen and Valkokari, 2016). All in all, sustainability transition requires innovative business models and collaboration between diverse organizations as well as between organizations and their stakeholders in diverse business ecosystems, value networks and platforms (Köhler, 2019; Aagaard et al. 2021; Planko and Kramer, 2021; Derks et al., 2022; Näyhä and Wallius, 2024; Nguyen, Haaker, and Le, 2023).

However, in-depth information on the impacts of innovative business models and ecosystems on system-level change is often lacking. Similarly, effects of system structures and the drivers and barriers they pose on sustainable business models requires more knowledge. Transition studies explore large-scale societal transformation towards sustainability, thus offering more systemic and interdisciplinary approaches to management and organizational studies (Markard et al., 2012). Management studies, in turn, when combined with transition perspectives, can illuminate the role of business actors and their agency in transition processes (Köhler et al., 2019). Further, the form that the business models and ecosystems take depends on the societal and business context in which they are to be embedded, such as Global North and Global South. For example, the Global South has informal low-income contexts which are rich in necessity-driven value retaining practices for materials and goods (Korsunova et al., 2022; Muchangos, 2021). While the transition contexts in these regions vary greatly, businesses in both regions are connected to each other through global telecouplings which affect the distribution of both environmental and social sustainability impacts and economic returns, highlighting also the justice aspects related to transition processes (Ramcilovic-Suominen, 2022).

Thus, attuning towards the specific challenges that arise from these contextual settings enhances the opportunities for promoting the role that innovative business models and collaborations can play in sustainability transitions.

This session welcomes studies that combine research on sustainable business models and large-scale, systemic sustainability transitions. The session explores the role of innovative business models and ecosystems in the sustainability transition both in Global South and North. Bringing together these diverse theoretical and geographical perspectives is a necessity for studying, understanding, and facilitating the sustainability transition in our society. The session is divided into two parts, one of them concentrating on presentations related to Global South, and the other one to Global North.

1.2 Ecosystems in support of sustainability

Track chairs: Abel Diaz Gonzalez, Maastricht University (The Netherlands); Nikolay Dentchev, University of National and World Economy (Bulgaria) and Vrije Universiteit Brussel (Belgium); Bart Leyen, Vrije Universiteit Brussel (Belgium); Valery Chistov, Deusto Business School, University of Deusto (Spain)

The ecosystem concept has gained significant attention over the past decade (Audretsch et al., 2018). Ecosystem thinking offers valuable insights into how various stakeholders can align, interact, and collaborate to gain competitive advantage, foster innovation, and enhance business productivity (Adner, 2017; Jacobides et al., 2018). Ecosystems support business growth by leveraging the diversity and complementarity of actors, their interactions, and coordinated efforts to mobilize resources (Neumeyer & Corbett, 2017; Roundy et al., 2017; Spigel & Harrison, 2018). Although there is still a lack of conceptual and theoretical clarity around ecosystems (Wurth et al., 2021), they serve as an ideal unit of analysis for addressing sustainability issues due to their holistic and systemic characteristics (Henriques et al., 2022).

In recent years, world leaders have increasingly advocated for more coordinated efforts to address various global challenges. Organizations like the World Economic Forum (World Economic Forum, 2020) have established supportive structures and programs to help entrepreneurs develop their businesses and increase their impact, offering both financial and non-financial assistance. Despite these initiatives, more cross-sectoral partnerships and support are urgently needed to address complex global challenges effectively.

As we strive to tackle sustainability problems, building well-functioning ecosystems becomes critical (Theodoraki et al., 2017). These ecosystems must prove their capacity to adapt, mobilize flexible and complementary resources (funding, infrastructure, knowledge), and evolve governance structures (Acs et al., 2017), policies (Stam, 2015), boundaries (Audretsch et al., 2019), and interrelationships (Stam & van de Ven, 2021). Ecosystem culture and resilience capacity are equally important (Roundy et al., 2017).

The ecosystem approach is crucial for both large, established businesses aiming to reduce their environmental impact and small, new sustainable ventures. For large businesses, ecosystems offer a platform to collaborate with diverse stakeholders, share knowledge, and access innovative solutions that help them transition to more sustainable practices and reduce their environmental footprint. These ecosystems provide the necessary support for integrating sustainable technologies, adjusting supply chains, and aligning with evolving environmental regulations. On the other hand, for small, new sustainable ventures, ecosystems are equally vital as they provide access to essential resources such as funding, mentorship, and networks, which are often limited for startups. By leveraging these ecosystems, small ventures can collaborate with key actors, foster innovation, and accelerate their growth while maintaining a sustainability focus. Ecosystems help these startups overcome barriers to entry and scale their impact more effectively by tapping into shared knowledge and resources.

This session aims to bring together scholars to discuss their current research on how ecosystems can be developed to support sustainability. Our focus will be on building ecosystems that foster new business models and address emerging global challenges. We welcome papers that explore the importance of ecosystems both for large, established businesses working to decrease their environmental impact, and for small, new sustainable ventures looking to scale their innovations. Papers from various methodological backgrounds, including literature reviews, theoretical, conceptual, and empirical work, are encouraged.

1.3 Business Models for Transition. Empirical observations and theoretical foundations of existing or emerging business models fostering societal transformation and transition

Track chairs: Niels Faber, Hanze University of Applied Sciences, Groningen and University of Groningen (The Netherlands) & Jan Jonker Radboud University Nijmegen, em (The Netherlands).

Recently, it has become clear that we need to develop innovative and radical solutions to tackle wicked and pressing problems associated with our current, linear economy and the sticky societal arrangements that are formed around it. Limitations of current society to tackle complex challenges become more and more visible. Efforts to address these issues thus far have only resulted in the creation of waste, pollution, depletion, and extreme forms of social exclusion.

A new generation of business models is needed that fosters a transition towards sustainable societies (Derks, et al., 2023; Faber and Jonker, 2023). Since many, if not all, of these problems, stem from how value creation is organised, it calls for a reconceptualization of how the amalgamation of sustainable, circular, inclusive, and restorative business models can bring about radical (system) change.

This track invites contributions exploring how sustainable business models can shape transformation and transitions towards a more sustainable and inclusive society (e.g., Jonker and Faber, 2021; Faber and Witjes, 2024). Problems to be addressed include a mixed and diverse perspective on circularity, sustainability, social well-being, and biodiversity (Rockström et al., 2009; Raworth, 2017). These problems are linked and should be addressed at various levels of aggregation.

Leading questions

For NBM2025@Reykjavík, we want to continue to explore the debate started at NBM2024@San Sebastian on how sustainable business models contribute to shaping transitions towards a more just, more inclusive, and sustainable society. We welcome both empirical as well as theoretical and conceptual contributions. Regarding practice, we are interested in contributions that address the question of where we may find examples of this in practices and/or policies, in which business models are deliberately applied to realize such transition. We are interested to learn what the real and if possible measurable impact of these business models is.

Concerning theoretical/conceptual contributions we are looking for ways in which the foundations and concepts of business models foster transition. How are the connections between the concepts of transition and value creation operationalized and to what effect?

Our concept of business models is not limited by thinking only in concepts based on organizations' pur-sang. On the contrary, we are convinced that value creation can be shaped through a rich and emerging variety of collective or collaborative business models based on collaboration between diverse stakeholders such as citizens, businesses, and government.

Our ambition is to chair two sessions. The first is on empirical observations and experiences of how business models shape societal transition. The second session will focus on exploring the theoretical and conceptual foundations of business models for transition. All those who submit to this track are cordially invited to join both sessions, present their work, and join the discussions.

2. EXPLORING THE SECTORAL AND ORGANISATIONAL LEVEL

2.1 Innovation through artificial intelligence and data-driven business models for sustainable transformation

Track chairs: Maya Hoveskog, Halmstad University (Sweden), Laura Michelini, LUMSA University of Rome (Italy), Magnus Holmén, Halmstad University (Sweden), Lauri Paavola, University of Eastern Finland (Finland); Luís Irgang Dos Santos, Halmstad University (Sweden)

This track theoretically and empirically analyzes and conceptualizes the emergence and structure of both firms' and ecosystems' value propositions for sustainability. The track focuses on, but is not limited to, the interplay between products and services vs data-driven business models and ecosystems; digitization, digitalization, and digital transformation of business models; the development and use of big data and machine learning, the use of generative AI for innovation and decision-making, data acquisition strategies and new business models; the role of digital platforms for business model innovation; methods for developing data-driven business models and ecosystems. A particular focus is placed on AI for data-driven business models for sustainable transformation.

Below listed are questions that illustrate relevant topics that the contributions can tackle. Those are neither exhaustive not comprehensive. Other relevant lines of investigation are welcome tackling innovation through artificial intelligence and data-driven business models for sustainable transformation.

- How to leverage AI and data-driven business models to address environmental and societal challenges? What are the associated drivers, barriers and enablers?
- What are the opportunities and challenges related to AI and data-driven business models for sustainability? More specifically, what are the factors that condition value creation and value capture from the use of AI and data-driven/digital technologies?
- What are the organizational and technological tensions and involved in AI and data driven business model innovation for sustainability? Additionally, how do organizations manage paradoxical tensions between data exploitation and privacy protection while pursuing sustainable business models?
- How do digital platforms, their corresponding ecosystems as well as overall ecosystem value propositions for sustainability emerge and evolve to leverage on critical complementarities?
- How can/should companies govern their engagement in digital platforms, and what are the implications for business models for sustainability?
- How can/should firms develop, acquire, attract, and evaluate AI/digital capabilities to diversify their product portfolio? Additionally, how does the interplay of various technical and non-technical capabilities contribute to realizing sustainability values through AI and data-driven business models?
- How can firms overcome the fears and mistrust towards the AI to create a culture that supports AI and driven business models addressing environmental and societal challenges?
- What are the tensions between algorithmic efficiency and social responsibility in data-driven business models for sustainability?
- How can organizations develop paradoxical mindsets to navigate competing demands in AI-driven sustainable transformation?

2.2 Community-led and community-based business models for sustainable development

Track chairs: Sonia Marcos, Universidad de Burgos (Spain); Jaime González-Masip, Universidad Politécnica de Madrid (Spain); Moniek Kamm, Saxion UAS

This track explores and explains community-based and community-led business models as a new approach to better understanding the necessity of bottom-up initiatives for sustainable development. Already, community-led and based actions and strategies result in successful new business models to address challenges in different communities, where the community's interests are closely linked to the preservation of the social capital and environment, such as rural communities. Collective and community-led business models can provide new solutions to local needs of communities such as ageing populations, elderly care, lack of essential services, access to affordable housing or integration of vulnerable groups, and spark the development of opportunities of circular economy in high potential sectors such as food and agriculture, new bio-based value chains and ecosystem services, among others. "The community is an intermediate, mediating and moderating environment" (Hindle, 2010, p. 601). The community context profoundly influences the types of entrepreneurship initiatives and how they are carried out (Peredo & Chrisman, 2006), demonstrating the importance of the community context in entrepreneurship (Mezias & Kuperman, 2001). The collective context and value proposition profoundly influence the types of entrepreneurship initiatives and businesses and how they are organised, demonstrating the importance of the community context in sustainable entrepreneurship.

Community-based business models (Jonker & Faber, 2021) are a distinct form of collective business models (Jonker, Hobé and Kamm, 2024) in which constituents collectively contribute to organizing themselves in an entrepreneurial manner (Kamm, 2022) around a collective value proposition.

In community-led approaches, initiatives are not led by an organisation or other outsiders but by a communal process (Wessells, 2018, p. 19). A community-led approach uses the practices of empowerment, mutual learning and consensus building to create bottom-up, citizen-driven change (Kolosy, 2020). The community holds the power and makes the critical decisions. Community-based business models addressing wicked problems related to sustainable development demonstrate parallels to institutes for collective action (Ostrom, 2010) and Social-Ecological Systems (McGuiness and Ostrom, 2014). Community-based initiatives addressing sustainable development bring a new element in that their constituents often represent different realms of society (Kamm, 2022), resulting in a broad and diverse number of community stakeholders that are involved in governing, supporting, acting and making decisions for the work done by the community, involving strategy and core activities next to self-determination and autonomy (Wessells, 2018).

Therefore, community-based organising forms are in demand of customised business models that support the community and its goals. Social innovation is essential in designing new solutions focused on communities' local and specific needs because it adds new economic and social value to the community (Vercher et al., 2020; Ubels, Haartsen & Bock, 2019), where community-led and community-based business models can act as support structures for community development and dynamics (Olmedo et al., 2023).

This session aims to attract academics to discuss their current research on community-led and community-based business models. We welcome articles from different methodological backgrounds, including literature reviews and theoretical, conceptual, empirical, existing projects, and case studies.

2.3 Business model experimentation for circular economy: close, slow, narrow, regenerate

Track chairs: Laura Niessen, Maastricht University (The Netherlands); Matthew Coffay, NHH Norwegian School of Economics (Norway); Sveinung Jørgensen, NHH Norwegian School of Economics (Norway); Lars Pedersen, NHH Norwegian School of Economics (Norway); Nancy Bocken, Maastricht University (The Netherlands)

The circular economy is an inspiration to many companies. Yet, established businesses and new ventures alike need significant experimentation to create desirable, feasible, viable, and sustainable business models (Bocken et al., 2021). Experimenting with diverse circular business models can support the acceleration of circular disruption with a "systemic, widespread and fast change" (Blomsma et al., 20222, p.1011) towards circularity. Research on business experimentation for circularity shows that experimentation requires considerable capability and planning but can create valuable learning and guide the transition towards sustainability (Weissbrod & Bocken, 2017). This reiterative approach can help overcome consumer barriers through finding interventions that address them (Bashhir et al., 2020).

While companies have been quite successful at creating business models focused on 'narrowing the loop' through resource efficiencies and closing the loop through recycling, the more challenging business models focused on regeneration, as well as slowing the loop through strategies such as sufficiency, are less commonplace (Bocken et al., 2022). Regeneration requires businesses to consider both societal and environmental well-being in their operations and to attempt to do "more good" rather than "less bad" (Konietzko et al., 2023). Sufficiency-oriented businesses seek to address the overconsumption of resources and provide alternative products and services to ensure that needs are met within the planetary boundaries (Niessen & Bocken, 2021). Both of these more strongly sustainable business transformations require piloting and experimentation to assess their desirability, feasibility and viability, as well as their real and measurable impact in terms of sustainability.

Finally, circular business models need to be designed and reviewed carefully to ensure that they do not accidentally create unintended rebound effects (Das et al., 2023). Circular business models often entail or require behavioural changes but might inadvertently lead to higher impacts due to convenience or new forms of consumption (Baczyk et al., 2024). Therefore, experimentation and experimentation tools can help to assess possible rebound effects (Das et al., 2023).

This track focuses on the cases, practices and tools of experimentation with new circular business model strategies.

3. EXPLORING THE ORGANISATIONAL IMPACT

3.1 Management, governance and accountability for sustainable business models

Track chairs: Burcin Hatipoglu, School of Business IRRG & PSRG, Canberra, University of New South Wales (UNSW), Australia; Silvia Cantele, Department of Management, University of Verona, Italy; Assunta Di Vaio, Department of Law, University of Naples "Parthenope", Italy; Vincenzo Riso, Department of Management, University of Verona, Italy

This track explores the future directions for developing managerial capabilities and accountability when innovating business models for digital, green, and inclusive transition. Engagement with sustainability and circularity involves integrating ecological and social aspects into products, processes, and organizational structures. Some avenues to explore in this track are governance and the role of boards, leadership, and managerial responsibilities; employee participation in eco-innovation processes; circular and sustainability KPIs and incentives; formal and informal organizational learning; knowledge management; sustainability practices and sustainability or integrated reporting; and creating co-creation opportunities with employees and other stakeholders.

Theories that lend themselves to exploring the managerial side of business model innovations include the resource-based view of the firm, dynamic capabilities, capability view of the firm, stakeholder theory, organizational learning, and sustainability transition frameworks. We invite research that applies some of these theories or proposes unexplored theories to examine how the managerial side of an organization can be developed when organizations innovate their business models.

3.2 New business models in times of crisis: scaling resilient and sustainable local solutions for global challenges

Track chairs: Dorleta Ibarra, Mondragon Unibertsitatea (Spain); Juan Ignacio Igartua Mondragon Unibertsitatea (Spain)

We are facing a paradigm shift marked by a convergence of multiple crises, such as climate change and environmental degradation, energy crises, water scarcity, global health crises, geopolitical conflicts, economic downturns, supply chain disruptions, social inequalities, and migration and displacement. The urgency to address these interconnected crises is driving the global triple transition—digital, green, and inclusive.

Crises stress societies, disrupt economies, strain public services, and can significantly challenge conventional business models. They increase uncertainty, challenge governance structures and regulations, aggravate inequalities, and damage social cohesion, leaving businesses and communities struggling to maintain stability and resilience while adapting to new contexts and market dynamics.

New business models emerging from crises and adapting to the triple transition often focus on agility, resilience and sustainability, accelerating technology diffusion and digital transformation to remain competitive in a changing world. In this context, emerging technologies such as artificial intelligence can play a crucial role in addressing crises by providing rapid data analysis, supporting decision-making, and predicting trends. Likewise, organisations are increasingly pivoting toward circular business models to address climate change, resource constraints and regulatory pressures. These business model innovations must be inclusive and just, placing people at the centre and ensuring that no one is left behind. We must

move towards organisations that integrate intergenerational challenges, promote diversity in all its forms (gender, race, class, etc.), foster (inter-)cooperation, create shared social value, and cultivate a culture that empowers individuals to play a more active role in social transformations.

This track explores research aimed at understanding the dynamics that help businesses and communities not only weather crises but also seize them as opportunities for innovation and sustainable growth. It focuses on building and assessing more resilient business models, considering dynamic capabilities, financial resilience, upskilling and reskilling needs and supporting tools for risk management and informed decisions-making.

We are particularly interested in cases involving startups, SMEs, and cooperatives, as they often address global challenges through local responses, promoting community-driven and solidarity-based solutions. Their unique characteristics make them naturally adaptive and resilient. Additionally, these models often focus on mutual aid, support for local economies, and the provision of essential services during times of distress.

The track encourages both conceptual and empirical contributions—quantitative, qualitative, and mixed-method studies—that offer insights into creating business models capable of navigating the complexities of a multi-crisis environment.

3.3 Measuring and managing the sustainability effects of business models

Track chairs: Florian Lüdeke-Freund, ESCP Business School Berlin (Germany); Romana Rauter, University of Graz (Austria); Henrikke Baumann, Chalmers University of Technology (Sweden); Ana Carolina Bertassini Chalmers University of Technology (Sweden); Joan Manuel F. Mendoza, Mondragon University (Spain)

Business models for sustainability (BMfS) aim at contributions to sustainable development and are therefore based on the principles of triple-bottom-line and stakeholder-centric value creation. They aim not just to improve the performance of organizations but also to have net positive ecological and social impacts beyond organizational boundaries (Freudenreich et al., 2020; Lüdeke-Freund et al., 2020). The aim of this track is to better understand whether and how business models can have such effects and how these effects – including outputs, outcomes, impacts, and value – can be managed and measured (Rauter et al., 2019). Assessing and managing the sustainability effects of business models requires exploring and integrating various topics and concepts (e.g., business model, system-level perspectives, types of effect) as well as tools and metrics (e.g., from sustainability reporting and accounting, life cycle assessment). Digitalisation and artificial intelligence as well as regulatory frameworks such as CSRD/ESRS, EU taxonomy, CSDDD etc. play an increasingly important role, too. This track is open to conceptual and empirical papers that integrate the notions of business models and measuring and managing the sustainability effects of organizations in novel and robust ways. Approaches based on life cycle assessment frameworks and methods are particularly welcome as these have proven to be promising and thought-provoking in past editions of this track (e.g., Böckin et al., 2022; Goffeti et al., 2022).

What does measuring and managing the sustainability effects of business models mean? Measuring and managing the sustainability effects of business models involves defining the units of analysis for the business model and its performance, which includes, for example, the created and destroyed value, its contribution to an organization's environmental performance, and the social impacts resulting from organizational activities. It also refers to the necessity to develop frameworks, methods, and tools that allow specifying, measuring, and managing such effects. Here critical questions emerge, such as: What sustainability effects do business models create? How can these be measured and managed effectively? How do we know that these effects are related to business models and their properties? This also requires

navigating challenges in defining terms like "performance," "value," and "impact" in relation to business models (e.g., Dembek et al., 2023), as these concepts are currently not well-connected to business models in standardized or meaningful ways.

Why is it an important topic? Business models are central to organizational value creation and, by extension, to societal value creation. Thus, integrating sustainability into their core operations is crucial for sustainable development. BMfS can help bridge the gap between businesses' relationships with society and the natural environment by promoting sustainability in their operations and outputs. Understanding and managing the sustainability effects of business models is hence essential to guide responsibility, accountability, and governance within and beyond organizational boundaries.

What are current challenges in dealing with this topic? As BMfS are defined using diverse theoretical perspectives (e.g., stakeholder, activity, or value flow perspectives) a high degree ambiguity exists, leading to challenges in developing meaningful approaches for sustainability assessment and management from a business model perspective. The broad and inclusive nature of BMfS concepts makes it difficult to focus on distinct sustainability impacts and qualities, which leads to significant boundary setting and scoping issues, such as assigning specific environmental or social impacts to certain business models, or parts thereof, as well as determining the scope of a BMfS in terms of responsibility and governance of both direct and indirect effects. Furthermore, value-creating activities and their sustainability impacts occur at various levels (e.g., individual, organizational, global), yet there is limited understanding of how these impacts unfold across levels as well as across different stakeholders (e.g., consumers, companies, regulators) with their varying needs and expectations. Overall, there is a lack of unified concepts and terminologies to address sustainability performance, outcomes, and impacts of business models.

These challenges highlight the need for robust, interdisciplinary research to address gaps in sustainability assessment and management for business models.

4. EXPLORING THEORETICAL AND METHODOLOGICAL FOUNDATIONS

4.1 New theoretical foundations of business models for sustainability

Track chairs: Florian Lüdeke-Freund, ESCP Business School Berlin (Germany); Tobias Froese, Borderstep Institute for Innovation and Sustainability (Germany)

This track explores the status quo and future directions of theories underpinning research on business models for sustainability (BMfS). Building on, and going beyond, established approaches – such as activity-based (e.g., Zott & Amit, 2010), component-based (e.g., Osterwalder et al., 2005), design-based (e.g., Lüdeke-Freund, Massa et al., 2024; Zott & Amit, 2010), value-logics-based (e.g., Laasch, 2018; Lüdeke-Freund, Froese et al., 2024), or values-based (Breuer & Lüdeke-Freund, 2017) theoretical views on BMfS – we are looking for novel and theoretically robust contributions that further develop our understanding of the antecedents of BMfS, conditions of their emergence, their inner workings, and their sustainability implications. New theoretical views that lend themselves to this endeavor include, for example, theories of social practice (e.g., Gherardi, 2012), Alexandrian pattern theory (e.g., Alexander et al., 1977), or social mechanism theory (e.g., Hedström & Swedberg, 1998).

We invite contributions that make use of such theoretical lenses as current research faces significant shortcomings in addressing the complexities and special features of BMfS. Most current theoretical approaches are mono-disciplinary, leading to siloed perspectives that restrict integration across disciplines and fail to capture the systemic nature of both business models and sustainability. Additionally, there is a lack of comprehensive frameworks that link firm-level to system-level phenomena, such as societal value creation or sustainability transitions and transformations. Conceptual clarity is another issue as existing theoretical frameworks struggle to explain how BMfS create and diffuse value, and how they resolve tensions between traditional and sustainability-oriented modes of value creation (e.g., Laasch, 2018). These and further gaps highlight the need for more holistic and integrative theoretical foundations that can address the multidimensional nature of BMfS.

Several theories have the potential to provide promising foundations for the study of BMfS by offering interdisciplinary and systemic perspectives (for an exemplary overview see Lüdeke-Freund et al., 2021). Beyond those mentioned above, interesting candidates are sustainability transition and innovation system theories that shed light on how BMfS drive systemic change across multiple levels and networks (e.g., Bidmon & Knab, 2018). Imprinting theory to emphasize the importance of initial design choices in shaping long-term sustainable outcomes (e.g., Snihur & Zott, 2020), or paradox theory that addresses the tensions and conflicts that arise when organizations attempt to balance traditional business models with sustainability objectives (e.g., Hahn et al., 2018). Overall, promising avenues for future research lie in fostering multi-, inter-, and transdisciplinary theoretical frameworks that merge firm-level and system-level perspectives, while also considering the growing importance of emerging artificial intelligence (AI) technologies that will undoubtedly influence how future BMfS research will be conducted.

4.2 Transitioning business models towards sustainability through finances

Track Chairs: Adam Gordon (Columbia Climate School); Þröstur Olaf Sigurjónsson (University of Iceland), Björg Jónsdóttir (Bifröst University), Lára Jóhannsdóttir (University of Iceland)

Business models for sustainability (BMfS) are relevant for transitioning towards more socially, equitable, and ecofriendly world. However, this transition requires sustainable finance (La Torre et al., 2019) and investments fostering global development that is sustainable (Cunha et al., 2021) by taking into account environmental, social and governance issues (ESG) (European Commission, n.d.; Zairis et al., 2024). Sustainable finance, traced back to 1986 (Ferris & Rykaczewski, 1986), combines the elements of finance and sustainable development goals (SDGs) (Kumar et al., 2022), but sustainable finance and investment (Cunha et al., 2021) is of key importance in addressing the 2030 sustainable development agenda and the relevant SDGs, the Paris Agreement (Sisodia & Maheshwari, 2023) and in delivering the European Green Deal policy objectives (European Commission, n.d.). If not, risk can be embedded in investment portfolios, including transition risk (Alessi & Battiston, 2022).

Responsible business practices can furthermore be incentivized through finance- and reporting-related regulatory frameworks, standards and criteria, including the EU Taxonomy, the Corporate Social Responsibility Directive (CSRD), European Sustainability Reporting Standards (ESRS), Environmental, Social, and Governance (ESG) criteria, Sustainable Finance Disclosure Regulation (SFDR), and more relevant for finance and investment decisions (European Commission, 2020; Greenomy, 2023), where finance is used to encourage companies to adopt more sustainable and ethical practices. The research has, for instance, been categorized in terms of value creation, ESG ratings and performance, green bonds, and banking, financial risks, banking and sustainable finance (Zairis et al., 2024). Material or subject topics related to sustainable finance include sustainable development and the SDGs, climate change, green bonds, financial performance and social finance (Zairis et al., 2024), but also commonly associated with impact investing (Agrawal & Hockerts, 2021; Lehner et al., 2019; Rathee & Aggarwal, 2022; Roundy, 2020) and corporate social responsibility (CSR) and corporate social performance (Dam & Scholtens, 2015).

The European Commissions definition of sustainable finance "understood as finance to support economic growth while reducing pressures on the environment to help reach the climate- and environmental objectives of the European Green Deal, taking into account social and governance aspects (European Commission, n.d.)" is seen as too narrow, whereas a broader definition states that "sustainable finance should encompass all activities and factors that would make finance sustainable and contribute to sustainability" (Kumar et al., 2022, p. 2). However, it should be noted that the literature on sustainable finance is still very fragmented thus offering rooms for exploring the topic further on different levels of the society (Cunha et al., 2021), including institutional and organizational levels.

The sustainable finance, or finance for sustainability, landscape is complicated as it includes operational and labelling standards, industry-originated frameworks, and wider policy context where the main components include environmental, social and economic goals, as a part of the SDGs, in addition other sustainability-related policy objectives, therefore much wider than climate finance, green finance, SDG finance (Migliorelli, 2021), ethical investing, conscious capitalism (Kumar et al., 2022) or similar finance aspects. The subject is, consequently, relevant to all economic sectors and activities such as energy production, transmission, storage, or efficiency, transport, buildings, agriculture, social infrastructures, reduction of inequalities, food security and food systems just to name some examples (Migliorelli, 2021).

The purpose of this session is to explore the theoretical, methodological and practical foundation of transitioning of business models towards sustainability through finance.

4.3 Actor engagement in sustainable (circular) business model innovation through design thinking and other practices

Track Chairs: Katrien Verleye, Ghent University (Belgium); Alexander Henkel, Open University (Netherlands)

This track aims to provide insight into ways to engage a multitude of actors – such as businesses, customers, and governmental bodies – in the development, launch, and adoption of circular and sustainable business models so that value is co-created. Specific attention is dedicated to the role of design thinking for circular and sustainable business model innovation. Yet, we also embrace research on practices for motivating actors (e.g., storytelling) and supporting actors (e.g., offering sharing platforms, smart lockers, and other technologies) to engage in the creation of circular or sustainable value.

5. CONFERENCE WORKSHOPS

Incorporating paradoxes into my research on business models for sustainability: insights from the case of the fashion industry

Organizers

Jaime Gonzalez-Masip. Universidad Politécnica de Madrid

Sonia Marcos. Universidad de Burgos

Esben R.G. Pedersen. Copenhagen Business School

Thorey S Thorisdottir. University of Iceland

Grace Achieng. Gracelandic

Research on the tensions generated by paradoxes in sustainability-oriented business is topical. This workshop will explore those paradoxes inherent in business models for sustainability and how stakeholder behaviour influences them. Through a case study of the fashion industry, we will discuss various theoretical and practical perspectives on these complex dynamics. A panel of practitioners and academic experts and an interactive session will enable participants to delve deeper into this topic, share experiences, and co-construct new ideas.

The workshop seeks to facilitate integrating and advancing participants' research agendas within the topic. By fostering collaborative discussions and exploring academic and practical experience, it aims to identify new avenues to expand the field's boundaries and practical and theoretical frameworks of ongoing and future research. Additionally, group activities will help participants connect with potential collaborators for future research projects.

Building Climate Solutions: En-ROADS workshop for Global Action

Organizers

Agusta Thora Jonsdottir, University of Iceland

Rósbjög Jónsdóttir, Icelandic Energy Cluster

The En-Roads Climate Workshop is an interactive session where participants, guided by a trained facilitator, propose climate solutions. These solutions are tested in real-time using the En-Roads Climate Solutions Simulator to evaluate their impact on global temperature. The workshop aims to develop scenarios that align with the Paris Agreement´s goals of limiting global warning to well below 2C, ideally 1.5, above pre-industrial levels.

The workshop is ideal for those seeking to understand the implications of climate mitigation strategies and their impact. Participants gain a deeper understanding of the interconnectedness of various climate solutions, such as renewable energy, carbon pricing, deforestation reduction, and their impact on global warming. They experience a hands-on, real-time simulation using the En-Roads Climate Solutions simulator, which visualizes the outcomes of proposed climate policies and actions.

The workshop emphasizes global goals and offers insights into policies that support international climate objectives. It also helps participants evaluate the effectiveness of different strategies for mitigating climate change while understanding the trade-offs and synergies among other actions.

By the end of the workshop, a panel discussion on individual and collective actions and how we, as individuals, the research community, and businesses, can make a meaningful difference in addressing climate change.

Interdisciplinary dialogues on new business models: recognizing the value of nature and people

Organizers
Dominika Alexa Teigiserova, Manchester Metropolitan University
Tulin Dzhengiz, Manchester Metropolitan University
Paul Dewick, Manchester Metropolitan University
Susana Toboso Chavero, Universitat Autònoma de Barcelona, Universitat Autònoma de Barcelona Erasmus University Rotterdam

Achieving meaningful sustainability in business demands a nuanced understanding of diverse approaches, including regenerative models, circular economy, strong and weak sustainability, sufficiency strategies, and community-based practices. These models intersect with a growing interest in inter- and transdisciplinary approaches, which transcend traditional disciplinary boundaries to address complex, real-world challenges. This workshop provides a platform for researchers and practitioners to collaboratively explore the synergies, tensions, and opportunities offered by inter- and transdisciplinary approaches, particularly in the context of sustainable, circular, social innovation, and other purpose-led business models and ecosystems. A variety of emerging 'new business models' and 'ecosystems' introduce inherent tensions, which we will explore by engaging with a spectrum of perspectives—ranging from weak sustainability, which seeks to balance environmental, social, and economic priorities, to strong sustainability, which emphasizes ecological value and empowers individuals as active contributors. This exploration will provide a deeper understanding of the interconnectedness of these models and uncover pathways to advance research practices.

Whether it is to learn more about these models or share your expertise, this workshop will offer you a platform. Interactive group activities and visual mapping exercises will culminate in a synthesis of insights, which will be shared with participants to inspire further research and collaboration. Through interactive activities and discussions, participants will:

- Learn from each other, co-create solutions to challenges of inter and transdisciplinary approaches to sustainability
- Gain a deeper understanding of how weak and strong sustainability interact with other models, emphasizing both ecological integrity and the role of social capital, as well as systemic interconnectedness.
- New insights to enhance your research or professional practice.
- Meaningful connections with potential collaborators for future projects.

The workshop is ideal for those eager to contribute to the evolution of sustainable business practices and particularly early career researchers interested in inter- and multi-disciplinarity.

Co-Creating a New Research Agenda: A Cross-Cultural Dialogue on Business Model Innovation to Solve Global Challenges

Organizers

Ondine Hogeboom (Director, Flourishing Startups, Fellow, Georgian College Canada)

Dr Maya Hoveskog (Halmstad University)

Levinia Jones (Specialist in cultural intelligence and cultural exchange - Southern Africa)

This workshop convenes entrepreneurial leaders from both the Global Majority and the North to engage in a reciprocity-centered exploratory dialogue about groundbreaking business models and their impact on sustainability, equity, healthcare, and climate resilience in order to surface current research gaps and opportunities for further research. Focused on addressing the world's largest challenges, we will explore two distinct business models tackling the same issue—one from the Global Majority and one from the North—while leveraging different resources and drawing from diverse cultural wisdom and knowledge.

Through dynamic presentations and an exploratory dialogue between entrepreneurs from South America, Africa, and the North, we will uncover the intersections of their innovations and the unique differences in their approaches. This session will challenge traditional perceptions of innovation by learning how these different approaches are advancing next-generation business models.

Building on the outcomes of these discussions, a facilitated workshop will engage participants in exploring further research opportunities. Together, we will identify key themes and opportunities to highlight new directions for future research.

Key Themes

- Unique Business Models: Examine the design, resources, implementation strategies, and impact of innovative business models.
    - Entrepreneurial Skills and Mindsets: Discover how diverse cultures, creativity, and wisdom empower entrepreneurs to envision innovative solutions and drive impact and change.
    - Reciprocity and Global Systems Change: Explore how collaborations between the Global Majority and the North can inspire and sustain transformative global impact.
    - New Research Agenda: Identify key opportunities and emerging themes to inform new research directions, aligned with the normative values, interests and expertise of workshop participants.

Workshop participants will gain valuable insights into innovative business model designs, uncovering new pathways for democratized transformative business practices. This session fosters cross-contextual learning, encouraging reciprocal collaboration, exploring new research themes and opportunities for future exploration.

CONFERENCE PROGRAMME

NBM 2025

www.newbusinessmodels.org

Conference venue:
Faculty of Business Administration – University of Iceland Sæmundargata 2, 102 Reykjavík
University Cinema (Háskólabíó), House of Vigdis (Veröld hús Vigdísar) Institute of Foreign Languages, Oddi – University of Iceland

Tuesday 24 June – Pre-conference day		Wednesday 25 June	Thursday 26 June
8:20 – 8.50	Doctoral Colloquium (Only for accepted doctoral students)	8:30 - 9:00	**Registration**	**Registration**
08:50-09:00 09:00-09:10 09:10-10:10		9:00 - 10:30	**Opening Plenary**	Parallel Sessions (Tracks)
10:10 -10:20		10:30 -11:00	*Break*	*Break*
10:20 -12:00 12:00 -12:10 12:10 -13:00		11:00 -12:30	Parallel Sessions (Tracks)	Parallel Sessions (Tracks)
13:00 -14:00	Lunch for Doctoral Students	12:30 -14:00	*Lunch*	*Lunch*
		14:00 -15:30	Parallel Sessions (Tracks)	**Closing Plenary**
15:30 -16:00	Registration Háskólatorg (University of Iceland)	15:30 -16:00	*Break*	
		16.00 – 17.30	Parallel Sessions (Tracks)	
16:00-18:00	Welcome drink for registered people Háskólatorg (University of Iceland)			

Conference dinner
Gamlabíó
Ingólfsstræti 2a, 101 Reykjavík
(An additional ticket is needed for this dinner, 18:30 – 21:00)

A detailed version of the conference program (session tracks and distribution of presentation of authors) will be available in ConfTool to all conference participants.

CONFERENCE TRACKS AND ABSTRACTS

Theme 1. Exploring the system level

1.1 Innovative business models and ecosystems for sustainability transition: perspectives from global north and global south

Track chairs: Annukka Näyhä & Irene Kuhmonen, Jyväskylä University School of Business and Economics, Finland; Timber Haaker Saxion, University of Applied Sciences, The Netherlands; Nguyen Hong Quan, Institute for Circular Economy Development, Vietnam National University - Ho Chi Minh City, Vietnam; Nguyen Cong Thanh, National Economics University, Hanoi, Vietnam; Milou Derks, Orange Corners and Eindhoven University of Technology, Netherlands

1.2 Ecosystems in support of sustainability

Track chairs: Abel Diaz Gonzalez, Maastricht University (The Netherlands); Nikolay Dentchev, University of National and World Economy (Bulgaria) and Vrije Universiteit Brussel (Belgium); Bart Leyen, Vrije Universiteit Brussel (Belgium); Valery Chistov, Deusto Business School, University of Deusto (Spain)

1.3 Business Models for Transition. Empirical observations and theoretical foundations of existing or emerging business models fostering societal transformation and transition

Track chairs: Niels Faber, Hanze University of Applied Sciences, Groningen and University of Groningen (The Netherlands) & Jan Jonker Radboud University Nijmegen, em (The Netherlands).

Theme 2. Exploring the sectoral and organisational level

2.1 Innovation through artificial intelligence and data-driven business models for sustainable transformation

Track chairs: Maya Hoveskog, Halmstad University (Sweden), Laura Michelini, LUMSA University of Rome (Italy), Magnus Holmén, Halmstad University (Sweden), Lauri Paavola, University of Eastern Finland (Finland); Luís Irgang Dos Santos, Halmstad University (Sweden)

2.2 Community-led and community-based business models for sustainable development

Track chairs: Sonia Marcos, Universidad de Burgos (Spain); Jaime González-Masip, Universidad Politécnica de Madrid (Spain); Moniek Kamm, Saxion UAS

2.3 Business model experimentation for circular economy: close, slow, narrow, regenerate

Track chairs: Laura Niessen, Maastricht University (The Netherlands); Matthew Coffay, NHH Norwegian School of Economics (Norway); Sveinung Jørgensen, NHH Norwegian School of Economics (Norway); Lars Pedersen, NHH Norwegian School of Economics (Norway); Nancy Bocken, Maastricht University (The Netherlands)

Theme 3. Exploring the organisational impact

3.1 Management, governance and accountability for sustainable business models

Track chairs: Burcin Hatipoglu, School of Business IRRG & PSRG, Canberra, University of New South Wales (UNSW), Australia; Silvia Cantele, Department of Management, University of Verona, Italy; Assunta Di Vaio, Department of Law, University of Naples "Parthenope", Italy; Vincenzo Riso, Department of Management, University of Verona, Italy

3.2 New business models in times of crisis: scaling resilient and sustainable local solutions for global challenges

Track chairs: Dorleta Ibarra, Mondragon Unibertsitatea (Spain); Juan Ignacio Igartua Mondragon Unibertsitatea (Spain)

3.3 Measuring and managing the sustainability effects of business models

Track chairs: Florian Lüdeke-Freund, ESCP Business School Berlin (Germany); Romana Rauter, University of Graz (Austria); Henrikke Baumann, Chalmers University of Technology (Sweden); Ana Carolina Bertassini Chalmers University of Technology (Sweden); Joan Manuel F. Mendoza, Mondragon University (Spain)

Theme 4. Exploring theoretical and methodological foundations

4.1 New theoretical foundations of business models for sustainability

Track chairs: Florian Lüdeke-Freund, ESCP Business School Berlin (Germany); Tobias Froese, Borderstep Institute for Innovation and Sustainability (Germany)

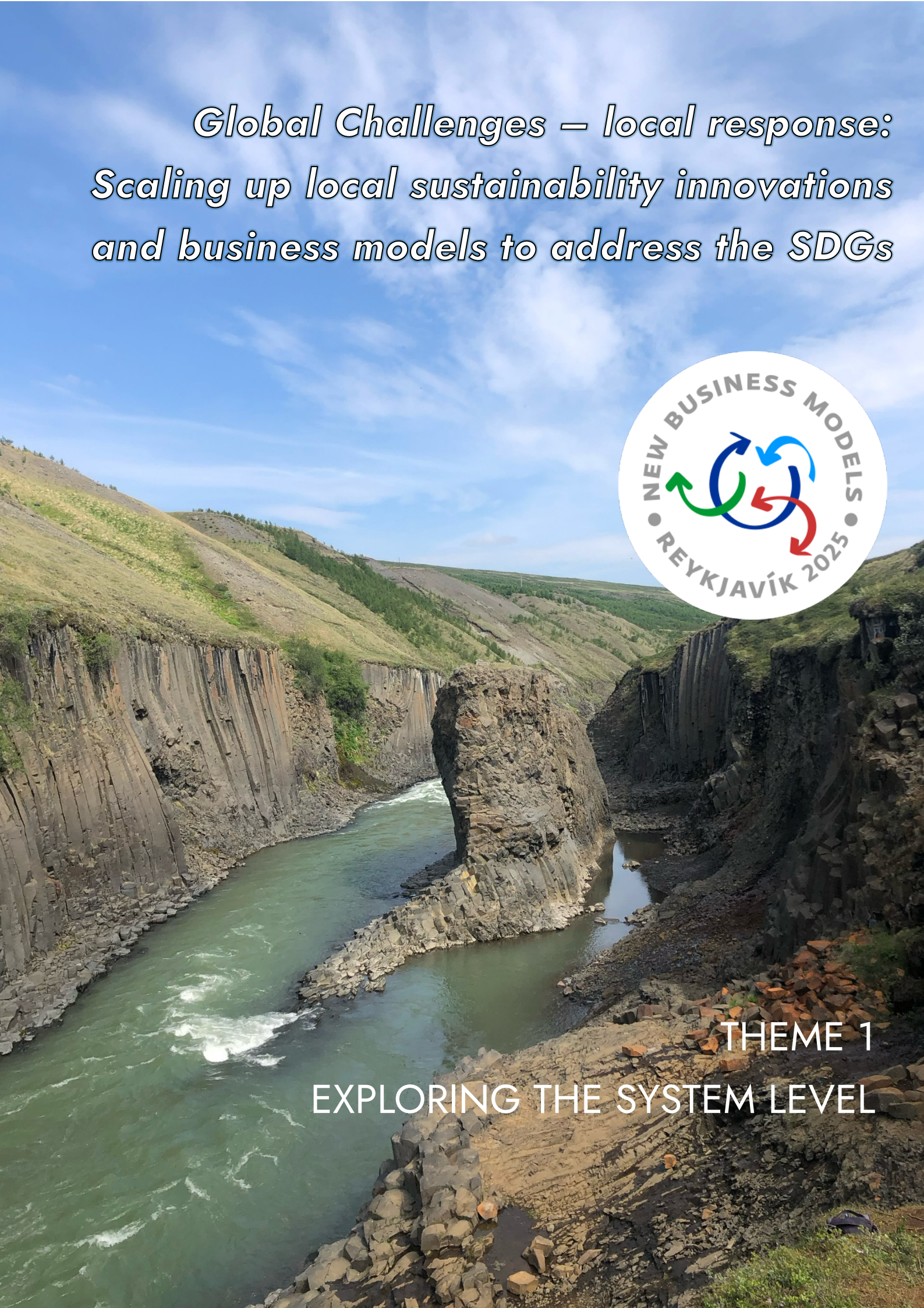
4.2 Transitioning business models towards sustainability through finances

Track Chairs: Adam Gordon (Columbia Climate School); Þröstur Olaf Sigurjónsson (University of Iceland), Björg Jónsdóttir (Bifröst University), Lára Jóhannsdóttir (University of Iceland)

4.3 Actor engagement in sustainable (circular) business model innovation through design thinking and other practices

Track Chairs: Katrien Verleye, Ghent University (Belgium); Alexander Henkel, Open University (Netherlands)

Global Challenges – local response: Scaling up local sustainability innovations and business models to address the SDGs



THEME 1

EXPLORING THE SYSTEM LEVEL

EXPLORING THE SYSTEM LEVEL

Awakening Beauty:

Understanding the Emergence of Regenerative Entrepreneurship Networks in Colombian Bioregions

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Abstract

In an era of interconnected global crises, biodiversity hotspots in the Global South face escalating threats from extractive activities. This study examines how regenerative entrepreneurship networks in Colombia emerge as locally-rooted responses to these challenges, enhancing both social and ecological resilience. Through a comparative case study of two bioregions in Antioquia, this research investigates how local innovations in business models can contribute to broader sustainability transitions. Using living systems theory as a theoretical lens, the study maps socio-ecological networks and their potential for scaling regenerative practices beyond their local contexts.

Keywords

Regenerative entrepreneurship, Bioregion, Systems view of life, Rural entrepreneurship, Social Networks.

Main text

Problem Statement:

The escalating planetary crisis, manifested through climate change, biodiversity loss, and socioeconomic inequality, poses particular challenges for biodiversity hotspots in the Global South, where extractive activities threaten both ecological and social systems

(Escobar, 2018) . While global sustainability frameworks like the SDGs provide targets, effective responses must emerge from local contexts through innovative business models that address interconnected social and ecological challenges (Mang and Haggard, 2016; Gibbons, 2020).

In Colombia, emerging networks of regenerative entrepreneurs represent a locally-rooted response to these global challenges. These initiatives seek not only to minimize environmental damage but to enhance the regenerative capacity of social-ecological systems through place-based business practices (Muñoz and Branzei, 2021). However, the mechanisms through which these local innovations emerge and potentially scale up remain understudied, particularly in Global South contexts where alternative development pathways are critically needed (Coffey and Polèse, 1984; Max-Neef, Elizalde and Hopenhayn, 2006).

By studying regenerative entrepreneurship networks in two bioregions of Antioquia, Colombia, this research explores how local responses to global sustainability challenges emerge and evolve within specific socio-ecological contexts. The bioregional focus allows examination of how place-based entrepreneurial initiatives can contribute to both local resilience and broader sustainability transitions (Muñoz & Kimmitt, 2019). This approach aligns with growing recognition that addressing global challenges requires understanding and supporting locally-appropriate solutions that can be adapted and scaled across contexts (Jonker & Faber, 2021).

By studying regenerative entrepreneurship networks in two bioregions of Antioquia, Colombia, this research explores how local responses to global sustainability challenges emerge and evolve within specific socio-ecological contexts. The bioregional focus allows examination of how place-based entrepreneurial initiatives can contribute to both local resilience and broader sustainability transitions (Shrivastava and Kennelly, 2013). This approach aligns with emerging perspectives from the Global South that emphasize how locally-rooted innovations can generate alternative development pathways while respecting territorial specificities and socio-ecological dynamics (Escobar, 2001; Muñoz and Cohen, 2017). Such place-based understanding is crucial for developing contextually-appropriate solutions that can be thoughtfully adapted across different bioregional settings while maintaining their regenerative integrity.

Objectives

The general objective is to analyze the socio-ecological dynamics that influence the emergence, evolution, and sustainability of regenerative enterprises in the bioregions of the Cartama River and Arenal River basins in Antioquia, Colombia, in order to propose pedagogical recommendations that promote regenerative entrepreneurship in similar bioregional contexts.

To achieve this, the research design includes characterizing the socio-ecological context of the mentioned basin bioregions, identifying factors that potentially influence regenerative entrepreneurship; analyzing the characteristics of local entrepreneurs and their business models, evaluating their alignment with regenerative entrepreneurship principles and, finally, examining the interactions between the socio-ecological characteristics of the bioregions and the practices of regenerative entrepreneurs; developing a conceptual model that explains the mechanisms that facilitate or hinder regenerative entrepreneurship in the studied bioregions

Theoretical Framework:

Living Systems Theory, as developed by Miller and Miller (1990) and further expanded by Capra and Luisi (2014), provides a comprehensive framework for understanding life as a complex network of relationships and interconnected processes. This theory posits that living systems are organized in networks at multiple levels, from cells to societies, where each level exhibits similar patterns of organization and emergent properties that cannot be reduced to the properties of their parts. The emphasis on networks represents a fundamental shift from the mechanistic view of life, highlighting that the essential properties of living systems arise from the relationships and interactions between their components rather than from the characteristics of individual parts (Capra, 2004). This network perspective is particularly relevant for understanding regenerative entrepreneurship, as it allows us to conceptualize businesses as living entities embedded within broader social-ecological systems, where their success depends on their ability to maintain and enhance the health of the networks they are part of (Muñoz and Cohen, 2017).

This systems perspective is particularly relevant for understanding entrepreneurship, defined as the capacity to identify opportunities, develop innovative ideas and take action to create economic or social value (Shane and Venkataraman, 2000) and especially for regenerative entrepreneurship, which aims to enhance and thrive through the health of social-ecological systems in a co-evolutionary process (Hahn and Tampe, 2021). This understanding suggests that sustainable enterprises must align their operations with natural processes and contribute to the health of the larger systems they are part of, requiring a shift from linear thinking to a more holistic, process-oriented approach that recognizes the interconnected nature of social, economic, and ecological systems (Muñoz and Cohen, 2017; Gibbons, 2020).

A social-ecological systems perspective, grounded in Living Systems Theory, provides a valuable framework for understanding bioregions - geographical areas characterized by natural rather than political boundaries, where ecosystems and human communities are deeply interconnected (Berg and Dasmann, 2014). This approach is particularly relevant when studying bioregions as complex networks of relationships between human and non-human actors, where entrepreneurial activities emerge and evolve. Indeed, bioregions

offer a unique context for studying regenerative entrepreneurship as they represent the convergence of natural systems (watersheds, ecosystems, biodiversity) and social systems (communities, cultures, economic activities), making them ideal units of analysis for understanding how regenerative practices emerge and spread (Muñoz and Kimmitt, 2019).

Methodology:

This research adopts a qualitative multiple case study approach (Yin, 2009) to examine regenerative entrepreneurship networks in two Colombian bioregions, enabling deep analysis of how regenerative practices emerge in distinct socio-ecological contexts. Following Eisenhardt's (1989) recommendations for theoretical sampling, the Cartama and Arenal River watersheds were selected as comparative cases representing different manifestations of regenerative responses to extractive development models in the Global South.

Social cartographi and Social network analysis techniques can be particularly useful in this context, as they allow researchers to map and analyze the complex web of relationships between entrepreneurs, communities, and natural systems, revealing patterns of collaboration, knowledge sharing, and resource flows that characterize regenerative initiatives (Muñoz and Cohen, 2017). This methodological approach aligns with Living Systems Theory's emphasis on networks and relationships, providing insights into how regenerative entrepreneurial practices are embedded in and contribute to the health of their bioregions (Whiteman, 2010; Shrivastava and Kennelly, 2013).

Data collection and analysis proceed through three interconnected phases, following Whiteman's (2010) guidance for qualitative research in socio-ecological contexts. The first phase employs comprehensive document analysis following Bowen's (2009) systematic approach to examine historical records, network documentation, and policy frameworks. This foundational analysis draws on decolonial methodologies (Santos, 2015) to ensure local knowledge systems and historical trajectories are appropriately contextualized.

The second phase utilizes participatory social cartography, building on Chambers' (2006) participatory research methods and Escobar's (2018) emphasis on territorial knowledge. Through facilitated workshops (3-4 per bioregion), community members co-create maps that reveal both tangible and intangible connections between social and ecological systems. This approach aligns with Muñoz and Kimmitt's (2019) framework for understanding place-based entrepreneurship in rural contexts.

The third phase applies social network analysis following Borgatti and Halgin's (2011) methodology for mapping knowledge flows and resource exchanges. This technique reveals patterns of organization within entrepreneurial networks, building on Shrivastava and Kennelly's (2013) work on place-based enterprise and socio-ecological embeddedness.

Data analysis integrates findings across all phases using MaxQDA for thematic analysis (Braun and Clarke, 2023) and system dynamics mapping (Meadows, 2008). The cross-case synthesis follows Eisenhardt's (1989) approach to theory building from cases, while maintaining attention to the unique characteristics of Global South contexts (Escobar, 2018). This multi-method approach aligns with Living Systems Theory's emphasis on understanding patterns of organization in complex socio-ecological systems (Capra and Luisi, 2014).

The data analysis employs a multi-layered systemic approach that integrates qualitative and systems thinking methodologies to understand the complex dynamics of regenerative entrepreneurship networks. First, a thematic analysis following Braun and Clarke's (2023) rigorous protocol examines interview transcripts, field notes, and participatory mapping outputs to identify recurring patterns in entrepreneurial practices and bioregional characteristics. This initial layer of analysis reveals how local actors interpret and respond to socio-ecological challenges within their specific territorial contexts.

Building on these insights, the second analytical phase employs systems analysis techniques grounded in Living Systems Theory (Capra and Luisi, 2014) to map feedback loops and dynamic relationships between key variables identified in the thematic analysis. This systems mapping illuminates how different elements of the socio-ecological system interact and influence the emergence and evolution of regenerative practices.

The final analytical phase develops theoretical models that explain emergent patterns in regenerative networks, drawing on Muñoz and Cohen's (201 7) social-ecological understanding of sustainable venturing to explore scaling potential while maintaining territorial specificity. This integrated analytical framework enables a nuanced understanding of how regenerative entrepreneurship networks emerge and evolve within specific bioregional contexts while contributing to broader sustainability transitions in the Global South.

Case selection:

The selection of the Arenal and Cartama River watersheds as comparative case studies represents a theoretically-informed choice to examine how regenerative entrepreneurship emerges in bioregions with distinct historical trajectories but similar contemporary challenges. Both watersheds exemplify the complex interplay between local responses and global pressures characteristic of the Global South.

The Arenal River watershed presents a critical case of post-conflict transformation. The region's historical trajectory - from hydroelectric development in the 1960s through armed conflict to current regenerative initiatives - illuminates how local communities develop alternative development pathways in response to extractive practices. The emergence of the Local Network of Conservation, Sustainability and Good Living Initiatives, with over 30

regenerative ventures, demonstrates how collective action can reconfigure socio-ecological relationships in the aftermath of conflict and displacement.

The Cartama River watershed offers a contrasting case where regenerative entrepreneurship emerges amid ongoing tensions between conservation and extraction. This bioregion's rich biodiversity, including endangered species like the spectacled bear, exists in tension with expanding agricultural frontiers and mining interests. The "Regeneradores en Movimiento" network, comprising 64 initiatives, represents a grassroots response to these pressures, illustrating how local actors mobilize to protect and regenerate socio-ecological systems.

Both watersheds offer compelling cases for studying the emergence and evolution of regenerative entrepreneurship within distinct social-ecological contexts, each with their own historical trajectories, challenges, and opportunities for regenerative development.

Expected Results:

This research aims to contribute to the theoretical understanding and practical implementation of regenerative approaches in the Global South context, exploring the intricate intersections of entrepreneurship, sustainability, and socio-ecological transformation.

Theoretically, the study develops a conceptual framework explaining how regenerative entrepreneurship networks emerge and evolve within specific bioregional contexts. By extending Living Systems Theory, the research provides critical insights into scaling dynamics of local sustainability innovations, challenging traditional epistemological frameworks and highlighting the unique perspectives of the Global South.

Practical implications focus on identifying key mechanisms that enable or constrain regenerative enterprises in contested territories. The study develops context-sensitive indicators for assessing regenerative impact across scales, offering practical guidelines for scaling local innovations while maintaining their regenerative integrity.

From a policy perspective, the research provides recommendations for frameworks that support bioregional approaches to sustainable development. It explores how local innovations can inform global sustainability strategies, balancing local autonomy with broader systemic transitions.

The findings have significant implications for multiple stakeholders. Entrepreneurs gain insights into implementing regenerative practices in complex bioregional contexts. Policymakers receive guidance for developing supportive policies at local and regional levels. Communities can understand the potential benefits of regenerative approaches for social well-being and ecosystem health. Academically, the research contributes to a deeper

theoretical understanding of regenerative entrepreneurship and its intricate relationship with bioregional characteristics.

By centering the experiences and innovations of the Global South, this study offers a nuanced, critical examination of regenerative development, demonstrating the potential for localized solutions to address complex global challenges.

Preliminary conclusions

Based on the initial field observations and preliminary engagement with regenerative entrepreneurship networks, several significant patterns are emerging that warrant careful consideration within the broader theoretical framework of socio-ecological systems and regenerative development in the Global South. These preliminary findings suggest complex dynamics in the emergence and evolution of regenerative networks:

The Role of Experienced Leadership in Network Formation: The emergence of both networks appears to be significantly influenced by individuals with extensive experience in governance and transformative leadership. In the Arenal network, the presence of pioneers from Colombia's first ecovillage (established in the Darién region) provides critical foundational knowledge in sustainability transitions. Similarly, the Southwest Antioquia network benefits from the 23-year legacy of the Western Environmental Belt Collective's resistance to extractivism. This pattern aligns with Muñoz and Branzei's (2021) observations about the importance of established social capital in catalyzing regenerative initiatives.

Multi-scalar Knowledge Networks: The research reveals sophisticated multi-scalar connections that facilitate knowledge exchange and resource mobilization. The integration of these local initiatives into international academic networks, exemplified by research partnerships with Norwegian universities, demonstrates how place-based innovations can contribute to global sustainability discourse. This dynamic reflects Escobar's (2018) conceptualization of pluriversal knowledge systems emerging from territorial experiences.

Institutional Support and Network Governance: The engagement of FOLU Colombia (Food and Land Use Coalition) illustrates the critical role of intermediary organizations in strengthening network governance. Their support in facilitating participatory processes for developing network principles and statutes exemplifies what Shrivastava and Kennelly (2013) describe as the institutional infrastructure necessary for place-based enterprise development.

Territorial Dynamics and Network Cohesion: Geographic proximity emerges as a significant factor in network development, with notable differences between the two cases. The Arenal network's geographical concentration (within a smaller radius) appears to facilitate more frequent interactions and collaborative problem-solving, while the Cartama network's broader geographical distribution (approximately 50km radius) presents challenges for regular engagement. This spatial dynamic aligns with Muñoz and Kimmitt's

(2019) findings on the importance of territorial proximity in rural entrepreneurship networks.

Metaphorical Framing and Collective Action in Socio-ecological Resistance: A particularly salient finding emerges in the Southwest Antioquia network's deployment of the "Fighting the beast is not enough; we must awaken beauty" metaphor, which transcends conventional resistance narratives by coupling opposition to extractivism with regenerative action. This discursive strategy aligns with Escobar's (2018) conceptualization of alternatives to development and Santos' (2015) epistemologies of the South, serving as a powerful tool for collective sense-making and action. The metaphor's dual nature - confronting extractivist mining while nurturing regenerative enterprises - reflects what Muñoz and Branzei (2021) identify as the simultaneously protective and transformative character of regenerative organizations. By framing their work not merely as opposition to a proposed gold mine but as the active cultivation of regenerative alternatives, network members demonstrate how local actors in the Global South can articulate and enact alternatives to dominant extractivist paradigms while building regenerative futures. This sophisticated understanding of socio-ecological transformation illustrates how metaphorical framing can unite defensive and creative aspects of territorial resistance, transforming potentially paralyzing opposition into generative action that reframes local development possibilities.

These preliminary conclusions suggest that regenerative entrepreneurship networks in Colombian bioregions represent complex adaptive systems where historical experience, multi-scalar connections, institutional support, territorial dynamics, and individual agency interact to create unique pathways for socio-ecological transformation. As the research progresses, deeper investigation of these patterns will contribute to understanding how local regenerative initiatives can effectively address global sustainability challenges while maintaining their territorial specificity.

However, these observations should be considered preliminary and will be subjected to more rigorous analysis as the field research continues. The ongoing investigation will particularly focus on understanding how these patterns contribute to the networks' capacity for scaling their regenerative impact while maintaining their integrity and connection to place.

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Coordination Mechanisms for Entrepreneurial Ecosystems in Emerging Economies: A Relational Coordination Theory Approach

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Abstract

Although research regarding entrepreneurial ecosystems (EE) has significantly increased over the past two decades, studies focusing on the coordination of activities among institutions remain scarce. Perhaps this occurred because the emphasis is on leadership and governance, often overlooking the specific details that facilitate or limit the coordination of activities between institutions. This paper addresses this gap by analyzing the main coordination mechanisms among institutions.

Utilizing relational coordination theory as a theoretical framework, this study draws on data from exploratory qualitative research, including 70 semi-structured interviews and three focus groups conducted in two developing economies in South America, Bolivia and Colombia. The findings highlight that shared meetings, information systems and boundary spanner role as coordination mechanisms by relational coordination theory together other mechanisms found in this study can enhance the coordination of activities in an EE; fundamentally through effective grouping and combining these mechanisms. Therefore, in an EE, when implementing a new coordination mechanism, it is essential to avoid displacing existing ones. This

research clarifies the main coordination mechanisms that should be applied in the early stages of entrepreneurial ecosystems in emerging economies.

Keywords

Entrepreneurial Ecosystem, Relational Coordination, Coordination mechanisms, Interorganizational Coordination

Main text

1. Introduction

Entrepreneurship is not an individual task; it requires crucial roles from numerous entities in both the public and private sectors that support innovation and other aspects of entrepreneurial development (Stam & van de Ven, 2021). An entrepreneurial ecosystem (EE) is an interdependent group of actors and factors that generate entrepreneurship activity (Brown & Mason, 2017; Kuckertz, 2019; Malecki, 2018; Roundy et al., 2018; Spigel & Harrison, 2018; Stam, 2015).

An EE can significantly contribute to increasing innovation and entrepreneurial activity, as well as addressing regional economic development (Audretsch & Belitski, 2021; Szerb et al., 2019). While in developed economies, the ecosystem tends to emerge naturally, this does not often occur in emerging economies due to multiple limitations such as structural gaps, resource scarcity, with this understanding, institutions in emerging economies deliberately work together to establish an EE (Harima et al., 2024; Roundy, 2017) , even though they agree on a vision, principles, and goals, they usually face a recurring problem: a lack of coordination. (Cao & Shi, 2021; Wurth et al., 2022), This arises from numerous differences among institutions, such as different sizes, divergent interests, asymmetries in information—

communication, and power imbalances (Ring & van de Ven, 1994; Wurth et al., 2022). Moreover, the coordination mechanisms within and among organizations are not necessarily the same (Roundy & Burke-Smalley, 2022).

It is well known that coordination of entrepreneurial ecosystems (EE) is essential for maximizing the impact and sustainability of entrepreneurial activities. (Audretsch, 2007; Aghion & Howitt, 1990; Isenberg, 2010) Despite the importance of coordination in an EE, few studies further analyze the coordination mechanisms, especially in the early stage; this knowledge gap is well-emphasized by (Roundy & Fayard, 2020, p. 121):

"In studies of entrepreneurial ecosystems, coordination is alluded to but typically not defined. For instance, Kuratko and colleagues (2017: 120) refer to EEs as "*coordinated* attempts to establish environments that are conducive to the probabilities of success for new ventures." Stam (2015: 1765) conceptualized an EE as "a set of interdependent actors and factors *coordinated* in such a way that they enable productive entrepreneurship" (emphasis added). However, very few studies focus on the role that coordinating activities play in ecosystems."

This study addresses this knowledge gap based on the following research question: "What are the mechanisms that facilitate coordinating a nascent entrepreneurial ecosystem in an emerging economy?", and using the relational coordination theory lens, this theory points out that applying mechanisms of coordination based on cross-cutting structures such as boundary spanner roles, shared information systems, frequent meetings, shared protocols—routines, and shared spaces, contribute to enhancing the coordination of activities in an EE. (Bolton et al., 2021; Checa-Morales et al., 2021; Holweg & Pil, 2008; Lee & Kim, 2020), To achieve this, the study employs data from qualitative research conducted in the developing economies of Bolivia and Colombia, including 70 interviews and three focus groups.

This paper begins by reviewing the theoretical background, which includes coordination intra-institutional and inter-institutional, entrepreneurial ecosystem coordination, and relational coordination theory. The following sections explain the qualitative and empirical methodology applied. After that, the paper shows the mean findings, followed by discussions that include a proposal model of coordination mechanisms for EE in the early stage, the concluding remarks, and limitations.

2. Theoretical background

2.1. Coordination: Intra and Inter-organizational

All Institutions or systems, regardless of their size or type, require some degree of coordination. However, as an institution grows in size and complexity, the need for more effective coordination mechanisms increases. Coordination involves integrating the different parts of the institution to ensure they work together toward organizational goals (Ven et al., 1976). Coordination is a concept approached from many theoretical perspectives and can be conceptualized as the harmonization of activities, roles, and resources in interdependent conditions toward a common goal. (Crowston, 1994; Jones et al., 2013; Mintzberg, 1980)

An institution usually applies coordination mechanisms such as supervision, standardization, mutual adjustment, and information systems to achieve high levels of coordination. (Jones et al., 2013; Mintzberg, 1980;Leonardi, 2015). Supervision is based on hierarchical authority in an organization's formal structure, clear authority lines and accountability facilitate organizational control and coordination (Jones et al., 2013; Mintzberg, 1980); Standardization involves developing and implementing uniform processes, talent, and expected outcomes (Mintzberg, 1980); Mutual adjustment based on direct feedback between individuals or groups (Ven et al., 1976; Thompson, 1967), and Information systems allow timely, transparent communication, knowledge sharing, and collaboration between institutional areas or departments. (Leonardi, 2015)

Coordination between institutions can be more complex than coordination within institutions and faces challenges such as trust, divergent interests, asymmetric communication, and power imbalances. (Owen & Currie, 2022; Ring & van de Ven, 1994; Van De Ven et al., 2022). Therefore, coordination mechanisms at the inter-institutional level are not necessarily the same and should be more flexible, fluid, and dynamic than those in an individual institution (Provan & Kenis, 2008; Roundy & Burke-Smalley, 2022). Whereas institutional coordination aligns activities and resources within a single entity, inter-institutional coordination aligns among various independent entities. In terms of governance at an intra-institutional level, based on formal authority, clear hierarchy, and organizational culture (Mintzberg, 1980), while at the inter-institutional level, based on leadership, peer relationships, and no common hierarchy exist (Kretschmer et al., 2022; Roundy, 2020; Roundy & Burke-Smalley, 2022). In terms of coordination mechanisms, hierarchical structure, supervision-control, standardization, mutual adjustment, and information systems are fundamentally within a single institution (Leonardi, 2015; Mintzberg, 1980), between various institutions is based on a network structure, shared vision, expected outcomes, trust-based relationships, and information-communication platforms (Huxham & Hibbert, 2004; Knox & Arshed, 2022; Owen & Currie, 2022). Whereas institutional coordination emphasizes formalized processes, inter-institutional coordination emphasizes autonomy, flexibility, and adaptability. (Huxham & Hibbert, 2004; Provan & Kenis, 2008)

2.2. Entrepreneurial Ecosystems Coordination

Adner (2017) points out that the term “ecosystem,” whether in the context of innovation, business, or entrepreneurship, carries different meanings that can be organized into two distinct but compatible and useful perspectives: the ecosystem as affiliation and the ecosystem as structure. The ecosystem as affiliation offers a helpful description of interactions at a macro level, focus on actors, their general

governance and community enhancements, following the strategy to increase the number of participants and their interactions, aiming to increase the entrepreneurial activity, while ecosystem as structure, begins with a clearly defined value proposition, focus on the necessary activities, and then identifies the actors required to execute those in order to materialize the value proposition. Achieving the value proposition demands that EE actors reach a sufficient level of coordination. Therefore, within the ecosystem as a structure perspective, the core elements are activities required to materialize the value proposition, actors are entities who execute these activities, positions refer to the locations of actors within the sequence or flow of activities, and links describe the resource exchanges between actors.

Coordination is a critical characteristic of business ecosystems (Adner & Kapoor, 2010), of the entrepreneurship process (Foss & Klein, 2004), and EE functioning (Roundy, 2020). Effective coordination of activities among actors and resources is essential for maximizing the impact and sustainability of entrepreneurial activities, and the entrepreneurial ecosystem's success (Audretsch, 2007; Aghion & Howitt, 1990; Isenberg, 2010). Therefore, a well-coordinated EE contributes to reducing redundancies and optimizing resource allocation (Mérindol & Versailles, 2024; Roundy & Fayard, 2020). It also develops inclusive governance, builds communication channels, and strengthens stakeholder relationships, which is crucial for mitigating asymmetric information communication. (Audretsch & Belitski, 2021; Isenberg, 2010, 2016; Brad,2012).

The relevance of coordination is also evident in transactions; when individuals, entrepreneurs, or institutions make transactions, they strive to minimize transaction costs, such as searching, negotiating, and enforcing contracts (David & Han, 2004) and/or capturing value for themselves. Whether the EE coordination increases, the transaction cost of entrepreneurs or other participants decreases (Roundy & Fayard, 2020). Just as having a diversity of agents involved in common activities in the EE is essential, understanding how their activities are coordinated is no less important.

(Autio & Levie, 2017; Colombelli et al., 2019; Colombo et al., 2019). Effectively coordinated EE facilitates the exchange and combination of resources among participating institutions (Fink et al., 2025; Nahapiet & Ghoshal, 1998) and tends to reduce transaction costs between them and for the entrepreneurs who are part of the ecosystem in each region. (Roundy & Fayard, 2020)

Although there is some research about entrepreneurial ecosystems coordination, focused on governance, leadership, alliances, contracts, platforms, network structures, and communication systems (de Esteban Escobar, 2020; Stam & Van De Ven, 2018; Thomas & Ritala, 2022) and these studies point out that the coordination is catalyzed for entrepreneurial support organizations – ESOs- such as incubators, accelerators, co-working spaces, and innovation hubs that provide resources, networks, services, spaces, and mentorship to entrepreneurs (Brown & Mason, 2017; S. Cohen & Hochberg, 2014; Nambisan et al., 2017)These studies regarding coordination activities in EE have not been systematically categorized, and there is a lack of empirical evidence to support their application.

Esteban Escobar, (2020) concluded that incubators, accelerators, and the other stakeholders of the EE comply with all the dimensions of relational coordination theory, and the entrepreneurs involved in EE achieve better results. Personal relationships are not enough to consistently achieve results because the results should not depend on a single person; role-based coordination is, therefore, necessary, especially as work becomes increasingly interdependent (Carmeli & Gittell, 2009; Claggett & Karahanna, 2018). Moreover, empirical evidence confirms that high levels of relational coordination result in higher effectiveness. (Claggett & Karahanna, 2018; Cramm & Nieboer, 2012; Lenz & Sarens, 2016; Noël et al., 2013)

2.3. Relational Coordination Theory

In an increasingly specialized, connected, and therefore interdependent world, there is a growing need for well-coordinated activities within and between institutions to achieve better results. These coordination tasks require systematized evidence that can serve as practical guidance, fundamentally at the interorganizational level, such as an EE that presents the challenge of aligning activities across institutions of different types, cultures, sizes, and industries; therefore, multiple stakeholders with multiple visions and interests. Given this context and the fact that relational coordination theory analyzes how the mutual reinforcement of communication and relationships facilitates the coordination of activities within and between institutions (Bolton et al., 2021; Gittell, 2002). This theory provides a helpful conceptual framework for understanding coordination mechanisms that are well-suited to the dynamic and heterogeneous nature of EE.

The relational coordination theory emphasizes the quality of relationships and communication among individuals in different organizations (Gittell, 2002). Relational coordination is a process among employees and /or institutions to execute practical activities under high task interdependence. (Bolton et al., 2021; Gittell, 2011a; Holweg & Pil, 2008). The mutual reinforcement between relations and communication is the heart of relational coordination theory (Checa-Morales et al., 2021; Gittell, 2011a; Lee & Kim, 2020). Relational coordination theory establishes that relationships based on shared goals, shared knowledge, and mutual respect help to support communication: frequent, timely, accurate, problem-solving, and vice versa, allowing agents to coordinate their work across boundaries. The main mechanisms of relational coordination theory are cross-cutting structures that include boundary spanner roles, shared information system, shared meetings, shared protocols and routines, shared space, relational job design, selection and training for teamwork, relational leadership work, shared accountability and rewards, conflict resolution (Bolton et al., 2021; Claggett & Karahanna, 2018; Gittell, 2011b). The main mechanisms of relational coordination theory regarding the interorganizational level that can strengthen EE coordination are the following:

Shared information systems

Inter-organizational Information Systems contribute to collaboration and information exchange among different types of organizations, such as public, businesses, NGOs, and academic (Gil-Garcia, 2016; Gil-Garcia et al., 2018). These systems help institutions integrate processes, improve decision-making, and enhance service delivery through shared information infrastructures to improve coordination (Gittell, 2011a; Roundy, 2020). They can contribute to enhancing transparency, reducing asymmetries in information and communication processes among different types and sizes of institutions in the ecosystem, enhancing psychological safety, especially of the small and poor EE institutions. (Cao & Shi, 2021; Wurth et al., 2022). The research regarding this topic is mixed; In health care industry there are a positive effect in the care providers' coordination, besides in the contracting processes among public and non-profit managers (Carnochan et al.,2019); whereas, the results in the airplane industry had not shown positive effect, probably because the information system tent to replace the existent communication mechanisms, such as in person communication. (Gittell, 2011a)

Shared Information systems enhance coordination within institutions if they can ensure equitable access for all stakeholders and contribute to the visibility and transparency across the whole work process that involves institutions and the overall information processes. When implemented relationally, these systems supplement rather than replace other forms of communication (Claggett & Karahanna, 2018). Moreover, the effectiveness of information systems depends on pre-existing relationships and institutional linkages, such as trust, shared vision, common goals, and collaborative activities.
(Tang et al., 2019).

Shared protocols and routines

Shared protocols provide visibility into the work process and identify the interdependence among activities to be coordinated by the different institutions involved. There is enough evidence in various contexts regarding how sharing routines or protocols among stakeholders enhances coordination (Aeyels et al., 2019; Cramm & Nieboer, 2012b; Hustoft et al., 2018; Margalina et al., 2017).

On the other hand, the shared goals between organizations and agreements in outcome expectations as a consequence of building a shared vision and establishing governance principles within EE institutions constitute the psychological contract across all EE participants, besides the starting point of the outcomes standardization. (Gittell, 2011a)

Shared meetings

Periodic meetings among interdependent stakeholders, moreover, facilitate building friendly ties within the EE participants, facilitate the links, that is, exchange and combination of resources, such as information, knowledge, talent, material resources, funds, etc. Therefore, if these presential meetings are frequent and highly oriented to problem solving, they tend to improve coordination. The positive effect of periodic meetings is proven in different industries, especially in human and social services such as health care, construction, and software development. (Abu-Rish Blakeney et al., 2019; Berntzen et al., 2019; Hellenes & Thrap-Meyer, 2017)

Shared spaces

Shared spaces generate the opportunity for face-to-face communication. (Bolton et al., 2021) These spaces usually exist in entrepreneurial support organizations such as incubators or accelerators in an EE. (de Esteban Escobar, 2020). The lack of proximity makes it challenging to define shared goals and information-sharing

procedures. (Madsen & Burau, 2018) Only a few studies about shared spaces exist, and most of these reveal their importance; however, Kuebart & Ibert, (2019) It has been proven that in the venture capital industry, shared space is not relevant, so coordination is not necessary depending on spatial proximity. Therefore, the relevance of physical proximity in coordination might depend on the nature of the work. (Bolton et al., 2021)

Boundary spanner role

Boundary spanners are people from institutions who help coordinate the work of others across departments or organizations. (Galbraith, 1974). Studies in different industries and contexts have shown that strengthening the cross-organizational boundary spanner role was associated with increased coordination across organizations. These studies have also found that strengthening the boundary spanner role was associated with higher coordination in education, health care, the airline industry, and community collaboration to reduce youth violence (Carmeli & Gittell, 2009; Gittell, 2002; Gittell et al., 2020). Another study found boundary spanners were effective when other practices, such as defined relational workspaces and opportunities for interaction with participants, were in place (McEvoy et al., 2011). For instance, EE intermediary organizations or entrepreneurial support organizations – ESOs- are known as boundary spanners because they provide networks, working spaces, and other services that facilitate collaboration and coordination among actors. (S. Cohen & Hochberg, 2014; Hernández-Chea et al., 2021; Nambisan et al., 2017).

In a nascent entrepreneurial ecosystem, usually, the leadership concentrates on an anchor institution; therefore, if assigned boundary spanners roles to the institutions, these boundary spanners can contribute to moving toward a new stage, multi-leader governance (Colombelli et al., 2019; Colombo et al., 2019). Although individuals with solid connections with participants in the entrepreneurial ecosystem may trust these relationships, they might need help relying on them when representing their

organizations because their primary responsibility is as agents. However, if interactions occur repeatedly, personal behavior can complement role-based behavior, strengthening personal relationships and deepening psychological contracts (Ring & van de Ven, 1994).

3. Methodology

Although the Stam, (2015) definition about EE "a set of interdependent actors and factors *coordinated* in such a way that they enable productive entrepreneurship" was broadly asummed for researchers and practitioners highlight coordination, few studies have explored and further analyzed the importance of activity coordination in the EE, and there is a lack of empirical evidence that supports coordination mechanisms in EE. To address this knowledge gap, the present research adopts a qualitative approach (Tomaszewski et al., 2020). This exploratory study with empirical data involved individuals who are part of entrepreneurial ecosystem institutions or whose institutions will be potential members of EE, such as public institutions, academic institutions, financing institutions, entrepreneur associations, business and professional associations, NGOs, and foundations. In all cases, the level of analysis was composed of the EE institutions that promote or provide support to ventures, while the unit of analysis, the individuals from these institutions who were involved in decision-making or operations regarding entrepreneurship.

The sample selection was prepared to consider at least one interview per institution member or potential member of the EE and included more interviews in accordance with each institution's size. Tables 1a and 1b summarize these aspects. The diversity of this sample, with individuals working in many different sizes and types of institutions, contributes to understanding the phenomenon holistically.

Table 1a: Interview Participants, Bolivia

N°	Domain	Participant
P1	Municipality Tarija	Director of economic and production and Development Secretary
P2	University	Rector
P3	Federation of Business Owners	Manager
P4	Productive Development Bank	Coordinator of services for entrepreneurs
P5	NGO	Technical service for entrepreneurs
P6	Asociation of Entrepreneurs TAS	Directory member
P7	University - Business Science	Deartament Director
P8	Entrepreneur support Service Velay	Co Founder
P9	Asociation of Entrepreneurs	Directory member
P10	Entrepreneur support Service Velay	Co Founder
P11	Municipality Tarija	Incubator worker
P12	Municipality Tarija	Worker of the economic and productive development secretary
P13	Municipality Tarija	Incubator Director
P14	Municipality Tarija	Secretary of economic and productive development
P15	Municipality Tarija	Worker of the economic and productive development secretary
P16	Departamental Gobernment of Tarija	Secretary of economic and productive development
P17	Departamental Gobernment of Tarija	Director of the economic and productive development secretary
P18	Departamental Gobernment of Tarija	Director of productive support fund
P19	Departamental Gobernment of Tarija	Worker of the economic and productive development secretary
P20	Municipalty San Lorenzo	Worker of the economic and productive development secretary
P21	21 BEYMAR RIVERA GAM EL PUENTE	Worker of the economic and productive development secretary
P22	Federation of Business Owners	Directory Member
P23	Federation of Business Owners	Directory Member
P24	Federation of Business Owners	Worker of Federation of Business Owners
P25	Industry and Comerce Chamber	Manager
P26	Professionals Federation of Tarija	Directory Vicepresident
P27	Professionals Federation of Tarija	Directory Member
P28	University	Academic Director
P29	University	Financial Director
P30	University	Research Director
P31	University	Director of the economic departament
P32	Entrepreneur Association	Directory president
P33	Entrepreneur Association	Directory Member
P34	Social Entrepreneur Association	Directory Member
P35	NGO 1	Program Director
P36	NGO 1	Entrepreneur assesor
P37	NGO 1	Technical service
P38	National Association of wine manufacturers	Manager
P39	University	Senior Professor
P40	Acelerator	Director
P41	NGO 2	Manager
P42	NGO 2	Director
P43	NGO 3	President
P44	NGO 4	President
P45	NGO 4	Technical support
P46	NGO 5	Program Manager
P47	NGO 6	Director
P48	Women Entrepreneur Association	Director
P49	Community of Artisians	Director
P50	University	Research Director
P51	Social Entrepreneur Association	Directory Member
P52	Departamental Gobernment of Tarija	Director
P53	National Industry and comerce chamber	Program director
P54	NGO 7	Director
P55	Entrepreneur support Service Velay	Co Founder

Table 1b: Interview participants, Colombia

N°	Domain	Participant
P1	University	Authority
P2	University	Program Coordinator
P3	University	Authority
P4	University	Authority
P5	University	Authority
P6	University	Authority
P7	University	Authority
P8	University	Authority
P9	University	Authority
P10	University	Authority
P11	University	Authority
P12	University	Authority
P13	Public University	Program Coordinator
P14	Comerce Chamber	Planification Director
P15	Municipality	Director

The semi-structured interview technique was used to explore and comprehend the phenomenon of interest in this research. The data collection process draws on 55 semi-structured in-depth interviews with actors and leaders of institutions in the south of Bolivia and 15 interviews in the Pacific region in Colombia, crossed with three focus groups, two in Bolivia and one in Colombia, developed through the lens of relational coordination theory in the context of the entrepreneurial ecosystem in the south of Bolivia and the Pacific region in Colombia, during approximately fifteen non-consecutive weeks between October 2022 and august 2024. These two small cities in two countries with the characteristics of emerging economies are appropriate settings for this research. The interviews in their first part focused on determining the interests, potential contributions, and relationships of each institution regarding their participation in the EE, while the second part of the interview and the focus groups were focused on exploring the mechanisms that facilitate coordinating activities at an interorganizational level, such as a nascent entrepreneurial ecosystem.

Participants were assured that their responses would remain anonymous and were encouraged to ask questions throughout the interviews (Cohen et al., 2018). The interviews lasted, on average, 32 minutes, while the focus groups averaged 61 minutes. The interviews and focus groups were recorded and then transcribed to increase the reliability of the research (Kvale, 2009). Table 2 summarizes the observations and focus groups conducted across each empirical setting.

Table 2: Focus Group Participants

N°	Domain	Participants
1	EE Directory Focus Group 1	NGO - Director
		University Authority
		University Profesor
		Municipality Authority
		Federation of Business Owners - Manager
		Entrepreneur Asociation Directory
2	EE Directory Focus Group 2	University Authority
		NGO - Programer manager
		NGO - Manager
		Comerce Chamber - Manager
		Financial Institution - Program Manager
3	Stakeholders Colombia Focus group 3	Comerce Chamber - Directory
		Comerce Chamber - Planification
		University Authority
		Public University - Director
		Municipality - Director

4. Findings

The data analysis was conducted with thematic analysis following the Strauss and Corbin (1998) approach outlined. The transcribed interviews were categorized using open and selective coding techniques (Strauss & Corbin, 2002; Creswell, 2003). Applying Atlas. Ti 24.0, open coding was first applied to identify initial codes, followed by second-order coding to explore relationships with coordination mechanisms of the relational coordination theory among subcategories. Table 3 provides examples of the core themes, emergent constructs, and higher-level

concepts, which ultimately informed the development of a proposed model or theory (Creswell, 2003).

Table 3: Structure of quotes and Illustrative data

Findings regarding relatinal coordination theory			
Ilustrative Cuote	First Order	Second Order	Category
Improving the relationships between the representatives of the organizations participating in the ecosystem, in addition to mutual respect, shared goals I would include horizontality."	Horizontality in relations	Mutual Respect Shared Goals Shared Knowledge	Relationship
Implementing timely and frequent communication methods among network members who are aligned and familiar with each other to facilitate actions and improve outcomes	Timely & Frequent communication	Timely Frequent Problem Solving	Communication
regular, focused, and agile meetings so that we come away with concrete results with each meeting. In other words, we make public commitments that we are obliged to fulfill, and if you meet more frequently with motivating, concrete activities and established deadlines, this allows for better coordination	Agile and focuse in results meetings	Periodic Meetings and Shared spaces	Cross Cutting Structure
... adopt common activities such as sharing schedules, having shared spaces to collaborate and connect	Shared spaces		
"The realities of support institutions are very different, and the needs of entrepreneurs are also very different. Therefore, it's necessary to ensure that there are representatives from the various types of institutions and entrepreneurs to create an efficient communication mechanism that better addresses needs and truly assesses whether the efforts we make as ecosystems are having a real impact."	Comunication Mechanisms	Tech-Mediated Communication	
"…. then suggested defining the leadership roles of each institution within each strategic line, meaning what roles each institution has. Also, having functions manual for the directory to understand the role of the President, Vice President, and the entire directory because one person alone cannot do it. Perhaps there is not much commitment from the institutions because they do not know what functions they are responsible for or if they are merely a member of the ecosystem	Clear leadership roles	Boundary Spanner Roles	
Other Findings			
Functions should be segregated according to the nature of the institutions, each one being responsible for something specific, for example, universities for education and the development of projects with a focus on entrepreneurship, etc	Specific role for each institution	Role Agrements	Cross Cutting Structure
We need to have common and clear objectives in the ecosystem, ensure that these are shared within each institution, and have a plan with activities, responsible parties, and a schedule	Goals become specific Plans	Operational Plans	
Create a calendar or annual activity plan and ensure that each institution is informed. Fairs, contests, in-person or virtual talks with influencers who inspire or have a track record with life experiences or testimonials	Activity Plans with a schedule	Public Schedules	
"...Keep institutions motivated to participate by communicating progress, showing the achievements and highlighting the benefits of being part of the ecosystem	Advancements and Benefits	Short-Term Outcomes	

4.1. Regarding relational coordination theory

Dimensions of communication and relations

Relational coordination theory is based on mutual reinforcement among relationships and communication. Relations are based on mutual respect, shared goals, and shared knowledge, while communication should be frequent, accurate, timely, and problem-solving (Bolton et al., 2021; Gittell, 2011a). The following quotes confirm this

theory: mutual respect is the base of relationships, and communication strategies are necessary to solve problems.

GF2: "Improving the relationships between the representatives of the organizations participating in the ecosystem, in addition to mutual respect, and shared goals, I would include horizontality."

E35 Bolivia: *"Implementing timely and frequent communication methods among network members who are aligned and familiar with each other to facilitate actions and improve outcomes."*

P SEP *GF1: "With a focus on problem-solving. ... we need to manage to improve the issue of communication?"*

The worry about horizontality highlights the differences through institutions, such as power imbalance and asymmetric information – communication. (Ring & van de Ven, 1994; Wurth et al., 2022). These differences make it necessary to work on communication and relations mechanisms to reduce the asymmetric perception.

In addition, shared goals are an essential element in the relational dimension of relational coordination theory and a necessary condition in the early stage of an EE (de Esteban Escobar, 2020; Gittell, 2011a). The following quotes confirm the importance of sharing goals in the EE and highlight the importance of considering the interests of each institution and becoming goals in concrete plans.

"Improving the relationships between the representatives of the organizations participating in the ecosystem, in addition to mutual respect, shared goals I would include horizontality."

E35 "…through the ecosystem, to ensure that everyone works toward a single goal, following a single line of work, looking toward a single horizon"

E10 Colombia: "That is why these activities are coordinated. We initially define the objective of what we want to achieve. Once the objective is clear, a work agreement is established, considering the interests of each institution and the goal we want to reach..."

To establish goals, considering the interests and expectations of each institution is necessary as the previous step to shared goals, because if the goals are incompatible with each institution's mission, it will be difficult for the employees to support it.

Information Systems

Technology-mediated communication is assertive if supplemented rather than replaced other mechanisms and reduces asymmetries while allowing transparency (Claggett & Karahanna, 2018). The following quotes show the relevance of this mechanism.

E13 Colombia: "There should be a platform where all the institutions can interact, present their offerings or services, as well as the activities they develop for entrepreneurs. This would help identify and avoid the overlap of activities and offerings."

GF1: "Setting up regular agile meetings and finally having a good communication mechanism or a collaborative work platform is one of those means, along with social networks and WhatsApp groups, among others."

GF2: "Establish agile methodologies for collaborative work, finalize the collaborative work platform. Share timely, accurate information using efficient applications or interfaces to link joint relationship processes."

These quotes suggest that technology-mediated communication can reduce the overlap in the EE; on the other hand, it is almost always associated with another coordination mechanism, in this case, regular, frequent, and agile meetings, as well as shared spaces.

Shared meetings and spaces

Periodic and frequent meetings among institutions generate fluid and flexible communication, which usually reinforces links or resource exchange. Therefore, coordination should be improved. (Perloff et al., 2017). The following quotes reflect this assumption in a significant way and complement it with other aspects.

GF1: "... regular, focused, and agile meetings so that we come away with concrete results with each meeting. In other words, we make public commitments that we are obliged to fulfill, and if you meet more frequently with motivating, concrete activities and established deadlines, this allows for better coordination."

E27: "... to keep institutions motivated to participate by organizing regular meetings that highlight the advances and advantages of being part of the ecosystem..."

While periodic and frequent meetings are important, their effectiveness depends on their focus on problem-solving and agility. Such meetings foster public commitments to action and motivate institutional representatives by demonstrating tangible progress toward achieving the shared goals or expected outcomes. Public commitments that generate high expectations among other stakeholders represent a self-demand not to fail in keeping one's word.

Regarding shared spaces, there is little explicit evidence in the interviews or focus groups highlighting their importance. This is likely due to the context of small cities, where universities in both cases, and the municipal incubator in Bolivia, already provide spaces where meetings can easily take place. In fact, these and other institutions often offer shared spaces as part of their contribution to the entrepreneurial ecosystem. Nevertheless, the following quote illustrates the necessity of these spaces.

E47 "...adopt common activities such as sharing schedules, creating shared spaces to interact and collaborate."

Boundary spanner roles

When coordination is treated as a separate function, it enables the inclusion of a transition broker (Cramer, 2020), dealmakers (Pittz et al., 2021) or the boundary spanner roles (Bolton et al., 2021) as a crucial systemic intermediary. The application of the boundary spanner roles as a coordination mechanism in the early stage (Bolton et al., 2021; Gittell, 2011a), can contribute to moving from an anchor institution as a leader in the EE to multi-leaders (Colombelli et al., 2019; Colombo et al., 2019). The empirical evidence of this research confirms this argument, as pointed out by the following quotes:

GF1 Bolivia *"…. then suggested defining the leadership roles of each institution within each strategic line, meaning what roles each institution has. Also, having functions manual for the directory to understand the role of the President, Vice President, and the entire directory because one person alone cannot do it. Perhaps there is not much commitment from the institutions because they do not know what functions they are responsible for or if they are merely a member of the ecosystem."*

E29 "... The university is responsible for bringing together various institutions that support entrepreneurs... being perceived as a neutral institution makes its coordinating role easier."

This suggestion highlights some critical aspects. First, it emphasizes the importance of moving the entrepreneurial ecosystem toward more distributed leadership, from the anchor or leader to various dealmakers or boundary spanners (Colombelli et al., 2019; Harima et al., 2024) Logic argues that one person or one institution alone cannot coordinate all the activities when the ecosystem is in its early stage and is moving from a small group of institutions to many institutions. Second, it establishes the importance of the role's definition among actors, which is necessary to keep commitment and minimize conflicts or resource waste. As established, boundary spanners are people who help coordinate the work of others among institutions (Galbraith, 1974). The importance of this aspect is expressed by participants in both focal groups and interviews:

GF2 Bolivia: *"Since the ecosystem is made up of people who represent institutions and these individuals do not report to an immediate superior within the ecosystem, I believe the most important elements to consider are, first, strategically selecting mid-level individuals who are committed to the ecosystem's vision, through whom activities can be planned, organized, and executed. This will help improve coordination."*

E3 Colombia: *"When we make agreements, we always assign a person in charge of the agreement who can serve as the direct contact because the agreement made with the other institutions already opens up all possibilities for institutional dialogue. However, it is important that the person who made the agreement, the institution that made the agreement, can have a response from someone with whom they can have that dialogue, so a person is designated as responsible or in charge."*

4.2. Other Findings

The next empirical findings and quotes highlight a coordination mechanism not explicitly addressed in relational coordination theory; nevertheless, it is directly linked and complements the boundary spanner role. In adhesion, it has a strong presence in the context under study and is presented here as an important issue.

Role Agreements

The above quotes not only highlight that broker or boundary spanner roles can serve as mechanisms for improving coordination within the EE, but they also underscore the importance of reaching agreements on the roles of each institution, as reflected in these and the following quotes. Adner (2017) identified 'positions' or 'roles' as one of the four structural elements of an ecosystem. The following quotes are examples of this point:

E3 Bolivia: "Make it very clear what the functions of the current municipal government are. Right? because currently, the municipal government takes on many functions that are not the municipality's role."

GF2 "Functions should be segregated according to the nature of the institutions, each one being responsible for something specific, for example, universities for education and the development of projects with a focus on entrepreneurship, etc."

An EE in its early stage needs to clarify, define, and agree on the institutional roles within the ecosystem. This involves establishing what each type of institution is responsible for, identifying areas for collaboration, and distinguishing where they might compete, helping to prevent conflicts. We refer to these as 'role agreements'.

Operational plans and Schedules

An EE should be more flexible and dynamic than an individual institution (Roundy & Burke-Smalley, 2022). Nevertheless, when institutions consider ecosystem coordination in emerging economies, they use an inflexible institutional model, thinking based on detailed plans with a chronogram and responsibility are required. Therefore, in the early stages of an EE in emerging economies, it is necessary to start with shared goals and expected outcomes among institutions, and then include operational plans, schedules, and roles as a coordination mechanism.

GF2 Bolivia: "We need to have common and clear objectives in the ecosystem, ensure that these are shared within each institution, and have a plan with activities, responsible parties, and a schedule."

D31: "Create a calendar or annual activity plan and ensure that each institution is informed. Fairs, contests, in-person or virtual talks with influencers who inspire or have a track record with life experiences or testimonials"

Operational plans that become public activity schedules can be shared with all ecosystem stakeholders, entrepreneurs in general, and regional institutions, thereby also contributing to transparency and encouraging stakeholder engagement in the activities. Based on these examples, there is sufficient evidence to consider operational plans and public activity schedules as important coordination mechanisms. However, they must be implemented with care to avoid compromising the independence of each institution, as well as the fluidity and flexibility of the ecosystem.

Short-Term Outcomes

Entrepreneurial ecosystems define a shared vision, purpose, and guiding principles to boost entrepreneurial activity or foster productive entrepreneurship (Stam & van

de Ven, 2021), or to deliver on a value proposition (Adner, 2017). However, these goals are often set far into the future, and current or potential ecosystem members need evidence of short-term progress or tangible advancements to stay motivated. The following quotes illustrate this point:"

E27 "...Keep institutions motivated to participate by communicating progress,
showing the achievements and highlighting the benefits of being part of the ecosystem..."

E50 "Hold a monthly meeting with the institutions to review what has been carried out, what has been achieved, and what could be improved."

E45 "Seek to ensure that the ecosystem has increasingly more impact, any activity carried out by the institutions should be supported and joined, so they are not left alone, and to show progress and results."

The importance of short-term wins that connect us to a greater long-term goal is evident in the implementation of personal plans, in strategic planning within companies, and most likely even more so when it comes to shared goals defined by a group of institutions within an entrepreneurial ecosystem, as reflected in the above quotes, these small victories help to maintain motivation, focus, and commitment.

5. Discussion

The scientific literature highlights a lack of coordination among the actors within an entrepreneurial ecosystem (Cao & Shi, 2021; Wurth et al., 2022). Despite its importance, the coordination of activities in EE has been underexplored (Roundy & Fayard, 2020). In this section and based on the findings, the study analyzes and discusses the main coordination mechanisms applicable during the early stages of EE

development in emerging economies, drawing on empirical data collected in Bolivia and Colombia, with the lens of relational coordination theory and conceptualizing the EE as a structure with its four elements: activities, actors, positions and links. The relational coordination theory suggests that mutual reinforcement within relations and communication facilitates coordination, as well as the coordination mechanisms are shared information systems, shared routines, boundary spanner roles, shared meetings, and shared spaces, which strengthen coordination, and thus better manage their interdependence (Bolton et al., 2021; Gittell, 2011a).

The general findings confirm the suggestions of the relational coordination theory regarding the mutual reinforcement within communication and relations and its dimensions, improving coordination among institutions in the EE, as de Esteban Escobar (2020) notes that all dimensions of the relational coordination theory are useful in the EE coordination. Furthermore, analysis and empirical evidence confirm that common and shared goals are essential for coordination within EE (de Esteban Escobar, 2020; Gittell, 2013).

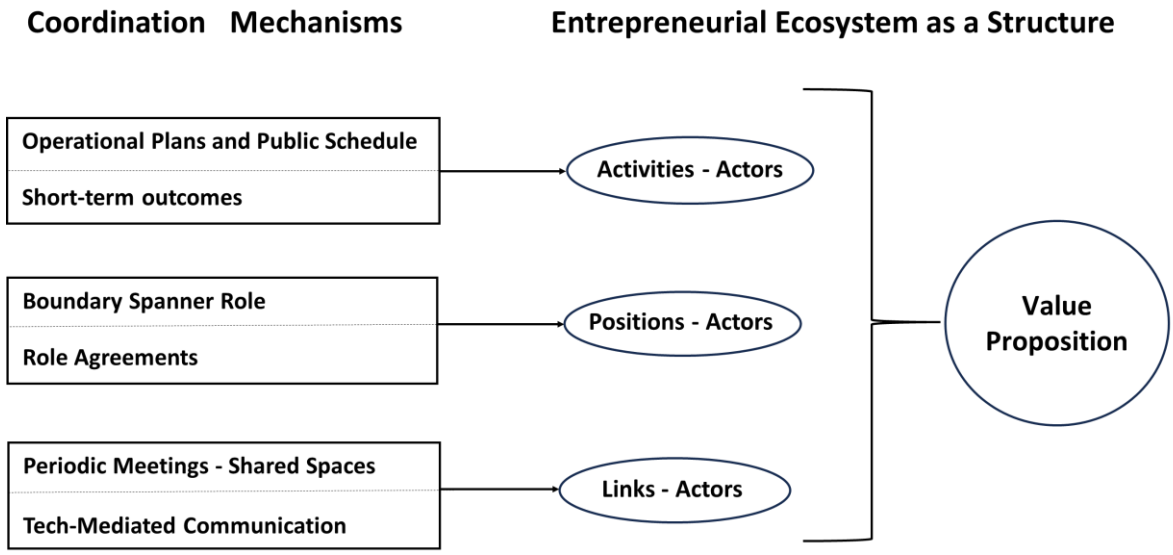
Specific findings confirm that shared information systems, shared meetings, and boundary spanner roles are relevant coordination mechanisms in an entrepreneurial ecosystem, nevertheless, there is no evidence of shared routines or standardization processes, this may be because, at this early stage, the actors have not yet identified processes or routines that can be standardized, and also as highlight Mintzberg (1980) the standardization is one of the more relevant coordination mechanisms within an organization, but as Roundy (2020) indicates its importance decreases among organizations or actors in the EE. On the other hand, the evidence regarding shared spaces is limited, maybe because many of the actors have the infrastructure required for that purpose.

As a result of this analysis, operational plans and public schedules emerge as relevant coordination mechanisms, elements not highlighted by relational coordination

theory. In some respects, operational plans and schedules pointed out for the this finding contrasts with the theory's emphasis on autonomy, flexibility, and adaptability as foundational principles for coordinating EE (Huxham & Hibbert, 2004; Provan & Kenis, 2008).

Beyond this confirmations, the empirical data reveals additional coordination mechanisms that do not directly align with the theory: role agreements, short-term outcomes, operational plans and public schedules emerge as relevant coordination mechanisms, elements not highlighted by relational coordination theory. In some respects, operational plans and schedules pointed out for this finding contrasts with the theory's emphasis on autonomy, flexibility, and adaptability as foundational principles for coordinating EE (Huxham & Hibbert, 2004; Provan & Kenis, 2008). Based on all these insights, the following figure presents the mean findings regarding coordination mechanisms in the early stage of EE in emerging economies, illustrating the relationship among EE as a structure, its elements, and the coordination mechanisms proposed.

Figure 1: Coordination Mechanisms for Entrepreneurial Ecosystems



Based on empirical data *Bolton et al., 2021; Gitell, 2013; Adner, 2017*

Conceptualizing the EE as a structure, everything originates from a value proposition – on the right side of the figure 1- or an expected outcome, achieving this outcome requires the execution of a set of activities involving multiple actors (Adner, 2017). In an EE within an emerging economy at an early stage, the mechanisms that facilitate coordination at this point are operational plans with detailed public activity schedules that outline short-term outcomes or 'short-term wins'. Once these plans are agreed upon, each actor is expected to assume the necessary position to support their implementation. The coordination mechanisms for this purpose involve role agreements, and given the diversity of actors, trustworthy intermediaries are needed to perform the boundary spanner role. These roles ensure compliance with role agreements and the positions each actor agrees to adopt for plan execution and the achievement of short-term wins. Finally, for the ecosystem to function effectively, links are needed to enable the exchange and combination of resources among actors; the coordination mechanisms are periodic meetings held in shared collaborative spaces with problem-solving orientation; the periodic meetings must be improved with technology-mediated communication to enhance transparency and reduce information and communication asymmetries, as well as duplicities.

Although the above explanations begin with the end following the concept of ecosystem as a structure, in the proposed model the coordination mechanisms aim to strengthen the ecosystem's elements, and the interaction among these elements addresses the value proposition. In this model, the mechanisms are set in three groups that they complement each other and can generate a more significant effect together. Furthermore, while within each group of mechanisms reinforces one another, the three groups of mechanisms also reinforce collectively, as will be explained in more detail below.

Operative Plans, Public Schedules, and Short-Term Outcomes

In the research context, with the empirical information gathered, there is a tendency to approach EE planning with the same institutional rigidity typically applied to internal organizational processes (Brown & Mason, 2017; Roundy et al., 2018b), overlooking the adaptive and dynamic nature of ecosystems. Additionally, it is evident that for the actors of an EE in its early stage, a key coordination mechanism is to turn common and shared goals into specific plans and detailed chronograms. Therefore, at least in the early stage, plans and public chronograms are highly relevant coordination mechanisms in an EE. Nevertheless, it is important to find a complicated equilibrium among specific plans, detailed public chronograms, and to hold the autonomy of each institution and the flexibility of the EE.

"The findings show that operational or short-term plans are required, turned into public schedules that become the activities executed by the actors to move closer to the ecosystem's value proposition. However, since a small activity by itself does not represent the achievement of the value proposition, which lies far ahead on the timeline, it is necessary to transform these activities into short-term outcomes that are connected to the long-term value proposition (Kania & Kramer, 2011). These outcomes should be celebrated and communicated as milestones, 'short-term wins' to keep entrepreneurs in the region motivated, to encourage the actors already participating in the entrepreneurial ecosystem, and to attract potential new participants (Isenberg, 2010; Spigel, 2017). Furthermore, by being public and shared in advance, the schedule of activities serves two crucial purposes as a coordination mechanism for the EE, first, it helps avoid duplication that is, institutions or actors independently investing in solving the same problems or performing the same tasks for similar populations, which frequently occurs in emerging economies, second, it allows actors who were not initial transactionally part of an activity to join it, either as partners, participants, or by providing specific support. As a result, public schedules can contribute to reducing uncertainty and transaction costs for participants in the ecosystem (Roundy, 2017).

Role Agreements and Boundary Spanner Role

Gebo & Bond (2022) develop a quasi-experimental study in the context of inter-organizational collaboration to reduce gang and youth violence, and demonstrated that implementing a boundary-spanner role in the periodic meetings between actors results in higher levels of coordination sustained over time. The empirical information confirms that boundary spanner roles (Galbraith, 1974), change agents (Bolton et al., 2021), or transition brokers (Cramer, 2020), could enhance EE coordination. Moreover, the present study points out the importance of agreements about each institution's roles in the ecosystem, also clearly establishing the roles of co-competition aspects in which there is competition and aspects in which there is collaboration. Both aspects are critical to the functioning of the ecosystem, for complementary reasons. The boundary spanner role can facilitate a shift and evolve the EE from governance centered on a single anchor institution to a model of multi-leadership. (Colombelli et al., 2019). Meanwhile, role agreements help clarify the responsibilities and positions that each institution should assume in specific activities. (Colombelli et al., 2019)

Communicating: Periodic Meetings, and Tech-Mediated Communication

Periodic and frequent meetings, preferably in the existing shared spaces, contribute to customizing the relations among institutions' representatives, making the communication more fluid and flexible, the empirical findings not only confirm this, but also point out the importance of take in account on these meetings: problem-solving orientation, agility and foster public commitments regarding exchange and combination of resources with other actors (Ansell & Gash, 2008) . In this sense, frequent meetings could significantly contribute to moving from words to action and motivate EE actors to work together on concrete issues to make progress toward achieving short-term victories in the right direction to the expected outcomes or EE

value proposition. Public commitments that generate high expectations among other stakeholders represent a self-demand not to fail in keeping one's word (Kreiner et al., 2006).

Technology-mediated communication generates a favorable effect in EE coordination only when supplementing instead of substituting other coordination mechanisms, such as periodic meetings. (Claggett & Karahanna, 2018). The empirical findings confirm the importance of tech-mediated communication for enhanced transparency (Bolton et al., 2021), facilitating timely access to the information, reducing the imbalance perception, and acting together with periodic meetings promotes horizontality in relations, communication, and improves coordination among EE actors, strengthening links, that is exchange and combination of resources and these timely flow of information, resources and knowledge tent to reduce the actors transaction costs.

After presenting these three groups of coordination mechanisms as a response of the research question “What are the mechanisms that facilitate coordinating a nascent entrepreneurial ecosystem in an emerging economy?”, and how these mechanisms facilitated the functioning of the ecosystem elements, showed the mutual reinforcement within each group, at this point, it is important to highlight the reinforcement between these three groups. For instance, well-defined role agreements can give rise to boundary spanners who establish regular meetings and develop a complementary, effective platform, such as technology-mediated communication. This platform serves as an appropriate channel for sharing the public schedule (Autio et al., 2017), encouraging greater participation from various actors. As more participants engage with the proposed activities, they combine and exchange resources, leading to short-term victories that signal the ecosystem is moving in the right direction. These early successes help to motivate actors: entrepreneurs, existing stakeholders, and potential new participants. In summary, the combination of these three groups of mechanisms among ecosystem actors strengthens links, enables the

assumption and recognition of necessary roles, and facilitates the coordination of interdependent activities towards an EE value proposition.

6. Conclusions

Although there is not enough research related to relational coordination in EE, some literature sustains that EE complies with all the dimensions of relational coordination (de Esteban Escobar, 2020). In the context of this study, based on empirical data, it is possible to confirm that the essence of this theory and its dimensions 'mutual reinforcement among communication and relations, enhances EE coordination.'

The coordination mechanisms proposed by relational coordination theory help improve EE coordination with strong empirical evidence regarding Boundary spanner roles, Periodic meetings, Information Systems, or tech-mediated communication. Nevertheless, the evidence in shared spaces was fragile likely because not represent a worry for the actors who have and offer spaces for the EE meetings or activities, and no explicit relevance could be evidenced by shared routines or standardization processes, this may be due justly to the early stage of the entrepreneurial ecosystem EE, in which processes that could be standardized have yet to be identified.

Furthermore, to contrast the relational coordination theory and confirm the applicability of their coordination mechanism in EE, because of the open coding methodology applied and answering the research question proposed, four specific coordination mechanisms were identified in the context of emerging economies in the early stage of EE development: Operational plans, public schedules, short-term outcomes, and role agreements. Based on these findings, the confirmed coordination mechanism of the relational coordination theory and the elements of ecosystem as a structure pointed out by Adner, the model of coordination mechanisms for early-stage entrepreneurship ecosystems was developed, which defines three groups of

mechanisms: the first group, related to activities included, operational plans, public schedules, and short-term outcomes, the second group regarding positions included, role agreements and boundary spanner role, and the third group related to links included periodic meetings and technology-mediated communication.

7. Limitations and implications

Using relational coordination theory, the study was developed in two small cities in emerging economies in the context of early-stage EE. Thus, more research is needed in other regions in a similar context and the same theoretical lenses, and in other contexts with the same or other lenses. Since this study's qualitative findings are limited to these regions, we need more specific evidence regarding the application of relational coordination theory in the EE context.

The relational coordination theory looks like a promising approach to understanding and improving EE coordination; nevertheless, more evidence is necessary to confirm that. The practitioners or entrepreneurial ecosystem actors could use the proposal model and evaluate the effects of the coordination mechanisms in the EE elements.

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The institutional fitness of nature-based business models with the agro-industrial food regime

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Extended abstract

One of the most pressing sustainability problems of the contemporary food systems is the loss of biological diversity. Food production is driving biodiversity loss via expansion of land use for food production purposes on the one hand and via intensifying use of the existing production areas on the other. Intensification of agricultural production leads to simplification of agroecosystems and abandonment of seminatural habitats such as meadows, pastures and grasslands, which host significant amounts of biodiversity (Herzon et al., 2022).

Intensification and the related countertrend of abandonment are both characteristics of the contemporary agrifood regime, which has been described as an agro-industrial food regime. It builds on the abundant supply of cheap food, intensive production practices, fossil metabolism, economies of scale and economic growth (Kuhmonen & Kuhmonen, 2023). These tendencies are detrimental for agrobiodiversity. For example in Finland, homogenisation of agricultural landscapes, monoculturalisation of agricultural production and decline of grazing rates are the biggest threats to agrobiodiversity (Herzon et al., 2014; Rytteri et al., 2024). As a result, the majority of species gone extinct in Finland thus far consist of species that once dwelled in semi-natural, human-modified agroecosystems, and 24% of the currently endangered species dwell in these habitats (Hyvärinen et al., 2019).

The tendencies of the contemporary agrifood regime that drive biodiversity loss are linked to the institutional logics of the regimes. The institutional logics give stability to social-ecological-technical systems, but they also act as a source of structural constraints, confining path-dependencies and systemic lock-ins that make overcoming many of the

system's sustainability problems extremely difficult (Fuenfschilling & Truffer, 2014). To promote a transition towards a more sustainable and biodiverse food system, it is necessary to understand the institutional logics that facilitate or hinder such production practices that leave room for and maintain biodiversity within food systems.

The institutional logics prevailing in the contemporary agrifood regime define what kind of business models are feasible in it. As Bocken et al. (2019, p. 1501) state; "The shaping of individual business models takes place in an institutional context, which provides rules that are conducive to certain forms or providing products and services." The institutional logics of a regime can be understood as the 'rules of the game' that guide the behaviour of the system's actors (Fuenfschilling & Truffer, 2014; Runhaar et al., 2020). The coherence of the regimes varies in relation to how 'tight' or 'loose' its institutional logics are: the tighter the logics, the more similar the business models. Previous research from the field of sustainability transition studies indicates that institutional logics play an important role in how sustainable practices and innovations can emerge and scale up (Fuenfschilling & Truffer, 2014; Novalia et al., 2022). Thus, incorporation of institutional analysis can be vital for understanding the potential of sustainable business models to spread and scale up – as well as understanding the reasons why they may not do so.

The prevailing trends of food-system related biodiversity loss indicate that most of the business models in the contemporary agrifood system are destructive to biodiversity. They follow the logic of the contemporary agro-industrial food regime that does not value the externalities impacting biodiversity, taking forms such as nutrient surpluses in aquatic and terrestrial ecosystems, conversion of pristine ecosystems, degeneration of living soils, homogenisation and monoculturalisation of agricultural landscapes and abandonment of seminatural habitats. However, alternatives to biodiversity-depleting production practices do exist. A prominent solution to the challenge of food system-related biodiversity loss lies within the nature-based business models. Nature-based solutions aim at solving sustainability challenges within natural or modified ecosystems while providing both biodiversity benefits and human well-being (Cohen-Shacham et al., 2016).

In the context of food production, the key features of nature-based solutions are regeneration, non-depletion and non-destruction (Ferri & García, 2023). Overall, nature-based solutions are all about finding complementarities between protecting biodiversity and producing food (Ferri & García, 2023). Nature-based solutions to food production thus go under various headers such as agroecology, regenerative farming, agroforestry and organic farming. When such farming styles form the core of the business models at specific farms, it is possible to observe them as examples of nature-based business models in agriculture. In relation to sustainable business model archetypes identified by Bocken et al. (2014), these solutions are a close match with the stewardship type business models.

In this study, we analysed the institutional logic of the Finnish food system from the point of view of nature-based business models in agriculture. We asked, what kind of fit the

nature-based business models in agriculture have with the institutional logic of the contemporary food regime. Our empirical material consisted of qualitative interviews with 18 Finnish farmers who have adopted nature-based business models along with 6 food system experts with extensive knowledge of the field. The production lines of the interviewed farmers included crops (7), sheep (4), dairy (3), beef (2) and landscape management (2). The farmers were based on different parts of Finland and had farm sizes varying between 6-260 ha. The interviewed experts, in turn, represented administration, advisory services and research. Interviews were conducted in 2023-2024 and analysed by means of content analysis.

The interviewees were invited to participate in the study because of their production styles that aimed at preserving and improving agrobiodiversity and were thus labelled as representing nature-based business models in food production. This ambition took many forms: organic farming, regenerative farming, management of traditional rural biotopes, maintaining genetic biodiversity via breeding traditional domestic breeds, biodiversity-mindful grazing practices and managing landscape elements. All of these practices and farming styles contribute to biodiversity conservation in the food system context and deviate from the conventional farming methods.

Overall, the studied nature-based business models in Finnish agriculture had a poor fit with the institutional logics of the contemporary agrifood regime. Nature-based business models create shared value for biodiversity and other stakeholders within the food system, but at the same time, the costs related to such business models tend to be higher than in conventional farming – or these farmers are not able or willing to pursue economies of scale in a similar fashion as many conventional farmers do. The underlying motivation of the studied farmers to engage with nature-based farming was not related to profit-seeking but it was driven by intrinsic motivations and universal values. As a result, most of the interviewed farmers had other income sources alongside agriculture. This created a sense of a constant hurry that the farmers cited as a barrier for them to do even more for biodiversity on their farms.

The agricultural support scheme includes targeted payments for many of the farming practices and styles adopted by our interviewees (such as organic farming, management of traditional rural biotopes, maintaining genetic biodiversity and managing landscape elements). The importance of these subsidies varied among the interviewees. At the same time however, the developments taking place in supply chain relations and agricultural policies were viewed as narrowing the room to manoeuvre for the interviewees. Many had shady outlooks about the future – despite them clearly acknowledging that societal values had developed into a direction that supports nature-based business models. Alternative institutional logics favouring nature-based business models are present in the food regime but the structural forces favouring centralisation are diminishing their strength.

Keywords

Agriculture, institutional logics, nature-based business models, regime, sustainability transition

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Designing fair business models for climate-smart agriculture

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Extended abstract

Achieving fairness, which encompasses addressing distributive, procedural, informational and interpersonal concerns to ensure equitable outcomes, transparent processes, accessible information and respectful interactions among stakeholders, is a fundamental challenge in sustainable agri-food system transition (Prete and Samoggia, 2023, Samoggia and Beyhan, 2022). This challenge is particularly evident in implementing sustainability solutions like climate-smart agriculture (CSA) – an integrated approach to address the interlinked challenges of food security and climate change (The World Bank, 2024). In implementing CSA, questions of fairness – who benefits, who decides, who has access to information, and who bears the risk – shape adoption patterns and outcomes (Rosenstock et al., 2020). Ensuring fairness is essential in fostering stakeholder's trust and long-term commitment to CSA (Rousseau and Have, 2022). This is particularly true for those most vulnerable in the agri-food system to the impact of climate change, such as farmers, whose vulnerability is compounded by the barriers they face in CSA implementation (Rosenstock

et al., 2020). Without explicitly considering fairness, the agri-food system risks perpetuating existing inequalities (Onyeaka et al., 2024).

Recent studies have highlighted the crucial role that business models (BMs) can play as solutions to enable fairness in agri-food systems (Samoggia and Beyhan, 2022). In the context of CSA implementation, BMs that ensure fairness are needed to generate climate-smart agriculture value (Rosenstock et al., 2020). Still, the literature lacks a clear conceptualization of the design and content of fair BMs. This gap is calling for studies to identify BMs that can address fairness-oriented challenges (Samoggia and Beyhan, 2022). The present research follows this call by answering the research question "How can fair business models be designed to support farmers' implementation of climate-smart agriculture?" through two complementary objectives. First, to conceptualize fair BMs. Second, to design and develop fair BMs for climate-smart agriculture.

Drawing insights from fairness literature (Gudbrandsdottir et al., 2021, Samoggia and Beyhan, 2022) and sustainable business model literature (Lüdeke-Freund et al., 2024, Freudenreich et al., 2019), which offers insights into the specific fairness dimensions that need to be embedded in BM design, the study employs a design science research methodology. Design science research was deemed suitable because its focus on developing artifacts and the knowledge about them to solve real-world problems, aligns with the study's objectives to develop theory around fair BMs and to design and develop implementable BMs for CSA (vom Brocke et al., 2020). The methodology followed a structured design science research process comprising six phases: problem identification; objective definition; design and development; demonstration; evaluation; and communication (vom Brocke et al., 2020). As these phases often require different approaches, it is common in design science research to employ multiple research methods (Johannesson and Perjons, 2021). In this study, we first conducted five co-creation workshops with supply chain stakeholders for the problem-identification and objective definition phases. The aims of the workshops were to understand fairness challenges in agri-food systems in the context of implementing CSA and to define the requirements for the BM solution. These workshops identified eight critical fairness requirements to address fairness and facilitate CSA implementation: providing incentives for farmers; equitable distribution of benefits and costs across the value chain; more facilitation towards sustainability; engagement and collaboration among stakeholders; improved access to technology; enhancing transparency among value chain actors; consumer education about sustainable choices; and exchanging sufficient and reliable information. Relevant actors that must be considered in the BM design were also mapped. The identification of these requirements, along with the mapping of the actors, formed the foundation for the design and development of fair BMs for CSA, ensuring both practical viability and contextual relevance. The design and development phase drew on Lüdeke-Freund et al. (2018)'s approach on developing new BMs using existing BM patterns to produce fair BM prototypes. This phase began with a conceptualization of what fair BMs are. Drawing

parallels from sustainable business models, we define ***fair business models*** *as business models that embed distributive, procedural, informational, and interpersonal fairness into all aspects of a firm's value proposition, value creation and delivery, and value capture. As such, fair business models provide value to the customer while ensuring equitable outcomes, inclusive processes, and just relationships among stakeholders.* This conceptualization was crucial as it provided a structured framework for addressing the critical requirements identified. A systematic literature review was then conducted to identify existing BM patterns in the literature resulting to a database. From the database, relevant BM patterns were identified and linked to specific fairness challenges. Using the BM patterns to define the core solutions in addressing fairness, the business model radar (Turetken et al., 2019) was used as a design tool to define the core elements of the BM prototypes. Overall, thirteen distinct fair business model prototypes for CSA were designed and developed with clearly defined components: value proposition, value creation and delivery systems, and value capture mechanisms. Key assumptions for successful implementation were found. The demonstration and evaluation phases are still underway and will be carried out in five co-creation workshops to assess the relevance of the BMs in addressing fairness challenges in different contexts and to validate the plausibility of the underlying key assumptions. In these phases, challenges in implementing the BMs will also be assessed. The results will be used to further refine the fair BM design.

The study has three outcomes. First, the study provides a clear definition of fair business models. This definition offers a foundation for understanding how fairness can be systematically embedded in business model design. Second, the study offers a comprehensive portfolio of thirteen business model prototypes, systematically addressing identified fairness challenges in the context of climate-smart agriculture. The thirteen business model prototypes include: (1) pay for climate-smart agriculture success and (2) crowdfarming to provide fair incentives for CSA adoption; (3) consumer-driven pricing and (4) risk-sharing fund for equitable distribution of risks and benefits across the value chain; (5) bio-districts, (6) retail choice editing and (7) open source models to create supportive environments for CSA; (8) outcome-based pricing and (9) shared resource pool to democratize access to climate-smart technologies; (10) transparency branding, (11) consumer engagement platform, (12) peer-to-peer knowledge sharing and (13) data coopetition network to enhance transparency and knowledge sharing. The thirteen prototypes will be validated through upcoming demonstration and evaluation phases to understand contextual relevance and implementation challenges across different agricultural contexts. These upcoming phases are expected to reveal cross-cutting success factors and context-specific adaptation requirements of the fair BMs, demonstrating how different agricultural settings may necessitate tailored approaches.

Overall, the study advances the sustainable BM literature by providing both theoretical insights and practical solutions to address fairness and facilitate CSA implementation. Specifically, it answers to calls in the literature for business models that can create wider

societal impacts and foster business ecosystem level connections e.g. Snihur and Bocken (2022). By offering a conceptualization of fair BMs and developing fair BMs targeting fairness challenges in the context of CSA, the study directly addresses calls in the literature for BMs that can address fairness challenges by developing fair BMs e.g. Samoggia and Beyhan (2022).The findings offer practical implications for agrifood stakeholders including policymakers, agribusiness, and farmers to ensure fairness in the transition towards climate-smart agriculture.

Keywords

Fair business models, sustainable business models, climate-smart agriculture, fairness, sustainability transitions

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Purpose under pressure: navigating the risk of mission drift

A qualitative comparative analysis (QCA) of entrepreneurs in Mali, Angola, and Algeria

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Summary

Entrepreneurs and small businesses are pivotal in addressing societal sustainability challenges in Africa. The extent to which entrepreneurs may successfully address sustainability challenges however critically hinges upon their ability to simultaneously advance social, environmental, and economic objectives. Yet, advancing dual or triple objectives frequently creates tensions, risking 'mission drift'. Organizations move away from their main purpose, and become too focused on one objective over the others. Multiple conditions informing mission drift have been identified, including scaling, funding sources, and business model particularities. There is however a need to explore the interplay among conditions and assess configurations of factors contributing to mission drift. Although mission drift has been extensively studied, focus has hardly been on African contexts. With a predominant focus on enterprises, the literature has largely overlooked entrepreneurs, despite their critical role as breeding ground for sustainable enterprises. This study addresses the question which combination of factors contributes to mission drift for entrepreneurs in Africa. It deploys a QCA (qualitative comparative analysis) based on survey and secondary data to study entrepreneurs engaged in the Orange Corners programme in Mali, Algeria and Angola. Orange Corners is an initiative by the Netherlands Ministry of Foreign Affairs to support young entrepreneurs in emerging markets building sustainable businesses. The study is expected to generate insight in the configuration of conditions that inform mission drift among nascent entrepreneurs in different contexts in Africa.

Extended abstract

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1 Introduction and literature background

The world is facing a complex mix of sustainability challenges, ranging from climate change and depletion of natural resources, to rising poverty, inequality, and exclusion (Stubblefield Loucks et al., 2010). Although global in nature, these challenges are felt acutly in Africa, where structural inequalities exacerbate vulnerabilities. Interaction with and addressing of sustainability challenges primarily occurs at the local level, by government, business, and non-profits, inter alia (Wittmayer et al., 2014). The private sector is increasingly claiming a role in furthering sustainable development goals in Africa (Borchardt et al., 2020; Dembek et al., 2020). Entrepreneurs and small businesses, comprising over 85% of employment in Africa, are pivotal in addressing these challenges (International Labor Organisation, 2019). This necessitates business models and innovations that integrate social, environmental, and economic goals. Much of the capacity of an entrepreneur or business to contribute to addressing societal sustainability challenges critically hinges upon their ability to simultaneously advance social, environmental, and economic objectives (Schaltegger & Wagner, 2011; Youssef et al., 2018).

However, combining social, environmental and economic business objectives often appears paradoxical (Cornelissen et al., 2020). Tensions are endemic to sustainability objectives (Van der Byl & Slawinsky, 2015), challenging the long assumed win-win-win approach where objectives seamlessly align. Instead, advancing dual or triple objectives frequently creates tensions (Santos et al., 2015). For instance, definitions of success and stakeholder expectations may vary by objective. Entrepreneurs risk prioritizing revenue generation over sustainability goals to ensure commercial viability (Ebrahim et al., 2014). Concretely, nascent entrepreneurs may conform to paying customers' demands while neglecting beneficiaries (including the environment), harming the business's success, image, and the broader sustainability transition.

This process whereby business becomes too focused on one objective over the other(s) is referred to as 'mission drift'. Mission drift can be defined as 'a process of organizational change, where an organization diverges from its main purpose or mission' (Cornforth, 2014:4). A key governance task for entrepreneurs is to properly align, prioritize, and navigate these different and sometimes conflicting objectives. Previous research has identified various factors that could influence mission drift. Key factors include scaling (Klein et al., 2021; Ometto et al., 2017; Rabi, 2016), funding sources, business model particularities (Klein et al., 2021; Santos et al., 2015; Besharov & Smith, 2014), and conversation space (Ometto et al., 2017; Hai & Daft, 2016; Battilana et al., 2015; Haug, 2013; Rabi, 2016). Entrepreneurship literature focused on Africa furthermore highlights the demand the entrepreneurial ecosystem places on businesses (e.g. Mukiza & Kansheba). This might potentially influence mission drift.

Despite the burgeoning literature and increasing knowledge on mission drift, particularly in relation to social enterprises, major gaps in knowledge remain. The contribution of this paper lies in addressing the following gaps. First, while a lot of research has been conducted on social enterprises and mission drift (e.g. Cornforth, 2014), most of this research has focused on high-income countries, while the role of the private sector in addressing development objectives in low-income countries is

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most prominent and pressing (Dembek et al., 2020)[1]. Second, an underexplored area of research involves the role and function of nascent entrepreneurs as breeding grounds of (social) enterprises. Yet, it is at this early stage of business development that key choices regarding business model, funding source, and scaling strategies are made (Zhang et al., 2024). Consequently, we expect these aspects to play a key role in informing mission drift among entrepreneurs. Third, although we have insight in the factors that individually play a role, business exists by means of a combination of factors, and entrepreneurs with limited resources need to prioritize their focus and investment. An identification of the configuration of factors that inform (to prevent) mission drift is helpful in this regard. Additionally, the entrepreneurial ecosystem has been largely overlooked as a factor in current literature on mission drift, while this might hold great importance for mission drift among African entrepreneurs. Furthermore, much of the empirical research on mission drift has been conducted through (single) case study research (Cornforth, 2014). Notwithstanding the rich and important insights this has produced regarding structures and strategies of organizations facing the risk of mission drift, the time has now come to test and refine these findings and assess their relevance and appropriateness in different contexts.

2 Methodological framework

The research question to be addressed in the research is: *"Which combination of factors inform mission drift for entrepreneurs in Africa?"*.

2.1 Case selection

We will analyse the factors contributing to mission drift for entrepreneurs in Africa by studying nascent entrepreneurs in the Orange Corners Program. Orange Corners is an initiative supported by the Netherlands Ministry of Foreign Affairs to empower young entrepreneurs in emerging markets by providing training, mentorship, and access to networks and funding.

We study three countries: Mali, Angola, and Algeria. Three cases offer a balance between collecting in-depth data and allowing for meaningful cross-case comparison. The reasons for selecting these specific countries are as follows: First, each country represents a distinct socio-economic and political context within Africa, providing diverse perspectives on how mission drift occurs among entrepreneurs. Second, all three countries have experienced significant challenges in aligning economic growth with sustainability goals, making them ideal contexts for studying tensions between social, environmental, and economic objectives. Third, the entrepreneurial ecosystems in these countries are at varying stages of development, allowing for an exploration of how different combinations of factors contribute to mission drift. Fourth, these countries are less frequently studied in entrepreneurship research, providing an opportunity to address gaps in the literature and contribute novel insights to the field.

[1] A scopus search reveals over 384 journal articles that mention mission drift, only 17 of these focus on Africa.

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2.2 Data collection and analysis

Data will be collected by means of surveys and secondary data. Surveys will be distributed among 20 entrepreneurs in each of the three countries Mali, Angola, and Algeria via the Orange Corners program. The surveyed entrepreneurs are participants in this program and have businesses with dual or triple logics, meaning they aim to balance social, environmental, and economic objectives. This approach ensures a targeted sample of entrepreneurs who are directly engaged in navigating the tensions associated with mission drift. Secondary data will consist of program documentation as well as data on the entrepreneurial ecosystem, including the African Entrepreneurial Ecosystem Index. Data collection will take place in February and March.

We use qualitative comparative analysis (QCA) for data analysis. QCA is an approach to systematically compare cases to identify patterns of causality, focusing on combinations of factors that lead to a particular outcome. It is particularly useful for examining complex phenomena, such as mission drift, where multiple factors and their interactions contribute to the outcome of interest (Leppänen et al., 2019). By identifying specific configurations of conditions that lead to mission drift among African entrepreneurs, QCA provides insights that can create deeper insights in when and why mission drift occurs, and may inform strategizing to prevent mission drift. Data analysis will be done from April-June.

3 Results and conclusion

We anticipate having the first results of our study ready by June 2025, in time to share them with a wider audience at the New Business Model Conference. This will provide an opportunity to present initial findings, gather feedback, and engage with scholars and practitioners interested in entrepreneurship and sustainable business models in Africa.

Keywords

Entrepreneurship, mission drift, qualitative comparative analysis (QCA), Africa, Orange Corners.

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Intern gebruik

Innovative approaches towards more inclusive business models.

Improving the labour market participation of refugees.

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Keywords

Inclusive business models, work-integration of refugees, work-study programs, multi-stakeholder partnerships.

Extended abstract

Background

Prompted by the unprecedented shortages in the Dutch labor market, businesses are increasingly looking for ways to tap into the labor potential of individuals at risk of social exclusion. An estimated 1.2 million people are willing to work but are currently marginalized in the Dutch labor market for various reasons (CBS, 2024a). This diverse group consists of long-term unemployed individuals, people with physical or mental disabilities, young people without a school diploma, older adults, ex-convicts, and individuals with a migrant or refugee background. In practice, however, many organizations still face numerous difficulties in successfully incorporating individuals with the appropriate support needs and coaching into their current organizations (de Bell & Dikkers, 2022).

People with a refugee background are often eager to work but face significant difficulties accessing the labor market compared to other groups with a migration background (Connor, 2010). Dutch cohort studies since 2014 show that only 48 percent were employed after 8.5 years (CBS, 2024b). Being unable to fully participate in the labor market not only increases long-term dependence on the welfare state but also hinders social connections, personal development, and negatively impacts the health and well-being of individuals with a refugee background (Bakker et al., 2017; Bakker et al., 2013). The causes behind this are

numerous. At the individual level, it takes time to build a new life, learn a new language, establish a new social network, and previously acquired resources, knowledge, and experience often cannot automatically be transferred to the host country and may need to be (partially) reacquired. Personal or family circumstances may also play a role. Policies and regulations regarding asylum and integration often cause additional delays in accessing the labor market (Bakker et al., 2023; Damen et al., 2023). Many employers, in turn, are still hesitant to hire people with a refugee background due to insufficient language proficiency, (supposed) cultural differences, or administrative challenges (Fasani et al., 2022).

Although the ongoing shortages of workers in various sectors of the Dutch labor market currently provide better opportunities for refugees to enter the workforce (Vervliet & Heyma, 2024), finding a permanent position at an appropriate level remains challenging, and additional efforts from all involved actors are still needed. In recent years, several pilot projects featuring work-study programs for refugees have been launched in sectors facing labor shortages (VIA, 2021). These 'dual' programs, in which participants acquire specific professional knowledge and practical experience on the job—including language proficiency and additional coaching—show great potential. They enable refugees to (re)skill in a relatively short period of time and secure permanent employment in a profession that aligns with their educational or professional background, in an area of high market demand.

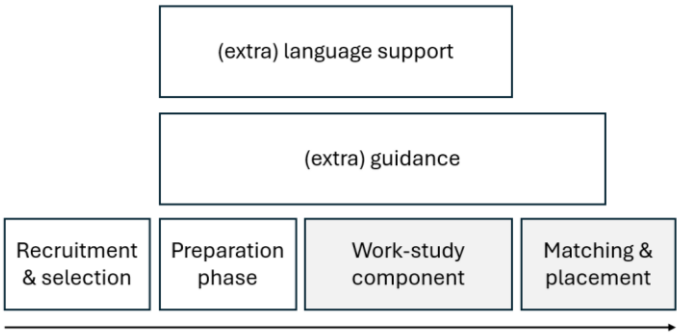
However, developing and successfully sustaining these programs is both time-consuming and complex, often requiring extensive coordination among various stakeholders concerning roles, responsibilities, and costs. As a result, many of these programs were discontinued after their pilot phases ended because they failed to become structurally embedded within organizations and could not be easily replicated, as the identified success factors are often difficult to apply in different contexts or economic sectors. Successfully embedding work-study programs for people with a refugee background within an organization, and making it truly inclusive, requires more than simply focusing on quick fixes and short-term gains. It requires intrinsic motivation, long-term commitment, a learning culture that allows for trial and error, and a dedication to collaborating with multiple stakeholders across private, public, and civil society sectors (de Bell & Bakker, 2022). As such, it requires a rethinking of existing business models, with a central focus on multiple value creation.

Objective

The main objective of this paper is to validate innovative approaches that can help enterprises to sustainably integrate people with a refugee background into their organizations and become more inclusive. After analyzing numerous work-study programs—both successful and less successful—across different economic sectors, the authors developed a generic model that highlights the key components to address in order to create a sustainable and potentially scalable work-study program for refugees (Figure 1). After determining the specific sector, profession, and desired level of the work-study

program, all relevant stakeholders (e.g., businesses, local governments, language schools, and educational institutions) need to identify the roles they will play in each component, as well as their commitment in terms of time and other resources.

Figure 1. Key components for sustainable and scalable work-study program for refugees



Source: Authors' own creation.

These types of multi-stakeholder partnerships, where organizations from different sectors (public, private, and civil society) join forces to tackle a specific societal challenge, are increasingly recognized as a powerful means of addressing complex social problems. In a compelling argument, Mazzucato (2021) uses the successful moon landing as an example of how public, private, and civil society sectors can effectively collaborate to tackle the major social challenges of our time. This inclusive approach may provide greater access to specific resources, knowledge, and networks, but at the same time, it often creates challenges in effectively coordinating the different interests (Kusters et al., 2018). Three key preconditions for successful multi-stakeholder partnerships are: a) a clear, shared goal among all stakeholders (public, private, and civil society); b) well-defined roles, a joint commitment of time and resources, and shared risks and rewards in pursuit of the goal; and c) a flexible, ongoing learning process that enables adjustments as needed (Mazzucato, 2021).

This study analyzes a two-year co-creation process involving multiple stakeholders to develop two sustainable and scalable work-study programs for refugees: one at IKEA, a multinational conglomerate that designs and sells ready-to-assemble furniture and home accessories, and another at Transdev, an international private-sector company that operates public transportation. The contribution of this study is twofold. Firstly, the results aim to provide a validated and transferable approach for achieving more inclusive business models by successfully integrating individuals with specific support needs into existing organizations. Secondly, the outcomes will enhance our understanding of how innovative collaborations among multiple stakeholders can be structured to create greater value for individuals, organizations, and society as a whole.

Methods

The development of the two work-study programs follows a methodical approach created by the authors (Figure 1). All relevant stakeholders were carefully selected based on their motivation and willingness to invest time and resources, with their roles for each component being defined collaboratively. The authors organized several consecutive sessions with all stakeholders present to co-create the various components of the generic model, including recruitment and selection, the preparation phase (which encompassed additional language support and guidance), the work-study component, and matching and placement. They also estimated the time and resource investments required for each component. The authors applied design thinking principles to structure the co-creation sessions (Brown, 2019). Notes were taken at every step of the process. Between sessions, the participating enterprises and their selected partners elaborated on the outcomes of the previous session, eventually resulting in two final designs for the work-study programs. These designs are implemented and tested by the stakeholders involved throughout 2024-2025, and adjusted as necessary. The authors monitor and evaluate both the design and implementation processes of the work-study programs, using the principles to design and facilitate effective multi-stakeholder partnerships (Brouwer et al., 2019).

Preliminary results

At the time of writing, the project is in its implementation phase, with participants having been recruited and selected and now entering the preparation phase. We expect to present our first results soon.

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Navigating Institutional Complexity: How Brokers Facilitate Cross-Sector Partnerships in Authoritarian Context

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Track 1: EXPLORING THE SYSTEM LEVEL

Sub-track 1.1: INNOVATIVE BUSINESS MODELS AND ECOSYSTEMS FOR SUSTAINABILITY TRANSITION: PERSPECTIVES FROM GLOBAL NORTH AND GLOBAL SOUTH

Abstract

Cross-Sector Partnerships (CSPs) between businesses and civil society organisations (CSOs) are essential for addressing societal challenges such as poverty alleviation, environmental sustainability, and inclusive education. However, CSPs often face significant challenges arising from divergent institutional logics—market, civil society, and state. These challenges are heightened in authoritarian contexts, where centralised power structures, restrictive regulations, and constrained civic spaces exacerbate institutional complexity. Brokers, as intermediaries, play a critical role in navigating these complexities by fostering collaboration, reconciling tensions, and aligning stakeholder goals. While prior research focuses on CSPs in democratic settings, this study aims to examine brokers' roles in authoritarian contexts, using Vietnam as an empirical focus. Drawing on five CSP case studies, the research illustrates brokers' dual roles: addressing internal complexities by connecting stakeholders and leveraging legitimacy, while providing technical and financial support, mediating discrepancies, and fostering learning; and managing external complexities by navigating bureaucratic systems, adapting projects to regulatory requirements, and framing partnerships to align with government priorities. This study advances the literature by incorporating authoritarian state logics into CSP frameworks and introducing an operational model of CSP brokers in the authoritarian context. The findings offer practical insights for fostering effective CSPs in politically constrained environments, indicating the importance of brokers' adaptability, strategic framing, and the need for supportive institutional policies.

Extended abstract

Introduction

Cross-Sector Partnerships (CSPs) between businesses and civil society organisations (CSOs) have emerged as critical mechanisms for addressing complex societal challenges, such as poverty alleviation, environmental sustainability, and inclusive education (Austin & Seitanidi, 2012; Selsky & Parker, 2005). These partnerships for sustainability bring together diverse stakeholders—businesses, civil society actors, and government institutions—operating under distinct institutional logics. While CSPs offer the potential for innovative solutions, the integration of market, civil society, and state logics often creates significant challenges, especially in authoritarian contexts where political constraints exacerbate institutional complexity (Vogel et al., 2022; Yin & Jamali, 2021).

Brokers, as intermediaries, play a pivotal role in managing institutional complexity, acting across sectoral, organisational, and geographical boundaries to foster dialogue, build trust, and align stakeholder goals (Christiansen , 2013; Hamann & April, 2013; Lee , 2015; Sanyal, 2006; Sonday & Wilson-Prangley, 2018; Stadtler & Probst, 2012; Vogel et al., 2022; Von Schnurbein, 2010). However, the literature has largely focused on CSPs in democratic or stable institutional environments, leaving a gap in understanding the roles and strategies of brokers in authoritarian settings. Authoritarian regimes introduce centralised power structures, restrictive regulations, and constrained civil society spaces that fundamentally alter the dynamics of CSPs (Maier & Gilbert, 2023).

This study addresses this gap by examining how brokers navigate institutional complexity to facilitate CSPs in Vietnam, a one-party state with an authoritarian governance structure. Drawing on case studies of five CSPs, this research explores how brokers operate within and across institutional logics to foster collaboration, resolve tensions, and ensure the sustainability of partnerships. By investigating the roles brokers play in managing both internal and external complexities, this study provides insights into the mechanisms through which CSPs adapt and thrive in politically complex environments.

Theoretical Background

Institutional complexity, as conceptualised by Greenwood et al. (2011), arises when organisations encounter multiple institutional logics with conflicting norms, values, and practices. CSPs inherently embody such complexity, as they involve actors with divergent logics—businesses prioritising market efficiency, CSOs advocating for social welfare, and governments enforcing public policy goals (Thornton et al., 2012; Vurro et al., 2010).

Brokers are recognised as critical intermediaries in CSPs, facilitating collaboration by reconciling tensions and aligning stakeholder interests (Christiansen, 2013; Lee, 2015; Stadtler & Probst, 2012). They perform different roles, for example, conveners, facilitators,

mediators, etc., addressing discrepancies between partners and navigating institutional divides (Hamann & April, 2013; Stadtler & Probst, 2012; Vogel et al., 2022). Yet, most studies examine brokers in democratic contexts, where civil society enjoys greater autonomy and governance systems are more transparent (Vogel et al., 2022; Vurro et al., 2010).

Authoritarian regimes add a dominant external layer of complexity through state logic, characterised by centralised decision-making, constrained civic space, and informal political pressures (Maier & Gilbert, 2023; Sallai & Schnyder, 2021). This study builds on these perspectives, theorising brokers as entities navigating the interplay of market, civil society, and state logics in authoritarian contexts.

Methodology

This study adopts a qualitative, case-based approach to explore the role of brokers in facilitating sustainability-oriented CSPs in Vietnam. Five case studies were selected for their diversity in objectives, stakeholder composition, and geographic scope. These include:

1. Enhancing CSR for Local Employment: A partnership aimed at creating jobs for local women by improving corporate social responsibility (CSR) practices in Central Vietnam.

2. Creating Jobs for the Poor and Environmental Protection: An initiative offering training on agricultural by-product processing to support low-income local people and promote environmental awareness.

3. Empowering Ethnic Women Through Sustainable Brocade: A project focused on restoring traditional brocade production to empower ethnic minority women and reduce reliance on natural resources.

4. Empowering Educators for Sustainable Development: A partnership strengthening educators' capacity for sex education for children, particularly in communities with high numbers of factory workers.

5. Effective Education for Children with developmental disorders: A nationwide initiative providing training for low-income parents to support children with developmental disorders.

Data collection involved 50 semi-structured interviews with diverse stakeholders, including broker representatives, business and CSO leaders and independent relevant experts. Additional data sources for triangulation included validation meetings, project documentation, and field observations. An inductive approach to data analysis (Ketokivi & Choi, 2014) was employed to identify patterns, themes, and theoretical insights. The qualitative software MAXQDA facilitated systematic coding and iterative refinement of findings.

Findings

This study illustrates the pivotal roles brokers play in addressing internal and external complexities in CSPs within the authoritarian context. Brokers facilitate collaboration by bridging institutional divides, reconciling conflicting logics, and navigating restrictive political environments.

Brokers address internal complexities by bridging the divergent priorities of businesses and CSOs, facilitating the formation and implementation of CSPs through initiating and supporting roles. Through these roles, brokers reduce information asymmetries, align stakeholder goals, and support partnerships in navigating institutional tensions.

1. Initiating Roles: Brokers connect diverse stakeholders by leveraging networks and local knowledge, fostering trust, and enabling dialogue. In the cases, brokers played a critical role in convening businesses and grassroots CSOs. They also enhanced partnerships by leveraging their legitimacy to provide resources such as funding and accreditation, overcoming barriers in the constrained civil society environment.

2. Supporting Roles: Brokers ensure the effective implementation of CSPs by providing technical, financial, and administrative support, such as capacity building and mentoring for both businesses and CSOs. As mediators, they address discrepancies, mitigate power imbalances, and foster trust between partners. Additionally, brokers promote mutual learning and sustainability awareness through workshops and training sessions, enabling CSPs to adapt and thrive in the authoritarian context.

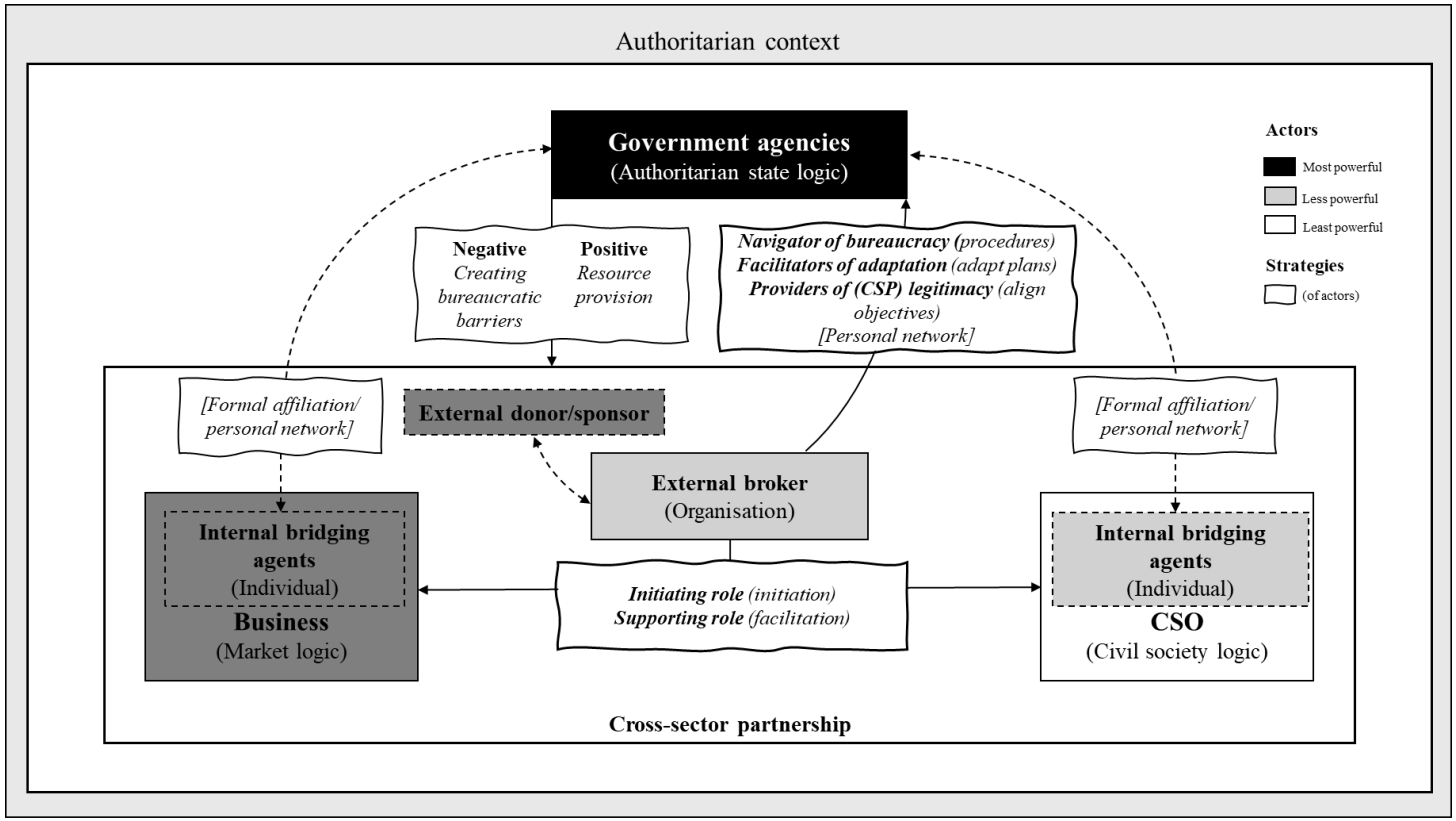
Brokers also play crucial roles in overcoming external challenges posed by the authoritarian context:

1. **Navigator of Bureaucracy**: Brokers facilitate engagement with governmental actors, obtaining project approvals and navigating opaque bureaucratic systems to mitigate delays and uncertainties.

2. **Facilitator of Adaptation**: Brokers orchestrate the adaptation of project plans to comply with legal and administrative requirements while maintaining partnership objectives, ensuring operational compliance without sacrificing effectiveness.

3. **Provider of Legitimacy:** By framing CSPs as aligned with state development priorities, brokers enhance partnerships' acceptance among key stakeholders, especially public authorities, and foster long-term resilience.

By addressing these external complexities, brokers bridge the institutional divide between CSP stakeholders and the authoritarian state, enabling CSPs to operate effectively despite significant political constraints. Figure 1 introduces an operational model of CSP brokers in the authoritarian context.



* The dashed lines indicate that the relationship between the two actors is not necessarily present.

Figure 1. An operational model of CSP brokers in the authoritarian context

Contributions and Implications

This study makes several theoretical and practical contributions. First, it extends the institutional complexity literature by incorporating the authoritarian state logic into CSP dynamics, offering a more comprehensive framework for understanding brokerage in politically constrained settings. Second, it illustrates the interplay between internal and external brokerage roles, demonstrating how brokers mediate between competing logics within and beyond CSPs.

Practically, the findings provide actionable insights for practitioners seeking to foster effective CSPs for sustainability in authoritarian contexts. Brokers must adopt context-sensitive strategies, leveraging their networks, adaptability, and legitimacy to navigate institutional constraints. For policymakers, the study underscores the importance of creating enabling ecosystems that support inclusive and equitable collaboration between businesses and CSOs for sustainability transitions.

Keywords

Authoritarian context, broker, cross-sector partnerships, institutional complexity, Vietnam

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Smart and Sustainable: The Determinants of Young Indians' Purchase Intentions for Refurbished Electronics

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Abstract

This study explores the factors influencing young Indian consumers' purchase intentions for refurbished electronics, with a focus on key factors such as environmental awareness, social acceptance, brand reputation and availability, and affordability. Findings highlight the need to prioritise environmental awareness and social acceptance in promoting refurbished electronic devices while addressing affordability and brand reputation.

Keywords

Circular economy, refurbished electronics, sustainable consumption, young consumer, business model

Introduction

The refurbishment of electronics plays a crucial role in promoting a circular economy by extending product lifespans, reducing electronic waste (e-waste), and conserving resources (Diwan, n.d.). According to Cardenas (2023), refurbishment significantly extends the useful life of electronic devices. Instead of discarding devices with minor defects or outdated features, refurbishing allows for repairs and upgrades, ensuring they can continue to be used effectively (Cardenas, 2023). This is particularly important as e-waste is one of the fastest-growing waste streams globally. Implementing modular designs and encouraging

repairability can potentially reduce e-waste by up to 50% (Hinds, 2024; Haaker & Ho, 2023; Kularatne et al, 2024). In a simple term, refurbished electronics could play a crucial role in reducing e-waste and fostering a sustainable future within the circular economy framework.

Meanwhile, the refurbishment sector is creating new economic opportunities in accordance with circular economy principles. This expansion can be seen in several areas, including the creation of jobs in repair and refurbishment centers (Hinds, 2024), the emergence of innovative business models that prioritize device longevity (Haaker & Ho, 2023; Hinds, 2024), and the increased affordability of technology for consumers (Haaker & Ho, 2023; Hinds, 2024; Islam et al, 2021).

Literature Review and Research Gap

Sustainable consumption has emerged as a critical area of research, driven by increasing concerns over environmental, social, and economic sustainability. The rise of environmental awareness plays a significant role in shaping sustainable consumption behaviours as consumers become more informed about the ecological influence of their purchasing decisions (Altın & Kırçova, 2024). Studies highlight that consumers with a higher environmental awareness tend to prioritise sustainable choices, including purchasing refurbished electronics. Green marketing strategies have also been essential in promoting sustainable consumption, offering eco-friendly alternatives and raising awareness about the benefits of reducing waste and reusing products. However, these strategies face challenges, such as the high cost of sustainable products and the complexity of providing clear information to consumers (Uchôa et al., 2024).

In addition to environmental awareness, social acceptance and peer influence play a significant role in shaping consumer behaviour toward sustainable products. Research indicates that social and peer networks greatly influence consumer attitudes and purchase intentions, especially in the context of online and social media platforms (Kenang, 2023; Li, 2023). These platforms facilitate information sharing and establishing trust, which is essential for encouraging sustainable consumption behaviours. Furthermore, social acceptance involves accepting sustainable practices and the willingness to adopt products that contribute to a circular economy. Social influence has been shown to bridge the gap between early adopters and the majority, highlighting the importance of peer recommendations and collective support in adopting green products (Li et al, 2024).

Affordability and accessibility are other critical components that shape sustainable markets. Affordability is an important driver for adoption of technology in the Global South as a significant share of the population belongs to the middle and lower income brackets (World Bank, 2024). Affordability of refurbished electronics remains a significant barrier, as consumers may view them as costly or of lower quality compared to new products.

Addressing these concerns requires financial strategies and technological and logistical solutions that ensure equitable access to sustainable alternatives, particularly for underrepresented and economically disadvantaged groups (Villapol et al., 2018).

Even though incorporating circular economy principles, efficient e-waste management, and the encouragement of refurbished electronics represents a promising strategy to tackle the global e-waste crisis, there is currently a lack of research regarding young consumers' perceptions and purchasing intentions about refurbished electronics. Most recent studies have concentrated on countries in the Global North, such as New Zealand (Kularatne et al., 2024) and the Netherlands (Haaker & Ho, 2023). This geographical focus fails to consider the distinct socio-economic, cultural, and technological contexts of the Global South, where affordability and environmental issues may influence consumer behavior differently (Chasta, 2024; Pravinkumar, 2024).

This research specifically targets young consumers in India, known as Generation Z. The reasoning behind this focus is the substantial influence Generation Z has on Indian society and its role in shaping technological trends. Squires and Ho (2023) note that “this young generation of consumers grew up with computers, iPhones, streaming music and videos, social media platforms, and other technological advancements” (p. 135). Research aimed at young consumers in the Global South is crucial to fill this gap, as it can shed light on their motivations and obstacles, allowing for the development of tailored strategies to promote refurbished electronics and further sustainable consumption on a global scale (Chasta, 2024; Schultz, n.d.).

Research Objective and Hypotheses Development

The objective of this study was to examine the influence of environmental awareness, social acceptance, brand reputation and availability, and affordability on young consumers' attitudes and purchase intentions toward refurbished electronic goods in India, with a focus on understanding the factors that drive sustainable consumption behaviour in this context. Our investigation was supported by the literature examined and by previous research conducted independently by Haaker and Ho (2023) in the Netherlands, as well as Kularatne and his colleagues (2024) in New Zealand. Their work uncovered several important factors that affect people’s willingness to purchase refurbished electronics. To illustrate these factors, we have developed a research model, as depicted in Figure 1.

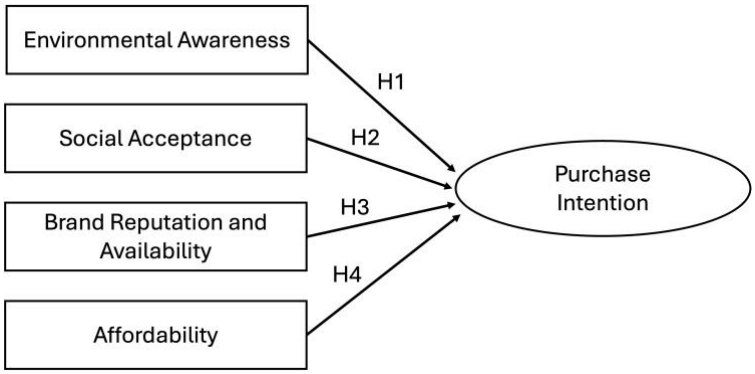


Figure 1: Research Model

Drawing from the research model illustrated above in Figure 1, the study has developed four hypotheses outlined as follows:

H1: There is a significant relationship between environmental awareness and young consumers' attitudes and purchase intentions toward refurbished electronic devices in India.

H2: There is a significant relationship between social acceptance and young consumers' attitudes and purchase intentions toward refurbished electronic devices in India.

H3: There is a significant relationship between brand reputation and availability and young consumers' attitudes and purchase intentions toward refurbished electronic devices in India.

H4: There is a significant relationship between affordability and young consumers' attitudes and purchase intentions toward refurbished electronic devices in India.

Methodology

This study adopts a quantitative research design to explore the factors influencing young Indian consumers' purchase intentions for refurbished electronics. The primary focus is understanding how environmental awareness, social acceptance, brand reputation, affordability, purchase intention and demographic influences shape their decisions. The questionnaire was adapted and localized from two previous studies conducted by Haaker and Ho (2023) in the Netherlands and Kularatne and his associates (2024) in New Zealand, which were previously used for a similar research project.

This study employed a purposive sampling method to select a diverse group of respondents actively involved in technology consumption. The researchers invited tertiary students at the University of Calicut, Kerala, India, to participate in the online survey either verbally or

via email. A total of 374 students took part in the study, offering valuable insights into their attitudes and behaviors towards refurbished electronics. Among the 374 respondents, 64 percent are bachelor's degree students, and around 17 percent are master's degree students. 41 percent of the respondents are male, and the remaining are female. Further, 96 percent are young adults aged 18 to 24 (a.k.a. young consumers). Data were collected using a structured questionnaire to capture responses regarding the key variables: environmental awareness, social acceptance, brand reputation and availability, affordability, and, attitude and purchase intention. Each variable was measured on a five-point scale using validated items with established reliability scores.

Results and Analysis

The results of Table 1 (see below) indicate a strong awareness of environmental issues among respondents, with a high agreement on the benefits of recycling and lifestyle changes in improving environmental quality (Mean = 3.96). However, social acceptance scored the lowest (Mean = 3.36), reflecting moderate influence from family, community, and government policies. Brand reputation and availability emerged as significant factors (Mean = 3.80), with respondents emphasising the importance of reputable manufacturers and sellers. Affordability also influenced decisions (Mean = 3.57), with price considerations being prominent but not overwhelmingly dominant.

Table 1: Descriptive statistics - Environmental awareness, social acceptance, brand reputation and availability, affordability (N=374).

		Mean	Std. Deviation
EA1	Recycling of electronic devices improves the quality of the environment.	4.03	.818
EA2	Recycling of electronic devices is useful to create a better living environment.	3.94	.795
EA3	I am willing to change my lifestyle to reduce the damage I cause to the environment.	4.02	.807
EA4	Everyone must be willing to change our lifestyle to reduce the damage we cause to the environment.	3.86	.858
EA5	Giving old electronic devices a second life is a great way to respect the environment.	3.92	.881
Environmental Awareness		**3.9551**	**.54376**

(Table 1 Continued)

SA1	If my family and friends were buying refurbished electronic devices, I will also engage in it.	3.60	.834
SA2	Those who have important influences on me (such as my boss and teachers) think that I should buy refurbished electronics.	3.39	.783
SA3	Those who are important to me (such as families and friends) support me to buy refurbished electronic devices.	3.39	.874
SA4	The community where I live could influence me in buying refurbished electronic devices.	3.38	.844
SA5	The media influences me in buying refurbished electronic devices.	3.26	1.010
SA6	The government policies influence me in buying refurbished electronic devices.	3.13	.908
Social Acceptance		**3.3578**	**.59519**
BA1	When shopping for any refurbished electronic devices, it is important for me that the seller has a good reputation.	3.75	.940
BA2	When shopping for any refurbished electronic devices, it is important for me that the seller has a reputation for good services.	3.89	.844
BA3	When shopping for any refurbished electronic devices, it is important for me that the manufacturer brand has a good reputation.	3.90	.867
BA4	When shopping for any refurbished electronic devices, it is important for me that the seller has a reputation for being fair in its relationship with its customers.	3.88	.830
BA5	When shopping for any refurbished electronic devices, it is important to me that these devices are widely available.	3.80	.813
BA6	When shopping for any refurbished electronic devices, it is important for me that these devices can be bought online.	3.55	.883
Brand Reputation and Availability		**3.7950**	**.63027**
AF1	I rather purchase a refurbished electronic device since it is cheaper than a brand new one.	3.43	.914
AF2	I choose a refurbished electronic device mainly because I cannot afford a brand new one.	3.33	.939
AF3	Price is always the most important consideration when I make a purchase decision of any electronic devices.	3.79	.846
AF4	If I bought a refurbished electronic device, I think I would be getting good value for the money I spend.	3.68	.826
AF5	I feel that acquiring a refurbished electronic device meets both my quality and price requirement.	3.61	.820
Affordability		**3.5701**	**.57243**

As stated in Table 2 (see below) attitudes and purchase intentions were moderate (Mean = 3.53), driven by environmental benefits like reducing e-waste, though actual purchasing behaviour appears constrained by weaker social influences and affordability perceptions. These findings suggest that enhancing social and community engagement, strengthening affordability messaging, and leveraging reputable brands can effectively promote the adoption of refurbished electronic devices.

Table 2: Descriptive statistics - Attitude and purchase intention (N=374)

		Mean	Std. Deviation
API1	Acquiring refurbished electronic devices is everyone's responsibility to reduce the volume of e-waste generated.	3.74	.830
API2	I have a favourable attitude towards purchasing refurbished electronic devices.	3.42	.868
API3	I am likely to purchase refurbished electronic devices in the near future.	3.38	.917
API4	I will encourage my relatives and friends to purchase refurbished electronic devices.	3.40	.926
API5	Acquiring refurbished electronic devices is a good idea since it helps to reduce: electronic waste (a.k.a. e-waste or discarded electrical or electronic devices).	3.89	.729
API6	Acquiring refurbished electronic devices is a good idea since it helps to reduce: the mining of valuable natural resources such as copper, silver, gold, and nickel.	3.37	.833
API7	Acquiring refurbished electronic devices is a good idea since it helps to reduce: air pollution by reducing the demand for manufacturing.	3.54	.797
API8	Acquiring refurbished electronic devices is a good idea since it helps to reduce: carbon emissions resulting from transport.	3.57	.788
API9	Acquiring refurbished electronic devices is a good idea since it helps to reduce: waste by keeping retired assets out of landfills.	3.48	.787
Attitude and Purchase Intention		**3.5297**	**.45398**

Correlation and Regression between Environmental Awareness, Social Acceptance, Brand Reputation and Availability and Affordability towards Attitude and Purchase Intention (H1-H4).

The descriptive statistics and multiple correlations (Table 3) show that Environmental Awareness has the highest mean (3.96), indicating substantial agreement on its importance. In contrast, Social Acceptance has the lowest mean (3.36), suggesting moderate social influence. Brand Reputation and Availability (3.80) and Affordability (3.57) are moderately relevant, with Attitude and Purchase Intention scoring an overall mean of 3.53, reflecting moderate intent to purchase refurbished devices.

Further, correlation analysis reveals significant positive relationships between all independent variables and Attitude and Purchase Intention. Social Acceptance (H2) has the strongest correlation ($r = 0.549$, $p < 0.001$), followed by Environmental Awareness (H1) ($r = 0.481$, $p < 0.001$), indicating their critical influence. Brand Reputation and Availability (H3) ($r = 0.360$, $p < 0.001$) and Affordability (H4) ($r = 0.349$, $p < 0.001$) show moderate effects.

Table 3: Descriptive statistics and correlations with Attitude and Purchase Intention

		Environmental Awareness	Social Acceptance	Brand Reputation and Availability	Affordability
Attitude and Purchase Intention	N	374	374	374	374
	Mean	3.9551	3.3578	3.7950	3.5701
	Std. Deviation	.54376	.59519	.63027	.57243
	Pearson Correlation	**.481****	**.549****	**.360****	**.349****
	Sig. (2-tailed)	**.000**	**.000**	**.000**	**.000**
	Testing Hypotheses	H1	H2	H3	H4
	Decision	Accept	Accept	Accept	Accept
	Results	There is Correlation	There is Correlation	There is Correlation	There is Correlation

All the alternate hypotheses (H1–H4) are accepted (see Table 3), confirming significant correlations. These findings highlight the need to prioritise environmental awareness and social acceptance in promoting refurbished devices while addressing affordability and brand reputation.

Conclusion, Recommendations and Future Research

This study explores the determinants influencing young Indian consumers' purchase intentions for refurbished electronics, with a focus on key factors such as environmental awareness, social acceptance, brand reputation and availability, and affordability. As the demand for sustainable consumption grows, refurbished electronics present a viable solution to address the rising concerns about electronic waste (e-waste) and resource conservation. The study, conducted among 374 tertiary students at the University of Calicut, Kerala, India, reveals that environmental awareness and social acceptance significantly impact purchase intentions, while affordability remains a crucial barrier.

These findings create useful suggestions for (re)designing value propositions and value delivery strategies in B2C business models for refurbished electronic devices. The strong correlation between social acceptance and purchase intention highlights the importance of stimulating positive awareness on REDs, especially via peers or influencers experienced as peers. Likewise, the overall high scores on environmental awareness and the positive correlation of environmental awareness with purchase intention indicate that offerings and promotion should stress the environmental benefits that REDs bring over new devices. While affordability shows relatively less correlation with purchase intention than social acceptance and environmental awareness, price considerations are found to be (very)

important when making purchase decisions. It is therefore crucial for sellers to balance the content of their actual offering, i.e. the quality of their refurbished electronic devices vis-à-vis the reputation of manufacturer and seller, and complementary services like warranty, with costs and price levels.

In future research, it will be interesting to continue parallel studies at other higher education institutions in both the Global South and North, to compare the results and identify differences in perceptions and potential approaches to stimulate business models for refurbished electronic devices. Comparative studies will provide deeper insights into regional preferences. Future research may also look at other dimensions such as perceived risk and/or how contextual and cultural differences and systemic barriers shape purchase intentions and sustainable consumption. Also, adding qualitative analysis through interviews or focus groups could enhance a deeper understanding of young consumers' perceptions and intentions. This research focuses on the final customers, in this case young consumers, of refurbished electronics. The results can be used to enhance value propositions, promotion and optimal delivery of refurbished electronics but further research is needed to understand how the business model can be configured in a viable way to realize these goals. Finally, while this research focuses on young consumers as a key target group for B2C business models for refurbished electronics, a similar research focusing on, for example, procurement officers in large organisations with an interest in sustainable business operations, may shed light on relevant B2B business models.

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Handling Waste by Connecting with the Informal Sector:

Social Symbolic Work and Interstitial Spaces in the Indian E-waste Ecosystem

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Extended abstract

Attending to the burgeoning problem of handling e-waste in emerging economies requires a focus on a broad, yet disparate, ecosystem that carries inherent tensions. On the one hand is attending to advocacy contexts at the policy level in an emerging country. Policy contexts, predominantly composed of formal institutions requiring skills in influence, advocacy, and collaboration, help shape ecosystem goals and provide guidance around mechanisms needed to achieve system level outcomes. As such, advocacy requires engaging with multiple stakeholders, representing various interests and information asymmetries within a competitive political system.

Simultaneously, attending to the social-economic context of handling e-waste materials necessarily involves informal workers in emerging economies. Crafting meaningful work by, for, and with informal workers is under theorized and under-examined. Importantly, an 'institutional voids' lens (Bothello, Nason and Schnyder, 2019) undermines the social-economic context of properly handling waste by informal workers. Drawing on social-symbolic work (Lawrence and Philips, 2019), we introduce interstitial space theorizing by examining how a social enterprise undertook a new type of organizing to meaningfully and pragmatically work across interstitial spaces in addressing e-waste ecosystem challenges. Our paper identifies new ecosystem theorizing that addresses each (and both) challenges using insights from the Indian e-waste management.

Social Symbolic Work

We draw on recent work based on the social-symbolic work perspectives of individuals and organizations (Lawrence and Philips, 2019) for its potential to show pathways and mechanism through which actors' intentional action bring about system level change. Social-

symbolic work perspective emphasizes how individuals within the organizations they inhabit are "purposefully constructed and how this happens" (Lawrence and Phillips, 2019, p. 49). This perspective is powerful in not only understanding the purposive action of individual actors but also as to how the individuals mobilize symbols, ideas, and objects to bring about change within an ecosystem they inhabit.

We are encouraged by the power of social-symbolic work perspective that brings attention to the connections among different forms of social-symbolic work that address environmental issues such as plastic pollution (Barberá-Tomás et al., 2019), the loss of nature based bio-physical objects (lakes in the case of Albareda and Branzei, 2024), and extending to construction of social issues such as gender inequality among others (Lawrence and Philips, 2019; Kouamé et al., 2022).

Using social-symbolic work perspective in empirical ways, Barberá-Tomás and colleagues (2019) show how complex sets of activities connect emotions and institutional life to bring social change by "multimodal interactions that conveys the meaning of symbols". The connections among forms of social-symbolic work and change can also be seen in the change in practices at the institutional field level (Zietsma and Lawrence, 2010).

Extending this inquiry into the repertoire of activities within a new social enterprise that aims to bring to change to the ecosystem at the institutional and individual levels, we build on empirical studies that show how actors construct new frames (Ansari et al., 2013) by bringing attention to larger systemic issues (Zietsma and Lawrence, 2010). We also acknowledge that extant practices such as 'responsibilizing,' 'energizing' (Barberá-Tomás et al., 2019), and discursive grounding (Albareda and Branzei, 2024) show that actors engage purposefully and reflexively with system level issues. In our empirical setting, we explore how a new social enterprise purposively engages with the complex e-waste ecosystem in the Indian context, the third largest e-waste producing country in the world.

Research Context – Karo Sambhav

Karo Sambhav, literally meaning 'make it possible' in Hindi, is a social enterrpise that provides a range of solutions such as EPR (extended producer responsibility) design, compliance management, and awareness programmes. In addition, Karo Sambhav provides collection infrastructure to address India's e-waste circularity aspirations through refurbishment, repair, and appropriate destruction of e-waste materials. Incorporated in December 2016, Karo Sambhav started e-waste operations in 2017 and now has branched out to different waste streams such as plastics and batteries.

Karo Sambhav, a social enterprise and the first PRO of India, was founded by Pranshu Singhal. Pranshu worked for electronic producers in Europe including more than a decade at Nokia, including as Head of Sustainability. At Nokia, Pranshu was instrumental in designing and creating a mobile phone take-back and recycling program in India in association with partners such as GIZ India and local NGOs. With a degree in Environmental Engineering from India and a Master of Science in Environment Management and Policy from Lund

University (Sweden), Pranshu also worked with the Confederation of Indian Industry (CII) in India on environment and development projects prior to founding Karo Sambhav.

Starting in 2014, Nokia, one of then-biggest mobile phone manufacturers in India, partnered with an Indian women's cooperative, SEWA, and an international women's empowerment organization, GIZ to engage informal women workers in e-waste circularity. This early involvement, that include one of the authors, had several goals. First, to create awareness about e-waste and its management within SEWA and to engage the informal sector in Ahmedabad. Then, engaging with various stakeholders in Ahmedabad to collect e-waste data which, in turn, helped facilitate e-waste collection, more broadly, in high schools, funded by Microsoft (which had acquired Nokia). Subsequent interactions and interviews with one of multiple co-authors and Pranshu ensued between 2014 and 2020.

We build on these initial set of interactions with Pranshu Singhal, both before and after setting up of Karo Sambhav, to both a) explain the contextual history in which the e-waste management of India evolved to its present state and b) understand the evolution of Karo Sambhav as the first PRO managing e-waste in India. The present paper is part of a larger study examinng the progression to circular pathways. We report the findings based on data that was collected between 2016 to 2020. Another author, who did not visit the field, took role of an outsider to attain the balance between emic and etic perspectives.

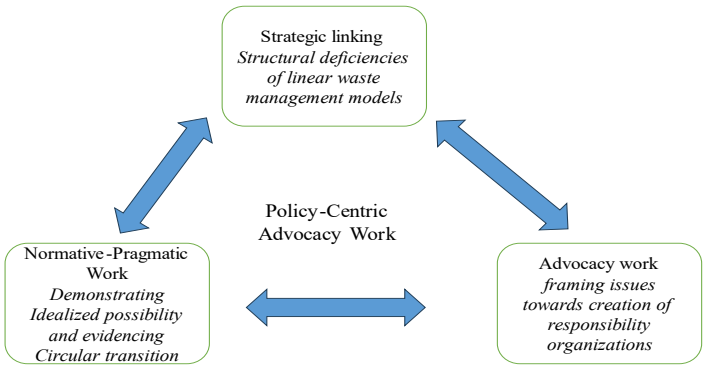
Table 2: Data Source, Collection, and Analysis

Data Source	**Data Collection (Mode)**	**Use in Analysis**
Observation and Interviews		
Founder-Karo Sambhav	Multiple interviews- in-person and online (over 30 hours of total observation and interaction)	Preparing history of events and building narrative of work in different phases of PRO 'movement'
Informal Sector workers and Organizations	Observation and immersion in multiple setting spread across different locations and *in-situ* interview with over 30 workers (20 hours of informal exchange and formal interviews)	Understanding the contextual challenges and perspective in e-waste management
Policy regulators	Interview with 3 senior functionaries (2 hours)	Understanding the policy perspective in evolving e-waste management dynamic

International Organizations	In person interview with two international organizations and organizing workshops (workshops – 20 hours and interviews – 4 hours)	Insight in to introduction of new methods and practices to engage with the ecosystem
PROs	3 other producer responsibility organization senior executives' interviews	Understanding the producer responsibility organization's perspective to emerging space of waste management
Non-Profits	2 leading non-profit founders/ senior executives (10 hours of informal exchange and interview)	Contextual history to work of informal sector and policy status
Policy Meetings	In person attendance (six meetings)	Understanding the dynamic of policy work

Overall, our four-stage empirical process allows us to theorize about a social enterprise within an ecosystem that addresses complex environmental challenges in an emerging country. As expected, based on developed economy models, creating a new organizational form may not become a stable, nor clear default in transitioning to circular waste streams in emerging economies. A social enterprise, created through policy-centered needs, must create space for itself. This is our premise and claim for more social enterprises undertaking 'interstitial work' in order to support ecosystem transitions to a circular economy, despite the best intentions of policy makers, organizations, citizens, and advocacy workers.

Figure 1: Policy Centric Advocacy Work of a New Policy Sponsored Organization



Keywords

India, social enterprise, informal workers, NGOs

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What do we mean by Circular Ecosystems? An analysis of Core Principles, Aims, Enablers

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Abstract

The transition towards circular economy is challenging and far from being complete. Circular economy requires to be implemented with an ecosystem perspective in order to fully leverage its potentialities. Circular practices, strategies and cycles need to be jointly designed and implemented by a wide set of actors to avoid burden shifting and mismatches. The concept of circular ecosystems has recently emerged to emphasize the need for this ecosystem perspective to undergo the transition towards circularity. However, as scholars have advanced the discourse concerning circular ecosystems, there is a need for an updated and comprehensive definition of circular ecosystems. Therefore, we perform a systematic literature review of academic and non-academic contributions collecting 123 documents. We replicate the methodology deployed by Kirchherr et al. (2017; 2023) to identify the main components of circular ecosystems and a comprehensive definition of circular ecosystems. The result of our research is an updated and comprehensive definition of circular ecosystems that clearly identifies core principles, aims and enablers. We believe that our research has relevant implications for scholars as well as practitioners, providing a compass to those trying to navigate the novel concept of circular ecosystems.

Keywords

Circular economy, circular ecosystem, core principles, aims, enablers

1. Introduction

The traditional economy model has been named linear economy. It is based on an open-loop system that takes natural resources from the environment, uses them to manufacture products or provide services and dispose of those resources at the end of the lifecycle of products and services (Su et al., 2013). The linear economy has led to several environmental challenges, such as pollution and resources depletion (Ghisellini et al., 2016). The latter is exemplified by the earth overshoot day, the day in which we consume the resources produced by our planet in one year. The earth overshoot day has been characterized by a negative trend, meaning that year-on-year the earth overshoot day comes earlier in our calendar. In 2000, the earth overshoot day was on September 17th. In 2024, it was on August 1st. So, more than a month and half earlier in 24 years (Earth overshoot day, 2024).

Recently, an alternative economy model emerged to face environmental challenges and, especially, resources depletion. This alternative economy model has been named circular economy (Bocken et al., 2016; Kirchherr et al., 2017). It is based on a closed-loop system that aims to retain the value of resources and extend the lifecycle of products and its embedded resources (Ellen MacArthur Foundation, 2024). Several technical cycles can be leveraged to implement circular economy and close-the-loop, such as reuse or remanufacturing (Kirchherr et al., 2023). The former aims to extend the lifecycle of products that are swapped among several users given that they are still in good condition. The latter refers to used products that are in poorer condition at the end of their lifecycle. The materials and parts embedded in the used products but still characterized by good conditions can be leveraged to manufacture new products. Not only technical cycles but also several strategies can be leveraged to implement circular economy, such as closing, slowing, narrowing and regenerating (Bocken et al., 2016; Konietzko et al., 2020). Those strategies refer to the following principles of use resources less (i.e., narrowing), longer (i.e., slowing), again (i.e., closing) and clean, not harmful (i.e., regenerating) (Konietzko et al., 2020).

The transition from linear to circular economy is not easy nor complete (Franzò et al., 2021). The circularity gap report detects a decreasing level of the world's circularity: from 9.1% in 2018 to 7.2% in 2023 (Circle Economy Foundation, 2024). It is so because several challenges remain to be solved to achieve circularity and move away from the traditional linear economy (Centobelli et al., 2020; Sgambaro et al., 2024). One of those challenges refers to the fact that circular economy needs to be implemented with an ecosystem perspective (Bocken et al., 2016; Kjaer et al., 2019). For instance, in order to implement circularity, products need to be designed to circular design practices, such as design for disassembly (Bocken et al., 2016). Circular design practices enable to implement circular practices along the lifecycle of the product to extend its lifecycle and retain the value of resources. Maintenance and remanufacturing activities can be properly performed if the product is design in a way that enables them, namely if it is designed according to circular design

practices. Besides, circular design practices need to be jointly implemented with remanufacturing or maintenance activities, meaning that if the product is designed according to circularity principles then maintenance and remanufacturing activities can and have to be implemented to extend its lifecycle (Sassanelli et al., 2020; Sgambaro et al., 2024). Often, circular design practices and the technical cycles to extend the lifecycle of products are implemented by different actors. Those actors need to jointly and coherently implement circular economy principles and practices, all along the products' lifecycle, not to have burden shifting and mismatches along the lifecycle of products (Kjaer et al., 2019). Therefore, the transition towards circular economy needs to be implemented with an ecosystem perspective to enable the engagement of all the actors involved in the lifecycle of products to turn them into circular ones (Aarikka-Stenroos et al., 2021).

The concept of circular ecosystems has recently emerged as a hot topic in managerial literature. The notion of ecosystem comes from the natural environment (Tansley, 1935) and has already been applied to the business context towards the end of the last century. In particular, the concept of business ecosystem was developed by Moore (1993) to identify "companies [that] coevolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations" (p. 2). Thereafter, several typologies of ecosystems were conceptualized by scholars and they differentiate among themselves as they aim to specific and different objectives, such as the development of innovative solutions (i.e., innovation ecosystems) (Thomas & Autio, 2020). Recently, the notion of ecosystems was tailored to the objectives of circular economy to identify the novel concept of circular ecosystems. In particular, the recent work by Aarikka-Stenroos et al. (2021) provided one of the first and seminal definitions of circular ecosystems, and laid the foundation for the emergence of a managerial debate on circular ecosystems. Circular ecosystems have been defined as "communities of hierarchically independent, yet interdependent heterogeneous set of actors who collectively generate a sustainable ecosystem outcome" (p. 261).

However, since the work by Aarikka-Stenroos et al. (2021) several contributions have advanced the discourse concerning circular ecosystems (see, e.g., Pietrulla, 2022; Trevisan et al., 2022). Scholars have given different interpretations of the novel concept of circular ecosystems with various nuances and each has investigated specific aspects of circular ecosystems, such as the role of orchestrators in enabling and coordinating relationships among the companies involved in circular ecosystems (Gomes et al., 2023). Hence, managerial debate has provided a clearer and deeper understanding of the concept of circular ecosystems lately. However, a contribution that reviews all previous definitions of circular ecosystem in a systematic manner is still missing in extant literature. Such a contribution could provide relevant contribution to both scholars and practitioners. From an academic perspective, the updated and complete definition of circular ecosystems can boost the managerial debate about it and further contribute investigating the transition

towards circular economy from an ecosystem perspective. From a practitioners' perspective, managers can grasp the relevance of implementing circular economy with an ecosystem perspective and better understand the concept itself of circular ecosystem.

Therefore, this paper aims to review previous literature concerning the concept of circular ecosystems and to ultimately, identify an updated definition of circular ecosystems by distinguishing among core principles, aims and enablers. We aim to answer to the following research question: "*What do we mean by circular ecosystems and what are its main components?*".

The paper is structured as followed. Section 2 describes the deployed methodology. Results are presented and analyzed in Section3, with reference to both the main components (subsection 3.1) and the comprehensive definition of circular ecosystems (subsection 3.2). Lastly, section 4 draws conclusions, highlights key findings, acknowledges limitations, and paves the way for future research.

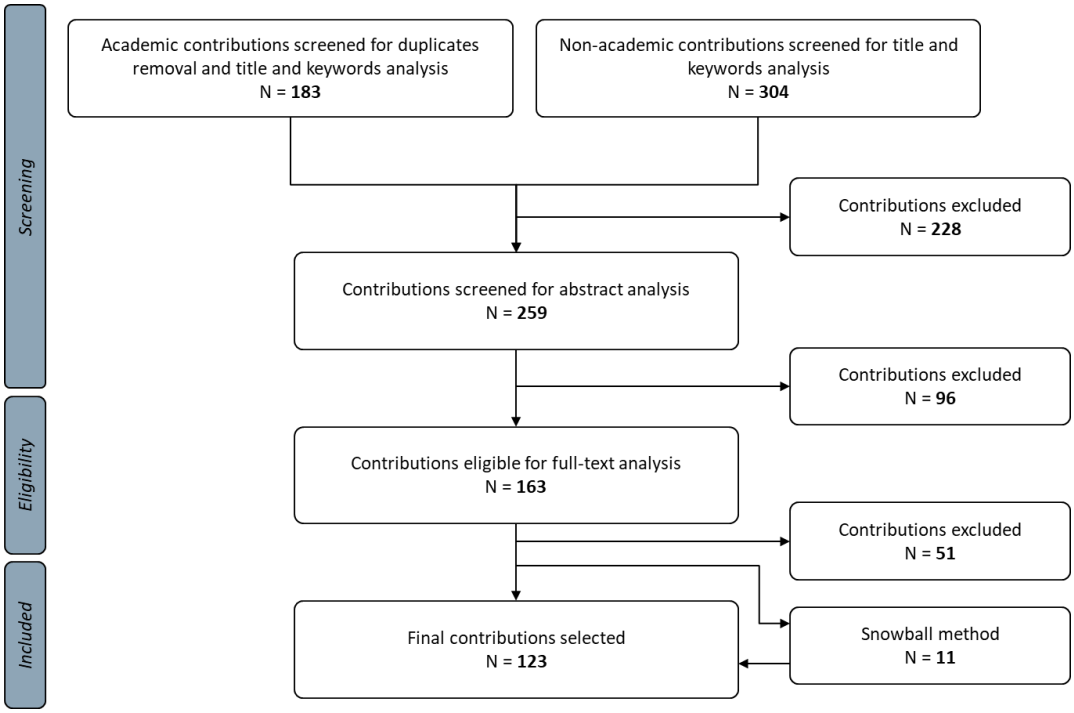
2. Methodology

We deployed a systematic literature review methodology (Denyer & Tranfield, 2009). The present study was initiated with a comprehensive search of the Scopus and Web of Science databases, given their extensive coverage of journal articles on the topics of circular economy and ecosystems. The query was developed to include the keywords related to circular ecosystems. In particular we selected the following query, namely circular W/0 ecosystem* or circular W/0 economy W/0 ecosystem*, as the concept of circular ecosystem is often referred to also as circular economy ecosystem (see, e.g., Pietrulla, 2022). Thereafter, two filters were then applied. First, we applied filters on the document typologies to exclude conferences articles and review and ensure rigor. Second, we selected only contributions in English. After removing duplicates, we retrieved a total of 183 academic contributions. Besides, given the novelty of the concept of circular ecosystems, we included in our systematic literature review not only academic contributions but also non-academic contributions, namely sectorial reports, press releases and news. To retrieve non-academic contributions, we selected LexisNexis, as it is a professional full-text database for international practitioners' document, company and sectorial news and press releases leveraged by previous research (see, e.g., Urbinati et al., 2017). We thus applied the same query described above also to LexisNexis and retrieved 304 non-academic contributions.

Overall, we retrieved a total of 487 academic and non-academic contributions. We screened them in order to include only the relevant contribution to answer to our research question, namely "*What do we mean by circular ecosystems and what are its main components?*". Therefore, we applied both exclusion and inclusion criteria. Firstly, contributions that exclusively analyze barriers and drivers to the implementation and

development of circular ecosystems, along with contributions that lacked a clear analytical perspective referencing circular ecosystems, were excluded. Conversely, contributions that concentrate on the role of one or more enablers of circular ecosystems, which analyze in depth the foundational principles of circular ecosystems, were included. The snowball sampling approach (Fan et al., 2022) was then employed to expand the retrieved contributions by leveraging relevant references cited in the full text of the included contributions, with main reference to the academic ones. The selection process resulted in the identification of 123 contributions that were deemed relevant in addressing the research question and objectives. The PRISMA diagram is presented in Figure 1.

FIGURE 1 – PRISMA DIAGRAM



The selected contributions were then manually coded to identify the core principles, aims and enablers of circular ecosystems. To do so, we replicated the methodology deployed by Kirchherr et al. (2017; 2023). Those works represent seminal contributions in the circular economy field. The former (i.e., Kirchherr et al., 2017) initially developed a comprehensive definition of circular economy by identifying its core principles, aims and enablers and gave a boost to the development of the academic debate concerning circular economy. The latter (i.e., Kirchherr et al., 2023) presents an updated and more nuanced definition of circular economy and again distinguishes among core principles, aims and enables. We followed the methodology deployed by Kirchherr et al. (2017; 2023), as it enabled to

develop a comprehensive definition of circular economy and was based on a solid procedure that enabled to clearly identify its main components, namely core principles, objectives and enablers. Hence, this methodology is aligned to our objective to provide a comprehensive definition of circular ecosystems and identify its main components.

3. Results

The present section is structured as follows. First, we identify and present the main components of the definition of circular ecosystems, and we describe them one by one in *ad hoc* subsections. Second, we present the comprehensive definition of circular ecosystems.

3.1. The main components of circular ecosystems

Table 1 presents the full set of core principles, aims and enablers that represent the main components of the definition of circular ecosystems. We deep dive into each component as follows. First, we define the core principles of circular ecosystems. Second, we describe the aims of circular ecosystems. Third, we identify the enablers of circular ecosystems.

TABLE 1 – THE MAIN COMPONENTS OF THE DEFINITION OF CIRCULAR ECOSYSTEMS: CORE PRINCIPLES, AIMS, ENABLERS

Core Principles
Adaptability and Learning
Holistic ecosystem understanding designed for circularity
Collaborative economy and governance
Mutual Benefit in a System-level outcome
Competition of heterogeneous yet interdependent participants
Aims
Resilience against turbulent times
Circularity (economic, social, and environmental point of view)
Implementation and diffusion of the circular economy culture
Coopetition
Enablers
Value co-creation

Infrastructural and technological tools
Favorable regulatory framework
Analysis of the location specificity
Education and awareness

3.1.1. Core principles

We identify five core principles underlying the concept of circular ecosystems. First, a circular ecosystem needs to adapt to the ever-changing environment, meaning that it has to seamlessly adapt to the continuous change in exogenous conditions, such as the regulatory framework, supply uncertainties, geopolitical tensions. A circular ecosystem needs to adapt, as quickly as possible, to whatever change might occur in the context in which it operates. Second, circular ecosystems have to be designed according to circular economy principles in a holistic way to consider the standpoints of all the actors involved in the ecosystem itself to ensure coherence and avoid mismatches. This holistic understanding is key to fully leverage on the potentialities of circular economy and, ultimately, achieve the transition towards circularity. Third, a circular ecosystem is not governed by hierarchical organizational structures, rather it is based on collaboration and a proactive engagement among all the actors involved in the circular ecosystem. Fourth, the actors involved in the circular ecosystems are characterized by a mutually beneficial relationship that enables the circular ecosystem to achieve a system-level outcome that is greater than the sum of the outcomes achievable by each individual actor. Fifth and last, the actors involved in a circular ecosystem are characterized by being heterogeneous and, at the same time, interdependent. Indeed, circular economy needs complementary skills, competences, and industrial processes to be fully implemented, and the collaboration among various actors with different characteristics is key to jointly implement circularity.

3.1.2. Aims

We identify four aims underlying the concept of circular ecosystems. First, circular ecosystems aim to be resilient and respond quickly to the changing context in which they operate. Second, circular ecosystems aim to implement the principles, strategies, technical cycles related to circular economy. Hence, circular ecosystems aim to promote not only economic but also environmental and societal benefits, taking into account not only the present but also future generations. Third, circular ecosystems aim not only to implement circular economy and its principles, strategies, and technical cycles, but also to promote awareness and the diffusion of circular economy among the actors involved in the circular ecosystem itself, the actors not already involved and, lastly, the society at large. Indeed, the transition towards circular economy demands a societal acknowledgement of the

impacts of the current linear economy and a collective engagement towards the implementation of circularity. For instance, circular economy aims to turn consumer into users because producers need to retain the ownership of products and offer them as a service to properly value resources. The concept of product-service-system (see, e.g., Centobelli et al., 2020) is one of the main circular economy practices and implies a proactive engagement of citizens to turn them into users. So, the diffusion of the circular economy principles by circular ecosystems enables to further support and promote the diffusion of circularity at larger scale. Fourth and last, circular ecosystems aim to achieve coopetition among the involved actors. Coopetition goes beyond the concept of competition, as circular ecosystems need to involve actors that jointly implement circular economy in a collaborative environment that does not hinder the sharing of information, knowledge and, also of resources in an effort to implement circular information and resources flows.

3.1.3. Enablers

We identify five enablers underlying the concept of circular ecosystems. First, circular ecosystems are enabled by the joint co-creation of value based on the proactive engagement and involvement of the actors involved in the circular ecosystem. The collective creation of value is key to enable smooth relationships among the actors involved in the circular ecosystems and to collectively design an attractive value proposition based on circularity principles, strategies, and technical cycles. Second, circular ecosystems are enabled by infrastructural and technological tools. Innovative technologies, such as digital platforms, have a role in enabling the development of a circular ecosystem in several ways, such as by facilitating the initial collaborations, by extending the number and variety of actors that can be involved in the circular ecosystem, by easing the managerial and coordination activities and burden among the actors involved in the circular ecosystem. Third, circular ecosystems are enabled by a favorable regulatory framework. The transition towards circular economy is still ongoing and far from being complete. Thus, support mechanisms and favorable norms and regulations have a role in enabling a wider implementation of circular economy and the development of circular ecosystems. Fourth, circular ecosystems are enabled by the analysis of the location in which they can be developed. Such an analysis can unfold the peculiarities and specificities of various locations in order to examine factors relevant to the development of a circular ecosystem, such as the presence of heterogeneous and interdependent actors or the existence of a favorable regulatory framework. Fifth and last, circular ecosystems are enabled by awareness and commitment towards circularity of the management of the actors involved in circular ecosystems. Circularity requires clear strategic choices and roadmaps, as the transition towards it may require investments, changes in the main departments of companies (e.g., operations) and collaborations with new actors. So, the development of circular ecosystems is enabled by a committed and shared vision towards circularity by the management of the actors involved in it.

3.2. The comprehensive definition of circular ecosystems

We have identified two similarities among certain main components of the definition of circular ecosystems. First, we summarize into a single component the core principle "holistic ecosystem understanding designed for circularity" and the aim "circularity (economic, social, and environmental perspective)" given their similarities. While the core principle represents a fundamental guideline for understanding a circular ecosystem, advocating a holistic view centered on circularity, and the aim seeks comprehensive circularity from economic, social, and environmental perspectives, there are nonetheless common themes that can be encapsulated within a single component. These themes have been integrated into the following component: "a holistic and joint effort to generate circular value." In this way, it is possible to join two similar components into a single one, preserving their meaning without hampering the readability and clarity of the final comprehensive definition. Second, we summarize into a single component the core principles "collaborative economy and governance" and "competition of heterogeneous yet interdependent participants," and the aim "coopetition" given their similarities. As previously noted, these two core principles and the aim possess independent validity, expressing distinct concepts and perspectives. Although these main components retain independent meaning as distinct concepts, they nonetheless share similarities, that allow them to be synthesized into a single component within the definition, avoiding unnecessary repetition and ensuring greater clarity. The unifying aspect of these components is the collaboration-competition duality that characterizes and defines the relationships among various actors involved in circular ecosystems. Here as well, the goal is to formulate a single component that encompasses those three components, integrating collaboration and competition among actors and conveying the idea of a dynamic balance between collaboration and competition. These themes have been integrated into the following component: "heterogeneous yet interdependent actors that balance collaboration and competition." It not only highlights the existence of collaboration and competition among actors but also expresses the perspective that these elements must coexist in a constant balance. After identifying those two similarities, we present the comprehensive definition of circular ecosystems, depicted in Figure 2. The definition presents clearly to readers what are circular ecosystems and identifies their main components, core principles, aims and enablers.

FIGURE 2 – COMPREHENSIVE DEFINITION OF A CIRCULAR ECOSYSTEM

A circular ecosystem represents an adaptive and learning entity of heterogeneous yet interdependent actors that balance collaboration and competition in a holistic and joint effort to generate mutual circular value at a system-wide level. Value co-creation, technological and infrastructural tools, a favourable regulatory framework, education and awareness regarding circularity and careful analysis for location specificity enable to achieve the implementation and diffusion of circular economy culture and resilience against turbulent times.

Core principles Enablers Aims

4. Conclusions

This paper contributes to academic literature concerning circular economy and circular ecosystems. In particular, the contribution of this research is twofold. First, we identify the main components of circular ecosystems, distinguishing among core principles, aims and enablers. Second, we provide a comprehensive definition of the concept of circular ecosystems. This paper represents a step forward in the academic debate concerning circular ecosystems and contributes to previous research, with particular reference to Aarikka-Stenroos et al. (2021), by providing an updated and comprehensive definition of circular ecosystems, drawing on the contributions about it published so far. We do so by replicating the methodology deployed by the seminal works by Kirchherr et al. (2017; 2023) that has been proven effective in defining novel concepts and identifying its main components. We retrieved and analysed academic as well as non-academic contributions concerning the concept of circular ecosystems. Our results have relevant theoretical and practical implications. Scholars can leverage our research to have an updated and nuanced understanding of the concept of circular ecosystems and to identify its main components. Besides, scholars could further deepen the understanding of one component, such as the enabling role of technological innovation, through further theoretical and empirical research. Managers can understand from our research the relevance of the implementation of circular economy from an ecosystems perspective and its nuanced characteristics. Also policy makers can grasp from our research the relevance of a favorable regulatory framework. Thus, our results represent a call to action to policy makers to promote the transition towards circularity and circular ecosystems with support mechanisms and favorable regulations.

This paper comes with limitations that represent also avenues for future research. From a methodological perspective, we focused on two main databases to retireve academic

contribution, namely Scopus and Web of Science. We do so, as they are acknowledged by scholars as being amongst the most significant ones concerning academic literature. However, other databases could have been considered to enlarge the initial set of academic contributions, such as JSTOR and GoogleScholar. Besides, we do not investigate the various typologies of circular ecosystems, such as circular platform ecosystems, as we aimed to provide an updated understading of the concept of circular ecosystems and its main components without diving into its variuos typologies. Thus, further research could focus on investigating the various typologies of circular ecosystems and identify their distinctive traits. To conclude, we highlight that future research could also focus on providing further empirical analysis concerning the development and implementation of circular ecosystems in real-world settings.

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Circular Ecosystem Development: a Process Framework and Practical Application

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Abstract

Collaboration is vital for the transition to a circular economy. However, existing ecosystem design approaches lack essential elements required for circularity. Our four-stage Circular Ecosystem Development Framework addresses these gaps, exemplified by the plastic packaging sector. It fosters sustainable, collaborative, and transformative circular ecosystems across diverse industries, incorporating governance and user-level transformation.

Keywords

Business Ecosystem, Circular Ecosystem, Circular Economy, Ecosystem Design, Circular Business Model

Introduction

Perceived as a "megatrend" in the 2010s, sustainability has increasingly become central to corporate strategies (Lubin & Esty, 2010). Sustainability integrates environmental, social, and economic considerations to ensure present needs are met without compromising future generations (Brundtland, 1987:p.15). Companies today face mounting pressures – from political entities, customers, and financial institutions – to adopt sustainable practices (Aluchna, 2024; Audi & Yu, 2024; Reznikova & Grod, 2024).

A prominent response to these pressures is the concept of the Circular Economy (CE), which proposes shifting from the linear "take-make-waste" model to a "cradle-to-cradle"

approach (Geissdoerfer et al., 2017). Achieving sustainable development through CE necessitates innovative Business Models (BMs) and value creation systems (Kirchherr, Reike & Hekkert, 2017), including new collaborative roles and partnerships (Lüdeke-Freund, Gold & Bocken, 2019; Ghisellini, Cialani & Ulgiati, 2016)

CE requires a systemic approach rather than the analysis of individual actors in isolation (Tate et al., 2019). Business Ecosystems (BEs), networks of interdependent actors collaboratively creating shared value (Jacobides, Cennamo & Gawer, 2018), provide such a systemic perspective. BEs enable cross-industry integration crucial for complex value creation within CE frameworks (Kanda, Geissdoerfer & Hjelm, 2021)).

Integrating CE with the BE concept leads to the notion of a Circular Ecosystem, a BE type explicitly designed to create circular value, aligning economic and environmental sustainability goals (Trevisan et al., 2022). However, while research recognizes the potential of Circular Ecosystems (Pietrulla, 2022), current literature primarily provides qualitative insights, case studies and reviews (Barquete et al., 2022; Kanda, Geissdoerfer & Hjelm, 2021; Moggi & Dameri, 2021; Konietzko, Bocken & Hultink, 2020; Langen, Sornn-Friese & Hallworth, 2020; Parida et al., 2019; Stewart et al., 2018; Fontell & Heikkilä, 2017), complemented by reviews that synthesize key elements and success factors for circular ecosystems (Barquete et al., 2022; Pietrulla, 2022; Trevisan et al., 2022; Asgari & Asgari, 2021; Konietzko, Bocken & Hultink, 2020). There remains a significant gap regarding structured methodologies or process-oriented frameworks explicitly tailored to the systematic design and development of Circular Ecosystems (Trevisan et al., 2022).

To address this gap, our primary aim in this paper is to provide both scholars and practitioners with a conceptual framework for circular ecosystem development. Thus, this paper seeks to answer the central research question: How can a process framework for the development of circular ecosystems be designed?

The paper proceeds as follows: Section 2 introduces and synthesizes key concepts – BE, CE, and Circular Ecosystem. Section 3 describes our research design. Section 4 reviews existing ecosystem design frameworks, evaluating their suitability for Circular Ecosystem applications. Section 5 introduces our proposed Circular Ecosystem Development Framework. Section 6 applies this framework to the context of the Open Circular-Collaboration-Platform for Sustainable Food Packaging from Plastics (COPPA) research project. Section 7 concludes by discussing theoretical and practical implications, limitations, and future research opportunities.

Basic Terms and Theoretical Background

Business Ecosystems

The concept of a BE originated in biology and describes a network of interdependent firms collaborating to co-create value (Jacobides, Cennamo & Gawer, 2018; Adner & Kapoor,

2010). Moore (1993) introduced it to the business world, redefining firms as components of cross-industry ecosystems rather than as isolated members of industries. This perspective emphasizes the dynamic interactions and the evolution of firms within ecosystems, enabling collective innovation and value creation (Moore, 1996).

Moore (1993) proposed four evolutionary stages of BEs: birth, expansion, leadership, and self-renewal. During the birth stage, firms collaborate to address specific customer needs and create a foundation for the BM. The expansion stage involves scaling the Value Proposition (VP) and competing with rival ecosystems. Leadership emerges as one actor dominates and directs the ecosystem. Finally, self-renewal determines whether the ecosystem can continuously adapt and innovate or is replaced by more competitive ecosystems. Each stage requires balancing several cooperative and competitive activities to ensure the BE's long-term survival (Moore, 1993).

The concept of co-evolution is central to ecosystems, as firms mutually influence each other's development and must adapt to changes to survive (Teece, 2016; Bateson, 1979). Failing to evolve risks extinction for individual actors or even the collapse of the entire ecosystem if adoption rates lag (Moore, 1993). Healthy ecosystems depend on strong inter-actor relationships and collective adaptation (Teece, 2016).

BE roles include leaders, niche players, and intermediaries, each with distinct contributions to value creation (Dedehayir, Mäkinen & Roland Ortt, 2018). Leaders (Dedehayir, Mäkinen & Roland Ortt, 2018; Adner, 2017, 2006; Moore, 1996, 1993) or orchestrators (Autio, 2022; Lingens, Huber & Gassmann, 2022) guide the ecosystem by defining its vision, governance, and partnerships (Jacobides, Cennamo & Gawer, 2018). Meanwhile, niche players provide complementary products and services critical to the ecosystem's success (Iansiti & Levien, 2004). Negative roles, such as dominators, extract disproportionate value or destabilize the ecosystem (Iansiti & Levien, 2004; Moore, 1996).

The structural characteristics of BEs differentiate them from traditional supply chains. BEs involve multilateral relationships that foster high interdependence among actors (Hoeborn et al., 2022; Adner, 2017). Despite the leadership role's prominence, individual actors maintain significant autonomy in their contributions, driven by shared rules and incentive structures rather than hierarchical control (Hoeborn et al., 2022; Jacobides, Cennamo & Gawer, 2018).

Circular Economy

The CE addresses the need to balance economic growth with ecological sustainability by optimizing resource efficiency and reducing waste (Heshmati, 2015). Over the decades, CE has synthesized ideas from various disciplines, including cradle-to-cradle design (McDonough & Braungart, 2002), regenerative design (Lyle, 1994), and industrial ecology (Graedel & Allenby, 1995).

Kirchherr, Reike & Hekkert (2017) define CE as an economic system that replaces the "end-of-life" concept with strategies to reduce, reuse, recycle, and recover resources. The CE model envisions closed resource loops, where biological nutrients are returned to the biosphere, and technological materials are reused within production cycles (Ghisellini, Cialani & Ulgiati, 2016). This dual-cycle approach necessitates a rethinking of product design and value creation to ensure compatibility with either biological or technical loops (EMF, 2013).

Three core strategies underpin CE: slowing, closing, and narrowing material flows (Bocken et al., 2016). They transform traditional linear value chains into circular networks, integrating forward and reverse material flows (Zeiss, 2021). CE strategies are operationalized through R-frameworks, which range from basic principles (e.g., reduce, reuse, recycle) to more comprehensive hierarchies such as Potting et al.'s (2017) 10R framework. The implementation of CE occurs at the micro levels (individual firms), the meso levels (industrial parks), and the macro (regional or national) levels (Ghisellini, Cialani & Ulgiati, 2016).

Adopting CE requires significant changes to BMs, as traditional linear models often conflict with circular principles. Circular BMs prioritize retaining value through repair, refurbishment, and recycling (Linder & Williander, 2017). Product-service systems, in which providers retain ownership and responsibility for reuse, exemplify this approach (Tukker, 2015).

Circular Ecosystem

The idea of a circular ecosystem integrates CE principles into the idea of a BE, creating systemic circularity in value creation (Konietzko, Bocken & Hultink, 2020). A circular ecosystem facilitates collaboration among actors to co-create circular value while addressing economic and environmental sustainability (Trevisan et al., 2022). Unlike traditional BEs, circular ecosystems emphasize structured value cycles that align with CE strategies (Trevisan et al., 2022). In accordance with the definition of a BE as outlined by Betz & Jung's (2021) well as Trevisan et al.'s (2022), we propose the following definition of circular ecosystems:

> A circular ecosystem is a dynamic structure of different interdependent yet autonomous actors, who coordinate their complementary activities towards a shared purpose to co-create circular value, providing opportunities for economic and environmental sustainability.

The VP for the customer addressed by a circular ecosystem differs from the VP of a conventional BE by its dedicated circularity (Trevisan et al., 2022). Its realization requires the activities of multiple actors in so-called *value cycles*. A circular ecosystem comprises different value cycles and therefore, it requires a more structured approach to collaboration than a linear value network (Trevisan et al., 2022).

Circular ecosystems rely on orchestrator roles, which manage ecosystem governance, support collaboration, and ensure alignment with CE goals (Parida et al., 2019). Orchestrators may be private companies (Parida et al., 2019; Hakanen & Rajala, 2018) or public institutions (Langen, Sornn-Friese & Hallworth, 2020). They monitor and support the implementation of CE characteristics (Parida et al., 2019), provide infrastructure (Langen, Sornn-Friese & Hallworth, 2020), and protect smaller firms within the ecosystem (Hsieh et al., 2017). Additionally, circular ecosystems include roles modeled after biological systems, such as *scavengers* and *decomposers*, to recycle and reintegrate resources into the ecosystem (Tate et al., 2019).

Data integration and resource sharing are critical to circular ecosystem operations (Konietzko, Bocken & Hultink, 2020). Actors must collaborate on data-driven strategies to enhance circularity, necessitating robust management practices and trust-building mechanisms (Trevisan et al., 2022). Digital platforms can facilitate this integration, by supporting shared goals and enabling efficient resource flows (Konietzko, Bocken & Hultink, 2020).

A shared vision and common goals underpin the success of circular ecosystems, aligning actors toward complementary circular strategies (Konietzko, Bocken & Hultink, 2020). These strategies drive economic benefits while also addressing environmental impacts, which can be internalized within operating costs (Stewart et al., 2018). Complementary activities in circular ecosystems are governed by rules and standards established through regulation or negotiation, ensuring alignment with circular objectives (Parida et al., 2019).

Methodology

This study utilizes a Design Science Research (DSR) methodology, which is recognized for its proficiency in creating new artifacts to solve particular issues (Gregor & Hevner, 2013; Peffers et al., 2007). DSR encompasses a range of artifacts, such as products, processes, technologies, tools, methodologies, techniques, procedures, or any other means for accomplishing objectives (Venable, Pries-Heje & Baskerville, 2012). Its intentional focus on the future (Gregor & Hevner, 2013; Venable, Pries-Heje & Baskerville, 2012; Jelinek, Romme & Boland, 2008) renders the research methodology highly suitable for comprehending circular ecosystem design in both theoretical and practical aspects (Jelinek, Romme & Boland, 2008).

To guide our research, we adopt the DSR framework outlined by Hevner et al. (2004), focusing on the three fundamental research cycles (Hevner, 2007) in three iterations. The relevance cycle establishes a connection between the need for a contextual environment and the design science activities. The second rigor cycle links the knowledge base, consisting of scientific foundations, experience, and expertise, informing the research project with the design science activities. Finally, the third cycle, the design cycle, involves

iterative processes focused on building and evaluating design artifacts and processes of the research (Hevner, 2007). Figure 1[1] provides a detailed overview of our DSR-based research.

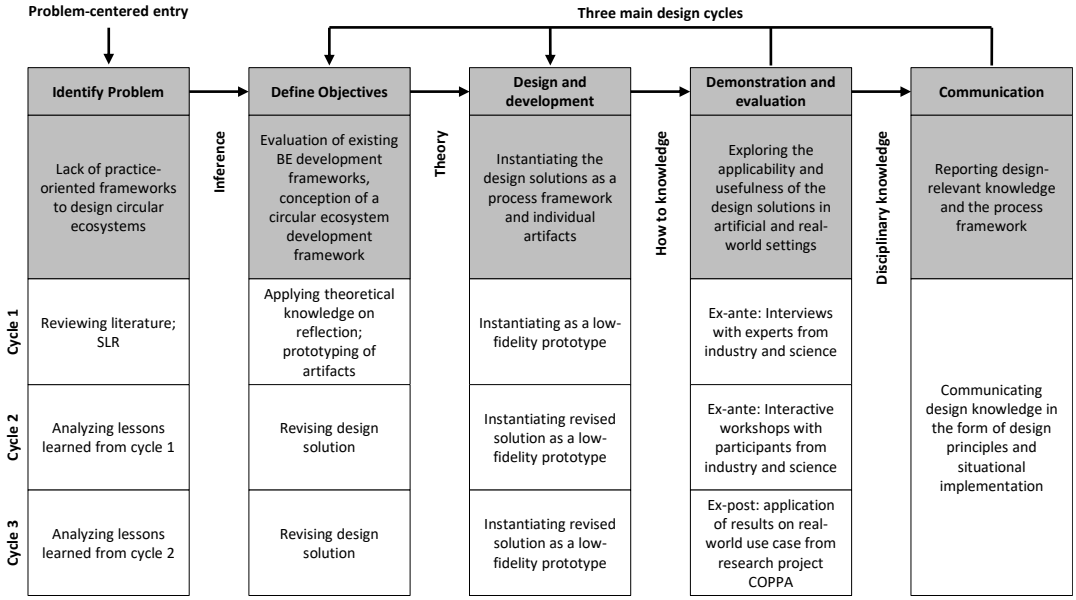


FIGURE 1: DSR RESEARCH APPROACH (ADAPTED FROM PEFFERS ET AL., 2007)

The artifact, the Circular Ecosystem Development Framework, was designed based on existing knowledge and challenges from existing research on the CE and circular ecosystems. Therefore, our study begins with a thorough analysis of the literature on circular ecosystems, as suggested by vom Brocke, Hevner & Maedche (2020). First, we identify particular aspects of circular ecosystems to develop an all-inclusive understanding of the associated requirements for practical circular ecosystem design. Second, we assess the potential setbacks and prerequisites for ecosystem design in practice, striving to determine the vital conditions for flourishing implementation. We integrate insights from ecosystem and business model literature with empirical research focusing on ecosystem development. This approach allows for a synthesis of theoretical foundations and practical observations and experiences (Pidun, Reeves & Schüssler, 2020b; Reeves et al., 2019). By following this methodology, we establish a robust foundation for evaluating existing knowledge and its applicability to circular ecosystem design. In this paper, the introduction presents content from the relevance cycle for the problem description, and the section on criteria development assesses existing approaches to ecosystem design.

To build a rigorous knowledge foundation for the development of the framework, a systemic literature review is conducted. This review provides an overview of the current state-of-the-art in ecosystem development and serves as a foundation for the suitability assessment (Rowley & Slack, 2004). To guarantee scientific rigor, we employ the five-step

[1] Note: SLR refers tot he systematic literature review.

literature review process suggested by vom Brocke et al. (2009). Our review only includes academic literature.

The purpose of the design cycle is to iteratively produce and assess alternative designs that meet the established requirements to a satisfactory degree (Simon, 1996). Research activities in this cycle entail a rapid process of creating the artifact, evaluating it, and incorporating feedback to enhance the design (Hevner et al., 2004). To assess the theory-based framework, we conducted several interviews in 2022 and held two workshops in 2024 with experienced representatives from the COPPA research project and the scientific community. The evaluation aimed to rigorously assess the framework's "utility, quality, and efficacy" (Peffers et al., 2007:p.49). We decided on a semi-structured interview format to enable knowledge production through dialogue and enable the interviewer to dynamically focus on specific aspects of the discussion (Brinkmann, 2018). Subsequent workshops were designed for the research purpose and documented following a strict agenda (Ørngreen & Levinsen, 2017). During the interviews, a researcher facilitated the sessions and recorded them for analysis. The researcher also created memos that captured initial interpretations following the discussions. To ensure the validity of the study, data triangulation was utilized, which combined field notes and questionnaires with a five-step scaling system. Workshops were facilitated by one researcher, with the assistance of another who was responsible for taking notes. The preliminary findings were reviewed by multiple researchers, ensuring its credibility and confirmabiblity (Miles & Huberman, 1984).

Concept Delimitations of Existing Approaches for the Development of Circular Ecosystems

Following the establishment of a foundational understanding of BEs, the CE, and circular ecosystems, the existing frameworks for BE development in the linear economy are assessed for their applicability to circular ecosystems. Evaluation criteria derived from literature analyze the approaches' suitability for circular ecosystem development.

Criteria Development

The following subsection outlines the derived ecosystem-related (ER) and application-related (AR) criteria for framework evaluation.

Ecosystem-related criteria

1. **Vision**: A circular ecosystem requires a shared understanding of value and goals (Pietrulla, 2022; Velter et al., 2020). A suitable framework must enable actors to define a common vision, establish goals, and develop the VP for beneficiaries (Konietzko, Bocken & Hultink, 2020).

   ER1: *The framework creates a common understanding of the goals pursued and VP to be created in the ecosystem.*

2. **Configuration**: Poor ecosystem configuration accounts for 18% of failed ecosystems (Pidun, Reeves & Schüssler, 2020b). A framework must define necessary activities, actor roles, and modular architectures while considering digital and physical value streams (Pietrulla, 2022; Trevisan et al., 2022; Konietzko, Bocken & Hultink, 2020; Adner, 2017). Motivational incentives and an orchestrating entity are also essential (Trevisan et al., 2022; Pidun, Reeves & Schüssler, 2020a; Parida et al., 2019; Hsieh et al., 2017).

   ER2: *The framework focuses on the ecosystem's configuration to deliver the targeted VP and launch a Minimal Viable Ecosystem (MVE).*

3. **Integration**: Resource and data sharing among actors is critical (Moggi & Dameri, 2021). A framework must incorporate shared infrastructure, digital data streams, and governance mechanisms to ensure trust (Trevisan et al., 2022; Hakanen & Rajala, 2018).

   ER3: *The framework incorporates relevant (data-)flows and the individual capabilities of the actors involved.*

4. **Management**: Governance issues contribute to 59% of ecosystem failures (Pidun, Reeves & Schüssler, 2020b). A framework must include internal governance structures, value distribution mechanisms, monetization strategies, and external collaboration incentives (Pietrulla, 2022; Konietzko, Bocken & Hultink, 2020; Pidun, Reeves & Schüssler, 2020a).

   ER4: *The framework considers aspects of value capture, incentives, and governance to ensure long-term success.*

5. **Transformation**: Circular ecosystems as networks of organizations may drive organizational change (Lacy, Long & Spindler, 2020). A framework must outline how circular strategies influence firms at the business, operating model, and organizational levels (Trevisan et al., 2022).

   ER5: *The framework provides guidance for the transformation of organizational culture, business, and operating models.*

Application-related criteria

1. **Process**: A structured yet adaptable process ensures usability. To balance complexity and usability, frameworks should have an appropriate number of steps and cause reasonable effort (Bocken et al., 2019). A framework shall incorporate iteration and validation loops, and accommodate both new insights and uncertainty in ecosystem development (Lingens, Miehé & Gassmann, 2021; Giessmann et al., 2013).

   AR1: *The framework focuses on the iterative development process of ecosystems.*

2. **Toolbox**: Another application-related criterion is that a model is applicable by practitioners with various levels of experience. It must guide the user through its methods and provides the necessary support to successfully complete the process by logically structuring the elements (Reuver & Athanasopoulou, 2016; Lofthouse, 2006). Following this, it shall offer methods throughout the development process of an ecosystem. To gain relevant experience through application and to ensure regular use, the scope of each method should be scalable to fit the available resources and capabilities of the corresponding users (Reuver & Athanasopoulou, 2016). To increase user acceptance, methods must be designed in a way that motivates users (Reuver & Athanasopoulou, 2016; Zec et al., 2014).

   AR2: *The framework offers practitioners a toolbox for the development of ecosystems.*

Table 1 provides an overview of the derived criteria.

TABLE 1: CRITERIA FOR FRAMEWORK EVALUATION

	Criterion	Criteria description
Ecosystem-related criteria	ER1: Vision	The framework creates a common understanding of the goals pursued and VP to be created in the ecosystem.
	ER2: Configuration	The framework focuses on the ecosystem's configuration to deliver the targeted VP and launch a minimal viable ecosystem.
	ER3: Integration	The framework incorporates relevant (data) flows and the individual capabilities of the actors involved.
	ER4: Management	The framework considers aspects of value capture, incentives, and governance to ensure long-term success.
	ER5: Transformation	The framework provides guidance for the transformation of organizational culture, business, and operating model.
Application-related criteria	AR1: Process	The framework focuses on the iterative development process of ecosystems.
	AR2: Toolbox	The framework offers practitioners a toolbox for the development of ecosystems.

Evaluation of Existing Approaches

Our initial literature search[2] from Scopus, Web of Science, IEEE Xplore and EBSCOhost yielded a total of 5,646 unique results. Using the open-source tool ASReview for semi-automated screening, we narrowed this to a final sample of 49 publications.

[2] Example of the search string used for Scopus: TITLE-ABS-KEY (("business ecosystem" OR "innovation ecosystem" OR "circular ecosystem" OR "value creation system" OR "value network" OR "value system") AND (development OR analysis OR strategy OR evolution OR orchestration OR innovation OR govern* OR structur* OR transformation OR genesis OR design) AND (model OR framework OR tool OR theory OR process))

This research evaluates a representative sample of eight frameworks for BE development and related concepts from a systematic literature review. The criteria assess their objectives and key characteristics. The frameworks under consideration include:

- Rong et al. (2015) explore how the Internet of Things can replace traditional supply chains, analyzing six BE components: *Context*, *Configuration*, *Capability*, *Cooperation*, *Construction*, and *Change*.
- Tura, Kutvonen & Ritala (2017) present a design science-based framework for platform design, addressing *platform architecture*, *value creation logic*, *governance*, and *platform competition*.
- Parida et al. (2019) present an interactive, two-stage CE transformation process for BEs in resource-intensive industries, focusing on an *ecosystem readiness assessment* and multiple *orchestration mechanisms*.
- Burkhalter (2020) critiques ideocentric business model ontologies and introduces the *Allocentric Business Model Ontology* considering actor interactions, value co-creation and individual value capture.
- Humbeck et al. (2020) develop the *BE Management Canvas* as a management tool for ecosystem orchestration, consisting seven key design fields.
- Talmar et al. (2020) introduce the *Ecosystem Pie Model* for strategic BE design distinguishing between *ecosystem-level* and *actor-level* constructs.
- Jacobides (2022) differentiates between *multi-product* and *multi-actor ecosystems*, proposing a two-plus-five-stage process for BE strategy definition.
- Kolagar, Parida & Sjödin (2022) examine digital servitization in manufacturing, outlining four areas of action during the transformation and a three-step transformation process.

A qualitative evaluation matrix (Table 2) based on ecosystem and application-related criteria compares these approaches. While each framework provides valuable insights, none fully meets the requirements for a practice-oriented circular ecosystem framework. Gaps in integration (ER3), management (ER4), and transformation (ER5) highlight the need for a more comprehensive approach.

TABLE 2: EVALUATION OF EXISTING FRAMEWORKS

	Ecosystem-related criteria				Application-related criteria		
	ER1: Vision	ER2: Configuration	ER3: Integration	ER4: Management	ER5: Transformation	AR1: Process	AR2: Toolbox
Tura, Kutvonen & Ritala (2017)	◕	◑	◑	◕	○	◑	◕
Parida et al. (2019)	◔	◑	◔	◑	◑	●	◔
Jacobides (2022)	◔	◕	◑	◑	◔	◑	◕
Kolagar, Parida & Sjödin (2022)	◕	◕	◕	◑	◑	◕	◑
Rong et al.	◔	◔	◔	○	○	◔	◑
Talmar et al. (2020)	◑	◑	◑	◔	◔	◑	●
Burkhalter (2020)	◕	◕	◕	◑	◔	◑	◑
Humbeck et al. (2020)	◕	◑	◕	◑	○	◑	●

The Circular Ecosystem Development Framework

Given the need for a novel approach to circular ecosystem development, this section outlines the derivation of an optimal method. The model's requirements are based on the central research question, defined criteria, and identified research gaps.

The ecosystem-related criteria from the previous section guide the framework's development, ensuring comprehensiveness while considering the model's reduction characteristic (Stachowiak, 1973). Its processual components allow elements of existing (linear) BEs to serve as inputs, supporting also ecosystem transformation. To act as a boundary object between academia and practice (Star & Griesemer, 1989) combining scholarly rigor with practical relevance specific tools and canvases complement the components.

The framework consists of six components, which are divided into two levels: the ecosystem-level and the actor-level. The four core components at the **ecosystem-level**, *Vision*, *Configuration*, *Manifestation*, and *Operation*, reflect the core process of ecosystem development. The components follow a processual order. In addition to the main components, the model includes two subcomponents at the individual **actor-level**:

ecosystem development is enabled by specific Actor-level Enablers and results in Actor-level Transformation considering the individual level of circular ecosystem actors is essential, as it reflects their unique enablers and initial conditions for participation in the ecosystem (Kolagar, Parida & Sjödin, 2022). However, it also highlights the transformative potential of such participation to drive organizational-level changes necessary for the transition to a CE (Parida & Wincent, 2019). Figure 2[3] shows a visualization of the framework.

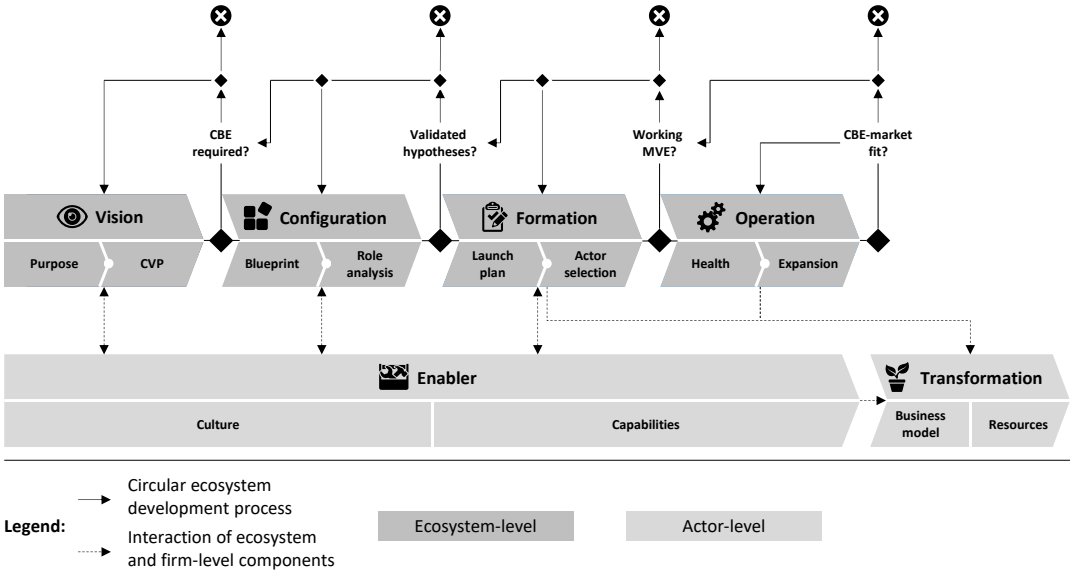


FIGURE 2: OVERVIEW OF THE CIRCULAR ECOSYSTEM DEVELOPMENT FRAMEWORK

Inspired by the stage-gate process for innovation and product development (Cooper, 2002), each main component is followed by a decision gate, serving as a milestone to determine whether to terminate, iterate, or proceed. Transition requirements are defined in advance for each phase, incorporating continuous learning and iteration through a *build-measure-learn approach* (Ries, 2011), thus addressing the critique of the stage-gate approach as too rigid for innovative projects (Cooper, 2014). Table 3 provides a summary of the main components with their descriptions and associated gates.

[3] Note: CVP refers to the circular value proposition of the circular ecosystem, while CBE denotes the circular ecosystem.

TABLE 3: OVERVIEW OF CORE COMPONENTS OF THE CIRCULAR ECOSYSTEM DEVELOPMENT FRAMEWORK

	Vision	Configuration	Formation	Operation
Description	Understand problem space and develop a vision for the circular ecosystem	Develop a blueprint for the circular ecosystem and analyze roles	Plan the initialization of the circular ecosystem and select stakeholders	Ensure the health and expandability of the circular ecosystem
Elements	• Initial situation • Customer segment & jobs-to-be-done • Purpose, vision, mission • (Circular) VP • R-strategies	• Value additions for implementation • Resources required • Roles in the circular ecosystem • BMs and value creation opportunities • Tangible & intangible flows • Risk and requirements analysis of each role	• Realization of the required resources • Onboarding strategy for circular ecosystem actors • Initial governance strategy • Selection of the orchestrator • Actor selection for each role	• Regular evaluation of the circular ecosystem • Ensuring stability • Ensuring prosperity • Identification of expansion opportunities
Outcome	Shared vision for the future	Hypotheses for the implementation of the CVP	Launch of the circular ecosystem	Circular ecosystem health
Gate	Circular ecosystem as a value creation system required	Validated hypotheses to realize the CVP	Working MVE	Circular ecosystem-market fit

Vision

The first component of the Circular Ecosystem Development Framework envisions a desired future, identifies challenges, and defines the CVP for the target customer segment. Guided by structured and unstructured factors, it follows a problem space-solution space approach

(Olsen, 2015). Target customer segments and challenges are identified using an outcome-driven innovation approach to optimize customer needs (Hankammer et al., 2019).

Stakeholder alignment is critical, as establishing a shared definition of sustainability and ecosystem goals is a significant challenge (White, 2013). Sinek's (2009) Golden Circle framework highlights the ecosystem's "why", its purpose, as derived from addressing the shared sustainability understanding and customer jobs (Pidun, Reeves & Schüssler, 2019; Sinek, 2009).

The solution space begins with defining the VP, initially addressing customer needs without integrating CE principles. Through iterative refinement with the application of CE's r-strategies, so-called *circularity debt* is minimized, and a comprehensive CVP emerges, integrating system-level goals (Konietzko, Bocken & Hultink, 2020). The selected r-strategies guide the "how", the circular ecosystem's value creation and differentiation, while the CVP informs the "what," or mission and final product (Sinek, 2009).

The Circular Ecosystem Vision Canvas visualized in Figure 3 supports this process, combining the Value Proposition Canvas (Osterwalder et al., 2014) with the technical cycle of the CE Butterfly Diagram (EMF, 2019) to emphasize circularity. Practical application incorporates all r-strategies, fostering an accessible, iterative development approach.

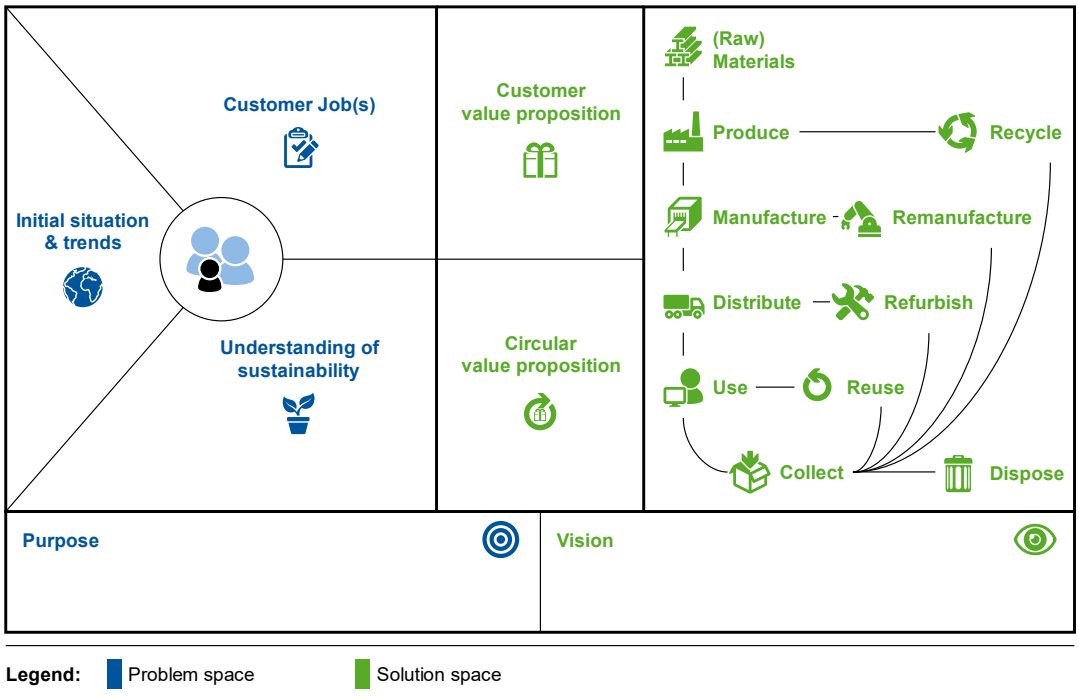


FIGURE 3: CIRCULAR ECOSYSTEM VISION CANVAS

A critical assessment determines if a circular ecosystem is suitable for realizing the CVP. Four guiding questions support this assessment (Jacobides, 2022; Pidun, Reeves & Schüssler, 2019; Jacobides, Cennamo & Gawer, 2018):

1. Does the realization of the CVP require multiple actors?
2. Does it require a high degree of coordination between the actors involved in the realization of the CVP?
3. Does collaboration with other actors in the realization of the CVP provide the opportunity to define the profile of the industry?
4. Does the solution to realize the targeted CVP require a high degree of modularity?

If unsuitable, the vision may proceed through sustainable business models or be discontinued (Antikainen & Valkokari, 2016; Mentink, 2014).

Configuration

The second component of the Circular Ecosystem Development Framework focuses on realizing the ecosystem through value additions, resources, roles, and exchange relationships. It develops and validates hypotheses for forming the ecosystem, starting from the CVP defined earlier. Value additions – representing the productive components of roles – are identified for pre-, during-, and post-use phases, ensuring circularity (Talmar et al., 2020). Resources underlying these activities include physical, human, and intangible assets, including capabilities, which may be owned, shared, or jointly utilized (Langen, Sornn-Friese & Hallworth, 2020; Lubik & Garnsey, 2016).

Roles are analyzed to determine their capacity to deliver value additions, emphasizing financial or non-monetary value capture as motivation for participation (Lepak, Smith & Taylor, 2007). Economic feasibility remains critical, requiring tailored business models to support value realization (Govindan & Hasanagic, 2018; Kirchherr et al., 2018). Exchange relationships between roles are mapped, integrating material, monetary, and intangible value streams to analyze interdependencies and associated risks (Ouden, 2012). Risk factors include participation incentives, role dependencies, and value creation complexity (Adner, 2006; Iansiti & Levien, 2004).

The Circular Ecosystem Configuration Canvas supports this stage, offering a role-level analysis while illustrating systemic interdependencies (Talmar et al., 2020). Validation is conducted through methods like stakeholder interviews, focus groups, or digital simulations (Konietzko, Bocken & Hultink, 2020). If assumptions are validated, ecosystem formation begins; otherwise, the process iterates or concludes.

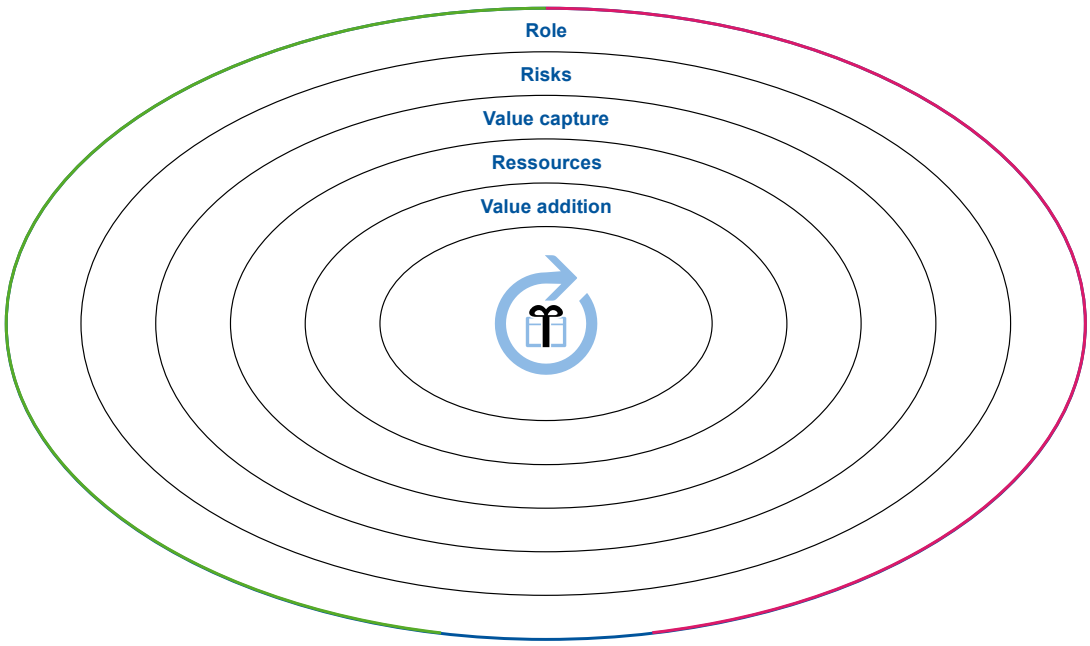


FIGURE 4: CIRCULAR ECOSYSTEM CONFIGURATION CANVAS (BASED ON TALMAR ET AL., 2020)

Formation

The third component, Formation, focuses on translating validated hypotheses into a functional circular ecosystem through a structured formation plan and actor selection. Four key action areas are addressed: *resources*, *onboarding strategy*, *governance structure*, and the *orchestrator role*.

Resources involve ensuring the necessary inputs for the launch and operation of the ecosystem. This includes distinguishing between existing resources from current contributors and the resource gap to be filled. Critical and complementary missing resources may require integrating suppliers as complementors or establishing dyadic relationships, depending on their relevance to value creation.

Onboarding strategy addresses capability development of involved actors, handling of digital data, technological infrastructure and product standardization, as well as funding. Key considerations include knowledge sharing, digital literacy, data exchange standards, and the need for a digital platform or modular CVP architecture to ensure actor autonomy (Kolagar, Parida & Sjödin, 2022; Konietzko, Bocken & Hultink, 2020). Upfront costs vary by role, necessitating funding strategies, such as subsidies combined with profit-sharing mechanisms (Parida et al., 2019).

Governance structure and control is crucial for the success of an ecosystem. It includes the overall governance structure, which formalizes collaboration. It also encompasses the rules of collaboration, which are responsible for regulating the behavior of individual actors within the ecosystem. Furthermore, it comprises metrics for goal-oriented management of

the circular ecosystem, ensuring that all actors align their actions towards a common goal. Finally, it involves value capture for all actors, guaranteeing the satisfaction of all parties involved. Governance must align actors' actions toward shared goals while ensuring fair value distribution.

The orchestrator is responsible for overseeing the ecosystem, balancing strategic tasks (e.g., CVP refinement) with operational coordination (Kolagar, Parida & Sjödin, 2022; Lingens, Huber & Gassmann, 2022; Brusoni & Prencipe, 2013). If a single orchestrator lacks requisite skills, co-orchestrators or a multi-orchestrator model may be implemented to ensure effective management (Lingens, Huber & Gassmann, 2022).

The Formation Canvas (Figure 5) supports ecosystem initialization, providing a structured approach to the planning of resources, actor, and governance. Following formation, a pilot launch of a MVE in a test market determines readiness for full-scale operations. If validation fails, the process iterates or terminates, potentially revisiting earlier components such as *Vision* or *Configuration*.

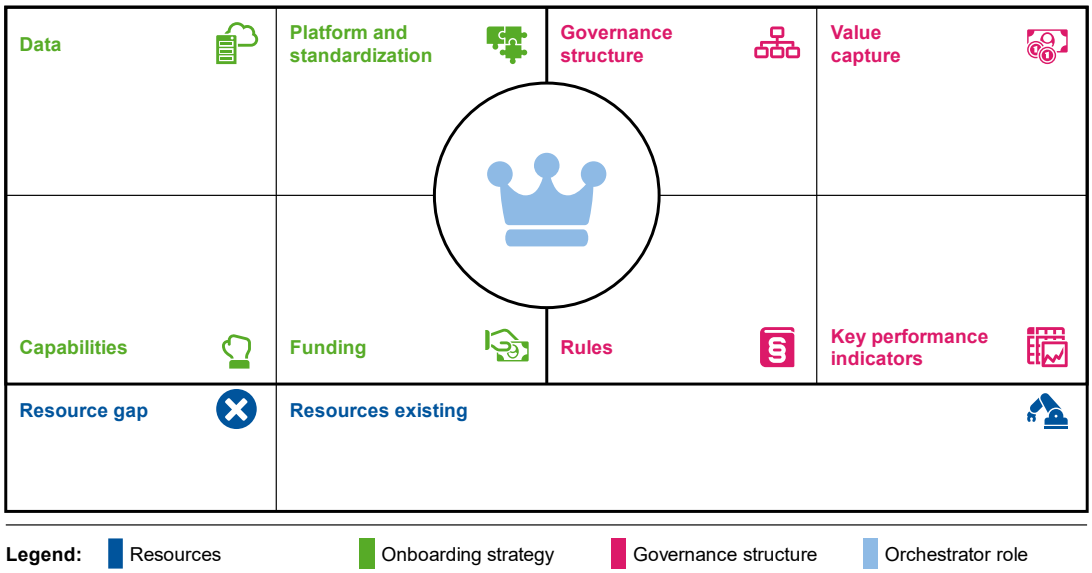


FIGURE 5: CIRCULAR ECOSYSTEM FORMATION CANVAS

Following formation, a pilot launch of a MVE in a test market may determine readiness for full-scale operations. If validation fails, the process iterates or terminates, potentially revisiting earlier components such as Vision or Configuration.

Operation

Following successful testing of the MVE, the Operation component transitions the circular ecosystem from development to maturity and expansion. This stage ensures long-term ecosystem health, defined by robustness, productivity, and niche creation (Iansiti & Levien,

2002). Activities focus on *stability*, *prosperity*, and *expansion*, with ecosystem health as the central objective.

Stability ensures the ecosystem's foundations, which consist of addressing governance, conflict resolution, task distribution, and actor coordination. Governance mechanisms, including decision-making, role definition, and rules of collaboration, must be reviewed and adapted as needed (Humbeck et al., 2020). Interfaces between actors must be maintained to prevent conflicts and ensure CVP realization, fostering integration and knowledge exchange (Parida et al., 2019).

Prosperity optimizes value creation by addressing gaps in capabilities, evaluating Key Performance Indicators (KPIs), and aligning actor-level and ecosystem-level strategies. Capability-building ensures actors can fulfill roles, while KPIs measure progress toward shared goals. Alignment reviews the appropriateness of the double-sided VP and strategies to sustain cooperation and motivation (Humbeck et al., 2020).

Expansion focuses on growth through openness and shaping industry standards. The ecosystem can expand by onboarding new partners or adapting the CVP to additional use cases, leveraging network effects (Tura, Kutvonen & Ritala, 2017). Shaping strategies, such as influencing legislation or market norms, can further amplify impact.

The Circular Ecosystem Operation Canvas (Figure 6) supports collaborative evaluation and planning for ecosystem health, incorporating stability, prosperity, and growth. Periodic assessments enable iteration or termination if the ecosystem’s health is insufficient. Sustainability-specific KPIs complement traditional metrics to align with ecosystem goals (Hristov & Chirico, 2019; Hartigh et al., 2013). This component ensures continued evolution or guides decisions to iterate or conclude the circular ecosystem endeavor.

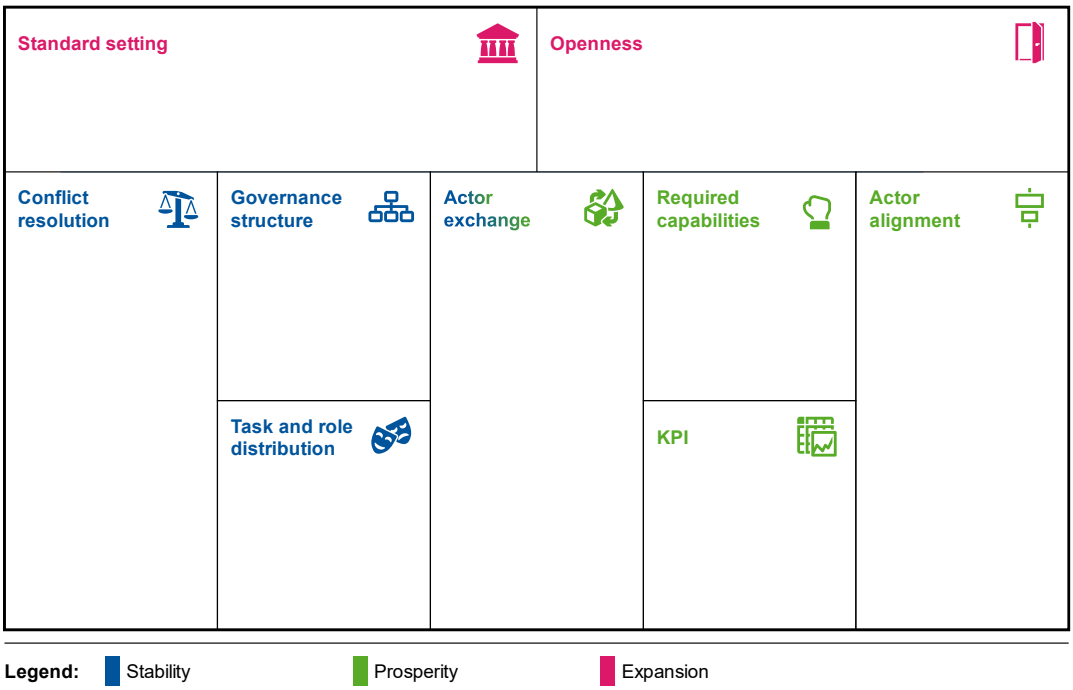


FIGURE 6: CIRCULAR ECOSYSTEM OPERATION CANVAS

Actor-level Components

Although the circular ecosystem is developed collectively under the orchestrator's leadership, individual actor-level factors significantly influence its success and design. This dynamic necessitates a focus on *Actor-level Enablers* and the *Actor-level Transformation* resulting from ecosystem participation.

Actor-level Enablers

The success of a circular ecosystem depends on actors' cultural characteristics and capabilities. Cultural enablers, such as transparency, openness, accountability, and trust, foster data sharing and collaboration. For instance, openness encourages knowledge exchange, while accountability ensures responsibility even in loosely regulated settings (Kolagar, Parida & Sjödin, 2022).

Key capabilities include relationships, digital, product development, and business model competencies. Relationship capabilities enable coordination and conflict management, particularly for orchestrators balancing internal and external priorities. Digital capabilities, including data processing and platform skills, are critical in the data-oriented circular ecosystem (Trevisan et al., 2022). Product development capabilities depend on roles and may involve engineering, material science, or design expertise (Los Rios & Charnley, 2017). Business model capabilities are essential for adapting and innovating VPs (Kolagar, Parida & Sjödin, 2022).

Actors can identify and close gaps in these enablers through gap analyses, roadmaps, and focused development efforts (Schuh et al., 2020).

Actor-level Transformation

Based on Trevisan et al.'s observation that actors in a circular ecosystem can take action to adopt circular strategies, even beyond the materialization of the CVP (Trevisan et al., 2022), the *Actor-level Transformation* component emerged. Participation in circular ecosystems shapes organizations by fostering new enablers and driving transformations in value creation, capabilities, and operations (Parida & Wincent, 2019; Bocken et al., 2014). Actor-level transformations often align with sustainability goals, requiring structured management tools like the Business Transformation Canvas (Gudergan, Feige & Krechting, 2017). Ultimately, circular ecosystems enable mutual growth, helping actors achieve sustainability while driving organizational transformation.

Application of the Circular Ecosystem Development Framework

One sector facing considerable pressure for sustainable transformation is the plastic packaging industry (Feber et al., 2022). Driven by customer demands and stringent political regulations, such as the European Union's (EU's) revised Packaging and Packaging Waste legislation (European Commission (EC), 2022; Cherel-Bonnemaison et al., 2022; Feber et al., 2022), the industry must significantly reduce waste and emissions. Despite Germany's high recycling rate of 65.9% for plastic packaging waste (Cayé et al., 2024), only 10% of the recycled material is reused in packaging of equivalent quality (Sestak, 2021). A fundamental shift towards proactive waste prevention in product design and development is required to reduce environmental impacts effectively (Lemille, 2019).

Context of the Field of Application

In Germany, Packaging consumption reached 8,867.1 kilotons in 2020, with plastic being the fastest-growing material, increasing by 111.4% since 1991 (GVM, 2022). Plastic packaging, especially in food, is favored for its moldability, light weight, and cost efficiency (Cooper, 2013). The packaging industry explores sustainable innovations like reusable packaging, deposit refund systems, and refillable options (WEF, EMF & McKinsey, 2016). Digital technologies and intelligent packaging design enhance sustainability efforts by improving life cycle assessments and supporting traceability (Sharma & Ghoshal, 2018). Achieving a CE in the food packaging industry requires systematic changes, including improvements in recycling technologies, new materials, and regulatory frameworks (Berg et al., 2020; WEF, EMF & McKinsey, 2016).

Digital platforms are a good example of new technologies that can have a significant impact on the food packaging industry. The research project COPPA, funded by the German Federal Ministry of Agriculture, aims to develop an open Circular Collaboration Platform (CCP)

designed to facilitate more precise and efficient information exchange among various stakeholders in the food packaging industry. The CCP enables participants to effortlessly track plastic packaging by automatically verifying information on quality, content, and recyclate availability, thereby supporting the closure of loops and advancing circularity. The transition from a predominantly linear economy to a digitally-enabled CE can lead to significant changes in value creation flows in the market and the requirements for market participants. Therefore, the project is developing and testing a circular ecosystem to realize and promote the CCP with existing and new stakeholders. The objective of COPPA is to develop a prototype demonstrator within the required CE and a Technology Readiness Level of around 5. Therefore, the application of the Circular Ecosystem Development Framework focuses on the initial two components of the development process: vision and configuration, with the results presented in the following section.

Vision of COPPA

The plastic packaging industry faces significant challenges in the transitioning to a CE, primarily due to a lack of transparency regarding material origin, quality, and availability. Market participants often struggle with trust issues and limited knowledge about technical and commercial opportunities, which hinders their ability to integrate recycled materials effectively. Additionally, strong regulatory restrictions, the absence of viable business and ownership models, and high costs for recycled materials further complicate the shift.

The COPPA research project aims to address these challenges by developing a transparent, efficient, and collaborative ecosystem for circular plastic packaging through the development of a circular collaboration platform. The platform offers its participants the following VP:

- Creation of an aggregated database to facilitate more accurate and efficient information exchange, enabling seamless tracking of plastics from food packaging
- Documentation of raw materials, additives, recycled content, recycled quality, origin, and ownership, all accessible via a Digital Product Passport (DPP)
- Notarization of data through a smart contract model to verify its authenticity
- Democratization of platform participation by adhering to data standards
- Provision of a CO2 calculator to assess the carbon footprint of products and offer decision support for reducing packaging material and increasing recycled content

Configuration of the COPPA Circular Ecosystem

The Configuration consists of developing a circular ecosystem blueprint and individual role analyses to develop hypotheses as a foundation for initializing the circular ecosystem. Based on the developed VP, the circular ecosystem blueprint is created as a plan for the ecosystem. The first step is to define the individual **value additions** required to realize the VP. The necessary **resources** are then allocated to individual value additions. The individual

activities and resources are then assigned to the respective **roles** in the ecosystem. In practice, an actor may take on multiple roles; for example, a grocery shop chain may take on the roles of *retailer* and *collector*, or a (petro-)chemical company may take on the roles of p*olymer producer* and *compounder*. From a **value capture** perspective, two sets of roles can be identified: first, the suppliers of the physical product components, and second, the providers of the services required to realize the circular VP, such as the platform operator and digital product passport aggregator. The central role of the Platform Operator for the circular ecosystem becomes clear when the **exchange relationships** are visualized. The material flows along the supply chain remains untouched, while the platform acts as the central hub for data aggregation and exchange between players. Prior to the launch of the circular ecosystem, the actors are assessed in terms of their **risk** regarding VP fulfillment. The full Configuration blueprint can be derived from the Configuration Canvas of the COPPA ecosystem provided in Appendix 1.

Conclusion and Contributions

The objective of our research is to address the gap in application-oriented frameworks for circular ecosystem development. To this end, a Circular Ecosystem Development Framework has been developed to fulfill this need. The framework is based on a systematic literature review, which evaluates existing models and offers a modular, flexible approach that accounts for both ecosystem-level developments and enablers at the individual actor level. The framework was applied and validated to a case study in the plastic packaging industry, based on the research project COPPA to demonstrate the suitability of the model.

This paper provides contributions to circular ecosystem research by offering a systematic literature review of existing development models and identifying their limitations in supporting circular ecosystems. It introduces seven criteria for evaluating frameworks based on ecosystem design moments, circular ecosystem characteristics, and application perspectives. The evaluation reveals that while some frameworks meet certain requirements, no one fully supports circular ecosystem development. The central contribution of this paper is the development of the Circular Ecosystem Development Framework, which addresses the limitations of existing methods by focusing on both ecosystem-level development and individual actor enablers. The framework is flexible and modular, allowing for adaptation to various starting points in ecosystem management and development. It includes four main components, supported by specific methodologies for practitioners, and allows for iterative development.

However, the applicability of the framework was tested in a specific context, limiting its generalizability. Future research should focus on applying the framework in diverse industries and with a broader group of participants to assess its broader relevance. The paper also underscores the necessity to explore enablers for participation in circular ecosystems and the impact of ecosystem activity on individual roles. Further studies could

examine actor roles within circular ecosystems, particularly the orchestrator role, and explore how different CE strategies require distinct circular ecosystem configurations.

Lastly, future research could integrate digital tools, such as artificial intelligence, into circular ecosystem development. These tools could support hybrid innovation teams, enhancing creativity and traceability in the process, and help expand the solution space for Circular ecosystem challenges.

Credit authorship contribution statement

L. Klapper: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – Original Draft, Writing – Review & Editing. **D. Spindler:** Validation, Writing – Original Draft, Project administration. **G. Hoeborn:** Conceptualization, Methodology, Validation, Investigation, Writing – Review & Editing, Supervision, Project administration, Funding acquisition. **W. Boos:** Resources, Writing – Review & Editing, Supervision.

Declaration of Interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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During the preparation of this work the authors used DeepL and ChatGPT 4o to improve readability and language of the manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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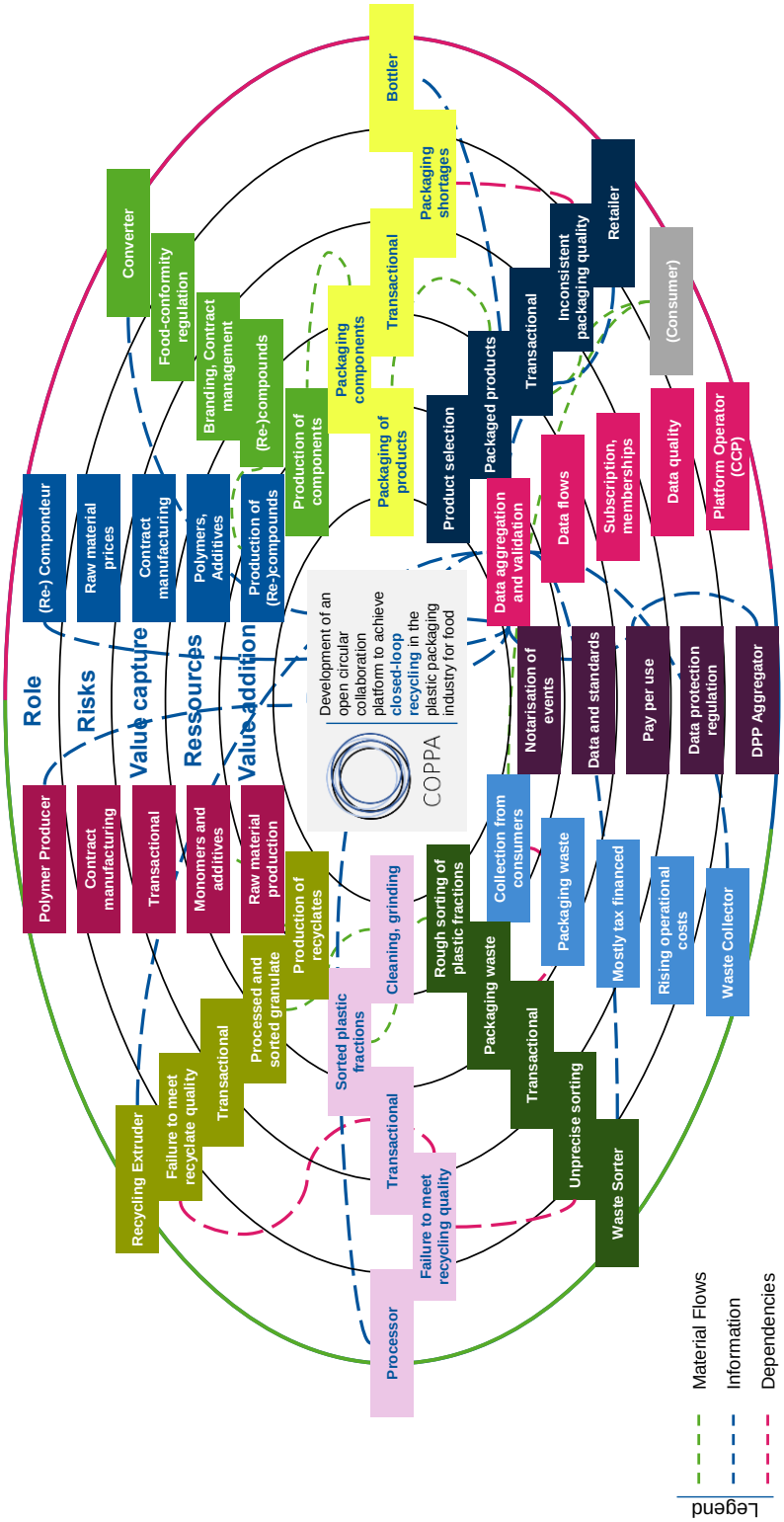
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Appendix



APPENDIX 1: CONFIGURATION CANVAS OF THE COPPA ECOSYSTEM

Imaginaries of Circular Economy Ecosystems

A Case Study of Textile Industry

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Abstract

Modern textile industry experiences increased pressure for transition to a circular economy (CE) across the countries due to its high environmental impact and social sustainability concerns. The transition requires, besides technological innovations, the development of social structures and the engagement of various actors to develop and legitimize a common vision of the textile CE ecosystem (CEE) supporting a desirable sustainable future. This case study adopts socio-technical imaginaries and CEE conceptual lenses, and empirically explores textile CEEs from Finland and Lithuania aiming at sustainability. The study results represent the collective imaginaries of the textile CEEs business and institutional actors and their vision of technological advancement, markets and industrial development, regulatory changes, and actors` interaction at the ecosystem level. The findings reveal three major inconsistencies in the imaginaries: expectations of technological progress are higher than technologies real capabilities to close a loop of textile circulation; while economic feasibility of CE processes depends on a scale of business operations, scaled production can rise sustainability concerns; and transition to a CE can increase as well as decrease competition in the textile markets. Our findings on the socio-technical imaginaries are captured into a conceptual framework which contributes to the management literature on circular ecosystems and aims to support textile industry executives and policy makers in transitioning to the CE.

Keywords

Circular economy ecosystem, textile industry, socio-technical imaginaries, case study, Finland, Lithuania

Introduction

Circular economy (CE) is an economic system that embraces the circulation of materials as well as the regeneration of natural systems (Velenturf and Purnell, 2021). CE focuses on decreasing the utilization of virgin natural resources and waste generation for sustainable production (Geissdoerfer et al., 2017) through reuse, repair, remanufacturing, and recycling of products and components (Korhonen et al., 2018). Transition to the CE is widely supported at international and national levels across the globe because CE contributes to (i) achieving the UN Sustainable Development Goals (SDGs) (SDGs, 2015), (ii) promoting a systemic industrial and societal transition in line with the European Green Deal (2022), and (iii) mitigating climate change effects caused by anthropogenic activity (Ellen MacArthur Foundation, 2019). CE transition often demands industries to transform their whole socio-technical systems (Geels and Kemp, 2007; Dace et al., 2024), including structural changes in society, culture, technologies, economics, ecological, and institutional environment (Hahn and Tampe, 2021; Piila et al., 2022). However, this transition is complex and still requires the support of diverse institutional and public organizations in facilitating e.g., material flows, infrastructure development, and knowledge sharing (Dace et al., 2024; Ritzén and Sandström, 2017). To further understand the complex, systemic CE transition, this research combines two prominent theoretical lenses: CE ecosystems and socio-technical imaginaries.

First, an established way to address complexity in systemic change towards circularity is to apply an ecosystem perspective (Asgari and Asgari, 2021; Trevisan et al., 2022). Ecosystems conceptualize complex multi-actor systems of organizations, technologies, and institutions actors that collectively and interdependently produce ecosystem-level outcomes (Autio and Thomas, 2022; Jacobides et al., 2018) for business or societal targets (Uusikartano et al., 2020). The ecosystem perspective has recently been introduced under the concept *circular economy ecosystems (CEE)*, where actors take various roles in achieving shared goals related to material circulation, and circular-oriented knowledge and value propositions (Aarikka-Stenroos et al., 2021; Aarikka-Stenroos and Ritala, 2017; Asgari & Asgari, 2021). However, as the CEE stream is only emerging (Aarikka-Stenroos et al., 2021) and real-world CEE ecosystems remain nascent, novel approaches need to be integrated for understanding and advancing the transition to CE in empirical real-life socio-technical ecosystem contexts (Trevisan et al., 2022).

Second, to legitimate circularity, institutions, businesses and public actors contribute by shaping narratives, visions and values in the CEEs (Bertassini et al., 2021). Therefore, we argue that understanding how the discourse around CE is constructed is important for interpreting public and institutional attitudes towards CE and providing guidance for policymakers and businesses navigating a systemic change towards a CE (Hermann et al., 2022; Marjamaa and Mäkelä, 2022). Accordingly, we adopt a *socio-technical imaginaries* approach, which emphasizes the interplay of technology and societal change in realizing CE goals in ecosystems. This approach uses imaginaries as an instrument to explore both the present and the emerging pathways to the imagined futures (Friedrich et al., 2022). We need further understanding of the shared imaginaries of circularity among businesses to foster collaboration, align values, and drive sustainable innovation (Narayan and Tidström, 2019). However, CE imaginaries remain underexplored, and rarely approached from the perspective of ecosystems to understand how diverse actors collectively envision a CE which, in turn, guides individual and collective strategy (Hermann et al., 2022; Narayan and Tidström, 2019).

Building on the identified research gaps, this study aims to explore socio-technical imaginaries of key businesses and institutions embedded in industry-specific emerging CEEs. Consequently, we pose the following research question: *How do ecosystem actors envision and pursue the socio-technical imaginaries of a future CEE development?* Empirically, this qualitative research explores industrial change towards CEEs with the socio-technical imaginaries in *the textile industry*. Our empirical exploration is grounded in an extensive comparative case study based on interviews with diverse actors directly involved in the textile circulation in two national textile industry ecosystems: (i) Lithuania, where CE adoption is a logical next step for the well-established textile industry, and (ii) Finland, where the focus is on innovating circular business models for the textile industry.

This study contributes to the scarce literature of CE regarding the discourse on the future of CE systems (Guzzo et al., 2021; Marjamaa and Mäkelä, 2022; Velenturf and Purnell, 2021) by shedding light on technological advancements and systemic social changes that are crucial in transiting to a sustainable CE. This research extends conceptual and empirical knowledge on CEEs as a specific type of ecosystem (Aarikka-Stenroos et al., 2021; Trevisan et al., 2022) and the diverse pathways for CEEs to develop in different socio-technical contexts (Trevisan et al., 2022). Finally, this study contributes to the conceptualization of socio-technical imaginaries (Friedrich et al., 2022; Hermann et al., 2022; Pfotenhauer and Jasanoff, 2017) when transiting to CE industries (Narayan and Tidström, 2019).

Literature review

Textile ecosystems transition towards a CE

The ecosystem concept enables considering the CE as a multi-level resource use system (Figge et al., 2023) where resource use, waste, emissions and energy losses should be integrated into closed energy and material flows (Geissdoerfer et al., 2017; Kirchherr et al., 2017; Velenturf and Purnell, 2021). Aarikka-Stenroos et al. (2021, p. 261) define CEEs as "*communities of hierarchically independent, yet interdependent heterogenous set of actors who collectively generate a sustainable ecosystem outcome*". Such sustainable ecosystem outcomes may focus on material, knowledge, and value flows (Aarikka-Stenroos et al., 2021) in industrial operations (Harala et al., 2023), urban settings (Aarikka-Stenroos et al., 2021), innovation (Bertassini et al., 2022), business (Kaipainen et al., 2023), and platform activities (Blackburn et al., 2023). Due to the diversity of ecosystems and their expected sustainability outcomes, various actors are needed, varying from companies, non-governmental organizations, research institutions, cities and municipalities, and consumer-citizens (Aarikka-Stenroos et al., 2021; Dziubaniuk at el., 2023; Kaipainen et al., 2023). The involved actors take different roles in activities and interactions to achieve the ecosystem outcome, which comes along with different opportunities and implications for the agency in the CEE, i.e., who takes an active role in shaping the CEE (Aarikka-Stenroos et al., 2021).

The textile industry is one of the most polluting industries, with a lengthy supply chain, subject to mass environmental and social impacts (Dziubaniuk et al., 2024; Gardetti and Muthu, 2015), where not only the production but also the consumption produces waste (Saccani et al., 2023; Manickam and Duraisamy, 2019). The textile industry is characterized by intense competition that is forcing companies to look for solutions to innovate and operate profitably under considerable cost and innovation pressure (Dagilienė et al., 2023; Dziubaniuk et. al., 2023). The attention to sustainability and CE as well as digitalization and automation of operations has undoubtedly become a fundamental driver in the development of the textile industry during recent years (Gazzola et al., 2020; Blackburn et al., 2023). Regulations and policies also create a stimulus for textile companies to promote sustainable production, consumption and new business models (Dziubaniuk et. al., 2023; Dziubaniuk et al., 2024). For instance, the EU European Green Deal (2022) has a special focus on the textile industry and reorienting it to CE by promoting eco-design of the textile products that can be reused, repaired, or recycled (see European Environment Agency, 2017). However, despite a variety of sustainability initiatives in the textile industry, radical changes toward CE are still delayed, and companies still face complex challenges in transitioning to CE with new circular business models (Abdelmeguid et al., 2022; Santa-Maria et al., 2021). Thus, there is a need for the textile industry to innovate and scale up novel business models (Han et al., 2023; Kambanou et al., 2024; Todeschini et al., 2017) and insert CE thinking in product development processes such as eco-design for achieving more sustainability and closed cycles (Teixeira et al., 2023).

The main actors in textiles CEEs are companies, non-profit and governmental organizations, municipal actors, research institutes and universities, policymakers and regulators, funding

providers, consumers, and media (Aarikka-Stenroos and Ritala, 2017; Dziubaniuk et al., 2023; Fontell and Heikkilä, 2017). The textile CEE may include actors acting for e.g., extraction of raw materials, production, retail trade, consuming, renting, repairing, performing sales or exchanges through consumer-to-consumer (C2C) and C2B2C platforms, performing waste management, sorting, recycling, import and export of textiles, incineration and landfill of textile waste (Blackburn et al., 2023; Koszewska, 2018). The textile ecosystem actors typically face challenges such as a lack of intensives and interaction (Dagilienė et al., 2023; Dziubaniuk et al., 2024), uncertainties in knowledge sharing and communication (Fontell and Heikkilä, 2017), a lack of general awareness of CE and textile industry capabilities and mechanisms (Staicu and Pop, 2018).

Socio-technical imaginaries lens for the CE vision

Technologies and innovations supporting circular material flows influence new consumption habits, business activities, and production (Koszewska, 2018; Manickam and Duraisamy, 2019). They also shape future perspectives of society on how systemic change toward circularity should be implemented (Marjamaa and Mäkelä, 2022). This imaginary reflects a desirable future and the ways of its achievement (Friedrich et al., 2022). Socio-technical imaginaries can be defined as collective and institutional common understanding, or a vision of the desirable future social forms of life and order empowered by technologies (Jasanoff, 2015) which is "*reflected in the design and fulfilment of nation-specific scientific and/or technological projects*" (Jasanoff and Kim, 2009, p.120). Imaginaries embrace expectations, symbols, feelings, or ideas that guide the collective perception of society about the world (Pfotenhauer and Jasanoff, 2017). However, the imaginaries are not delimited to nation-specifics but can be applied to other organized groups such as business organizations, social movements, and other professional social structures. Imaginaries are extended beyond visions of what can be achieved through science and technology and can be implied to general societal focus on "*how life ought or ought not to be lived*" (Jasanoff, 2015 p.4). Thus, imaginaries are not only institutionalized but rest in the public consciousness where a diversity of actors can shape evolving collective imaginaries (Huang and Westman, 2021).

Management literature on imaginaries related to CE and associated innovations conventionally approaches the national level of technological advancement and societal transition to CE (e.g., Hermann et al., 2022; Narayan and Tidström, 2019; Marjama and Mäkelä, 2022), that leaves a room for research on specific industries and exploration of the phenomenon in industrial ecosystem settings. CE contradictory imaginaries underline the complexity and uncertainty of circular futures and solutions. Since CEEs involve a variety of business, institutional, and public actors, their collective imaginaries are grounded on their individual visions of the developments in the markets, social changes, innovations, and disruptive events that the ecosystem might experience in the future (Hooge and Le Du, 2016). Exploration of these imaginaries supports understanding current industrial

challenges and the future strategic perspectives from perspectives directly involved in the ecosystem actors (Hermann et al., 2022; Narayan and Tidström, 2019). Thus, we set to empirically explore socio-technical imaginaries of various actors involved in the textile industry ecosystems transiting to CE.

Methodology

Case study settings

Empirically, this case study explores the textile ecosystems in a two-country comparison suitable for discovering future imaginaries (Friedrich et al., 2022). As country-level studies are typical for exploring imaginaries (Hermann et al., 2022; Marjamaa and Mäkelä, 2022), we purposefully selected national CEE cases with differences in economic development and industrial specialization, namely Lithuania and Finland. In Lithuania, the textile industry is underlined in the national roadmap for industrial transition to CE (Dagilienė et al., 2024). The Lithuanian textile manufacturers are part of the international (mainly European) supply chains and work mainly on subcontracting (about 85% of production is exported). In Finland, textile CEE is characterized by a relatively small number of business actors who closely interact and collaborate particularly in B2B markets (Dziubaniuk et. al., 2023; Fontell and Heikkilä, 2017). Finland also proactively introduced a roadmap for 2035 to become a forerunner in the sustainable and knowledge-based textile industry (Kamppuri et al., 2021).

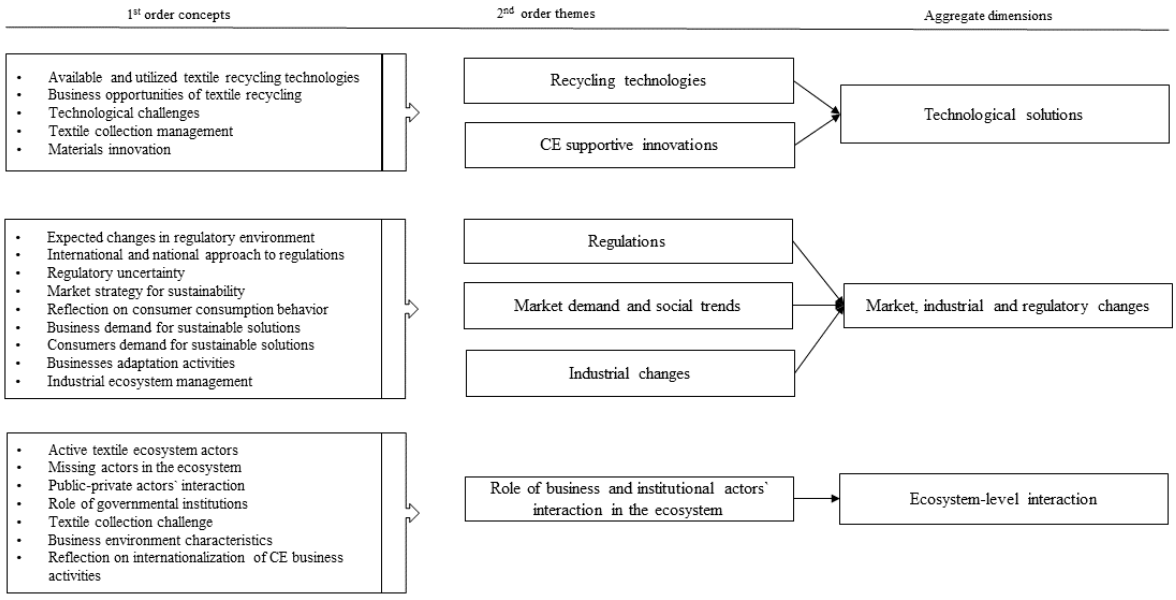
Empirical data collection and analysis

Empirical qualitative data was collected from 2020 to 2023 through interviews with the managerial representatives of business and institutional organizations face-to-face or via Zoom platform. Selected interviewees held responsibilities in the CE activities of their organization. The key themes of the interviews concerned: 1) the organization's involvement and its role in a CE textile ecosystem; 2) organization's collaborations for circularity; 3) current situation in the textile market and industry concerning circularity; 4) influences of technologies and sustainability regulation to the textile industry transition; 5) future of the textile industry development.

From Finland's side, semi-structured interviews were conducted with 1-2 persons per organization, in total: 20 interviews from 17 companies, governmental, non-profit organizations, research and education institutions directly involved in the textile circulation. From Lithuania's side, 34 interviews were collected from the companies, regional waste management centers, municipalities, and non-profit organizations. Therefore, **54** interviews were conducted in both countries. The average duration of an interview was 70 minutes, with a maximum of 110 minutes. Interviewee anonymity was preserved by assigning reference codes: C_x – company, I_x – institution, and FI - Finland, LT –

Lithania. (Full list of the intervwees and their position/role in the organizaiton can be provided on demand).

The interviews were analysed through content analysis conventional to qualitative studies. To identify the main themes in our data analysis, we followed the steps were: First, the interview transcriptions read to grasp the general meaning and to highlight the most relevant pieces of the texts. Second, the highlighted textual parts were reduced by selecting the most relevant ones to the first order concepts shaping imaginaries of textile CEE. Third, the second order themes were selected by following inductive reasoning. Finally, the second order themes were generalized into aggregate dimensions indicating focus of the imaginaries. Data analysis structure is represented in Figure 1.



Figue 1. Data analysis structure

Results

Imaginaries of the technological solutions

Lithuanian and Finish textile manufacturers are highly technologically developed, focusing on digitalization and adoption of innovations to reduce costs and increase productivity (eco-efficiency strategy). For instance, Lithuanian textile companies identify themselves with product quality, innovations, technology development and a high-skilled workforce, which enable them to compete in international markets, but not without challenges. Finland is striving to become a forerunner in textile collection by establishing full-scale mechanical

and chemical recycling facilities (Kamppuri et al., 2021). Finland aims to develop a national textile recycling system with textile recycling plants playing a crucial role, such as company C1(FI) which performs mechanical recycling.

According to the C2(FI) representative, the implementation of chemical recycling – particularly for cellulose-based textile fibres – is also regarded as crucial for the textile CEE. The commercialization of chemical recycling technologies is expected to increase the supply of recycled fibres on the market and therefore, make recycled fibres a more appealing option for textile manufacturers searching sustainable fibre alternatives. However, while small-sized companies in Finland recycle textiles outsourced to them from the large firms, Lithuanian small-sized companies have less capacity to engage in recycling.

The main technological focus for enhancing textile circulation in Finland is on developing textile identification and recycling technologies, as stated by the interviewees C1, C2, and C5(FI) and the representatives from the research institutions. Lithuanian interviewees also confirm that an accurate fibre-level material identification is essential for separating different material compositions for recycling. Additionally, they report that new products would benefit from having trackable tags enabling electronic reading of product data. This highlights a need for automated material recognition technologies as "equipment is a big part of it all" I29(LT).

Digital service platforms facilitating borrowing, renting or sharing of clothing are also expected to multiply. For instance, C4(FI), which offers clothing renting services, predicts the mainstreaming of ethical consumption as well as the renting of garments instead of buying new ones. Despite several online shops already provide renting services, a centralized digital platform is missing. Apart from the C2C and B2C markets, centralized platforms could also support the flow of textiles in the B2B market. In Lithuania, digital platforms are also becoming increasingly popular, especially in the second-hand clothing market which contributes to extending the lifetime of textiles. For example, Vinted, one of Europe's leading second-hand clothing platforms for consumers, allows end-users to share and resell used clothes.

Imaginaries of market, industrial and regulatory changes

The implementation of CE triggers changes in the market and textile industry. A representative of C2(FI) indicated that textile recycling is not a new thing, but the novelty lies in the fact that recycling is more often carried out for a larger market. Despite increased demand for recycled fiber, its volume of production is still not enough to satisfy the whole market and to lower prices for recycled materials compared to virgin ones. The representative of C7(FI) described an emerging stage of this business activity as "there is still no price for the recycled fibres and there's no marketplace." Nevertheless, in both Finland and Lithuania, the demand for recycled fibre, predominantly, comes from large companies that produce textile products for both B2B and B2C markets. Customers`

demand for sustainable materials put more pressure on companies to implement circularity, according to the interviewees C3(FI), C4(FI) and C16(LT).

Representatives of Lithuanian companies point to unbalanced market issues: companies outsourcing their textile production to Lithuania attempt to engage in CE but face a challenge of a low recycled raw material quality and that “perhaps, the arrival of quality recycled raw material to Lithuania has yet to happen" I28(LT). This issue creates a tension between economic efficiency and sustainability aspects. Thus, most textile manufacturing companies in Lithuania choose an efficiency path by further offshoring production to neighbouring countries with cheaper labour. To reduce production costs and stay competitive, Lithuanian textile manufacturing companies have to rely less on recycling innovation and more on outsourcing which is not really favourable to the future development of circularity. Additionally, products from recycled fibres are perceived to have a shorter life cycle. Due to high competition companies may prefer to avoid using these materials to preserv quality.

Currently, Finland does not have a separate collection of household textiles but aims to implement it in the near future (Kamppuri et al., 2021), whereas Lithuania has already introduced containers for household textile collection in designated locations. Manual sorting and organized collection of textiles post-consumption remain the most challenging tasks due to high labour costs in Finland (Dziubaniuk et al., 2024; Fontell and Heikkilä, 2017). The interviewee of I3(FI) pointed out that only charity organizations, such as I8(FI), collect and sort textile garments but cannot reach an industrial scale. In Lithuania, a key challenge is the poor quality of used consumer textiles, making them difficult to reuse or recycle.

Textile and fashion companies constantly monitor the regulatory environment that have a significant impact on their operations. Although the European Commission announced in 2023 its intention to introduce a mandatory extended producer and importer responsibility principle for textiles in all the EU Member States, this regulatory change was not unexpected for businesses. Local regulations on textile waste are expected to change in Finland and Lithuania to achieve CE goals set by the EU European Green Deal (2022). Thus, both countries have developed directives such as the roadmap for 2035 in Finland (Kamppuri et al., 2021) and the Roadmap for Lithuania’s industrial transition to a Circular Economy (Dagilienė et al., 2024). One of the current regulatory challenges is that end-of-life textile is not recognized as a source of raw materials in either Finland or Lithuania. Instead, it is treated as municipal waste.

This study's interviewees highlighted that regulations should address issues relating to national and international standards, quality control of recycled fibres, and safety criteria of using post-consumption textiles as raw materials. The companies providing clothes renting services or serving at B2C markets are especially hoping for future legal incentives from the government such as tax relief. Such business actors in Finland are convinced that

"the legislation in Finland will accelerate this initiative [transition to CE]" (C8(FI)), as the systemic changes required to achieve a CE would affect "the whole society where laws and policies need to be changed" (C1(FI)).

Imaginaries of ecosystem-level interaction

A variety of actors operates in the Finnish and Lithuanian textile CEEs, including companies with different functions such as design, manufacturing, services, wholesalers and retailers, and organizations such as research institutions, municipal actors (cities, municipalities, and waste management companies), NGO sector, industrial associations, ministries, and consumers. The advancement of the textile CE in Finland has been driven by two national consortia that foster active public-private partnership to innovate collective solutions for the textile CEE of which one is interviewed for this study i.e., I1(FI). Similar, in Lithuania, the growing role of the state as a catalyst for the future transition to CE is important.

Role of consumers is found critical for the future of textile CEE in both countries, as they drive demand and enable the closing of the textile material loop, as noted by interviewees C8, C9, and I8(FI). Hence, textile companies will need to further engage consumers including those who are not yet interested in sustainability issues in the development of textile CEEs.

The key businesses driving the Finnish textile CEE are currently concentrated in the largest cities, but the future textile CEE would need to spread its operations and cover all the country through concerted efforts, determination, and collaboration. The collaborative environment in Finland is characterized by trust, transparency, and mutual knowledge-sharing according to the interviews with representatives from C3, C6, I1, and I3(FI). In the Lithuanian textile CEE, actors tend to work independently indicating less collaboration. The interviewees attribute this to a lack of certain actors, such as recycling companies, in the textile ecosystem: "Another problem is a low number of companies in Lithuania that process textile waste" I13(LT), and "It takes time to build exclusive, trusted relationships with partners" C14(LT). Despite collective initiatives for textile circulation in both countries, many critical operations are still lacking such as systemic textile waste logistics or large-scale yarn spinning and fabric/knit manufacturing.

Another important future perspective is strengthening collaboration between textile companies working with popular B2C brands to modify the design of clothing to reduce fabric volumes or to make disassembly easier. In Lithuania, textile manufacturing companies, mostly producing for foreign brands, adhere to international standards across the entire value chain. Some brands request that CE practices are implemented and are ready to pay a premium for material efficiency.

The textile industry has linkages with other Lithuanian and Finnish industrial sectors. For instance, synthetic fibres can originate from the plastic industry, where PET bottles are processed into fabrics. Particularly, end-of-life textile can be used in other sectors: the

construction industry could use synthetic or natural fibres as an insulation material, and the agriculture sector can use them as geotextiles for improving soil features. Additionally, transition of the textile industry to CE can make a strong contribution to alleviating various social problems by for example providing employment for and integration of socially vulnerable groups such as refugees and immigrants, young or elderly people.

Socio-technical imaginaries summary

The key findings of the imaginaries of CEE of the textile industry are summarized in Table 1.

Table 1. Socio-technical imaginaries of the textile CEE

Category	Socio-technical imaginaries	Rationale
Technological solutions (T)	T1 Recycling (waste management) technologies will ensure full circularity of end-of-life textiles.	- Flexible recycling solutions are expected to be developed that can handle mixed materials recycling. - Post-consumption industrial and consumer textiles that are currently incinerated or landfilled need to be reduced. - To achieve cost efficiency, technology has to enable mass production instead of small-scale production of recycled fibre. - Recycling, sorting and digital support should form a system.
	T2 Recycling technologies will not completely close the loop.	- Fabric complexity remains a challenge. - Limited number of times textiles can be recycled. - The quality of recycled fibres, textiles and products is hard to predict. - Unclear what technical characteristics products from recycled materials will possess. - International standards for recycled materials are lacking.
	T3 Eco-design focusing on fabric innovations, usage of recycled materials and enhanced durability and other the design interventions that close the loop will become mainstream.	- The availability of recycled (secondary) materials and fibres will increase. - Product passports and other digital solutions will transfer knowledge from other lifecycle stages to designers. - New treatment technologies will create new design possibilities. - Development of “smart” textile: longer-lasting, durable, easy to repair textiles.
	T4 Investment in CE technologies will ensure eco-efficiency and materials recovery.	- Innovations will receive financial and other support from governmental and research institutions. - Investment will encourage innovations for eco-efficiency.

		- Circular operations will reduce waste in production and create raw materials flow.
	T5 Investments in CE technologies pay off with mass production and potentially increase consumption.	- While technology has evolved, small-scale operations pose financial challenges for technological adoption. - Lower return on investment in clean technologies in small-scale production. - Mass production may lead to increased consumption.
	T6 Services supporting used and end-of-life textile flow will be more digitalized.	- More digital platforms will be developed to support production, consumption and the recycling of textiles CE by providing several different services. - Textiles will be enhanced with digital functionality e.g. sensors or tags.
Market, industry and regulations (MIR)	MIR1 Demand for sustainable textiles is expected to increase.	- B2C and B2B market demand for sustainable materials and sustainable production solutions.
	MIR2 “Secondary market” is expected to expand.	- Expanding repair/renewal services to prolong lifetime of textile products. - Textile products are manufactured from recycled feedstock. - New logistics solution for transporting small and heterogeneous textiles batches.
	MIR3 Competition in the EU textile market might decrease.	- Tightened environmental regulations in the EU. - Higher labour and material costs in the EU. - Low willingness of consumers and companies to pay for sustainable products (cost-based purchasing decisions) - Coopetition among industry competitors will be mainstream to address infrastructure needs and advance technology rather than solely compete.
	MIR4 Competition in the EU textile market might increase.	- Conscious consumers’ demand and preferences for sustainable textile products. - Sustainable innovations in production and products. - Compliance to a brand name. - Fragmented infrastructure of collection system is not favourable for developing coopetion among business actors. Tightened environmental regulations may foster CE and new businesses.
	MIR6 Textile CEE businesses will provide employment and other opportunities including for vulnerable social groups.	- Employment for people with special needs. - More need for workforce both skilled and less skilled in textile production and waste management.

	MIR7 Regulation of post consumption textiles and textile waste management will increase.	- The EU policy will align national policies. - Extended textile producer responsibility schemas will arise and expand. - Increasing regulation coherence for CE practices (e.g., harmonise textile collection, sales of secondary materials, safety of materials). - Higher involvement of the public sector e.g., through knowledge sharing and education will ensure better management of consumer textile waste. - Regulation of export and import is expected to increase.
	MIR8 Product design and production processes are expected to be more regulated.	- The EU policy will align national policies. - Regulations on textile products' traceability and product labelling - Using alternative materials and less chemicals. - Adopting cleaner production processes and ensuring transparency.
Actors' interaction in the CEE (A)	A1 Textile CEE actors will change their roles and new actors will emerge in the ecosystem facilitation.	- Institutional actors will support businesses' transition to CE by knowledge dissemination and research collaboration. - Promising linkages to other industries exist. - Established actors may switch their business models to new activities – engagement in recycling, collection or reuse of textile. - New actors supporting CE infrastructure will emerge e.g. logistics providers, digital marketplaces, recycling experts, textile repair providers). - Digital technologies improve actors' collaboration.
	A2 Consumers' role will increase in the ecosystem.	- Changes in consumers consumption patterns. - Consumers' feedback importance will increase to shape demand for sustainable products. - Brands will drive changes to clothing design. - Digital technologies enable downstream actors' participation.
	A3 Collaboration between private and public sectors for efficient CEE will increase as well as international business collaboration.	- International standards of textile management need to emerge. - Development of collaborative environment, especially between neighbouring countries, to align countries' specializations in textile production, recycling and design. - More CE projects between companies and institutions are expected for developing strategic partnerships between textile collectors, municipalities, recyclers and research community. - Digital technologies enable actors' collaboration.

	A4 Role of local companies and products will strengthen.	- Demand for local textile products will increase. - Supply for local textile products will increase.

Discussion

Although the empirical data was collected in two different EU countries, most of the imaginaries are overlapping according to actors' future expectations. Since socio-technical imaginaries are a vision of the future advances with technology (Jasanoff and Kim, 2015), innovation of textile recycling and digitalization of supportive services are found as driving elements of the CE transition, as highlighted in the previous studies as well (Dziubaniuk et al., 2023; Dziubaniuk et al., 2024; Franco, 2017). Companies and research institutions in Finland and Lithuania are working on multidisciplinary projects to increase the quality of recycled fibres and to develop innovations allowing the recycling of mixed composition textiles. While methods of textile recycling are gaining momentum at the markers (Franco, 2017; Kamppuri et al., 2021), collection and sorting end-of-life textile remains a challenge especially in the high-wages countries. Separated collection of textiles from consumption is expected to become mandatory within the following decade in accordance with the European Green Deal (2022) and country-level regulations corresponding to the Roadmaps for CE transition (Dagilienė et al., 2024; Kamppuri et al., 2021). Governments can catalyse CE transition not only with regulations but also through funding allocation, initiatives and transition programs, and information campaigns (Dziubaniuk et al., 2024). They can foster CEEs by empowering research institutes to develop these socio-technical imaginaries.

Surprisingly, few inconsistencies emerged from our analysis (see Table 1). First, inconsistency between **T1** and **T2** reflect societal goals to implement textile recycling technologies as enablers of full textile circularity, whereas the challenges of recycled fibres quality, lack of international standards and information about end-of-life textiles cause uncertainty of the industry development. The challenge of recycled materials utilization for production of high-quality products also remains. Despite the idealistic idea of all used fabric recycling, not every textile can be easily recycled or even incinerated (Parisi et al., 2015). Thus, industrial development should be realistic while acknowledging that currently technologies cannot solve all challenges which also calls for more scientific projects and collaboration. Eco-design of the products can be one solution in this case (Teixeira et al., 2023), where sustainability characteristics and recyclability are embedded product features. Orientation to eco-design and durability of textile products is also promoted by the EU Commission (European Environment Agency, 2017).

Second, inconsistency between **T4** and **T5** reflects tension between investment into technologies for eco-efficiency of textile circulation, and economic feasibility of CE processes which can be reached in the large-scale production scope. Although innovations

may help to eliminate production waste and make recycling efficient, amounts of textile waste that needs to be recycled requires economies of scale (Franco, 2017). Increased industrial volume of recycling and production can potentially increase consumption due to lower costs of manufacturing and consequently of the final products. A gradual shift to eco-efficiency from mass production and to small scale production may be needed in this case. Small-sized companies may gain power to serve reginal needs of material recovery and production without scarifying sustainability. Automation of processes and digitalization may aid to decrease operational costs (Gazzola et al., 2020; Blackburn et al., 2023) and drive value creation in the CEE (Trevisan et al., 2022). New business models also need to emerge to address textile CE (Abdelmeguid et al., 2022; Teixeira et al., 2023) - models that would be extended beyond recycling, borrowing, and repairing and developed to make textile ecosystem more connected with other industries, where recycled fibres can be used as raw materials. Cross-industry collaboration can also solve an issue of small markets for secondary recycled materials and to reach the industrial scale of their production.

The third inconsistency between **MIR3** and **MIR4** concerns competition level that may change after the tightened regulations for CE within next decade. More environmental regulations may force some business actors to leave the markets or decrease their competitiveness compared to innovative businesses capable of adapting to consumer and business preferences for environmentally responsible products. On the other hand, emergence of new business actors, innovations and business models can stimulate competition in the textile industry (Dziubaniuk et al., 2023; Jia et al., 2020; Todeschini et al., 2017). Despite the textile industry being highly competitive (Dagilienė et al., 2023), companies may need to focus on collaboration and active engagement in the industrial ecosystem to share risks of market uncertainty (Dziubaniuk et al., 2023). This may require companies to rethink their approach to value chain management and adopt ecosystem thinking (Aarikka-Stenroos et al., 2022; Autio and Thomas, 2022) which, in our case, reflects transition to a CE.

The following Figure 2 graphically summarizes the imaginaries and inconsistencies framing the CE transition in the textile industry discovered in this study.

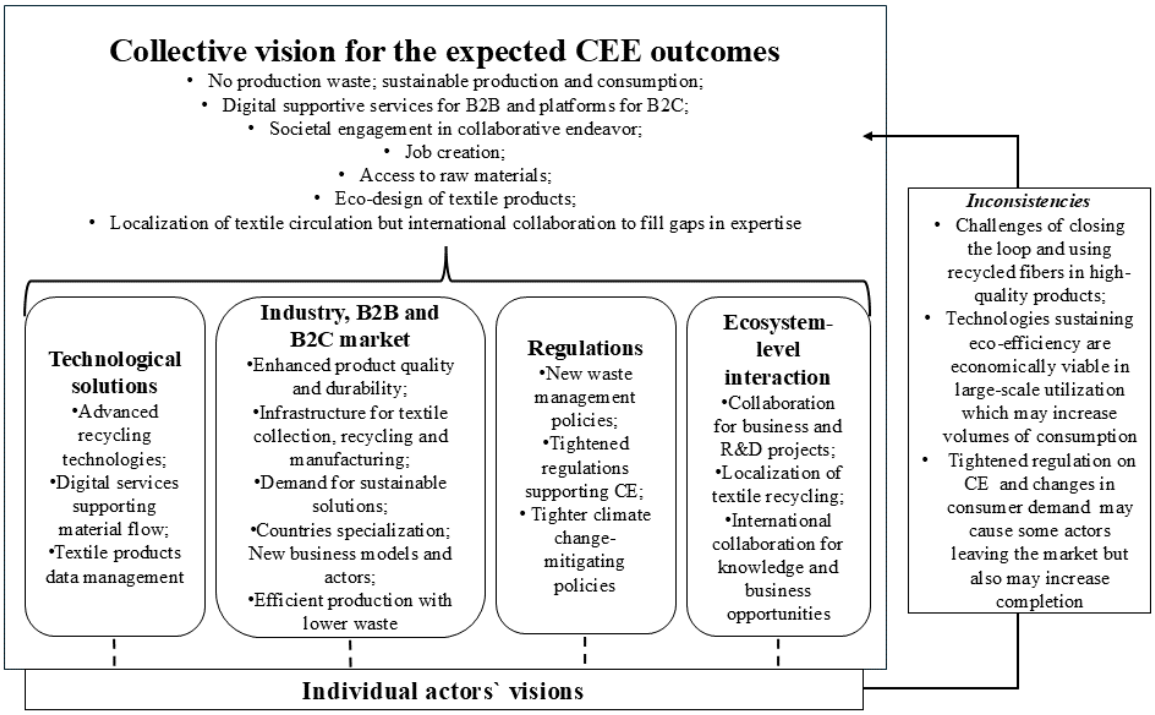


Figure 2. Socio-technical imaginaries of textile industry towards CE transition.

Two overarching observations can be made about these imaginaries - they are little consistent, and they lack ambition. While some efforts address aspects such as recycling technologies and the emergence of new actors, many critical elements are overlooked. For instance, social dimensions of circularity such as labour practices and community impacts in countries of production were limited in the data. Moreover, different actors often have varying interpretations of what circularity entails, with some imagining local and others global supply chains. To have well-functioning circular textile ecosystems, goals and strategies of actors need to be aligned through more consistent socio-technical imaginaries. Without alignment, efforts will be fragmented, and strategies are conflicting. Closing the loop of textiles circulation should not be pursued as a technological challenge of the industry (Genovese and Pansera, 2020; Corvellec et al., 2022) but as socially constructed practices within the industrial ecosystem (Geels and Kemp, 2007).

Conclusions

This study explores socio-technical imaginaries envisioned by the textile industry ecosystem actors from Finland and Lithuania regarding their understanding of crucial changes in industry and markets, regulations, technological solutions, and their role in the textile ecosystem aiming for a CE. Besides investigating the desirable collective vision, this research regards strategic aspects for companies, institutions, and society for an efficient

textile CEE. We find textile CEE imaginaries to be focused primarily on recycling technologies, eco-design, collaboration for innovations, societal changes in consumption and tightening regulations on waste management. We discover three inconsistencies among the projected imaginaries regarding the industry's future: (i) inability to completely close a loop of textile circulation, (ii) a challenge to balance a scale of textile utilization with sustainability concerns and economic feasibility, and (iii) uncertainty regarding competition on the markets influenced by changes in regulatory environment.

Combining CE ecosystems and socio-technical imaginaries lenses, this research adds to the literature on managing sustainable and circular production and consumption by supporting our understanding of industrial transition to CE and its conceptualization (Guzzo et al., 2021; Corvellec, 2019; Velenturf and Purnell, 2021; Oskam et al., 2021). Here, discovering the national pathways in Finland and Lithuania contribute to understanding the diversity of possible pathways for CEEs to develop in different socio-technical contexts (Trevisan et al., 2022). We shed light specifically to the understanding of CEEs that frequently emerge around innovations and societal changes for pursuing CE and sustainability (Aarikka-Stenroos et al., 2021; Kaipainen et al., 2023; Trevisan et al., 2022). Particularly, uncovering the ecosystem-level interactions and unexpected inconsistencies in a conceptual framework (Fig 2) support the emerging CEE literature in defining the specificities of CEE (de Vasconcelos Gomes et al., 2024).

This study has several practitioner contributions. First, the empirical case illustrates a need for international collaboration to efficiently manage circulation of textile flows. Specifically, companies of Nordic and Baltic regions can find this study inspiring in search for collaboration in the textile industry in pursuit of sustainability. Second, the study results indicate the upcoming changes in the legal regulations that may significantly affect companies engaged in a textile ecosystem. Thus, long-term strategic planning needs to consider the regulatory environment as well as global trends on textile waste management policies. Regarding policymakers in particular, this study indicates that companies may find it challenging to adapt to the rapidly changing regulations. Thus, policymakers need to consider the current level of technological development and companies' capabilities to adapt their strategies to the future changes. Finally, developing an efficient textile ecosystem may require business actors engage in close collaboration or coopetition instead of rivalry for resources (Harala et al., 2023), that should include transparency and proactive actors' actions to engage in the interaction.

After discovering the socio-technical imaginaries and the related inconsistencies drawn from the study of textile CEE, future research could track the development of the studied CEEs in an ongoing process study or retrospectively to uncover what mechanisms will be implemented to bring about the envisioned imaginaries. Since different countries have different approaches to the post-consumption textile treatment, the future research could expand from Finland and Lithuania to explore other countries or regions. Socio-technical

imaginaries, conventionally investigated at the country level (Hermann et al., 2022; Marjamaa and Mäkelä, 2022), are explored in this study in the context of textile industry, whereas other industrial and institutional actors would benefit from the future vision exploration of their industries (Fratini et al., 2019). Despite the empirical focus on business and institutional actors in this study, we find the role of consumers for CE transition to be crucial. Therefore, exploration of how the consumers imagine the future of the textile markets, products and textile waste utilization could identify new directions for the circular production and consumption of the textile industry.

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Circular transition, disruption, or leapfrogging?: Innovating circular ecosystems for immature industries

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Extended abstract

Introduction

Academic scholarship on the circular economy (CE) has grown rapidly over the past decade and developed from a primarily conceptual discourse into a wide research field (Kirchherr et al., 2023b), with much attention currently awarded to questions surrounding its implementation or the lack thereof (Corvellec et al., 2022; Khan et al., 2022; Lieder and Rashid, 2016). The sub-stream of CE scholarship on circular business models (CBM) and ecosystems has also evolved from conceptualisation (Bocken et al., 2016, 2014; Urbinati et al., 2017) towards addressing implementation challenges (Baldassarre et al., 2020; Konietzko et al., 2024). One of the main challenges for establishing CBMs is the complexity of markets, as businesses' actions depends on others' actions and business models. Consequently, the concept of circular ecosystems evolved to address these dynamics and consider value chains on the system level to assess the required cooperation to create circularity (Geissdoerfer et al., 2018; Kanda et al., 2021).

Empirical studies on how to foster and implement circular ecosystems are sparse, albeit growing in recent years (e.g., Blomsma et al., 2023; Reike et al., 2023). The circular business models and ecosystems literature is influenced by the innovation system literature, especially 'mission driven innovation systems' (Mazzucato, 2018), with multiple researchers highlighting the role of innovation to meet the CE ambition of sustainability (Brown et al., 2021; Geissdoerfer et al., 2023; Reike et al., 2023). Furthermore, by studying CBMs and ecosystem implementation with the goal to facilitate them, researchers also engage with the European CE mission (European Commission, 2020). Blomsma et al. (2023) brought the literatures of technological innovation systems together with circular ecosystems and developed a framework to assess what is required

to accelerate the transition from a linear to a circular economic model. They apply the framework to the textile industry and argue for its applicability to all circularity transitions, however, not all value chains are firmly established yet. Therefore, we seek to investigate the applicability of such a transition framework to the exemplary case study of proton exchange membrane (PEM) electrolysers and answer the research question below:

(RQ) What actions are required from private and public sector stakeholders to foster circularity in the hydrogen technology value chain (as an example of an immature industry ecosystem)?

Theoretical Foundations

This research draws on two main strands of academic literature that act as a theoretical lens in their combination in the WaveS model (Blomsma et al., 2023): the literature on circular business models and ecosystems, and the literature on innovation systems for societal goals (see figure 1). The mission-driven innovation systems framework underpins the study, emphasising coordinated innovation efforts to solve societal challenges, as exemplified by EU policies like the Circular Economy Action Plan (see Mazzucato, 2018; Kirchherr et al., 2023a). The technological innovation systems (TIS) model (Hekkert et al., 2007) identifies five functions critical to fostering innovation and system transitions. In their application, these functions have been discussed and further developed, e.g. by Reike et al. (2023). The WaveS model, integrating seven TIS functions with circular transition dynamics, conceptualises systemic change as progressing through phases of release, reorganisation, and eruption and maps required stakeholder actions to accelerate this transition. While previous studies applied this framework to mature industries, their application to immature sectors remains underexplored.

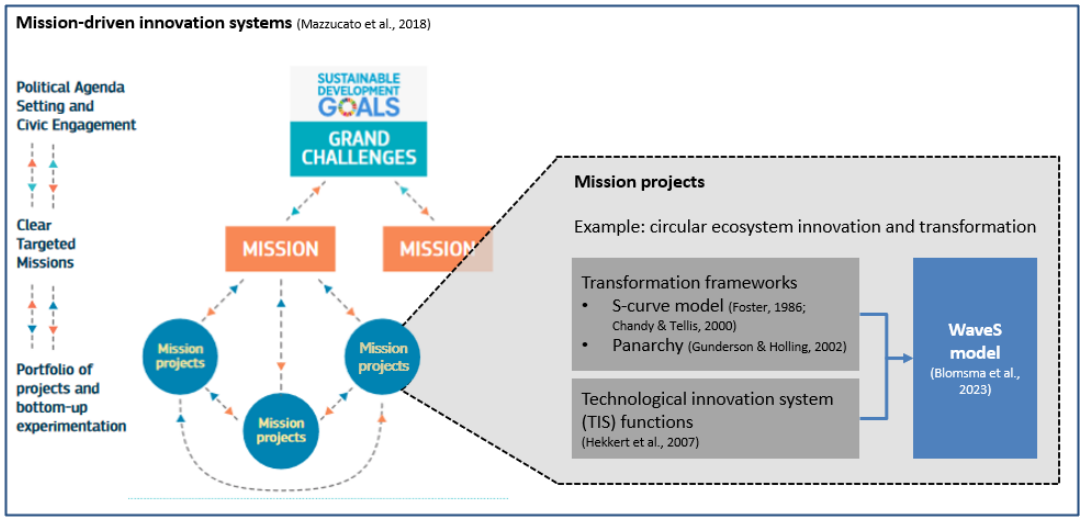


FIGURE 1: THEORETICAL ANCHORING, AFTER MAZZUCATO (2018) AND OWN ILLUSTRATION

Methods

The PEM electrolyser industry was chosen as a case for this investigation. As an emerging sector integral to green hydrogen production and with severe primary materials challenges, it holds significant potential for circularity (e.g., IRENA, 2020; Carrara et al., 2023). While hydrogen production through electrolysis is not new, the required scale to meet the EU's decarbonisation and energy autonomy ambitions demands the rapid development of technologies and their scale-up (Hydrogen Council, 2022), leading to the establishment of novel business ecosystems in Europe. Unlike mature industries, the PEM electrolyser value chain has not yet entrenched linear practices, offering a unique opportunity to design circularity from the outset. Having identified the relevant circular strategies and their respective drivers and barriers during previous research work (Axt et al., forthcoming), the aim of this work is to further investigate how circularity in this value chain could be integrated in business practices and what stakeholder collaboration is required. With the European Union increasingly broadening the applicability of circular and sustainable rules and regulations (Bundgaard et al., 2017; Talens Peiró et al., 2020; Polverini, 2021), it can be expected that eventually circularity strategies will become a requirement for the electrolyser industry.

The research employs a qualitative, mixed-methods case study approach in two phases (Flyvbjerg, 2006). Phase 1 involved desk research and stakeholder interviews to conceptualise CE business models for the PEM electrolyser value chain. Based on interview inputs, we developed several potential business model approaches that would address circularity strategies currently not widely practiced. In phase 2, we conducted a research workshop with 28 experts from across the electrolyser value chain, policy and academia to discuss the proposed business models and evaluate what actions would be required to create an ecosystem in which the preferred model could be successful. The workshop participants were split into four focus groups for the discussion to ensure sufficient data to be collected and to cross-verify results. The workshop took place virtually and was recorded. The transcripts were subsequently coded, utilising the WaveS model as a coding framework.

Results

The study presents two main findings from each of the research phases, contributing to circular ecosystem innovation for this exemplary ecosystem. First, four distinct but possible ecosystem options have been developed and assessed for the value chain in question, each with different actors taking responsibility for end-of-life activities. They vary in feasibility and desirability depending on the maturity of the industry and stakeholder collaboration dynamics. The four options are briefly summarised below.

1. Market-Led Recycling Scheme: Recycling companies profit from selling secondary materials they recover from electrolysers they seek and collect from end-users.

2. Producer-Managed Life-Cycle Models: Electrolyser manufacturers retain product ownership, ensuring repairs, refurbishments, and recycling; e.g., through leasing contracts.
3. Producer Responsibility Organisation (PRO): Publicly mandated entity that manages end-of-life processes collectively for all manufacturers, funded by mandatory fees.
4. EU Stockpiling: public institution collects all products containing critical raw materials and takes responsibility for their processing and recycling; feeding secondary stock into the market as needed.

We found that most stakeholders favour option 1 or 2, instead of public entities dominating the end-of-life management. However, option 1 would require substantial subsidies while the market grows in scale, and option 2 tasks manufacturers with additional responsibilities for which they have no expertise. At the same time, options 2 allows manufacturers to better protect their intellectual property. A likely scenario is that manufacturers retain ownership of the process, but outsource the operative handling of the dismantling and recycling process. Indeed, in the discussions it became apparent that the question of who takes responsibility at the end of life is one of the key challenges to solve for to promote circularity. We furthermore compiled a comprehensive overview of actions that need to be taken by different stakeholders to implement circular end-of-life management. By applying the WaveS framework to these actions, we derive a sequencing logic and therefore a prioritisation. We find that while some actions, especially the introduction of regulation requiring circularity, are likely to most accelerate adoption, other activities must happen prior in order for those actions to be most effective.

Discussion and conclusion

The research contributes to industry practice by providing a structured roadmap for enhancing circularity in the PEM electrolyser value chain, aligning with EU policy goals such as the Circular Economy Action Plan and Critical Raw Materials Act (European Commission, 2020, 2023). Insights from this work could inform circularity strategies for other emerging industries, emphasising the value of learning from mature sectors to avoid costly restructuring. The study also advances theory by applying the WaveS model (Blomsma et al., 2023) to an immature industry, testing its relevance across all transition phases, and proposing potential adaptations for early-stage system design. It furthermore highlights how circular economy research can enhance our understanding of how mission-driven innovation systems can be operationalised on the project level. Overall, this study highlights the strategic importance of designing circularity into emerging industries before linear business models become entrenched and initiates the discussion on how this can be achieved.

Keywords

Circular ecosystems, circular business models, mission-driven innovation systems, PEM electrolyser, immature industries

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Leading The Loop

A Circular Ecosystems Leadership Model

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Extended abstract

Introduction and theoretical background

Companies face growing pressures to become more sustainable due to market demand, regulatory requirements, and rising resource costs (Ellen MacArthur Foundation, 2013; Geissdoerfer et al., 2017; Heikkurinen et al., 2019). They increasingly consider moving toward a circular economy (CE), which replaces the traditional "end-of-life" paradigm of products with a regenerative system aimed at slowing, narrowing, or closing material and energy loops (Geissdoerfer et al., 2017; Kirchherr et al., 2017). Correspondingly, policymakers, practitioners, and researchers promote CE as a practical pathway to achieve sustainability, reduce material costs, and increase resource security (Kirchherr et al., 2017; European Commission, 2020; Geissdoerfer et al., 2020; Walker et al., 2022; Baldassarre & Calabretta, 2024).

Implementing CE requires a redesign of strategies, products, processes, ownership structures, and revenue models (Ferasso et al., 2020). Therefore, interest in circular business models (CBMs) as enablers for CE implementation is growing (Kirchherr et al., 2017; Ferasso et al., 2020). Business models describe the logic by which companies create, deliver, and capture value (Teece, 2010). CBMs integrate CE principles into the business model elements, their interrelation, or the value network (Geissdoerfer et al., 2020). Unfortunately, CBM innovation (CBMI) often fails, as companies are challenged by the complexity and transformation of their ecosystems (Evans et al., 2017; Ritzén & Sandström, 2017).

Recent work has suggested that successful CBMI is not rooted in the actions of a single company but rather in the interconnected activities of independent actors bound by collaborative goals and governance structures (Antikainen & Valkokari, 2016; Heikkurinen

et al., 2019; Gomes et al., 2023). Jacobides et al. (2018) describe such actor systems as business ecosystem. Building upon this theoretical foundation, a circular ecosystem represents an interdependent multi-actor entity emerging around collective circular goals, knowledge, resources, or business models (Pietrulla, 2022).

Initial studies into circular ecosystems have focused on individual cases (Pietrulla, 2022), limited value propositions (Asgari & Asgari, 2021), large companies (Parida et al., 2019) or the conceptualization of different ecosystem types (Aarikka-Stenroos et al., 2021). Research into the shaping and coordination of circular ecosystems suggests that these entities require a leading actor to ensure the collective outcome (Jacobides et al., 2018; Aarikka-Stenroos et al., 2021). Nambisan and Sawhney (2011) describe the process through which these actors coordinate, influence and direct other companies as orchestration. Current research lacks a comprehensive understanding of the development and orchestration of circular ecosystems (Aarikka-Stenroos et al., 2021; Pietrulla, 2022; Trevisan et al., 2022). The goal of our study is to gain a deeper understanding of how leading actors shape and orchestrate circular ecosystems by establishing an empirically grounded circular ecosystem leadership model.

Method

We adopt the grounded theory methodology to develop a theoretical model from qualitative interview data (Gioia et al., 2013). To gain insight into the development of circular ecosystems and the orchestration activities between non-hierarchical business partners, we conducted seven interviews with experts from various business-to-business industries. Circular ecosystems are a heterogeneous phenomenon and need to be investigated across multiple contexts (Pietrulla, 2022). Therefore, our sample includes not only decision-makers from established CBMs in the automotive, metal, concrete, and chemical industries but also CBMI consultants and the managers of a major circular economy network in the automotive sector.

We used an inductive coding approach to analyze the transcribed interviews (Gioia et al., 2013). Starting with in-vivo coding, we captured the experiences of leading actors in developing and orchestrating circular ecosystems. We then grouped related concepts into 2nd-order themes representing specific activities. Finally, we aggregated these activities into three dimensions reflecting the stages of circular ecosystem development and developed a theoretical model that illustrates the dynamic relationships between these stages. Additional interviews are planned to refine the model and ensure its applicability across diverse contexts and industries.

Preliminary results

Figure 1 shows the circular ecosystem leadership model, which encompasses a shared pathway through which circular ecosystems are shaped and orchestrated. The model

describes three stages with essential activities and core elements: circular ecosystem vision development, circular ecosystem initiation, and circular ecosystem expansion.

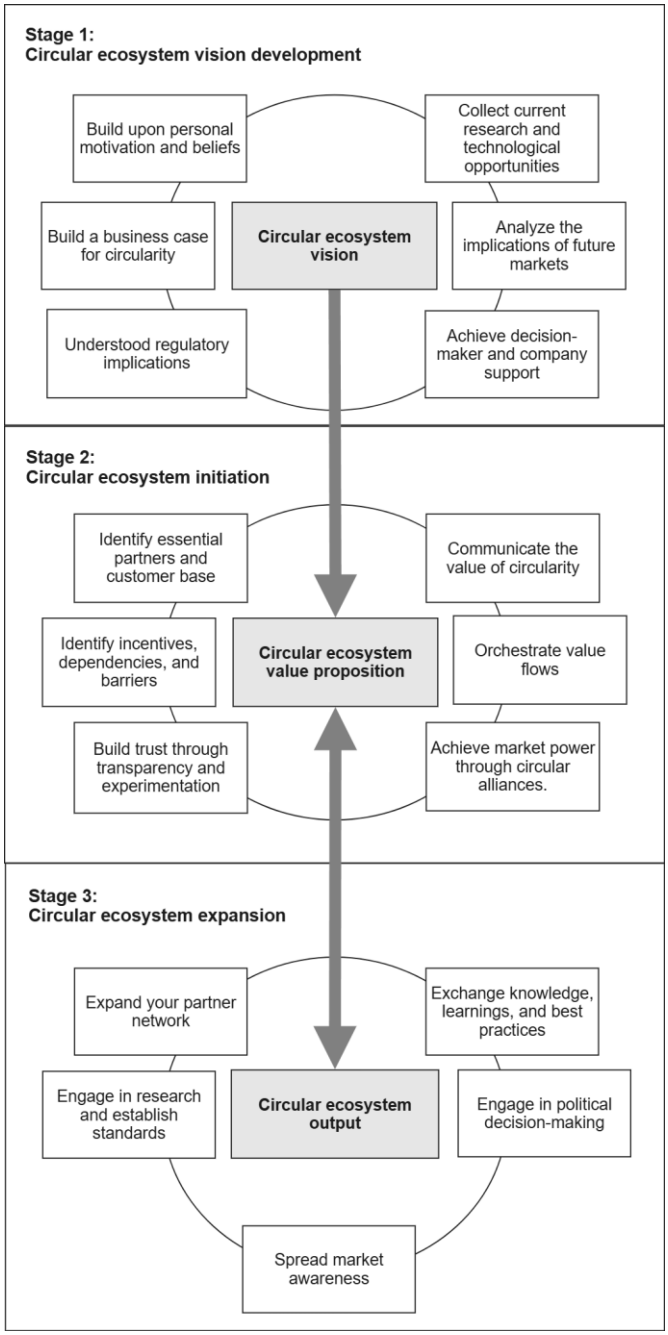


FIGURE 1: CIRCULAR ECOSYSTEM LEADERSHIP MODEL

The first stage entails the development of a foundational circular ecosystem vision. All experts emphasized the importance of a visionary leading actor and orchestrator. The visionary establishes and adapts a long-term perspective and drives the company and ecosystem transformation. The circular ecosystem vision is fueled by the inherent beliefs

and personal motivation of the visionary and supported through current research, technological developments, market trends, and regulatory implications. Additionally, the visionary must gain decision-maker support and build a business case for circularity.

In the second stage the visionary develops the circular ecosystem value proposition based on the circular ecosystem vision. This value proposition entails the circular offering of the company and a shared goal for the ecosystem. The visionary must identify essential partners and a suitable customer base and effectively communicate the new value proposition. Therefore, it is crucial to orchestrate all value flows between ecosystem actors to align interests, create incentives, and remove barriers. Trust-building with ecosystem partners is critical, as the values of circularity might be uncertain or conflicting with existing business models. Therefore, companies must engage in experimentation to prove the feasibility and viability of circular solutions as well as seek alliances with like-minded partners to establish a strong market presence.

In the final stage, the company utilizes the generated knowledge and outputs to expand its circular ecosystem by acquiring new partners and customers. The interviewed experts described this as a natural phenomenon through the exchange of learnings and development of standardized processes with like-minded partners, research institutions and circular networks. This process is supported by continuous advocacy for circular policies and regulations, as well as ecosystem wide inspiration and education. New partnerships, opportunities and regulations foster the development of novel circular value propositions, changing the circular ecosystem output thereby influencing the broader ecosystem. This reciprocal dynamic leads companies to continuously transition between stages 2 and 3.

Discussion and further development

Our study conceptualizes a three-stage model with core elements and actions necessary to visualize, initiate and expand a circular ecosystem. Prior studies by Gomes et al. (2023) and Parida et al. (2019) have examined the role of network orchestration for the successful development circular ecosystems. Our study expands this research by examining the specific stages and activities of leading actors developing circular ecosystems. We highlight the importance of establishing a foundational circular ecosystem vision and emphasize that companies often revisit earlier stages as they acquire new resources and capabilities. These insights foster a deeper understanding of the dynamic and iterative nature of circular ecosystem development, which necessitates a visionary leader in the role of network orchestrator. Future research could utilize the upper echelons theory as a theoretical lens to further investigate the role of the visionary leader. This theory posits that organizational outcomes are heavily influenced by the characteristics, values, and experiences of top executives, as these shape their interpretations of situations and strategic decisions (Hambrick, 2007). Additionally, research into tools for circular value flow mapping (e.g., business ecosystem architecture modeling (Wieringa et al., 2019)) might support companies in the orchestration of circular ecosystems.

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Keywords

Circular economy, business model innovation, circular ecosystem, network orchestration

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An Extended Abstract Submitted to the NBM Conference 2025

Brewing Circular Success: How to Map, Replicate and Scale Circular Business Ecosystems.

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Extended abstract

Introduction

The transition to circular models requires an integrated approach that combines systemic thinking, continuous innovation, collaboration and value optimisation (Bertassini et al., 2021). In this context, circularity-oriented business ecosystems, known as Circular Business Ecosystems (CBEs), are emerging as effective solutions to transform value creation from linear to circular. CBEs are defined as multi-actor networks in which interdependent actors work together to promote resource circularity, knowledge diffusion and the implementation of circular business models (Aarikka-Stenroos et al., 2021). These ecosystems offer an innovative perspective for overcoming the limitations of linear economic models, thanks to their ability to integrate different actors - businesses, institutions, communities - in synergistic relationships that enable the exchange of resources, knowledge and skills (Klofsten et al., 2024; Asgari & Asgari, 2021).

The complexity of circular dynamics, characterised by multiple interdependent actors with different objectives and resources, requires flexible and resilient organisational structures. Through their adaptability, CBEs facilitate iterative experimentation, dissemination of best practices, and scalability of circular solutions, mitigating the associated risks (Zucchella & Previtali, 2019; Levin, 1992). To accelerate the circular transition, it is essential to consider the aspects of replicability, i.e. the adaptation of successful models to different contexts, and scalability, i.e. the progressive integration of new actors and processes (Dehkordi et al., 2024). These dimensions require structured methodological tools, currently lacking in the

literature, to map interdependencies, identify critical steps and design adaptation mechanisms.

Relevance of the research

In response to the global urgency of the transition to regenerative economic models, CBEs are gaining increasing importance in both academic and practical circles.

Despite recognising their potential, significant gaps remain between theory and practice. Existing literature has focused on structural and functional aspects, such as mapping actors and defining circular value streams and governance mechanisms (Aarikka-Stenroos et al., 2021; Pietrulla, 2022). While research such as that by Klofsten et al. (2024) explores the dynamics of inter-firm coordination, there is a lack of methodological frameworks to transfer these dynamics to different contexts. Similarly, studies of governance structures outline general principles (Marques-McEwan et al., 2023). These studies, however, neglect critical dimensions for large-scale deployment, such as contextual replicability and systemic scalability.

This fragmentation of knowledge reflects an academic tendency to favour static analysis over the design of evolutionary pathways, leaving organisations unprepared for challenges such as integrating new actors or optimising circular models in unstable contexts.

The lack of integrated methodologies is a real barrier to circular transition. Methodologies exist in the literature to map flows and ecosystem elements. Although several contributions offer tools to map ecosystem flows and elements (e.g., Bertassini et al., 2021), to the best of our knowledge, no comprehensive and integrated methodology addressing the full process of mapping, replication, and scaling of CBEs has been proposed.

Indeed, without tools to replicate and scale CBEs, success stories remain isolated and limited to geographical or sectoral niches. At the same time, companies face high experimentation costs and risks of failure associated with non-transferable solutions (Bertassini et al., 2021). Furthermore, the lack of contextual adaptation guidelines threatens to create ecosystems that are misaligned with local specificities, reducing their effectiveness.

Contribution

We argue that there is a gap between theoretical contributions and empirical studies on the structuring and evolution of CBEs. Specifically, we propose a methodology for the mapping, replicability and scalability of a circular ecosystem, with a focus on identifying the key steps that guide its definition and expansion.

In contrast to the predominantly static approaches observed in literature, our methodology incorporates an explicit focus on the evolution of actor interconnections and governance mechanisms over time. This enables the design of dynamic, adaptive pathways that better reflect the evolutionary nature of CBEs and support their real-world transformation and growth.

Our approach focuses on analysing the methodological steps required to map and understand the evolution of interdependencies between actors within the CBE, with a focus on the evolution of governance and orchestration mechanisms and the subsequent steps for testing, modelling for replicability and scalability of circularity.
Our contribution fits into this framework, proposing a structured methodology that combines the initial mapping of the ecosystem with operational approaches for its replicability and scalability.
Considering this gap in literature and practice, we focus on the research question:
RQ: How can a circular business ecosystem be systematically analysed and modelled to enable the scalability and replicability of its structures and flows?

Research Strategy

This paper aims to contribute to expanding the knowledge base on the management of circular ecosystems and proposes a methodology to map, replicate and scale them.
To validate this theoretical proposition, a research approach based on design science has been adopted (Hevner et al., 2004; Hevner, 2007).
The problem definition and proposed solution were grounded theoretically, while an empirical case study provided a concrete context to assess their applicability. In particular, three activities were carried out: a structured literature review, the conceptualisation of a mapping, replicability and scalability tool tailored to CBEs, and a single case study. (Peffers et al., 2007). In accordance with the exploratory nature of the research and the objective of verifying the application of the proposed methodological tool, the single case study is a particularly appropriate approach for analysing and validating the effectiveness and relevance of a method in relation to a specific managerial dynamic (Hevner et al., 2004), in line with what has been adopted in previous studies (Culot & Battistella, 2024; Battistella et al., 2013).
The approach employs an iterative cycle that alternates between theoretical and practical problem areas, a hallmark of design science research (Hevner et al., 2004; Peffers et al., 2007; Gregor & Hevner, 2013). The research outcomes are artifacts, including constructs, models, methods, and practical implementations, which can be utilized in real-world managerial settings (Blanka et al., 2022; Battistella et al., 2013).
In the test of this study, the intervention is the application of the proposed methodology and the context in which the company is studied. The sector chosen for this study is the coffee industry, viewed as an interconnected ecosystem where actors and natural resources interact to sustain global production and consumption. The sector faces significant challenges across economic, social, and environmental sustainability pillars. Economically, small producers struggle with profit inequality due to information asymmetry. Socially, issues include poor working conditions, gender inequality, and labour-intensive processes. Environmentally, the industry generates over 23 million tonnes of waste annually, impacting the climate and affecting coffee cultivation. To address these challenges, the research examines an Italian coffee company with B-corporation

certification, recognized for its sustainable and circular practices, including regeneration and decarbonization efforts. This case serves as a model for mapping, replicating, and scaling a CBE.

Description of preliminary results

The proposed methodology aims to provide a theoretical framework and an operational roadmap for the mapping, replicability and scalability of CBEs. Specifically, this methodology will be developed in four phases:

1. Assessment of the CBE, aiming at an initial mapping of the ecosystem, including the regulatory environment in which it operates;
2. Analysis of the evolution of the linkages' mechanism in the CBE, analysing how relationships between actors evolve over time and how they affect circularity;
3. Testing and modelling to replicate circularity in controlled contexts to assess their effectiveness and prepare them for replicability;
4. Testing and modelling the scalability of circularity, identifying solutions for expansion into different contexts.

The outputs from these phases represent the methodological elements to be implemented to map, replicate and scale a CBE. The result is therefore as follows:

- The *CBE mapping model* to understand the structure and dynamics of the system, providing a solid basis for the subsequent steps.
- The *CBE value analysis* identifies governance mechanisms and circular value creation strategies, best practices and areas for improvement.
- The *connection evolution matrix* monitors the relationships between actors, analysing how these connections evolve in response to internal and external changes.
- The *replicability modelling toolkit* is used to support the contextual adaptation of circular strategies by providing a flexible and iterative set of instruments—such as pilot project protocols, impact assessment metrics, and feedback loops—that allow for the testing, validation, and refinement of solutions within specific organisational, geographic, or sectoral settings.
- The *scalability design framework* is used to facilitate the systematic expansion of validated circular models across broader ecosystems. It consists of standardised operational protocols, digital platforms for knowledge and data sharing, and structured training programs aimed at building the technical and cultural capacity of new actors. This framework enables the consistent replication of successful practices at scale

Figure 1 summarises the four phases and briefly describes the objectives, content and outcomes.

Figure 1 - Methodology steps for CBE mapping, replicability and scalability

PHASE	OBJECTIVES	ACTION	OUTPUT
CBE assessment	Define the composition of the constituent elements of the ecosystem, decide what identifies it and define its boundaries. Detail the information to be collected regarding the context in which it operates.	• Identification of actors and their roles • Identification of resource flows and linked activities • Identification of infrastructure/technologies • Definition of the operational perimeter and degree of openness to external interactions. • Analysis of the regulatory and institutional context influencing ecosystem dynamics.	*CBE mapping model*
	Definition of how the ecosystem is managed by the actor playing the role of orchestrator. Definition of the ecosystem value process.	• Mapping of orchestration mechanisms to manage the ecosystem • Identification of existing governance structures • Identification of strategies around circular value creation	*CBE value analysis*
Analysis of the evolution of connections mechanism into the CBE	Understand and monitor the connections between actors and their evolution to respond to the dynamics set by the circular context.	• Mapping the dynamics between actors (trust and confidence, dependencies and convergences, etc.) • Analysis of the mechanisms governing relations between actors (complementarities, interdependencies, co-opetition, etc.) • Analysis of the evolution of connections in response to changes	*Connection evolution matrix*
Testing and modelling to replicate CBE's circularity	Test and validate circular solutions through experimentation to promote the integration of circular strategies into CBEs. Measure the impact of testing and optimise solutions.	• Design and implement pilot studies to experiment with circular solutions in bounded settings. • Define performance indicators to measure effectiveness, feasibility, and adaptability. • Use feedback loops to iteratively refine the solutions and their implementation conditions. • Derive context-specific design principles from experimental evidence.	*CBE Replicability modelling toolkit*
Testing and modelling to scale CBE's circularity	Standardise and structure the circular model through guidelines, operational protocols and digital tools. Promote the dissemination of skills and knowledge through sharing platforms and training programmes.	• Translate validated models into formalised design frameworks, blueprints, and standard operating procedures. • Build digital infrastructures (e.g., platforms, repositories) to enable resource sharing, knowledge codification, and actor coordination. • Design training programmes to disseminate technical and cultural skills related to the circular economy.	*CBE Scalability design framework*

Keywords

Circular Business Ecosystem, Circular Economy, Case study, Methodology

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From Linear to Circular: An Ecosystem Approach in Chemical Manufacturing

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Extended abstract

Background and context

In the chemical manufacturing industry, where supply chains are typically linear, transitioning to circular value chains, where resources are reused and recycled across industries, is both necessary and challenging (Mohan and Katakojwala, 2021). Achieving this transition requires new forms of collaboration, both within and across industries, to mobilize complementary resources such as funding, expertise, and technology (Neumeyer and Corbett, 2017). However, this shift is filled with complexity, uncertainty and disagreement.

The *complexity* of coordinating diverse stakeholders with varying goals, combined with the *uncertainty* of emerging technologies and volatile regulatory landscapes, creates significant barriers to progress (Gray and Purdy, 2018). Additionally, *disagreements* over responsibilities, resource allocation, and risk-sharing often undermine collective efforts (Bryson, Crosby and Stone, 2015). Without a comprehensive approach to address these challenges, current sustainability initiatives risk remaining fragmented and failing to scale effectively.

To overcome these obstacles, a robust ecosystem approach is essential. Unlike traditional value chains that operate in a linear and transactional manner, ecosystem approaches enable dynamic coordination among diverse actors, including competitors, regulators, and

adjacent industries. This is particularly valuable in circular transitions, which require simultaneous technological, regulatory, and behavioral shifts. Global sustainability challenges, such as climate change, resource scarcity, and environmental degradation, demand urgent, systemic solutions that traditional industrial structures are ill-equipped to address (Dentoni, Pinkse and Lubberink, 2021). As key industries, such as chemical manufacturing, attempt to meet global sustainability goals, the ecosystem concept serves as a promising framework for encouraging cross-sector collaboration, resource mobilization, and innovation (Audretsch et al., 2019, Adner, 2017). Ecosystems have the potential to bring together different actors and align their efforts, providing a way to tackle the complex challenges of sustainability transitions (Jacobides, Cennamo and Gawer, 2018, Parida et al., 2019). But despite its increasing popularity in academia, the ecosystem framework is still rarely used in practice, especially in industries that are used to linear, transactional relationships.

From a theoretical perspective, while ecosystems hold promise as a solution to these challenges, their practical implementation remains underexplored, especially in industries like chemical manufacturing. Theoretical development has not kept pace with the needs of practitioners, with a lack of conceptual clarity and guidance on how to operationalize ecosystem thinking in these contexts (Wurth, Stam and Spigel, 2022). Filling these gaps is essential for advancing ecosystem theory and helping industries move from small, isolated improvements to large-scale transformations needed for sustainability.

This theoretical shortcoming is particularly pressing given the societal relevance of the challenge. Chemical manufacturing plays a critical role in achieving sustainability goals but also contributes significantly to environmental degradation (KümmererClark and Zuin, 2020). For chemical manufacturing, circularity offers substantial potential to reduce dependency on fossil-based inputs, lower emissions, and improve resource efficiency. However, this shift is impeded by legacy infrastructure, fragmented supply chains, and the complexity of scaling new biobased inputs. The European Green Deal has pushed the industry towards more sustainable production, but these efforts are often small and isolated from larger, systemic change (Thormann, Neuling and Kaltschmitt, 2023).

This research aims to address these gaps by exploring how an ecosystem-driven approach to circular value chain formation can speed up the transition to renewable resources, driving innovation and supporting large-scale sustainability in the chemical manufacturing industry.

Research question

How can an ecosystem-driven approach to circular value chain formation in the chemical manufacturing industry help overcome the challenges of complexity, uncertainty, and disagreement in the transition to renewable resources?

Methodology

This research employs an action research methodology within the BioBased Circular initiative in the Netherlands, which focuses on creating and scaling new circular value chains for polymer products derived from carbohydrate-rich biobased feedstocks. The initiative involves developing at least five circular value chains with relationship to industries such as agri-food, forestry, waste management, and chemistry, aiming to build a sustainable industrial ecosystem. Due to confidentiality agreements, we are unable to disclose specific details about the value chains or the materials involved.

The research will follow action research cycles (Willis & Edwards, 2014), actively engaging stakeholders in co-creating solutions to the systemic challenges involved in biobased circular transitions. These cycles involve iterative phases of planning, acting, observing, and reflecting, where stakeholders collaboratively identify challenges, implement solutions, and refine strategies based on observed outcomes. Stakeholders include suppliers of biobased inputs, chemical producers, logistics companies, recyclers, knowledge institutes, and policymakers. Stakeholder identification is both guided by existing networks and expanded through ecosystem mapping conducted in early action research cycles. The first step in the process involves barrier removal and establishing enabling conditions. This includes the development of regulatory frameworks, supply chain agreements, and support systems designed to address the obstacles impeding the scaling of biobased circular value chains.

Next, the research focuses on blueprint development (Table 1), aiming to create and test a scalable blueprint for value chain formation. While the blueprint outlines distinct phases, the process is inherently iterative. Stakeholders may revisit earlier steps as conditions evolve or insights emerge, ensuring adaptive learning and responsiveness to system dynamics. This blueprint will be applied to at least five new circular value chains, involving stakeholders across sectors. Through this process, collaborative business models and scaling strategies will be developed and refined (Ciulli et al., 2022). Throughout the research, iterative learning and co-creation will be integral. The research team will work closely with stakeholders to refine strategies and solutions through continuous feedback and collaboration.

TABLE 1 BLUEPRINT FOR CIRCULAR VALUE CHAIN FORMATION

Phase	Step	Description
1. Create	**Physical & Energy Flow**	At different points in time, this step defines of the current, future and reference boundaries of the physical system.
	Ambition	Define at the ecosystem, circular value chain and actor level for multiple points in time.
2. Connect	**Value Network**	At different points in time, this step defines the actors within the value network and supply chain, their roles, the resources and the value exchanges.
	(Mission-oriented) innovation system	This step defines how the value network is embedded in and influenced by the wider innovation system.
3. Collaborate	**Business Case**	This step identifies the business case for the individual actors and the value network at different time horizons.
	Risks & uncertainties (total & for each stakeholder)	For the entire value network and the individual stakeholder, this step defines the risks inside and outside the network and market dynamics.
	Control Points / Strategic Autonomy	At three different levels control points – positions in the network from which actors can enact influence – are defined.
4. Commit	**Roadmap towards Commitment**	The final step involves identifying the next scaling step by creating roadmap by translating the uncertainties and control points to the necessary roadmap dimensions; and developing a decision-based roadmap that leads to a final investment decision.

Expected contributions

The research will enhance our understanding of how ecosystems, supported by an integrated value chain approach, can address key transition challenges: complexity, uncertainty, and disagreement. This will bridge gaps in ecosystem and value chain literature by offering a unified framework that supports collaboration in sustainability transitions. In particular, the research contributes original insights by developing and empirically testing a blueprint for circular value chain formation grounded in action research. While existing ecosystem literature highlights the promise of coordinated multi-actor innovation, few studies offer concrete, scalable models for how such ecosystems are initiated and governed in traditionally linear sectors. This study addresses that gap by combining ecosystem theory with a field-based methodology to derive actionable mechanisms for ecosystem design, stakeholder alignment, and iterative decision-making.

Practically, this research will provide actionable insights for industries, particularly the chemical manufacturing industry, on accelerating sustainability transitions. By developing tools for better coordination, transparency, and trust-building, this approach can guide industries in scaling innovations and manage complex societal transitions more effectively.

Keywords

Ecosystem-driven innovation, circular value chains, business model innovation, sustainability transitions, chemical manufacturing

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An Extended Abstract Submitted to the NBM Conference 2025

What is role of support organizations in entrepreneurial ecosystem vs. clusters?

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Extended abstract

In this paper the subject studied is support organizations, primarily entrepreneurial support organizations but also a cluster organizations. The focus is on the role such organizations play in the environment it operates in, that is in the entrepreneurial ecosystem which it is a part of. This study also addresses the impact that an entrepreneurial support organization can have on the competitiveness of the location in question when it comes to entrepreneurial activities, business development and innovation in a social and environmentally responsible manner. The theoretical section of this research addresses the recent knowledge on entrepreneurial ecosystems and links it to theories on competitiveness of locations. The aim of the literature review is to bring forward a frame of reference to discuss the findings from the empirical examples that are studied in this paper.

The main case studied in the paper is an organization serving entrepreneurs in Iceland with the name Klak – Icelandic Startups. In its present form the organization is based on a merger in 2013 between two different organizations, Klak, an innovation center established in 1999 by a private business firm and Innovit established in 2007 as a university based entrepreneurial support unit. Starting as Klak-Innovit the organization continued as an entrepreneurial support organization but in 2016 it changed its name to Icelandic Startups after a change in a focus on becoming mainly an accelerator service provider. The main service provided is running 3-4 different accelerators together with mentor service and

related support to entrepreneurs. The accelerator services have been successful and the organization, now renamed as Klak – Icelandic Startups holds a very central position and role in entrepreneurial field in Iceland.

Klak is operated as a non-profit organization. The owners come from different sectors in Iceland, both the private and the public sector. The owners provide around 10% of the operational budget. Around 2/3 of the operational funds are provided by actors in the public sector and 1/3 come from actors in the private sector (Klak, 2023). This work-process paper presented here is part of a research project that is designed as a longitudinal study of the entrepreneurial ecosystem in Iceland (Hannes Ottósson and Runólfur Smári Steinþórsson, 2024).

An ecosystem metaphor, borrowed from biology, is increasingly being used to understand the context for entrepreneurship in specific regions (Spigel, 2017). The concept draws on related concepts from regional innovation studies (Acs et al., 2017), and management and policy studies (Adner, 2017). Here the focus is on the theoretical framework for entrepreneurial ecosystems, based on the following definition:

„a set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organisations (e.g. firms, venture capitalists, business angels, banks), institutions (universities, public sector agencies, financial bodies) and entrepreneurial processes (e.g. the business birth rate, numbers of high growth firms, levels of 'blockbuster entrepreneurship', number of serial entrepreneurs, degree of sellout mentality within firms and levels of entrepreneurial ambition) which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial environment" (Mason and Brown, 2014, p. 5).

Different theoretical frameworks have been used to explain the concept of an entrepreneurial ecosystem. The Triple Helix model, developed by Etzkowitz and Leydesdorff (2000), emphasizes the importance of collaboration between government, academia, and industry. Burt (2000) has proposed theories of social networks that provide insight into how social ties drive entrepreneurial activity within ecosystems. The literature also emphasizes the importance of governments having active policies that encourage entrepreneurship and ecosystem development, including funding for research and development, investment incentives, and regulatory reform (Mazzucato, 2013; Hannes Ottósson and Rögnvaldur Sæmundsson, 2024).

The theories on entrepreneurial ecosystems are dealing with similar phenomena and research problems as the theories on regional clusters and industrial districts (Rocha and Audretsch, 2022). The theories on industrial districts are oldest (Marshall, 1920) explaining how small businesses within regions did tend to concentrate in suitable locations providing both economic benefits and positive social influence on the 'industrial district' in question (Beccatini, 1990). The theories on clusters are addressing similar issues but from a different

perspective. Theories on clusters are rooted in studies of competitiveness of the business environment within nations (Porter, 1990) and within regions (Porter, 1998, 2008). The concept of clusters was defined by Porter (1998, p. 225) as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities". The work by Porter and his associates has had a tremendous impact on both economic policy and business practice throughout the world (Sölvell, 2015) and the effectiveness of clusters has been further improved through the activities of cluster organizations (Sölvell et al, 2003; Ketels and Memedovic, 2008; Morgulis-Yakushev and Sölvell, 2017: Runólfur Smári Steinþórsson, 2020).

In this research the focus is on the role of entrepreneurial support organizations within entrepreneurial ecosystems (Bergman and McMullen, 2022). The theoretical interest also includes theories on clusters and competitiveness and similarly the role on cluster organizations in making possible to ensure economic and social development within clusters (Belso-Martinez, Diez-Vial, Lopez-Sanchez og Mateu-Garcia, 2017). In relation to the empirical research of Klak as an entrepreneurial support organisation it will be compared to two examples of functioning cluster organizations in Iceland, The Iceland Ocean Cluster and The Iceland Tourism Cluster. A special focus will be put on the similarities and differences of the business models in the respective examples of the entrepreneurial support- and cluster organizations and how they address social responsibility and sustainability issues.

Keywords

Entrepreneurial support organizations, entrepreneurial ecosystems, clusters.

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Firms Shaping Sustainability-Oriented Markets: Control Points perspective and Strategic Mechanisms in environmental business strategy

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Abstract

The climate crisis necessitates a shift in production and consumption patterns, requiring a reconfiguration of traditional markets to align with sustainability principles. This transformation introduces unique challenges for companies operating in sustainability-oriented markets including technological disruption, regulatory shifts, unpredictable customer behaviour, financial constraints, and strategic inertia such as waiting games. While the literature on market shaping identifies firms as pivotal agents in the formation of new markets it is less clear whether firms can truly act as catalysts for sustainability-oriented markets. The additional complexities inherent in these markets raise questions about whether and how firms can effectively navigate these challenges to drive the formation of new market models without compromising their competitive positioning. To address this gap, we use a control point perspective to analyse key positions within the value network where firms can generate systemic value while ensuring future value capture. Our case study of nine key firms in the emerging green hydrogen market in Italy reveals how market-shaping roles - Market Drivers, Market Supporters, and Market Missionaries - navigate challenges of value creation and capture amidst technological disruptions, regulatory shifts, and financial constraints by exploiting different configurations of control points. Additionally, we identify specific positioning mechanisms that provide deeper insights into the agentic role of actors driving the transition to sustainable markets. By emphasizing the coexistence of sustainable transformation and competitive dynamics, this study offers practical insights for firms seeking to navigate emerging sustainable markets.

Keywords

Market Shaping, control point, sustainability-oriented market, sustainable transition, hydrogen ecosystem, environmental business strategies

1) Introduction

Strategic marketing and management studies emphasize the importance of market-shaping mechanisms in the evolution of industries (Helfat, 2021; Mollinger et al., 2021; Nenonen et al., 2020). Assuming the market as a dynamic, plastic, multi-actor system (Nenonen et al., 2014; Storbacka, 2019), this perspective acknowledges how such systems can be shaped by the actions of their constituent actors (Mele, Pels, & Storbacka, 2015; Nenonen et al., 2014). Consequently, the recognition of the pivotal role of firms in shaping new markets (Nenonen, Storbacka, & Windahl, 2019) has prompted an increasing number of scholars to question the role of business agency in sustainability transitions (Novalia et al., 2018; Werbeloff et al., 2016), emphasising the need to investigate the role of businesses as potential catalysts for the transition towards sustainability-oriented markets (Mintrom & Rogers, 2022; Schaltegger et al., 2022; Koistinen & Teerikangas, 2021).

However, while shaping new markets subject to traditional market dynamics, is already an inherently demanding endeavour for any firm, a company's role as a catalyst for a sustainability-oriented market constitutes an exceptionally complex and strategically significant challenge. Factors such as technological disruption, regulatory changes, unpredictable customer responses, and financial constraints (Syvari et al., 2025) compel firms to proactively anticipate market positions where they can establish control and gradually capture value.

Therefore, shaping a sustainable market is fundamentally different from traditional market-shaping activities. As highlighted by Kullak et al. (2022), sustainable market shaping entails considering all the interdependent layers of a market system and this in turn involves reconfiguring business definitions, exchange practices, networks, representations, rules, and norms. Pinkse et al., (2023), categorise the unique constraints that companies operating in emerging markets focused on sustainability face as follows: (i) limited availability of low-carbon substitutes, (ii) the need for new infrastructures, (iii) difficulties in using existing production facilities with low-carbon inputs (Geels, 2014), and (iv) challenges in delivering the same quality or quantity of output at a comparable price when using low-carbon inputs.

A review of the literature on market shaping for sustainability revealed a paucity of studies that do not provide a comprehensive description of the phenomenon. The few exceptions mainly explore how the incumbent actors prepare the market for the replacement of existing technologies with more sustainable ones (Doganova & Karnøe, 2015; Keranen et al., 2023; Werner et al., 2022) or how market systems are collectively shaped in order to promote social change in an emerging economy (Kullak et al. 2022). In light of this, recent research has underscored the need to extend the conceptual scope of market shaping beyond a traditional focus on economic improvement to encompass sustainability (Koistinen & Teerikangas, 2021; Sheth & Parvatiyar, 2021), highlighting the need for further research to balance the business and sustainability objectives of shaping strategies (Werbeloff et al., 2016; Köhler et al., 2019; Stathakopoulos et al., 2022).

We posit that the *control point perspective* provides an excellent lens through which to explore this phenomenon. This perspective enables to consider simultaneously the positions in the value network that companies need to manage to create and capture values. By integrating this perspective in the process of formation of new sustainable market, it becomes possible to understand how firms can foster harmonious value creation aligned with sustainability objectives, while strategically managing ecosystem positions that hold the potential for long-term profitability. The literature on control points thus provides a valuable lens to explore how firms (i) navigate new emerging markets (Datté et al., 2018), (ii) operate through the multiple layers of a value network (Yoo et al., 2010), (iii) balance initiatives of value creation and capture (Bohnsack et al., 2024), (iv) tackle peculiar constraints of these new markets (van Dyck et al. 2021).

Since the interaction between market-shaping roles in sustainable markets and how these actors navigate control points remains underexplored, studying both perspectives simultaneously will enable us to advance the understanding of the roles and the underpinning actions of the various actors during the shaping of a new sustainable market.

This paper thus addresses the following research question: *What control points are adopted by shaping companies to overcome sustainable market constraints and*

capture value? What mechanisms do shaping companies use to position such control points within emerging sustainability-oriented markets?

To our scope, we conducted a multiple case study involving several actors engaged in developing the emerging green hydrogen market in Italy. Using a qualitative approach, our study identifies the roles of companies in market-shaping and how they shape a sustainability-oriented market.

Our study contributes to the literature by extending market-shaping research with empirical evidence in sustainability, uncovering patterns in control point development and management, and offering insights into the roles and dynamics of actors driving the transition to sustainable markets.

2) Theoretical Background

2.1) Companies' roles in shaping sustainable markets

The agentic effort of companies is nowadays considered as a significant driving force in strategic management, as it influences the evolution of an operating environment (Helfat, 2021) and highlights the potential role of a focal company in shaping a new market (Nenonen and Storbacka, 2021). Recognizing the firm not as a passive actor within the market system, subject to external and deterministic forces, but as a proactive entity capable of deliberately driving market change (Nenonen and Storbacka, 2021), highlights the critical role of firms in the creation of new market models oriented toward sustainability. The market-shaping literature thus offers a valid lens to study the formation of a sustainable market, and specifically focuses on the agency of different actors (Ottosson et al., 2020).

Market-shaping are purposive actions of an actor. Thus, different players participating in the shaping process use different approaches and levels of engagement in creating a new market system (Nenonen, Storbacka, and Windahl 2019). The engagement of a focal company in creating a new market and its ability to involve as many market actors as possible has been used to cluster different market shaping roles (Fehrer et al., 2020).

Recent findings (Flaig and Ottosson, 2022) shown that roles are determined by the actions of a focal actor and the responses of the other actors involved (Heikkinen et

al., 2007; Nystrom et al., 2014). Such actions determine what resources are accessed and utilized, which actors to collaborate with, and which networking objectives to be pursued to engage a broad number of players (Nystrom et al., 2014). In essence, by fulfilling specific roles, actors transform themselves and exert their agentic role to influence the surrounding market (Ford, 2011; Story et al., 2011). Flaig and Ottosson (2022) identified the roles involved in market shaping domain based on the different levels of engagement exerted by the actors. Drawing on their study, our focus is on the actors who intend to build the markets and, therefore, will not take into consideration the roles of those companies hindering and opposing the evolution of new markets since they fall behind our purpose. These roles are:

- Market Drivers who outline a market vision and allocate significantly more resources than other actors to realise this vision. These actors steer market-shaping process driven by the possibility of reaching a leading position in the new emerging ecosystem. These players have a profound commitment to the creation of the new market.
- Market Supporters are companies who endorse this vision and do not interfere with the Market Drivers' shaping efforts. These companies facilitate the education of the market regarding the advantages of the nascent ecosystem, thereby enabling the positioning of their products and services within a novel market segment. Compared to the Drivers, Supporters have limited resources, and thus they leverage opportunistic partnerships to drive sales growth.
- Market Missionaries are crucial in developing market networks and promoting the market vision to a broader audience. Often funded by industry or government, they act as proxies for other actors' market-shaping efforts, extending these ambitions in line with the focal vision (cf. Mountford, 2019).

While recent studies have investigated shaping strategies for social change (Beninger & Francis, 2021; Fehrer & Bove, 2022; Tarnovskaya, Hånell, & Tolstoy, 2022), or how players pursue market changes to promote sustainable innovations (Keranen et al., 2023; Mehtälä et al., 2023; Werner et al., 2022), a thorough understanding of how these roles operate within a sustainable market is lacking. A deeper investigation of the roles' underlying actions to achieve economic and

environmental equilibrium in sustainable market-building would contribute to overcoming the current fragmented literature on shaping sustainable markets (Nenonen & Storbacka, 2021).

2.2) Using control points perspective to untangle market shaping roles

To understand why the control point perspective is a valuable lens for analysing these dynamics, it is essential to clarify two key dynamics that characterize market-shaping processes.

The first is the *systemic nature of the value creation process* in market formation (Nenonen, Storbacka & Windahl, 2019). The literature on marketing and management has progressively recognized markets as networks, systems, or ecosystems (Johanson and Vahlne 2011; Vargo and Lusch 2016; Adner 2017). This implies that value creation lies beyond the borders of the firm, and therefore value is viewed as being co-created with a multitude of stakeholders in the market (Tantalo and Priem 2016). To shape a market successfully, a firm must leverage both its own resources and those of a network of organizations to create new resource linkages and integration patterns (Bingham and Eisenhardt, 2008).

The second aspect regards the "*temporality*" of the value capture process. Whatever the reasons (e.g. improved competitiveness or social and environmental purpose), market shapers need to generate profits throughout the value capture process (Geiger & Gross, 2018). Therefore, unsurprisingly, the value capture concept remains fundamental in situations where the aim is to create a sustainable market (Giuliani, Tuan, & Calvimontes Cano, 2021). However, particularly when involved in the creation of a new market, market shapers are dealing with a "potential market" that has not yet fully emerged, which leads to great uncertainties (Adner, 2013; Ozcan & Santos, 2015). Companies thus have to develop control into a nascent market (Tilson et al., 2010) to strategically navigate the value capture process. In other words, this is about defining in advance the system's positions where value will be created in order to apply the value capture mechanisms once value creation has occurred (Dattè 2018).

These two aspects suggest that managerial attention should shift from the sole focus on current strategical resources to a more encompassing focus on the control

of system dynamics. The intrinsic characteristics of control points are thus particularly well-suited for studying the phenomenon of market shaping.

Control points are defined as abstract positions of greatest value and control within a given business ecosystem, thereby inherently introducing a "systemic dimension" to these positions (Pagani, 2013). Such positions are not necessarily within the firm boundaries but are placed between layers on the layered architecture of a value network (Yoo et al., 2010). According to this approach, companies first identify the assets, technologies, or industry-level value systems that could create market value. Subsequently, they develop and occupy these positions to exert dynamic control, ensuring future value capture dynamics (Baldwin & Woodard, 2007; Baldwin, 2015; Hannah & Eisenhardt, 2018).

Control points can be technical, above all identifying the potential value creation in the various layers of an ecosystem, and strategic, by determining the value capture potential (van Dyck et al., 2021). Technical control points refer to technical solutions that enable access to a company's market, while strategic control points encompass sociological and institutional aspects which help the company to benefit from the ecosystem. Finally, the influence and power of control points are also shaped by regulations (Elaluf-Calderwood et al., 2011), which may exert a crucial agentic role in creating a new market.

As with the value creation dynamic, control points are therefore useful for understanding how firms guide the evolution of the value network, creating value at a systemic level (Hannah and Eisenhardt, 2018; Helfat and Raubitschek, 2018). With respect to the potential for value capture, establishing control points within an emerging business ecosystem involves the identification and occupation of strategic positions in advance to gain control of the ecosystem with the goal of capturing value (Dattè, 2018).

The control point perspective provides a valuable lens for understanding how companies balance sustainable markets shaping actions (value creation) with enhancing competitive advantage (value capture). It extends market-shaping literature by highlighting differences among actors and identifying recurring patterns that reveal the unique characteristics of each role in shaping sustainable markets.

3) Methodology

3.1) Empirical context: the Italian emerging market of green hydrogen

The burgeoning green hydrogen market in Italy is an optimal setting for analysing the shaping of an emerging sustainability-oriented market.

The development of the green hydrogen market is hindered by several issues (IRENA, 2022; IEA, 2022) tied to input, process, and output constraints, which are common to emerging sustainable markets (Pinkse et al., 2024). These constraints include limited large-scale hydrogen production to ensure competitive supply, the absence of high-capacity transport infrastructure like pipelines, and the need for new or upgraded equipment to integrate hydrogen into industrial processes. Additionally, hydrogen's higher costs compared to fossil alternatives and its impact on maintaining quality in certain production processes pose significant challenges (IPCC, 2022, Nunez-Jimenez et al., 2022).

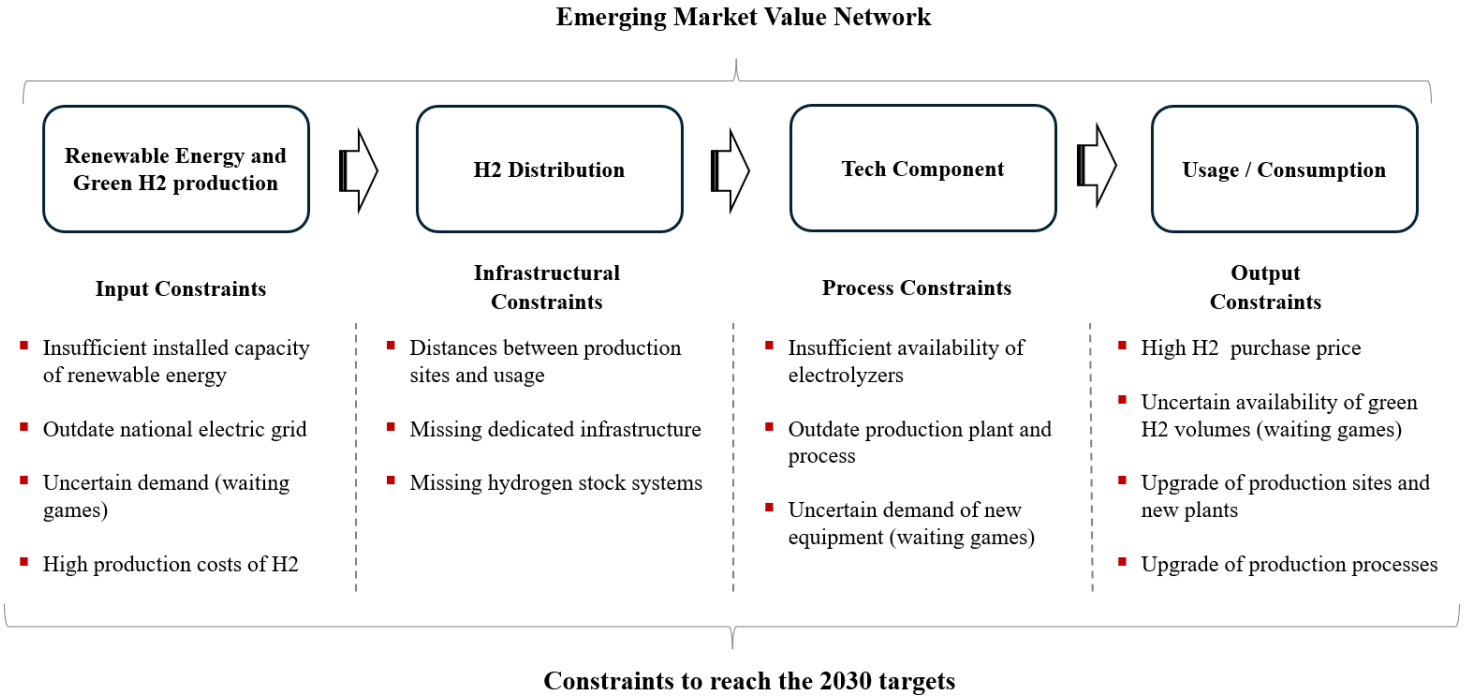
Consequently, this emerging market is characterized by significant uncertainties regarding its evolution (IEA, 2022), thus reflecting the complex process of systemic value creation and the temporal gap in value capture. Companies seeking to operate in this market face high levels of unpredictability and associated risks: (i) the "waiting games" (Robinson et al., 2012), which stem from the required coordination between production growth and demand; (ii) technological changes, which can lead to unexpected shifts and open up a broad range of future applications that may diverge from a company's current positioning (Gruber, MacMillan, & Thompson, 2008); (iii) a fluid and unstable regulatory framework which can hinder decision-making due to unexpected mid-term changes; and (iv) misperceptions of the risks from end customers.

Despite the numerous complexities associated with this emerging market, many corporate actors are currently dedicating significant resources and efforts to building it

All things considered, this setting is particularly suitable for investigating the actions taken by companies entering a distinctive and promising emerging market and their

efforts to shape it. ***Figure 1*** shows the value network layers used to achieve the 2030 target, highlighting the main constraints companies will have to face.

Figure 1: Green hydrogen value network's layers and associated constraints



3.2) Sample and data collection

To identify market-shaping roles and related company actions, we firstly conducted interviews with two experts from GME, Italy's energy market authority. These discussions revealed opportunities, barriers, and the value network's structure—encompassing hydrogen production, technological development, distribution, and usage—aligned with European funding priorities for balanced market growth.

To identify the firms that are active in this emerging market, we began with the IEA dataset, which catalogs the hydrogen projects launched since 2000 and the respective companies leading them. We supplemented this with a list of companies affiliated with associations such as the European Hydrogen Alliance and H2IT, and we also attended the Hydrogen Energy Summit & Expo in Bologna (October 2022), which is the key industry event in Italy attended by major stakeholders.

To determine the companies most committed to shaping this market, we applied criteria including declared investments in the emerging market, ongoing projects impacting the national supply chain, and public statements to shareholders. This approach identified nine companies extensively engaged in large-scale industrial initiatives to advance green hydrogen development, with investments totaling several million euros. These actors are recognized as key actors in this emerging market, given their potential to revolutionize the entire Italian hydrogen supply chain (e.g., Osservatorio H2IT and Osservatorio H2 Agici-Fichtner 2023). We contacted these companies, requesting interviews with representatives who were extensively involved in hydrogen projects, as well as senior executives responsible for the company's strategic direction. Between October 2022 and September 2023, we conducted interviews via Teams with a total of 22 interviewees. A semi-structured interview protocol was developed to conduct the interviews which lasted 45 - 90 minutes. Secondary data were used to triangulate our findings (see **Table 2**).

Table 1: Overview of the interviewees and their company activities

Company Profile / Pseudonym	Interviewees	Market shaping initiatives
Energy Hubs Developer	COO; Head of strategy; Head of market development	- Coordination of an industrial district for the use of green hydrogen - Development and management of renewable energy hubs dedicated to H2 production and direct interconnection with off-takers.
Energy Company A	Head of H2 BU; Head of special projects; Project manager	- Development of hydrogen valleys - Coordination of H2 mobility initiatives and H2 refuelling stations development - Collaboration to develop H2 supply and usage in hard-to-abate sectors (ceramic, steel, glass etc)
Energy Company B	Head of Strategy; 2 Project Managers	- Development of renewable power plants dedicated to H2 production - Orchestration of multiple H2 pilot projects in collaboration with hard-to-abate (e.g., refinery, chemical) - Development of a national platform to test new H2 technologies to involve startups, and industrial off-takers and create networking
Gas Distributor	Head of H2 BU; Head of decarbonization BU; H2 Project Leader	- Upgrade and replacement of gas pipelines to enable national H2 supply - Launch of a new company in collaboration with electrochemistry partner to develop an electrolysers gigafactory - Coordination of a multiparter project to develop H2 rail mobility - Collaboration with hard-to-abate players (steel and refinery) to test H2 integration into production cycle
EPC Contractor A	CEO; Business model developer	- Development of new H2-based technologies for steel making - R&D collaboration with steel producers - Development of an in-house lab to test new technologies with potential clients
EPC Contractor B	Coo; Head of engineering	- Development of new H2-based technologies for metal heating - Technical support for pilot projects aimed at decarbonizing ceramic and metallurgical industries.
EPC Contractor C	Head of strategy; Project Manager	- Development of new H2-based technologies - Partnerships with H2 valley developers to test new hydrogen storage models - R&D collaboration with city councils to develop hydrogen mobility projects.
Steelworks Company	President and Coo	- Multi-partners alliance to decarbonize production cycle integrating H2 (DRI technology) - Dissemination of ongoing results internationally to position the initiative as an industrial alternative in the steel sector. - Interactions with policymakers to guide regulatory development and establish a supportive framework for H2 usage initiatives.
Refinery Company	Head of strategy; Project Manager	- Multi-partner alliance to manage the production, distribution, and direct use of green H2 in crude oil processing. - Lobbying in Italy and the EU to unlock funding for industry decarbonization. - Committed to buy and use large volume of hydrogen on a long-term horizon, thereby enabling large-scale H2 production in the reference industrial district.

Table 2: Secondary data sources

Secondary Data source	Number of Reports / Articles / Db	Use in our analysis to triangulate findings from primary data on:
Press releases, sustainability reports	45 • Including two years of sustainability reports for each of the nine companies • and an average of three press releases per company detailing ongoing activities in the hydrogen market.	Ongoing projects mentioned in the interviews
News from h2 industry magazine	63 out of 144 An average of seven articles per company, collected over approximately twenty months of data gathering from Hydronews; Hydrogen-news.it; H2it	Sample selection and projects mentioned in the interviews
National and International Industry reports on H2 market development	7 KPG, PWC, Accenture, Deloitte, Rina, Intesa Sanpaolo, Confindustria	The main constraints hindering market development
National and Intergovernmental databases	3 • IEA DB covers all projects commissioned worldwide since 2000 to produce h2 for energy or climate change-mitigation purposes • Italia Domani and OpenCoesione datasets contain data and relationships regarding the progress of interventions and activities within the National Recovery and Resilience Plan (NRRP)	On project, investments and funding received

3.3) Data analysis

The data analysis employed a qualitative, abductive research methodology appropriate for examining intricate, real-world phenomena. This approach allows for the generation and refinement of theories grounded on empirical observations (Behfar and Okhuysen, 2018;

Dushnitsky and Yu, 2022). Consistent with previous research (e.g., Weber et al., 2019), our study's abductive analytical approach incorporates inductive and deductive reasoning. By consulting the literature and comparing emerging codes and themes with prior studies, we aimed to refine theory development, in line with the methodologies of Gioia et al. (2013) and Weber et al. (2019).

First, we followed Gioia et al. (2013) for inductive reasoning, deriving first-order codes that closely represented our raw data (Gioia et al., 2010). Our raw data comprised approximately 280 pages of interview transcripts, which were analysed using the qualitative data analysis software NVivo. The analysis of interview transcripts was an iterative process that led to the identification of 32 first-order themes relevant to the subsequent identification and description of control points.

In the second step, we used deductive reasoning to assign the first-order codes to pre-defined second-order themes (Weber et al., 2019); these themes represent control points previously discussed in the literature (Bohnsack et al. 2024).

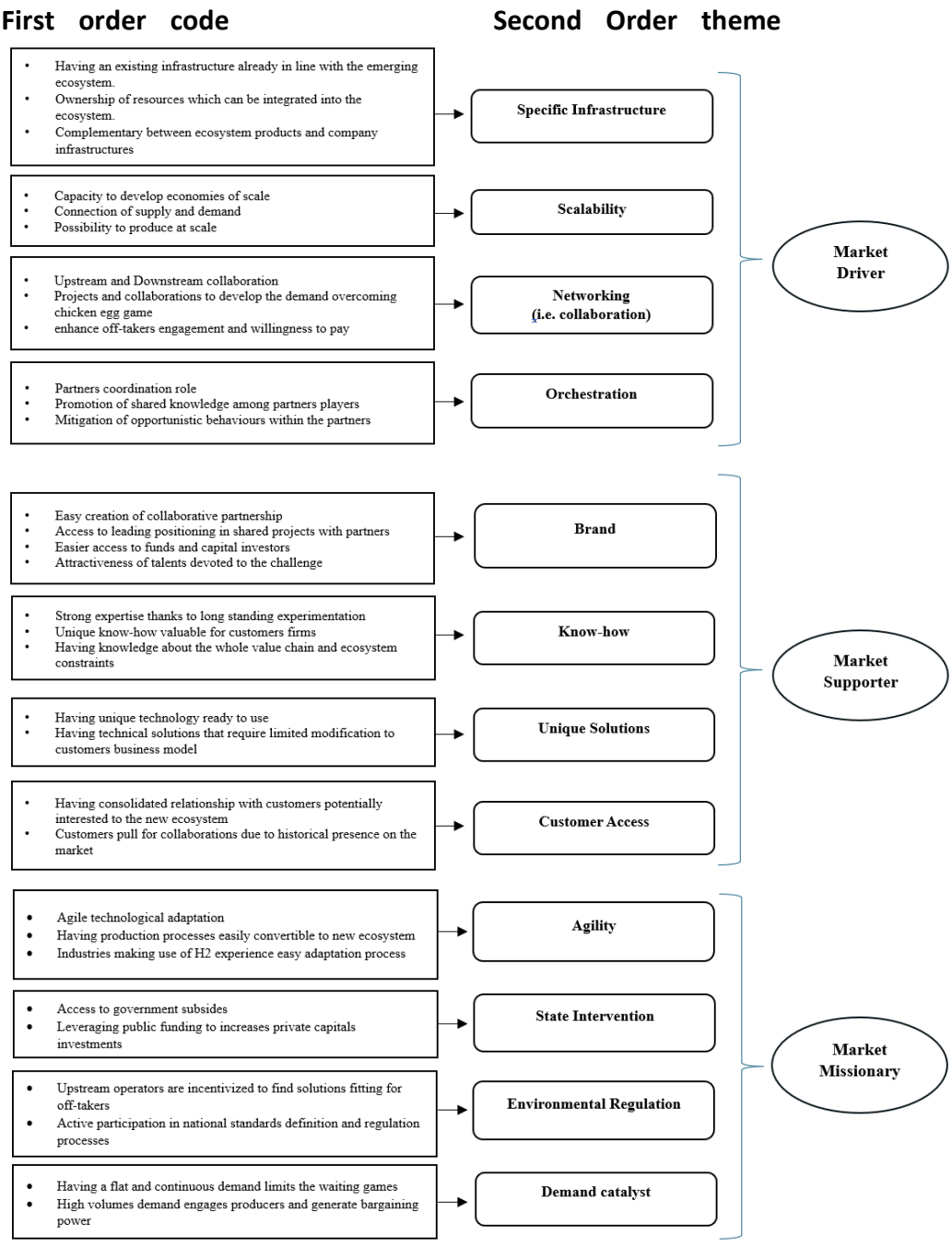
In a third step, the 12 second-order themes were aggregated into three overarching dimensions representing the market shaping roles: Market Drivers, Market Supporters, and Market Missionaries. This deduction was based on the characteristics of market shaping roles developed in prior studies (Flaig and Ottosson, 2022) and consistently aligned with previous role conceptualisations in the ecosystem and market strategy literature (e.g., Adner, 2017; Nenonen & Storbacka, 2020). **Figure 2** represents the data structure that emerged from analysing control points within market shaping roles.

Finally, based on interviews, the rich amount of secondary data, and in line with the distinctive characteristics of the market-shaping roles (Flaig and Ottosson, 2022; Adner, 2017), we associated the nine companies in our sample with three shaping roles: Market Driver, Supporter, and Missionary. To do this, we counted the number of first-order codes belonging to each individual firm that converge on each of the three shaping roles. This provided us with a comprehensive representation of the control points and the related market shaping role adopted by each company within our sample.

We then analysed the actions that each group of companies undertakes to establish and position control points within the market. Based on interpretive approach (Rynes and Gephart 2004) we identified recurring mechanisms adopted by each group of market-shaping roles. These mechanisms reflect the business, relational, or commercial initiatives developed by

companies to take control of specific control points and exert influence over the emerging market. These mechanisms are infrastructural upgrade, branching-out, collaborative r&d programs, and sustainability-oriented symbiosis. This examination provided a deeper understanding of the systematic logic behind control point positioning across different shaping roles, highlighting the inherent differences and unique characteristics of each role.

Figure 2: Analysis and data structure



4) Findings

4.1) Control points underpinning market-shaping roles in a green market

Market Drivers:

The role of the Market Driver is characterised by a targeted vision of the emerging ecosystem, as a result of this role, companies commit significant resources to develop the market, defining its boundaries, and engaging with multiple actors. Energy companies A and B are structured energy utilities that manage electricity production. The Gas Distributor is Italy's leading natural gas transporter and owner of the national distribution network. The Energy Hubs Developer is a company focused on the design, installation, and management of integrated energy systems. These firms first position themselves in the market segments where they can create great value for the whole system. To this end, *Specific Infrastructure* and *Scalability* are key control points for these companies, as they facilitate the scale-up of production and distribution. These companies are therefore investing in converting or adapting existing assets and resources, aimed at establishing a foundation for the emerging market.

> *"Developing large hydrogen valleys is the foundation for ensuring the system's scalability […] our business focuses on renewable power plants […] this makes us the best player to manage new valleys capable of producing at scale, lowering unit production costs and making the transition to H2 more appealing for potential off-takers."* (COO; Energy Hubs Developer).

However, Market-Driver companies face great uncertainty regarding demand evolution, and it is essential for them to promote the harmonious growth of the entire system by securing the engagement of other actors and synchronizing their actions toward market creation (Fehrer et al., 2020; Kleinaltenkamp, et al., 2021; Nenonen, Storbacka, & Windahl, 2019; Storbacka, 2019). *Orchestration* and, most importantly, *Network Engagement* are control points purposively developed to build market boundaries, develop demand, and capture future value by becoming the selling reference for other actors. As prior studies have highlighted, obtaining access to resources and orchestrating other players is crucial to implementing a new value network (Amit and Han, 2017; Nenonen, Storbacka, & Windahl, 2019).

Energy Company B, for instance, is developing a physical platform where many different players (e.g., producers, users, tech providers, and researchers) can experiment with H2 technologies. By fostering widespread engagement among multiple actors, the aim is to establish conditions that will enable them to capitalize on the new assets they are creating, thereby securing a strong bargaining position and ensuring future value capture.

> *"We need to create the market, so we have developed a platform that enables us to work with startups, innovative firms, and various end-users. This creates engagement with new entities and more coordinated efforts from different supply chain actors […]"* (Head of Strategy; Energy Company B).

Through new initiatives across the value network, Marked Drivers involve the participation of actors throughout the value chain, thereby creating the bones of the new market. By orchestrating projects and other companies' efforts, they seek to build a coherent value network that strengthens their bargaining power and enhances value capture.

Market Supporters:

Market Supporters view market shaping as an opportunity to increase sales without significantly diverging from their core business. This role suits market actors that are more cautious about the shaping process (Nenonen & Storbacka, 2020). They recognise that the new market can provide opportunities, but they take a more conservative approach. These firms therefore pursue activities that enable them to maintain flexibility and enable experimentation to improve their knowledge (Rindova and Courtney; 2018).

EPC contractors A, B, and C are technological providers responsible for the Engineering, Procurement, and Construction phases of a project and they are exploring the potential of this emerging market. They develop solutions that can be used in emerging markets, aiming to capitalise on new market demands.

As for their contribution to the system value creation, they leverage control points, such as deep technological *Know-How*, to develop *Unique Solutions*. These control points address the process constraints (Pinkse 2024) that companies transitioning to green hydrogen will have to face. Updating the technological paradigm is crucial for creating a new stable market (Sandvik;

Sjödin et al., 2024) and increase use value through improved offerings (Ghauri et al., 2016; Kumar et al., 2000) by removing technical constraints to support customer usage (Burr, 2014).

For instance, EPC Contractor B has developed a unique know-how and, subsequently, a unique technological solution used in heating processes within the steel industry.

> *"The technological solution we developed already enables the use of green hydrogen in the heating process of steel and metals and thus supports companies approaching a green transition. However, it can also be installed in steel mills using traditional production processes which makes it very flexible for multiple potential customers …" (*Company Director; EPC Contractor B*).*

This solution addresses both the current and prospective markets that might operate entirely on hydrogen. This conservative approach, resulting from collaborative R&D projects and knowledge development, is consistent with the core business while being prepared for potential market developments, by offering customers plug-and-play solutions.

As value creation and value capture in such emerging markets become timely separated, control can no longer be connected solely to fixed assets. Instead, dynamic control over the process of market shaping will draw increasingly on institutional, sociological, and relational dynamics (Thomas et al., 2014). Our findings suggest that organisations that adopt this role proactively try to leverage their established name in the industry (*Brand*) and the direct interface with end-users (i.e., *Customer Access*), by steering the process toward intangible control points. In fact, end-users embarking on transition paths are inclined to seek out well-known and experienced technology partners. Market Supporters are deeply intertwined with the industry sector. They therefore exploit these control pints to position themselves as the primary point of contact for new users in the emerging market.

> *"We are striving to inform the market about our commitment toward decarbonization […] so that we can leverage our historical name as technological partners of major industrial entities […] using our customers' portfolio to become the first reference point for companies transitioning to the emerging ecosystem."* (Head of strategy; EPC Contractor C).

These companies thus establish their presence in the emerging market by conducting experimental projects with customers and by leveraging their brand as a symbol of reliability. This strategic use of control points is crucial for capturing value as the demand for new technologies grows.

Market Missionaries:

The aim of Market Missionaries is to meet challenging environmental goals, with the emerging market serving as the means. They support the envisioned market as far as their resources permit (Flaig & Ottosson 2022), given the significant technical and economic challenges they face (i.e., input, process, and output constraints). However, they play a key role in the market-shaping, as their ability to realize the vision of the new market often leads Market Drivers and Market Supporters' actions to converge on them (Flaig & Ottosson, 2022; Mountford, 2019).
Despite being in hard-to-abate sectors, the Steelworks Company and the Refinery Company are committed to reaching net-zero emissions by 2040.
To enter this market, these actors leverage their potential to generate a stable and consistent demand for hydrogen. This reduces the uncertainty for producers regarding the presence of off-takers, thereby mitigating the risk of waiting games (Robinson et al., 2012). We refer to this control point as the *Demand Catalyst*.

> *"By collaborating with us, hydrogen producers have the opportunity to supply large volumes for years […] few companies may be willing to commit to as we are. This is an important leverage point we can exploit in negotiations […] our volumes generate economies of scale that are beneficial for us and the entire ecosystem."* (Head of Strategy; Refinery Company)

The uncertainty surrounding the creation of the new market typically hinders the participation of many firms, along with the associated resource commitments (e.g., Ozcan & Santos, 2015; Adner, 2013). Producers (e.g. Marked Drivers) may hesitate to engage due to the risk of investing resources with uncertain returns (Datté 2018). By leveraging this *Demand Catalyst* control point, Market Missionaries create systemic value by reducing uncertainty and incentivizing other players to scale production.
In addition, Market Missionaries capitalize on their ability to quickly adapt, making them highly attractive players for collaboration and exploratory projects (*Agility*). In an industrial context,

this refers to a company's ability to adapt its production processes to the needs of the new market, while minimizing disruptions (Liljenberg 2022).

> *"We can utilise existing burners with minimal infrastructural modifications. Partner companies that are developing hydrogen-based pilot projects with us find this a significant benefits, as they can test new processes without the project's P&L having to bear huge capital expenditures (Capex)."* (Group President; Steelworks Company)

Finally, it is important to stress that business objectives are deeply intertwined with environmental goals in shaping sustainable markets. Market Missionaries, experience the most significant benefits in emission reductions and can leverage this advantage. The generic control points determined at the institutional level, such as *State Intervention* and *Environmental Regulation***,** are exploited mainly by Market Missionaries. These companies are the first players entitled to apply for government grants and participate in regulatory discussions to address key constraints and systemic challenges in evolving regulations.

> *"The decarbonisation of our industry is a national interest […] for these reasons, we communicate directly with policymakers to discuss market constraints and the regulation evolution. Nobody can explain what works better than us and what is missing from a normative perspective. […] in these discussions, we take on board our big project partners to strengthen the evidence coming from the market […]"* (Head of Strategy; Refinery Company)

Lobbying with institutions is a well-recognized action in market shaping (Nenonen, Storbacka, Sklyar, et al. 2020) and it is needed to redesign the normative framework in line with business needs. This involves creating new standards and influencing formal rules and laws via regulatory work (Alvarez et al., 2015; Ghauri et al., 2016; Humphreys, 2010). The privileged position of Market Missionaries makes them an appealing partner for all the other players (particularly Marked Drivers) who are seeking deeper connections with policymakers to influence new developing regulations. This control point is leveraged by Market Missionaries to hook companies that seek to establish a voice at the institutional level and to forge new collaborative relationships that are instrumental in supporting their transition projects.

4.2) Mechanisms of control point positioning in sustainability-oriented market

This section describes the recurring mechanisms used by different market shapers to position such control points, thus highlighting both the practical actions and the specific differences among players.

Figure 3 illustrates a matrix to help understand the dynamics of control point positioning. The rows list the different market-shaping roles we have analysed. The columns represent the four key steps we identified in the emerging market: production, distribution, technological development, and final use. This matrix enables us to identify the entry segment of each player within the value network (going-in position) and the process of control points positioning, through which each market shaper pursues its strategy to capture value (target position).

Structural Upgrades:

Through structural upgrades, companies invest in creating essential assets and infrastructure that will be essential for the development of the market. Companies thus define the market boundaries that overlap with their organizational structure (Santos and Eisenhardt 2009) and build the skeleton of the new value network. This approach is common among Market Drivers since they have a stronger commitment to market shaping than other players.

> *"We start from a unique positioning. In fact, our business focuses on the development of renewable power plants, which are the fundamental assets for driving the hydrogen economy forward [...]"* (Project Manager; Energy Company A)

Market Drivers have resources that can be integrated into the ecosystem through upgrades to meet the specific demands of the emerging market. In this market, for example, energy companies can develop renewable energy plants dedicated to hydrogen production, while gas distributors can expand the hydrogen distribution network.

In essence, through this mechanism, Market Drivers adapt parts of their assets to the needs of the emerging market in order to establish the necessary support infrastructure. By doing so, they enter the emerging market and develop essential resource for systemic value creation (i.e., specific infrastructures and scalability).

> *"We are developing new infrastructure to integrate the direct production of green H2 to our offshore wind energy hub. This will enable us to bring H2 to the system at scale level"* (Head of Market Development, Energy Hubs Developer)

Branching Out:

Unlike structural upgrades, by branching out firms do not integrate resources from their core business into the emerging market. Instead, companies establish separate business divisions positioned in different segments of the value network from their original domain. These initiatives are common to Market Drivers as they aim to ensure the harmonious development of the entire value network, preventing bottlenecks in the supply chain and securing future value capture.

> *"How do we bring other actors on board? We invest directly in their business areas where engagement is necessary […] In this way, it is as if we coordinate market development operations across the entire value chain."* (Head of H2 BU; Energy Company A).

Through this mechanism, firms operate in underdeveloped segments of the value network to engage other actors in the market formation and to coordinate resources and efforts toward a common goal—which are key aspects in market-shaping (Nenonen, Storbacka, & Windahl, 2019).

For instance, the Gas Distributor is working on developing a gigafactory for electrolyzers in collaboration with high-tech firms, while Energy Company A is developing refuelling stations with transport companies to promote hydrogen mobility.

> *"We cannot afford to play the chicken-and-egg game. We cannot build a hydrogen valley that we then cannot fully utilize. For this reason, we are actively operating downstream to ensure the development of the supply chain, which will guarantee full use of our position" (Head of H2 BU; Energy Company A).*

As illustrated in **Figure 3**, branching-out serves the dual purpose of value creation and capture. This mechanism involves direct investments to scale up resources and critical infrastructure in segments where engagement from other players is limited (e.g., specific infrastructures, scalability). Additionally, it promotes the engagement of other firms within that specific

business segment (e.g., networking). In this way, Market Drivers position themselves within the layers of the value network where demand is expected to grow through its orchestration, thus ensuring the readiness to capture value as the market matures.

Collaborative R&D programs:

Collaborative R&D programs are common to Market Supporters and involve research and development projects in collaboration with various industrial partners. This mechanism allows the company to understand the specific needs of the emerging market and develop new solutions that respond to the market demand while positioning the company as the reference supplier for new potential customers.

> *"We support players who are experimenting with pilots to test industrial transformation, offering free consultancy in the initial stages. These jointly developed R&D programmes give us the opportunity to strengthen our skills and further develop new solutions […]"* (CEO; EPC Contractor A).

These initiatives do not provide immediate economic returns and are offered free of charge. For example, the EPC Contractor C is offering its consultancy to a municipality in southern Italy and a local transport company to test hydrogen mobility and jointly identify obstacles to be solved. Similarly, EPC Contractor A is overviewing an experimental project aimed at testing steel production using hydrogen (DRI process) with steelmakers.

> *"[…] by offering our consultancy to these experimental initiatives, we become the new key reference for further projects aimed at an extensive transition."* (CEO; EPC Contractor A).

In doing so, companies operating in areas related to technological development can thus approach the emerging market while limiting their exposure to risk, developing new competencies, and establishing themselves as key partners for new clients. This dynamic explains the double harrow of these mechanisms (see **Figure 3**) indicating the dual purpose of such endeavours. This approach enables companies to establish direct contact with future potential clients (i.e., customer access) and associate their brand with the nascent market.

Sustainability symbiosis:

Sustainability Symbiosis are common to Market Missionaries and involve building new collaborations where companies develop strong interdependencies. Such Symbiosis are sought by firms aiming to transform their production processes to reduce emissions, with the emerging market serving to achieve this goal. Through this mechanism the focal company triggering the collaboration, benefit from the contributions of multiple partners in order to overcome the financial and operational constraints characteristic of these transition pathways.

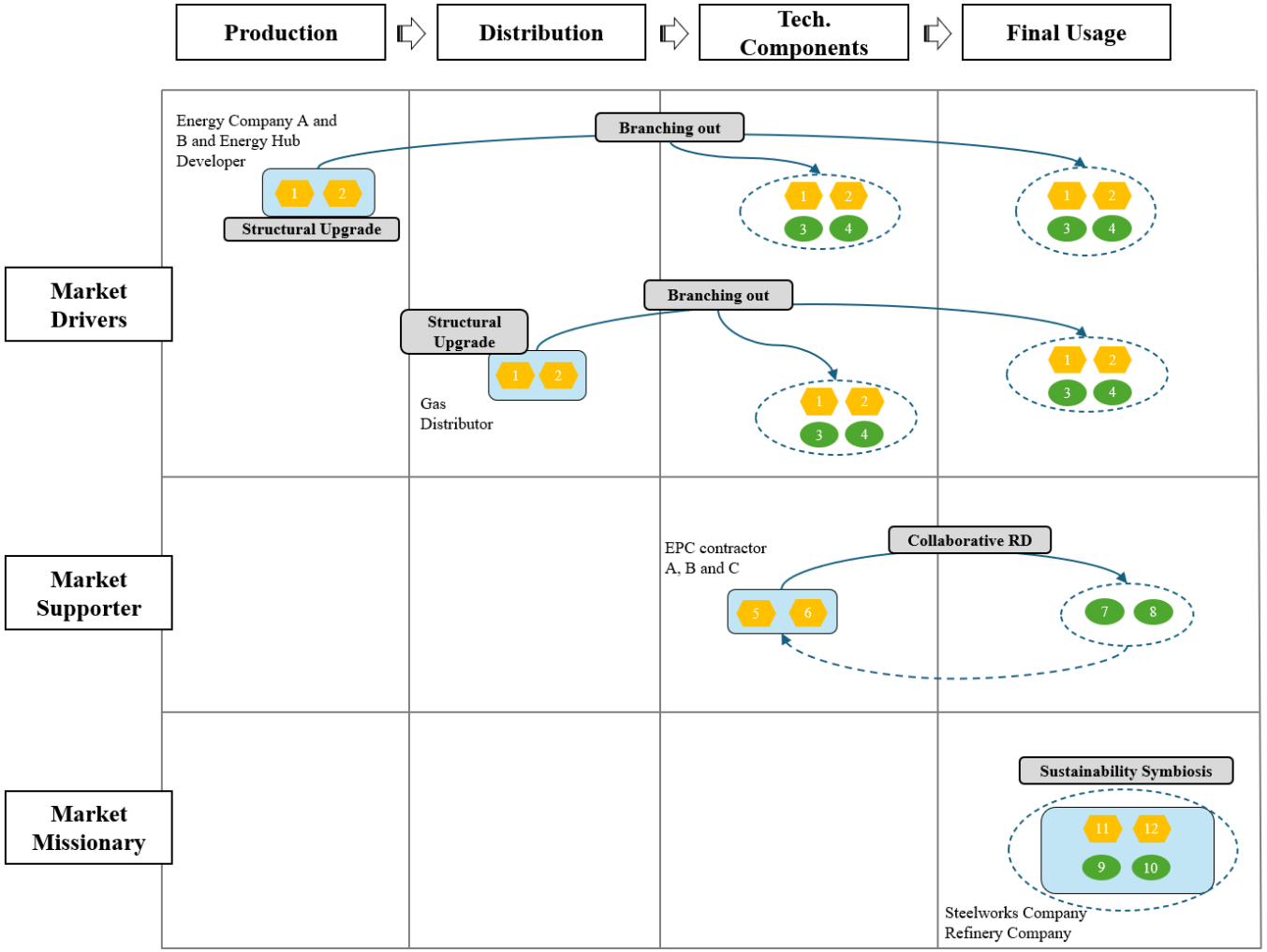
> *"The decarbonization project we are developing involves several partners with whom we have a symbiotic relationship. For instance, the energy company we collaborate with has developed a solar park exclusively for hydrogen production, for which we are the sole buyers. This example illustrates the extent of our interdependence and mutual commitment"* (Head of Strategy; Refinery Company)

To foster these valuable collaborations, Market Missionaries seek to elevate the visibility of their projects, presenting them as unique initiatives at both national and international levels (e.g., the first fully green steel plant or the first net-zero refinery). Additionally, by leveraging their capacity to provide a stable demand and adapt quickly (i.e., demand catalyst, agility), they create substantial value for the emerging ecosystem by reducing uncertainty. In doing so, they become appealing partners for Market Drivers and Supporters seeking to expand their scope of action and shaping influence.

> *"After announcing our intention to create multi-partner collaboration to use of H2 in our production cycle and decarbonize steel production, we received an unimaginable number of requests from various operators. Honestly, we never expected so much attention and so many contacts… to give you a size of this, we've also been contacted by a foreign bank, which is willing to fund our project under very competitive conditions..."* (Group President; Steelworks Company)

As illustrated in the figure, Sustainability Symbiosis operates within a single layer of the value network where the Market Missionary can harness the power of collaboration among multiple

actors to secure public and third-party funding and establish itself as a key partner for institutions.



Control Points	N
Specific Infrastructures	1
Scalability	2
Networking (i.e. collaboration)	3
Orchestration	4
Know-how	5
Unique Solutions	6
Brand	7
Customer Access	8
State intervention	9
Environmental Regulation	10
Agility	11
Demand catalyst	12

Value Creation
Value Capture
Going-in Position
Shaping Mechanism
Target Position

Figure 3: Market shaping mechanisms and the positioning of control points within the value network

5) Discussion and conclusions

5.1) Control points as a lens to shape the sustainable market

Our findings show how different market-shaping roles contribute to the formation of a new sustainable market. Each player exerts its agentic role and develops specific mechanisms to position control points useful to either create systemic value or capture it at a later stage. We found these bundles of mechanisms and underlying control points to be common to different categories of actors, therefore enabling a deeper understanding of market-shaping roles in sustainability-oriented contexts. **Table 3** shows the clear association between roles, mechanisms, control points, and, ultimately, the market constraints that hinder the development of new sustainable markets. These results highlight both the distinct *contributions of various actors to market development* and the specific positioning dynamics that foster *value capture mechanisms and competitive equilibrium*.

We found that Market Drivers leverage technical control points (e.g., specific infrastructure) to establish foundational pillars across the entire value network. By initially integrating their assets into the emerging market, these players subsequently progress through various layers of the value network to ensure cohesive development. Through strategic control points (e.g., networking), they secure broad and coordinated commitments. This approach mitigates some of the entry barriers (Pinkse et al., 2024) hindering market development, such as the limited availability of low-carbon substitutes, lack of infrastructure, and high production costs.

Market Supporters leverage their technological expertise to initiate trial collaborations with new potential customers, thus expanding their technical knowledge and developing essential new technologies (e.g., unique solutions) that facilitate market entry for new entrants. They contribute to the market's development by addressing operational efficiency issues, such as the need for new facilities and technological applications, thereby opening potential new sales channels. In this case, value creation occurs in-house, however the impact extends across the value network, influencing new industrial sectors that could emerge as

future players in the nascent market by adopting these newly developed technologies.

As end-users, Market Missionaries play a key role in stabilizing the market and reducing uncertainty, thereby avoiding waiting games (Robinson et al., 2012). Their pioneering and challenging projects, developed through close multi-partner collaboration, bring visibility to the new market and attract private capital and government funding. In doing so, they gain national visibility, and open dialogue channels with policymakers to influence regulatory directions. The mechanisms employed by these players are designed to overcome operational challenges within their business domain, such as high production and process conversion costs.

As a systemic process, market shaping reveals that certain roles, such as the *Market Driver*, operate across the entire value network, initiating business ventures that diverge significantly from their core business. Conversely, other roles (*e.g. Market Missionaries*) engage in market-building processes by developing initiatives that remain more closely aligned with their existing business domain. This dual dynamic not only describes and categorizes *market shaping roles*, highlighting the unique mechanisms underlying market creation, but also sheds light on the differing impacts generated by these approaches.

These findings help bridge the gaps in market-shaping research applied to sustainability-oriented markets (Nenonen & Storbacka, 2021; Sheth & Parvatiyar, 2021) by identifying a systematic and structured approach by which companies - based on their long-term vision - act to address peculiar barriers of sustainable markets.

Table 3: Systematization of the intersection between the impact of control points on firm value dynamics and their role in overcoming market constraints

Market Shaping Role	Shaping Mechanisms	Control Points	Dynamic	Market constraints tackled
Market Driver	Infrastructural Upgrade	• Specific Infrastructure • Scalability	Value Creation	Limited availability of low-carbon substitute High production costs Lack of distribution system Harmonious growth of the whole value network
	Branching out	• Networking • Orchestration	Value Capture	
Market Supporter	Collaborative R&D	• Unique solution • Know-how	Value Creation	Need for new technological components Need for replacement of facilities
		• Brand • Customer Access	Value Capture	
Market Missionary	Sustainability Symbiosis	• Agility • Demand Catalyst	Value Creation	Uncertain demand and waiting games Higher output price point Lack of a clear regulation
		• Environmental Regulation • State intervention	Value Capture	

5.2) Contribution to theory

Our findings firstly contribute to the literature on the agency role that firms can exercise to shape new markets to promote sustainable transition.

The literature on sustainable transitions highlights the role of firms as key actors driving systemic changes. Firms, developing new products, services, and business models, contribute to market creation for emerging technologies, and facilitate the establishment of new industries (Rosenbloom et al., 2016; Berggren et al., 2015; Turnheim and Geels, 2013; Geels and Verhees 2011). Despite the recognition of firms as one of the central agents in transition processes, the intersection of sustainable transition research—viewed as a systemic process—and organizational and managerial studies remains relatively underdeveloped (Köhler et al., 2019).

Scholars therefore emphasize the untapped potential of intensifying research at the intersection of sustainable transition studies and managerial research (Farla et al., 2012; Musiolik et al., 2018).

Drawing on market-shaping literature, this study positions the firm as an active driver of systemic changes. Our findings identify strategic and operational levers that go beyond corporate sustainability or adaptive strategies. From a corporate perspective, the research explores the manner in which firms can act as catalysts for green market formation addressing the foundational processes of creating new markets. Furthermore, leveraging the control point perspective, this study highlights critical ecosystem points that are essential for the evolution of new value networks and the mechanisms of value capture—key conditions for firms to drive transition processes while maintaining competitive equilibrium. By integrating a managerial lens (e.g., market-shaping roles and control point perspectives) with a systemic dimension derived from transition studies, this research sheds light on how companies trigger systemic transitions and identifies levers firms can use to effectively steer these processes.

Secondly, our study offers a more detailed understanding of the functioning and unique characteristics of various market-shaping roles. Recent studies have emphasized the need to explore the diversity of actions and approaches employed by market shapers (Kohli and Jaworski, 2023), highlighting that the literature remains quite broad and vague regarding market-shaping actions companies undertake in sustainability contexts (Nenonen & Storbacka, 2021). By presenting a case study that illustrates the initiatives undertaken by market shapers in developing a sustainable market, we help bridge this gap by providing detailed evidence of the mix of actions needed to balance systemic value creation and profitability (Sheth & Parvatiyar, 2021; Köhler et al., 2019; Stathakopoulos et al., 2022). By doing so, our study contributes primarily by characterizing the distinctive dynamics of each market-shaping role with greater precision. We identified the propensity of Market Drivers to operate across the entire value network, the cautious approach of Market Supporters focused on limited initiatives in value networks' layers further from their core business and the Market Missionaries' strategy, which entails a strong anchoring to the value network segments closest to

their business domain. These findings build on the categories provided by Flaig and Ottosson (2022) to broad the different market-shaping roles in forming new sustainable markets. In so doing our results contribute to the literature providing the disentanglement of the composite process of market shaping and thus fill the gap highlighted by recent research (Storbacka et al., 2022; Nenonen & Storbacka, 2021) on the limited applicability of the market-shaping literature within the sustainability context.

Finally, our study contributes to the control point perspective by applying it outside a digital, profit-oriented market to a physical, sustainability-oriented context. This not only responds to recent calls (Bohnsack et al., 2024) to further enhance the explanatory power of this theoretical perspective, but also helps address the sustainable transition challenge with a more critical and concrete approach: firms that can lead the transition need to understand how it can be pursued in alignment with a profit-oriented economic model. Understanding how a sustainability-oriented market can also reinforce competitive positioning is fundamental to maximizing the engagement of multiple economic actors.

5.3) Implications for companies, policymakers, and further research

Our research contributes to the critical discussion on transforming production and consumption paradigms to address the climate crisis. Sustainability-driven markets are emerging across sectors, such as electric mobility, renewable energy, and sustainable construction. Our study focuses on one of these emerging markets and offers insights that could apply to other contexts.

The critical importance of our setting is highlighted by EU policies that aim to foster green hydrogen development as part of a broader energy transition and decarbonization strategy, with substantial funding allocated at both EU and national levels. However, EU institutions themselves recognise that while government action is essential, sustainable transitions require the engagement of multiple stakeholders.

The implications of this study are useful to foster firms engagement into emerging sustainability-oriented ecosystem. Companies seeking to engage in market-shaping initiatives can leverage our framework to strategically evaluate resources, identify

value-generating opportunities, and navigate control points to secure sustainable competitive advantage. By integrating the control points lens within sustainable market shaping, the framework offers a new perspective that encourages firms to explore market positions beyond their traditional core activities, and to thus reveal opportunities for substantial long-term value creation and capture.

Like any study, ours has its limitations. These include the qualitative nature of our findings, which are based on nine case studies. Future research should investigate the control points and positioning mechanisms in other sustainable emerging markets. Furthermore, our analysis did not address the roles of firms that resist or actively hinder change to preserve the status quo. Further studies could explore how such firms operate, the control points they leverage, and how their positioning strategies either interact with or oppose the market-shaping roles examined in this study.

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Emergence of Circular Service Ecosystems: A Multiple Case Study

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Extended abstract

In the quest for long-term viability and circularity, many organizations implement circular services as an alternative for, or addition to, linear consumption offerings. Think about manufacturers of electronic devices that launch take-back services (e.g., www.recycling.dell.com) and retailers of sports and outdoor materials that offer repair and maintenances services and even experiment with rental services (e.g., www.asadventure.com). Next to that, a wide range of new businesses with circular service offerings emerge, such as sharing platforms for campers (e.g. www.goboony.com) and rental services offering children's toys (e.g. www.tinylibrary.nl). These services build upon a circular logic instead of a linear logic, hereby keeping products and materials in use (De Bruyne and Verleye, 2023).

Regardless of their form, the introduction of a circular service is accompanied by the emergence of new ecosystems around the circular service. These circular service ecosystems are service ecosystems with resource-integrating actors exchanging service in which (material, intellectual, digital, and financial) resources are saved, extended and/or (re)generated in order to co-create circular value and enhance the well-being of the ecosystem as a whole (Fehrer et al., 2023; Karpen et al., 2023; Vargo et al., 2023).

With multi-actor engagement being key for a circular economy, service researchers underline the importance of a systemic view in circular economy research, encompassing multiple actors (customers, competitors, suppliers, governments, and others) and their circular value co-creation efforts (Fehrer et al. 2024, Vargo 2021, Verleye et al., 2024). Furthermore, Karpen et al. (2023) state that circular service ecosystems require

coordination, which implies that managers need guidance on how to engage resource-integrating actors in circular service ecosystems to succeed in value co-creation. Yet, there is still a limited understanding of the practices that underlie the emergence of a circular service ecosystem (Fehrer et al., 2023; Vargo et al., 2023; Verleye et al., 2024). Hence, further research is needed to understand how circular service ecosystems emerge.

Drawing from service-dominant logic, service ecosystems emerge from ad-hoc resource integration and service exchanges that lead to the appearance of novel outcomes. Over time, these resource integrations and service exchanges become routinized practices, up to the point that they turn into institutions (Vargo et al. 2023). Yet, a key question revolves around the organizational practices that contribute to the emergence of circular service ecosystems. Inspired by Löfberg et al. (2025), we investigate these practices by building upon practice theory and the interplay between practice, practitioners, and praxis. By looking at *praxis*, i.e. the actual activities performed (Reckwitz, 2002), we aim to unravel the practices that lie at the basis of the emergence of circular service ecosystems. Here, *practices* are the instructions or templates, characterized by an iterative nature, that actors follow to engage and co-create value in circular service systems. *Practitioners* refer to the individuals involved in concrete work in the circular service ecosystem, such as customers, competitors, suppliers, governments, and others. Yet, the instructions embedded in practices can be interpreted differently among practitioners, resulting in different praxis across organizations (Löfberg et al., 2025).

To better understand how organizational practices shape the emergence of circular service ecosystems, we performed a multiple case study for which we selected six companies based on maximal variety in terms of circular service offering type, industry, size, and scope, including both established businesses and new ventures. All cases participate in the Green Deal Renting and Sharing (https://vlaanderen-circulair.be/en/cases/detail/green-deal-renting-and-sharing), which is a living lab to strengthen the rental and sharing sector supported by the Flemish Government in Belgium. Data collection took place by doing in-depth interviews with key informants of the organizations regarding the circular service offering. Additionally, we have engaged in observations during the events organized by the Green Deal: Renting and Sharing. This information was complemented with secondary data from their websites and publicly available company documents. The data was analyzed in detail following an abductive logic.

Focusing on the practices that contribute to the emergence of circular service ecosystems, our research identifies (1) shaping connections for circularity and (2) sustaining connections for circularity as two overarching practices to guide the management of actors in circular service ecosystems for long-term circular value co-creation. The former refers to a group of practices that intentionally bring about, enable, and coordinate circular value co-creation among all resource-integrating actors in the circular service ecosystem (Kelleher et al., 2019; Vink et al. 2021). The latter encompasses practices that purposively maintain the

collective of competent actors over time to create and change institutions (Kelleher et al., 2019; Vargo et al., 2023). Specific to service ecosystems around circular offerings is the increased responsibility of the customer in the value cocreation process, think about returning the products on-time and in good condition. Here, the findings show that practices related to monitoring and trust-building are present in all cases. Next to that, all cases are characterized by organizational efforts to indirectly attract new customers, as they, next to promoting their own circular offerings, also invest in increasing general awareness in society regarding sustainable consumption. In line with Provan & Kenis (2008), remarkable differences among the cases are related to the governance of the circular service ecosystem. Next to one focal organization taking the lead in governing the ecosystem, our data also shows examples of shared governance among multiple organizations in the circular service ecosystem, as well as of one organization taking on the role of connecting multiple actors in the circular service ecosystem without being further involved in the circular service offering. In short, the findings emphasize the need for systemic coordination and long-term partnership building for successful circular value co-creation.

This research contributes to the conference track on 'Ecosystems in Support of Sustainability' by taking on a system perspective and unraveling the practices underlying the emergence of circular service ecosystems. The present research makes a number of important contributions to the academic literature. Firstly, the investigation of organizational practices linked to the emergence of circular service ecosystems advances the conceptualization of circular services, which was initiated by Karpen et al. (2023). Furthermore, this research adds to the stream of (circular) service ecosystems (Fehrer et al., 2023; Vargo et al., 2023), as the concepts of practices, practitioners, and praxis facilitate a better understanding of the actual day-to-day activities. Next to that, by taking into account the interplay between these concepts, this research further uncovers the complex nature of (circular) service ecosystem emergence without neglecting different praxis across organizations.

From a managerial perspective, the identified practices support managers in enabling the emergence of circular service ecosystems to co-create circular value through partnerships between resource-integrating actors. Furthermore, on a societal level, circular service ecosystems form part of sustainable cities and communities, also having the potential to enable and facilitate responsible consumption and production patterns.

Keywords

circular service ecosystems, emergence, service-dominant logic, practice theory

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The Consumer Prism in Circular Ecosystems: Navigating the Multi-Level Maze of Circular Economy Transitions

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Extended abstract

The global economy faces severe challenges from escalating environmental degradation, resource scarcity, and economic instability (Nguyen et al. 2023). Unsustainable consumption, wasteful production, and the impacts of climate change have led to pollution, biodiversity loss, and the depletion of natural resources, underscoring the urgent need for sustainable solutions (Bocken and Short 2021; Arora and Mishra 2023). The traditional linear economic model, with its "take-make-dispose" approach (Kirchherr et al. 2023), has proven unsustainable, driving calls for a transformative shift toward a Circular Economy (CE) (Geissdoerfer et al. 2017; Lüdeke-Freund et al. 2019). CE represents a regenerative economic framework that decouples growth from resource consumption and environmental harm, emphasizing the continuous use and renewal of materials within closed-loop systems (D'Angelo et al. 2023). This alternative approach directly counters the resource-intensive, waste-generating nature of the linear model, offering a path to long-term sustainability (Korhonen et al. 2018; Bocken et al. 2019).

Despite the importance of CE, the transition is hindered by systemic barriers such as the contested nature of circularity goals, inadequate knowledge diffusion, and challenges in scaling circular innovations (Coenen et al. 2023). Barriers to CE are interwoven, with

dependencies across managerial, market-related, financial, technical, and regulatory aspects. Ignoring these dependencies can lead to suboptimal solutions and unsuccessful projects, highlighting the need for a systemic approach to untangle these complex interrelations (Jensen et al. 2022).

A systemic and holistic approach is crucial for achieving a successful transition to CE (Ahmadov et al. 2024). For instance, a holistic approach emphasizes societal inclusion, recognizing the importance of collaboration at the societal level to strengthen the CE transition. This includes addressing aspects like consumer behaviour, corporate involvement, and governance measures (Liu et al. 2023). Holistic approach helps identify critical success factors across various domains, ensuring a comprehensive CE implementation framework (Koc et al. 2024). Moreover, systemic thinking facilitates the alignment of policies, technologies, and consumer behaviours with circular principles (Luukkonen et al. 2024). Without a holistic perspective, efforts to implement CE risk being fragmented or insufficiently integrated into broader socio-economic systems.

Ecosystem thinking offers valuable insights into how various stakeholders can align, interact, and collaborate to gain competitive advantage, foster innovation, and enhance business productivity (Adner 2016; Jacobides et al. 2018). Stakeholders in a circular ecosystem include businesses, suppliers, customers, research centers, and public authorities, each playing specific roles to support the system (Zucchella and Previtali 2019), whose collective actions shape sustainability outcomes (Audretsch et al. 2018). A focal actor often orchestrates the network, ensuring effective collaboration and innovation among participants (Zucchella and Previtali 2019). By adopting an ecosystem lens, researchers can examine how these actors mobilize resources, share knowledge, and co-create value in pursuit of circular objectives (Adner 2016). This perspective also underscores the importance of adaptability and governance in fostering resilient ecosystems capable of addressing sustainability challenges (Stam and van de Ven 2021).

Stakeholder interactions play a pivotal role in shaping the dynamics of CE transition. Effective collaboration among stakeholders can accelerate the adoption of circular practices by facilitating knowledge exchange and innovation (Schultz et al. 2024). However, current research on consumer roles in CE transitions remains limited (Carreira et al. 2023). While consumers are often viewed as passive recipients of circular initiatives (Duarte et al. 2024), their potential to drive systemic change is significant (Vidal-Ayuso et al. 2023) but not fully understood. Against this background, this research aims to centre the consumer in the CE transition, examining how consumers both influence and are influenced by various stakeholders from an ecosystem perspective. The primary objective is to map the complex interactions between consumers and other actors in wider CE, identifying key leverage points for accelerating the transition. The study seeks to answer: How do consumers catalyse or hinder the transition to circular economy, and how are they in turn shaped by the evolving CE landscape?

Addressing the research gap requires comprehensive frameworks that capture the multidimensional and interconnected nature of consumer engagement in CE ecosystems. The integration of Multi-Level Perspective (MLP) and Stakeholder Theory provides a robust framework for studying consumer roles in CE transitions. MLP analyses socio-technical transitions across three levels: macro (landscape), meso (regime), and micro (niche) (Geels 2011). This framework enables researchers to explore how consumers influence—and are influenced by—broad societal trends, established practices, and emerging innovations within ecosystems. Stakeholder Theory complements MLP by examining bidirectional relationships between consumers and other ecosystem actors (Freeman et al. 2010). Together, these frameworks offer a comprehensive lens for understanding consumer interactions at multiple levels while highlighting their impact on systemic transitions.

A systematic literature review (SLR) is well-suited for this study due to its rigorous methodology for synthesizing existing knowledge. SLR enables researchers to identify patterns, gaps, and contradictions within the literature while ensuring transparency and replicability (Snyder 2019). By employing bibliometric analysis and thematic synthesis techniques, this study aims to develop conceptual frameworks that elucidate consumer roles in CE ecosystems. The integration of MLP and Stakeholder Theory within the SLR framework will provide nuanced insights into how consumers interact with other actors across different levels of analysis.

This research is expected to make several contributions to the literature on CE transitions:

- By integrating MLP and Stakeholder Theory perspectives, this study will enhance theoretical understanding of consumer roles within CE ecosystems.
- The research will provide a detailed mapping of consumer interactions with other ecosystem actors at macro-, meso-, and micro-levels.
- Findings will inform strategies for engaging consumers in circular practices while identifying leverage points for accelerating transitions.
- The study will offer actionable recommendations for policymakers seeking to foster collaborative governance structures that support CE initiatives.

Keywords

Circular Economy; Ecosystem Perspective; Consumer Engagement; Stakeholder Interactions; Multi-Level Perspective; Systematic Literature Review.

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Overcoming Barriers to Circular Economy Adoption in SMEs: Development and Validation of a Digital Guidance Tool for the Implementation of Circular Economy

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Extended abstract

The prevailing linear economic model, characterized by the rapid devaluation of end products after consumption (Bomsma et al., 2019), and focused on revenue generation through product sales (Achterberg et al., 2016), has resulted in unsustainable resource consumption. In Austria, as globally, over 90% of the economy remains linear (Circle Economy & ARA, 2019), leading to resource depletion, escalating commodity prices, and transgression of planetary boundaries (Steffen et al., 2015). The transition to a circular economy (CE) (The Ellen MacArthur Foundation, 2015) is therefore critical.

The CE, based on the principles of narrowness, slowness, closeness, and regeneration (Konietzko et al., 2020; Potting et al., 2017), encompasses ten strategies for reducing primary resource consumption, hierarchically assigned to life cycle phases based on value preservation (Achterberg et al., 2016). While CE's potential is widely discussed (Uhrenholt et al., 2022), its operational implementation

remains insufficiently understood, often perceived solely as recycling. The complexity of CE transformation, requiring coordination across the supply chain (Holly et al., 2023), presents significant challenges, particularly for Small and Medium-sized Enterprises (SMEs). Large companies dominate CE investment plans, while SMEs, comprising over 99% of Austrian companies and 66% of its employees (Statistik Austria, 2021), often remain sceptical (ARA, 2020).

This research addresses the barriers for CE adoption in SMEs, focusing on the need for bespoke information and knowledge building as well as the capacity to translate CE principles into specific business processes (Ormazabal et al., 2018; Rizos et al., 2016; Thorley et al.). Key obstacles include administrative and regulatory hurdles, lack of government support, time and personnel constraints in seeking circular solutions, inadequate understanding of CE benefits, technological limitations, weak supply chain positions, and insufficient financial resources (Averina et al., 2022; Baratsas et al., 2022; Chrispim et al., 2023; Roos Lindgreen et al., 2020; Valls-Val et al., 2022). Existing international CE assessment tools (e.g., Ellen MacArthur Foundation's Material Circularity Index and Circulytics, World Business Council for Sustainable Development's Circular Transition Indicators, etc.) often lack adaptation to SME-specific characteristics (size, industry, management level, etc.), standardized key indicators, clear operationalization of CE principles, and actionable recommendations.

Methodology

To overcome these limitations, a solution-oriented digital approach—a "Circular Economy Compass"—was developed using a design science approach (Hevner et al., 2004). Following the process model of Peffers et al. (2007), the development involved six phases:

1. **Problem identification:** A systematic literature review and environmental analysis (Kitchenham BA & S. Charters, 2007) identified existing CE assessment tools and the challenges faced by SMEs in their CE transition.

2. **Target definition:** Workshops with SMEs established requirements for a low-threshold, SME-tailored assessment tool.

3. **Design and development:** The Circular Economy Compass was designed as a digital self-assessment tool accessible via an online questionnaire, providing circularity scores (KPIs), actionable recommendations, and practical examples, available for download in PDF format. The tool links digitalization and CE, addressing intelligent resource use, extended product lifecycles, and recycling.

4. **Demonstration:** The Compass was presented to a select group of experts and stakeholders for feedback and refinement. Trials and case studies assessed usability and efficacy.

5. **Validation:** A three-phase validation process (Cloquell-Ballester et al., 2006) involved self-validation by the consortium, expert validation ensuring objectivity, and company validation to ensure quality and transparency.
6. **Refinement:** Findings from the demonstration and validation phases were used to refine and optimize the Compass, ensuring continuous improvement and adaptation to SME needs.

Results

The “Circular Economy Compass” provides a low-threshold introduction to CE for SMEs, raising awareness, translating abstract concepts into practical applications, and facilitating the implementation of CE measures. It systematically identifies CE potential across the product lifecycle, encompassing intelligent resource use, service life extension, and recycling. The tool encourages collaboration and networking, fostering the development of resource-efficient supply chains and enhancing SME competitiveness. It addresses the challenge of integrating CE into management practices by framing it as a strategic management issue concerning risk and innovation and overall, serves as a learning tool to build up knowledge in SMEs.

The main focus lies on manufacturing SMEs due to their higher raw material intensity. However, the compass utilizes a flexible framework applicable across various sectors. The tool highlights five key internal fields of action for SMEs based on existing literature (Konietzko et al., 2020; Evans and Bocken, 2014; Vermeulen et al., 2019; Ellen MacArthur Foundation, 2015; Walcher and Leube, 2017): circular product development; purchase of recyclable materials; resource-efficient production; product utilization extension; and product-service systems. The Compass directly links CE to climate protection by referencening to its potential to reduce greenhouse gas emissions (UNEP/IRP 2019; Geissdörfer et al., 2018), also addressing the risk aversion often associated with SME's adoption of CE initiatives (Rizos et al., 2016).

Conclusion

The Circular Economy Compass represents a significant contribution to bridging the gap between the theoretical understanding of CE and its practical implementation in SMEs. By offering a user-friendly, adaptable, and actionable tool, it addresses the critical need for SME-specific resources and support, ultimately promoting sustainable economic growth and environmental stewardship. The project directly addresses the Austrian government's CE and climate neutrality objectives. Further research could explore the long-term impacts of Compass usage, including the quantitative effects on resource consumption, emissions, and SME competitiveness.

Keywords

Circular Economy (CE), Circular Economy Ecosystems, Small- and Medium-sized Enterprises (SMEs) , Collaboration, Digital Guidance Tool , Implementation Barriers , CE Assessment Tools, Sustainable Business Practices , Innovation in SMEs

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Investigating Sustainable Business Model Interactions in the EV Lithium ion battery ecosystem: A Norwegian context

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Extended abstract

The road transport sector is transitioning towards electrification. In Norway, this transition has been significant because of the sustainability trends and policy incentives favoring electric vehicles (EVs) such that 89% of all new cars sold were fully electric in 2024 (Adomaitis, 2025). EVs typically use lithium-ion batteries (LiBs) valued for their high density and capacity. A LiB is generally retired from an EV once it reaches 70%-80% of its capacity, which consequently starts its 'second-life'. The materials present in LiBs are hazardous and if treated irresponsibly after their first end of life (fEOL), can result in increased pollution and safety concerns (Jiao and Evans, 2018). Bõrner et al. (2022a) propose a sustainable circular model that illustrates the different pathways a LiB can take after its fEOL such as repurposing, reusing, and remanufacturing before it is eventually recycled. Repurposing batteries in second-life applications (SLB) typically in energy storage systems (ESS) in household or industrial contexts can potentially prolong the battery life and give additional time for recycling technologies to develop further (Ahmadi et al., 2014; Albertsen et al., 2021; Ali et al., 2021; Hansen and Schmitt, 2021). This can potentially fulfill the increasing energy storage demand and lead to additional revenue streams (Wu et al., 2020).

The challenges related to the second life batteries include but are not limited to variable battery designs, inefficient recycling processes, feasibility of repurposing processes, lack of collaboration between stakeholders, and policy regulations (Börner et al., 2022b; Melin, 2018; Reinhardt et al., 2019; Wrålsen et al., 2021a). These challenges need improved collaboration among stakeholders across the battery value chain, calling for a more holistic understanding of their roles and interdependence, whereby using an ecosystem lens can be pertinent (Asgari and Asgari, 2021). An ecosystem perspective considers multiple actors including and beyond the battery value chain, such as policy makers or non-governmental organizations. These actors are typically present in a value creation network collaborating, complementing or competing with one another (Pietrulla, 2022). The emerging ecosystem of EV LiBs is especially complex because of numerous actors- over 40 types approximately- that are working or can work together (Stefan and Chirumalla, 2025).

Developing sustainable business models (SBMs) comes forward as a possible approach to mitigate the challenges for the second life of the EV LiBs. Unlike traditional BMs that focus mainly on the economic value, SBMs also include social, environmental and intellectual considerations, and can potentially make repurposed EV LiBs viable (Geissdoerfer, 2018; Reinhardt et al., 2019). Moreover, SBMs exist in an institutional context and interact such that a change in one firm's business model can create a change in another firm's business model. For example, the research from Bocken et al. (2019) shows that these interactions can be neutral, competitive, or symbiotic. Mitigating the barriers for these interactions can increase the overall positive value at both the firm and ecosystem level. However, there remains paucity about this in the literature, especially concerning the EV LiB ecosystem.

Mapping the EV LiB ecosystem can thus contribute to understanding how the multiple SBMs of the stakeholders interact systemically (Bocken et al., 2016; Cheng et al., 2022; Wrålsen et al., 2021b; Zulkarnain et al., 2014) and whether it can lead to business model innovation. However, the current research has mostly focused on the economic and technical aspects of battery circularity without considering BM elements and their interactions that exist at both firm and value chain level (Ahmed et al., 2023). Thes interactions could include, for example, contractual agreements between the stakeholders, value chain activities such as sourcing and delivering the fEOL batteries, applications of different financial models, and influence of policy and regulations.

This study maps the EV LiB ecosystem in Norway with an aim to get a deeper insight into the SBM interactions taking place and understanding the drivers and barriers that can influence them. It addresses the following primary research question: *How do SBMs interact in an emerging EV LiB ecosystem?*

A case study is used as a research method and the data is collected through workshop, semi structured interviews with the stakeholders in the EV Lithium ion battery ecosystem in the Norwegian context, and document analysis. Semi-structured interviews are suitable to gain a deeper insight into a phenomenon (Miles and Gilbert, 2005; Weiss, 1994), while workshops can assist in conceptualizing and dealing with complexity, and can assist in inclusion of multiple perspectives (Geissdoerfer et al., 2016). The interview trasncripts are systematically coded and different themes are identified. This can help in identifying different patterns of SBM interactions in the ecosystem. Afterwards, the respondents will be invited for a second interview to review the preliminary findings and increase the reliability of the study. The ecosystem stakeholders central to the the study include battery manufacturers, EV retailers, used battery collectors, second-life battery repurposers, municipalities implementing EV transport systems, energy storage system companies (repurposed batteries, and/or recyclers etc.) and policy makers. While the ecosystem is analyzed holistically, the focus of the study is on the battery repurposers.

The preliminary results from the study show that the actors present in an emerging Norwegian EV LiB ecosystem collaborate at different levels; some actors have established contractual agreements with partners where there is more active engagement, for example by sourcing the second-life batteries from one established original equipment manufactuer (OEM) while the other actors do not have set contractual agreements, for example they sell the fEOL batteries directly to consumers. There is also an increased uncertainty because of the dynamic market and regulatory landscape, where new actors are emerging while others are exiting. Moreover, the roles of actors in the ecosystem are not yet clarified, which creates challenges with collaboration and partnerships. In line with the study by Bocken et al. (2019) concerning SBM interactions, the preliminary results of this study also indicate that SBMs in the EV LiB ecosystem are interdependent, and how they interact can lead to either positive or negative value for the individual firms and for the ecosystem. Other challenges are also highlighted in the results such as reduced prices of new EV LiBs, increased repurposing cost due to battery design variability and state-of-health testing, and lack of trust between stakeholders when it comes to battery data sharing. However, data collection for the study is ongoing and further interviews are yet to be conducted that may provide a better picture of the ecosystem.

The contribution of the study is thus expected to be threefold: First it will contribute towards theory development for SBMs and the second-life of EV LiB from an ecosystem perspective, secondly it aims to map the emerging battery ecosystem in Norway and clarify stakeholders roles, their business models, and how they interact, expanding on the literature about the types of SBM interactions and the value they produce at both firm and ecosystem level. Identifying barriers and drivers for these interactions can then potentially lead to increased feasibility of the second life batteries. Thirdly it aims to help policy makers to identify the regulatory barriers present in the battery value chain and provide guidelines on how they can be mitigated through different policy interventions such as tax incentives to lower down repurposing costs.

Keywords

Electric Vehicles, Lithium ion batteries, Sustainable Business Models, Ecosystems, Business Model Interaction

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Balancing Tensions: Ecosystems for Safe-and-Sustainable-by-Design (SSbD) in the Dutch Chemical Industry

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Extended abstract

Context and Rationale

The chemical industry in contemporary society has a two-sided character. On the one hand, it generates much of the building blocks for products considered essential to modern life; on the other hand, it is a source of significant environmental challenges that cannot be overlooked, such as pollution and hazardous waste (Barnosell & Pozo, 2023; Vaz Jr & de Souza, 2024). Producing chemicals emits huge amounts of greenhouse gases, leading to climate change, ocean acidification, and biodiversity loss (Barnosell & Pozo, 2023). When these chemicals leak to the environment, they pose severe risks to human and environmental health, sometimes leading to the transgression of planetary boundaries (Persson et al., 2013).

Facing pressure to address their negative environmental impacts, the chemical industry has sought inspiration from innovations around sustainable chemistry, green chemistry and circular chemistry. These build on ideas of waste prevention, safer synthesis, and energy efficiency, among others, in the design of chemical products and processes (Prabitha et al., 2024). In parallel with this, however, is a surge in the development of new chemicals and materials, which are becoming widespread as *novel entities* in daily life, with potentially disruptive and long-lasting effects on the Earth system (Melymuk et al., 2022; "Novel Entities: Crisis Unknown," 2022). One example that has come under intensive scrutiny in the past years is "forever chemicals" (i.e. per- and polyfluorinated substances (PFAS)). PFAS are highly resistant to degradation and can persist in the environment for a very long time, leading to bioaccumulation, health issues (e.g. cancer, hormonal disruption), and damage to aquatic and terrestrial ecosystems (Nasr, 2024; Sahoo et al., 2023).

To address this, "Safe and Sustainable by Design" (SSbD) is gaining traction as a holistic approach that would mitigate the environmental and social impacts of the chemical industry (Apel et al., 2024; Leso et al., 2024). Drawing from "Safe-by-design" and "Sustainable-by-design" (Reins and Wijns, 2024), SSbD takes a proactive, lifecycle-based approach to the design and development of (novel) chemicals, materials, and products. Rather than leading to a future society where we are surrounded by a myriad of novel entities, SSbD promises a toxic-free environment, a circular economy, and a more sustainable future (Furxhi et al., 2023).

Effective implementation of Safe and Sustainable by Design (SSbD) demands a coordinated, system-level approach (Soeteman-Hernandez et al., 2024) that integrates diverse stakeholders across complex value chains and business ecosystems. These stakeholders include industry players, policymakers, researchers, and societal organizations. Aligning these stakeholders behind SSbD is a challenge, as differences in incentives, perceived benefits and costs, and underlying values can create tensions that hinder collective action.

To examine this challenge, we can frame SSbD as a shared, value-adding goal—or alternatively, the "value proposition"—within various innovation ecosystems. An innovation ecosystem is "the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors" (Granstrand and Holgersson, 2020). In this study, we will uncover the tensions, uncertainties, and trade-offs that ecosystem actors encounter when implementing SSbD and propose strategic approaches for addressing these challenges.

Research Approach

To capture the complexities of SSbD ecosystems, this study employs a qualitative case study approach. Cases are drawn from diverse contexts within the chemicals-materials-products continuum, focusing on the Dutch (Global North) context, which in turn is influenced by SSbD developments at an EU (European Union) level. Data collection includes semistructured interviews with ecosystem actors, analysis of policy and industry documents, and focus group discussions to observe the dynamics between diverse kinds of stakeholders.

The case studies envisioned for this study are shown in the table below:

Table 1. Envisioned case studies on the chemicals-materials-products continuum.

Case	1	2	3	4

Title	Developing chemical substitutes: high throughput screening and production	Plasma-based alternative process for acrylonitrile production	Safe-by-design circular products: mattresses, biobased plastics, etc.	SSbD framework development
Position in Continuum	Chemicals & Materials	Production Processes	Products	Full continuum
Ecosystem	Research consortium around SSbD alternatives to persistent, mobile, and toxic substances (PMTs) and other substances of concern (*universities, governmental bodies, society*)	Innovation ecosystem around the development of a plasma-based production process (*universities, chemical companies, local government, NGOs, society*)	Design ecosystem of product designers, process engineers, material selection experts who collaborate and co-create for new product design and development	Quadruple helix stakeholders (*academia, industry, government, and society*) jointly developing a framework for SSbD

Expected Findings

Based solely on its intentions, SSbD is a compelling instrument for sustainability. In practice, however, we anticipate that its implementation would be fraught with challenges that stem from the complexity of aligning ecosystem actors, for instance their differing understandings and definitions of safety, sustainability, and circularity. This would be further complicated by differences arising from an analysis of chemicals vs. materials vs. products vs. production processes. Other expected tensions include conflicting priorities between short-term economic gains and long-term sustainability goals, as well as variability in regulatory frameworks that could create uncertainty for ecosystem actors. Additionally, disparities in access to resources, knowledge, and capabilities could further exacerbate misalignment within the ecosystem, particularly for smaller or less-resourced stakeholders.

Alignment with the Conference

The transition to Safe and Sustainable by Design is not merely a technical or organizational challenge but a systemic one that requires a reimagining of ecosystems. This research will highlight the critical role of ecosystem actors in shaping the pathways to SSbD adoption, emphasizing the need for alignment and collaboration among diverse stakeholders. By identifying and analyzing the tensions, uncertainties, and collaborative mechanisms within these ecosystems, the study seeks to provide actionable insights for stakeholders navigating the complexities of sustainability transitions. Ultimately, fostering alignment within

ecosystems will be essential to realizing the full potential of SSbD and addressing pressing global challenges.

Moreover, this work will shed light on a very important context: chemicals, the backbone of global manufacturing. The chemical industry operates within a highly interdependent network, where decisions in one part of the system influence others. This complexity makes an ecosystem perspective particularly useful for understanding how actors can align toward SSbD adoption, and how the ecosystems they operate in can be structured and managed to drive sustainability transitions. Beyond contributing to theoretical insights, the study will also provide practical guidance for practitioners by identifying key challenges—such as tensions, uncertainties, and trade-offs—and proposing solutions that support sustainable business models, future competencies, and capacity-building initiatives. Ultimately, this research seeks to contribute to the broader understanding of how ecosystems can foster new business models and sustainable innovations (in the chemical industry), in line with the objectives of **Track 1.2.**

Keywords

Safe-and-sustainable-by-design, ecosystem tensions, decision-making, chemicals-materials-products continuum

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Paths to Sustainability: Comparing Stakeholder and Literature Perspectives on Plastics Sustainability

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Extended abstract

Currently society is largely in agreement that we need to shift to a more sustainable system in order to mitigate climate crises (United Nations, no date; European Commission, 2019). Creating a sustainable society, is not a quick and easy transition but more of a wicked problem (Rittel and Webber, 1973; Frantzeskaki, Loorbach and Meadowcroft, 2012; Jonker and Faber, 2021). Due to its complexity, there is not one quick-fix solution, thus several strategies are necessary and it is important to have actors aligned on these strategies (Adner, 2017; Tessitore, Corsini and Iraldo, 2023). This is no different for the plastics ecosystem (Milios *et al.*, 2018; van der Vegt *et al.*, 2022). The plastic ecosystem includes actors that have an influence on and/or are influenced by the plastic value chain. Literature describes strategies to a circular economy for plastics, however, a holistic approach is missing. Some studies focus on policies to shift to a circular plastic value chain (Foschi and Bonoli, 2019; Çevikarslan, Gelhard and Henseler, 2022), others emphasize technical innovations in the material chain (Aristi Capetillo, Bauer and Chaminade, 2022; Zhu *et al.*, 2022;

Schultz and Reinhardt, 2023). Moreover, the scope of research largely differs between studies, where some focus on the direct supply chain(Milios *et al.*, 2018; Johansen *et al.*, 2022; Bachmann *et al.*, 2023), and others consider some actors in the larger ecosystem as well (Moad and Solomon, 2021; Çevikarslan, Gelhard and Henseler, 2022; van der Vegt *et al.*, 2022; Stumpf, Schöggl and Baumgartner, 2023). Research sometimes focuses on barriers and enablers (Milios *et al.*, 2018; van der Vegt *et al.*, 2022), whereas others only discuss the barriers (Bening, Pruess and Blum, 2021). There are also reports in grey literature that highlight different pathways for plastics in the future (SYSTEMIQ, 2022).

Through all these strategies, one of the underlying goals is improving quality aspects across the chain, resulting in more recycled plastics being able to be used in applications such as plastic packaging. Quality is perceived differently by different actors (Eriksen *et al.*, 2018; Demets *et al.*, 2021; Tonini *et al.*, 2022; Molenbuur *et al.*, 2025). While there is evidently a continuous debate on the topic of improving the plastic system for a sustainable future, there have been only few attempts to investigate the actual actor perceptions in comparison to existing strategies to move forward (Milios *et al.*, 2018; Siltaloppi and Jähi, 2021; van der Vegt *et al.*, 2022). However, the alignment of actors in the plastic ecosystem on circular strategies from a holistic perspective is still missing in literature. Moreover, in-depth research on how these actor perceptions compare to existing reports that describe pathways to move forward is also lacking.

To have a successful adoption of strategies and thereby transition to a more sustainable ecosystem for plastics, it is important to understand the level of alignment between this literature and actors' perception in the ecosystem. The aim of this research is twofold, firstly we aim to create an overview of perceived improvements necessary to improve the quality of plastics throughout the chain by actors in the ecosystem. To understand the actors' views on improvements, it is first also essential to acquire an understanding of their perceptions on quality of plastics. While this is studied for actors in the material chain (Molenbuur *et al.*, 2025), it is yet to be done for broader actors in the ecosystem such as governmental organizations, non-governmental organizations (NGOs), research institutes, start-ups and investors. Next, this study compares the perceived improvements from actors in the ecosystem to described improvements in existing studies and reports on pathways to a circular economy for plastics.

This research uses semi-structured interviews with actors in the ecosystem to acquire an overview of perceived improvements necessary in the ecosystem. We conduct a literature study on a compilation of existing reports and studies that describe future improvements in the system, such as (European Commission, no date; SYSTEMIQ, 2022; European Environment Agency, 2023).This compilation is composed based on input from several experts in the field on their most used documents as guidelines for the future of plastics.

In terms of practical implications, this research contributes to a better understanding of the alignment of actors in the ecosystem. With this overview of actor perceptions and existing reports, we provide suggestions on where alignment is necessary and

strategies that might have been overlooked by some actors in the ecosystem such as recommendations on policy, technical and communication recommendations.

From an academic perspective, this research is of interest since it takes a holistic approach, which has barely been done in existing research in the plastics ecosystem. Most studies only focus on actors in the direct material chain such as polymer producers, brand owners, and recyclers, and others consider organizations such as governments but still leave out other organizations in the system such as start-ups, investors, and research institutes. We include most of the actors that have a role in the plastic ecosystem.

Keywords

Circular strategies, plastic ecosystem, stakeholder alignment

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Theorizing The Emergent Field Of Young Impact-driven Innovators: Sustainability Entrepreneuring Ecosystem

A Short Paper Submitted to the NBM Conference 2025. 1.2 Ecosystems in Support of Sustainability.

by

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Abstract

Upon completing the research effort described in this submission (short paper), we will propose a framework for theorizing the sustainability entrepreneuring ecosystem, the social arena of young impact-driven innovators' practices, as the field, in the Bourdieusian perspective. The overlapping broader fields of economics, policy, and society also host fields and subfields, such as the emergent field of sustainability entrepreneuring, one of the key actors of which are young impact-driven innovators. They construe and construct their field, and it, in turn, shapes their practices. To construct the framework for theorizing the sustainability entrepreneuring ecosystem as the *field*, we employed Hoon's (2013) meta-synthesis methodology, which is the basis for building theory from qualitative case studies.

Keywords

sustainability entrepreneuring ecosystem, impact-driven enterprises, Bourdieu's field, Theory of Practice.

Introduction

This submission to the "1.2 Ecosystems in Support of Sustainability" track of the New Business Models Conference 2025 is a conceptual short paper. Upon completing the research effort described in this submission, we will propose a framework for theorizing the sustainability entrepreneuring ecosystem, the site of young impact-driven innovators' practices, as the *field*, in the Bourdieusian perspective. The overlapping broader fields of economics, policy, and society also host fields and subfields, such as the emergent field of sustainability entrepreneuring ecosystem, one of the key actors of which are young impact-driven innovators. They construe and construct their *field*, and it, in turn, shapes their practices.

Bourdieu's framework for analyzing social reality is particularly compelling when developing conceptual categories, constructs, or categories of analysis. He offers a set of interconnected concepts designed to be applied across diverse contexts, facilitating the study of everyday life in those contexts. Central to his Theory of Practice are the concepts of *habitus*, *field*, and *capitals*, complemented by notions of struggle and strategy. While *habitus* and *field* primarily, though not wholly, refer to the social structures, the concepts of *capital* [including the types of], *struggle,* and *strategy* highlight the agency of individuals, families, and social groups as they navigate and strive to influence their positions and advance their interests within various social fields. Furthermore, Bourdieu employed these concepts as a robust methodology for investigating practices as deeply social endeavors. Though these concepts come alive and generate meaningful insights through empirical investigation, the lack of theorizing attention to them in entrepreneurial and sustainability theories is surprising (Steyaert, 2007; Walsh et al., 2020). Moreover, this approach is conducive to transferring knowledge between scholarly fields, e.g., entrepreneurial ecosystems (Spigel, 2020; Stam & Van de Ven, 2021) and entrepreneurship as practice.

The ***young impact-driven innovators*** are enterprises constantly re/developing re/new/ed business models aiming to positively impact the environment and/or society through space-and-time-bound initiatives of value and impact creation. Hence, their impact is in the advancement (and promotion) of sustainability in and for (not 'of'!) their ecosystem. Sustainability is the what, the how, and the why of human activity on Planet Earth spanning over temporal, spatial, environmental, and societal dimensions with the aim of continuing to sustain social life on Earth through conservation and regeneration of the natural environments, as well as the harmony of living and non-living beings and objects. In this research, the enterprises are considered 'young' not by virtue of the usual rigid deterministic schemata, such as the one promoted by the Global Entrepreneurship Monitor, implying that the development of business models and ventures follow a strict time-line of milestones and stages (GEM 2023), but rather through understanding the

emerging, processual and relational nature of their business activities (Steyaert, 2007; Žebrytė & Jorquera, 2017).

The term ***sustainability entrepreneuring ecosystems*** fuses two largely practice-oriented areas of study –sustainable entrepreneurial ecosystems (SEEs in Theodoraki [2022]) with the entrepreneur**ing** perspective (Steyaert, 2007; Johannisson, 2011, 2018, 2023). There is an increasing body of knowledge in the scholarly tradition of the "Entrepreneurship as Practice" (EaP). It draws on a variety of onto-epistemological traditions but usefully centers around the behaviors of agents in a given space and time or geo-historical context (Champenois et al., 2020; Thompson et al., 2020; Sklaveniti & Steyaert, 2020; Teague et al., 2021). This relationality-based approach interconnects elements of social life that are otherwise viewed as dichotomous rather than reciprocal or mutual. The approach of fusing two paradigms and employing their tools to better understand the complex realities of sustainability entrepreneuring, including the construction of the subfield resulting from the innovators' practices, is beneficial because it allows tackling the age-old issue of lack of research which examines the elements of the system and the system itself as fully interconnected, interrelated (Walsh et al., 2020).

To construct the framework for theorizing the relatively new concept of the sustainability entrepreneuring ecosystem as the social field of practices executed by the young impact-driven innovators, we employed Hoon's (2013) meta-synthesis methodology, which is the basis for inductive theory-building from qualitative case studies and constructivist grounded theory approach to analysis (Charmaz, 2006, 2014). By synthesizing research studies across systematically selected published case studies, we theorize the sustainability entrepreneuring ecosystem and discuss the implications of the new theoretical framework.

Theoretical Grounding

Deeper knowledge of the layers of practices and their influence on young impact-driven innovators' cognition, emotion, and behavior cannot be discerned without understanding "the nature of the fields" in which innovators operate (Recke, 2011). Thus, to zoom in on one of several elements of entrepreneuring at play –the ecosystem– this research endeavor is reflexively and systematically analyzing empirical cases (Bourdieu & Wacquant, 1992; Sklaveniti & Steyaert, 2020), those with the protagonism of a range of companies, enterprises, firms, or organizations which qualify as "young impact-driven innovators".

Sustainability entrepreneuring ecosystem as the *field* builds on Bourdieusian Practice Theory and Entrepreneurial Ecosystems theories, which are related in that both are concerned with actors, factors, processes, resources, and relationships. We use the following formula to summarize and visually present the practice approach to understanding the development of entrepreneurial practices as a result of reciprocal and

mutually interconnected relationships between the relevant elements and their characteristics:

(*habitus* x capitals) + ***field*** ⇔ *practices* (adapted from Teague et al. [2021] to illustrate the core tenants of Bourdieu's works [1977, 1985, 1987, 2005]).

The mutually constitutive nature of *habitus*, cultural, symbolic, economic, specific or meta capitals, the *field* **and** practices is evident throughout the EaP scholarship (Thompson et al., 2020; Teague et al, 2021) even if Bourdieu's Theory of Practice is not invoked and the almost colloquial name of 'Practice Theory' is wielded to embrace the practice turn in entrepreneurship studies (Gartner et al., 2016; Nicolini, 2017; Thompson et al., 2020; Thompson et al., 2022). The Theory of Practice perspective applied to entrepreneurship studies produced the concept of entrepreneur**ing** (Steyaert, 2007; Johannisson, 2011, 2018, 2023). Accordingly, the sustainability entrepreneuring ecosystem hosts entrepreneuring [practices] directed at enacting sustainability through everyday practices of value and impact creation (Markman et al., 2019), 'creative organizing' (Johannisson, 2011, 2018), sense-making (Johannisson, 2023), impactful innovation (Audretsch et al., 2022) or new venture ideation (Nicolai & Thompson, 2023), risk-taking (Žebrytė & Jorquera, 2017), strategy-setting, multi-/stakeholder relations or interactions (Johannisson, 2023; Theodoraki et al., 2022) or day-to-day business operations (Žebrytė, 2024).

Consistently, the researchers investigating a variety of *fields* conclude the following about their general characteristics (for the broader field of economy and subfield of the real estate market, see Bourdieu [2005]; for the field of fine arts, see Gaižutytė-Filipavičienė [2005], for the literary field see Jurgutienė & Satkauskytė, [2019], for vulnerable entrepreneuring ecosystems see Žebrytė [2024]):

1. Within the structure of a *field,* its agents' subjective manifestations take the form of bundles or nexuses of practices referred to by Bourdieu himself as '*strategy'* and '*struggle.'* Social positioning by an agent in the field takes place through (i) the *struggle* to acquire, capture or gain capitals (they may be specific to the field [symbolic capital, cultural capital, etc.] or 'meta capitals,' such as the economic capital relevant in the fields of economics, policy, etc.), and (ii) the *strategy* practices are deployed to navigate *nomos, doxa,* and *illusio* (interests, values) in pursuit the achievement of that agent's objectives.

2. The relative autonomy of an agent in any field is delineated by its specific set of norms, collectively known as nomos, an order shaped by constantly re/produced patterns of social life, rules, and laws.

3. The taken-for-granted, unquestioned, and commonsensical *doxa* of a field still allows for the pursuit of individual interest if the common rules of the game are understood and then used by the agents playing the social game. The individual

interests are shaped by the *illusio*, structured, and structuring a set of values and routines considered important by the agents.

4. *Field* (broader fields, fields, and subfields) is specific, identifiable, and delimited, but its demarcations are porous. Fields are overlapping and mutually constitutive by and of the practices enacted by the agents' social trajectories (or constant movement between a variety of subfields and fields).

What connects entrepreneurial or entrepreneurship ecosystems thinking and *field* thinking? We argue that young impact-driven innovators resemble the main actors of the social innovation ecosystems (Audretsch et al., 2022) and sustainable entrepreneurial ecosystems (Theodoraki et al., 2022). Taken separately, these two studies on ecosystems do not provide a sufficient basis to investigate the mechanisms behind the dynamics, dimensions, and characteristics of both the agent and the structure. Thus, reflexively engaging with both these seminal works and applying the particularly useful Bourdieusian *field* perspective. We base such thinking on the following assumptions about what connects entrepreneurial ecosystems and the *field*.

First, both are "relations-based"; however, the relational nature of practices is promoted and recognized more widely in the EaP tradition (Champenois et al., 2020) than in the socio-eco-systems tradition (Walsh et al., 2020). Wacquant (1992: 15) in Smith (2020) states that P. Bourdieu 'affirms the primacy of relations' in studying social phenomena, instead of dichotomies or viewing the world through alternative rather than summative conceptualizations (structure over agent, system over actor or *vice versa*). In our inquiry into the sustainability entrepreneuring ecosystem as the *field*, we adhere to the maxim that all social phenomena are to be construed and constructed as related to each other and others (Champenois et al., 2020).

Moreover, Champenois and colleagues note that there are patterns in the flow of actions and activities, and 'doings' and 'thinkings' lay bare the "processual dimension" (p. 282, 2020). Practices are not series of dynamic states or states; they are actions and interactions of constant becoming and change or transformation.

Third, both possess the ability to be identified, discerned, named, and delimited from other objects of study (Champenois et al., 2020). The materiality of practices may be captured through the examination of the interplay between the economic *capital*, cultural *capital*, social *capital*, symbolic *capital,* and meta *capital* of a young impact-driven innovator and their *habitus* structures what young impact-driven innovators see as existing within the realm of possibilities for their business models, innovation activities and sustainability entrepreneuring practices. This interplay demarcates the avenues of access to resources, such as supports, funding, policy, and talent, all essential for innovators' activities (Audretsch et al., 2022). Further, as per Audretsch and colleagues (2022), culture and markets are the remaining two pillars of innovation. They render visible the dimensions of

entrepreneuring: the materiality of practices takes shape and becomes appreciable by the academic field under the gaze of academic practitioners.

Methodology

First, to deal with the complexity of agent and structure, cognition and emotion, behavior and ecosystem, we borrow analytical tools from Sustainability (Walsh et al., 2020) and Theory of Practice (Champenois et al., 2020; Sklaveniti & Steyaert, 2020) paradigms. Second, we chose the constructivist grounded theory approach as a method (Charmaz, 2006, 2014) because the constructionist approach to simultaneously construing social reality and constructing social phenomena through social inquiry closely mimics and structures the Bourdieusian approach of reflexive sociology (Sklaveniti & Steyaert, 2020).

In line with Hoon (2013), we start with formulating the overarching research question: **How do young impact-driven innovators construct their sustainability entrepreneuring ecosystem from the perspective of the *field*?** Further, we developed sub-questions that correspond to different elements of the *field*, as listed in Table 1 below.

Table 1. Research sub-questions and corresponding elements of the *field.*

Research Sub-question	**Corresponding element of the *field***	**Explanations and definitions**
How do young impact-driven entrepreneurs' worldviews permeate their actions in the sustainability entrepreneur**ing** ecosystem?	*Doxa* (common belief or popular opinion)	… refers to the deep-seated, taken-for-granted beliefs, values, and perceptions that shape individuals' understanding of the world and their place in it. Doxa operates at a pre-conscious level, meaning individuals are not typically aware of its influence on their thoughts and actions. It is so ingrained in the social fabric that it appears as natural and self-evident, making it difficult to challenge or even recognize.
How do young impact-driven entrepreneurs' practices connect into meaningful norms governing their behavior in a particular sustainability entrepreneur**ing** ecosystem?	*Nomos* (the body of law governing human behavior)	… refers to the underlying principles and structures that organize and give meaning to a particular social field. It can be understood as the "rules of the game" within a specific domain of social life, shaping the actions and interactions of individuals operating within that field. Nomos is closely related to the concept of doxa, as it provides the framework within which doxa operates. Understanding the nomos of a social field is crucial for understanding the behavior of individuals within that field.
How do the values and interests of ecosystem actors impact the practices of entrepreneuring?	*Illusio* (illusion)	… refers to the belief in the value and worth of a particular *field*, its elements, and the commitment to playing by its rules. It is the enchantment or illusion that keeps individuals dedicated to the *field* and motivates them to strive for success within its boundaries. *Illusio* is not simply an individual delusion but rather a collective belief system that is deeply ingrained in the social structure of the field.

How does the pursuit of capitals and jockeying for a better position within an ecosystem relate to the achievement business goals?	*Struggle*	See the section on Theoretical Grounding above.
	Strategy	See the section on Theoretical Grounding above.
	Practices (*praxis*)	Developing his Theory of Practice, Bourdieu criticized and shunned the usage of the concept of praxis to describe bundles, nexuses, or sets of 'doings' and 'thinkings'. However, other members of the academia might have used this term in the texts relevant to our research endeavor, so we have included it in our primary data analysis.

We performed a systematic search on WoS-Clarivate and Scopus databases and located 948 peer-reviewed papers published between 2014 and 2024 with the various combinations of selected keywords (see Box 1 below).

Box 1. Keywords for peer-reviewed paper search

'entrepreneurial / entrepreneurship / entrepreneuring ecosystem/s' **AND**
'impact entrepreneur*/ship'
'sustainability/sustainable entrepreneur/s'
'social entrepreneur/s' /
'green entrepreneur/s' /
'eco entrepreneur/s' /
'social innovator/s' /
'green innovator/s' /
'eco innovator/s' /
'sustainability/sustainable innovator/s'
'young innovative companies' /
'young innovative enterprises' /
'young innovative firms' /
'new innovative companies' /
'new innovative enterprises' /
'new innovative firms'
AND/OR
'sustainable/ sustainability innovation' / 'sustainable/sustainability business model/s'.

We proceeded to set inclusion/exclusion criteria as listed in Table 2 below and narrowed down the list to include qualitative empirical studies revolving around young impact-driven innovators engaging in entrepreneurial activities of risk-taking and innovating.

Table 2. Inclusion/exclusion criteria (Step 3: following Hoon, 2016).

Inclusion criteria	Exclusion criteria
Papers in Social Sciences journals indexed in WoS-Clarivate or Scopus	Research notes, book reviews, conference papers, and extended abstracts in conference proceedings
Papers from Business, Entrepreneurship, Management, Engineering and Sustainability	Papers classified as Life and Natural Sciences or Arts and Humanities
Empirical qualitative case studies of young businesses / entrepreneurs / innovators operating in comparable temporal-spatial contexts	
Empirical qualitative case studies of sustainable ecosystems	

We are in the process of extracting and coding the data (Step 4); our preliminary considerations are as follows. We will then proceed with analysis on a case-specific level as prescribed by Hoon (2023) and the synthesis on a cross-study level that will involve abductive and inductive thinking modes of locating patterns across cases and helping us to develop a theory of sustainability entrepreneuring ecosystem as a *field*.

Preliminary Findings

Our proposed framework for theorizing the sustainability entrepreneuring ecosystem as an emergent (new, developing) will contemplate the *field* as a social arena in which young innovators deploy their impact-driven practices. The following table is a template for researchers to register the results of their analysis.

Table 3. Template for organizing the papers included in the study.

Field **characteristics, elements, dimensions, dynamics, and relations**	**Relevant qualitative case studies published over the last decade in WoS-Clarivate and Scopus-indexed journals**	**What actions and interactions relevant to the relational and material nature of entrepreneuring, as well as its processual dimension, are being described in the paper?**
Nomos	Andion, C., Alperstedt, G. D., Graeff, J. F., & Ronconi, L. (2022). Social innovation ecosystems and sustainability in cities: a study in Florianópolis, Brazil. Environment, Development and Sustainability, 24(1), 1259-1281.	This example paper focuses on two types of ecosystem actors: co/funders and support actors. They "Leverage of social innovation initiatives, promot[e] scalability".
Doxa		
Illusio		
Power relations		Other actors "Provide quality seals and creates benchmarks", "Promote communication and interaction between actors", "Provide funds, grants, prizes or other forms of financing", "Promote technical training", "Incubate social innovation initiatives".
Struggle		Engage in "Promotion of social entrepreneurship Encourages", "Advising, consulting, monitoring and technical support", Articulation and links Promotion of interaction and partnerships between the SIE actors", "Co-

		creation and diffusion of knowledge, research promotion and transfer".
Strategy		
Habitus		
Capitals (per type)		
TBD	Navarro-Valverde, F., Labianca, M., Cejudo-García, E., & De Rubertis, S. (2022). Social innovation in rural areas of the European Union learnings from neo-endogenous development projects in Italy and Spain. Sustainability, 14(11), 6439.	

At the time of the conference presentation, we will present the initial results of our analysis and theorizing, and we expect the results to yield propositions for further empirical and theoretical work in the realms of entrepreneuring ecosystems and young impact-driven innovators' practices.

Conclusions

This research endeavor is a work in progress, and the conclusions presented here are preliminary. The proposed framework for theorizing the sustainability entrepreneuring ecosystem as an emergent field will contemplate the field as a social arena in which young innovators deploy their impact-driven practices. The results of this study are expected to yield propositions for further empirical and theoretical work in the realms of entrepreneuring ecosystems and young impact-driven innovators' practices. Implications for academia include (i) a strong framework for theorizing mechanisms native to the sustainability entrepreneuring ecosystems and (ii) a better understanding of young impact-driven innovators' roles within their ecosystems. Finally, our research opens avenues for future research dealing with research questions identical or similar to these:

- How could young impact-driven innovators move away from their habitus? What would it imply, and what might it result in?
- What elements and characteristics of the *field* does it take for young impact-driven innovators to operate in the thriving *versus* surviving mode at the start of their venturing?
- How could young impact-driven innovators exercise the role of connectors who help them to help themselves and, in turn, help their ecosystem?
- How to facilitate the acquisition of specific capital by young impact-driven innovators in a given sustainability entrepreneuring ecosystem?

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Integrating Social Value in Circular Economy: A Dynamic Capabilities Perspective from the Automotive Sector

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Abstract

The study examines how organisations develop dynamic capabilities to integrate social dimensions during circular economy transitions. Through an in-depth case study of a UK-based automotive components manufacturer, we extend dynamic capabilities theory by identifying 'reacting' as a fourth capability that bridges immediate stakeholder demands with long-term transformation goals. We develop a three-level framework for social value integration that progresses from operational practices to strategic alignment and ecosystem engagement. Our findings reveal the complex interplay between reactive responses and strategic capability building, contributing to both theoretical understanding and practical implementation of socially inclusive circular economy initiatives in manufacturing contexts. This research addresses an important gap in sustainability transition literature by clarifying how organisations can systematically develop capabilities that balance technical efficiency with social value creation.

Keywords

Sustainability transition, Circular economy, Dynamic capabilities, Social value creation, Automotive

1. Introduction

The transition toward circular economy principles represents a fundamental shift in how organisations create, deliver, and capture value while addressing pressing sustainability challenges (Murray, Skene & Haynes, 2017). The automotive industry, in particular, faces mounting pressure to transform its operations due to regulatory requirements, customer

demands, and societal expectations (Wells & Nieuwenhuis, 2017). While technical and environmental aspects of circular economy transitions have been extensively examined (Bocken et al., 2016), the social dimension remains underexplored, especially in manufacturing contexts where established operational paradigms may conflict with circular economy objectives (Linder & Williander, 2017).

Recent research has highlighted significant challenges in integrating social considerations into circular economy implementation. Geissdoerfer et al. (2018, p. 405) note that "the integration of social considerations into circular business models remains one of the most significant challenges facing manufacturing organisations." Similarly, Pieroni et al. (2019) found that while technical aspects of circular business models are well-developed, social components often remain peripheral or underdeveloped. This gap is particularly evident in manufacturing sectors where technical efficiency has traditionally dominated decision-making processes (Hofmann & Jaeger-Erben, 2020).

The automotive manufacturing sector presents unique challenges in implementing circular economy principles. Component manufacturers must navigate complex global supply chains, resource-intensive operations, and increasing stakeholder pressures while maintaining competitive advantage (Urbinati, Chiaroni & Chiesa, 2019). These organisations face the dual challenge of meeting immediate sustainability demands while developing long-term capabilities for systematic transformation. Furthermore, as subsidiaries of multinational corporations, they must balance local sustainability initiatives with global corporate strategies, creating additional complexity in capability development (Christmann, 2004).

Our research addresses these gaps by examining how organisations develop dynamic capabilities to integrate social value creation during sustainability transitions. Through an in-depth case study of a UK-based automotive components manufacturer, we investigate the interplay between immediate stakeholder pressures and long-term transformation goals. This research setting provides rich insights into how organisations balance local implementation with global sustainability objectives while developing the capabilities necessary for comprehensive social value integration.

The study makes three primary contributions to existing literature. First, we extend dynamic capabilities theory by identifying 'reacting' as a distinct fourth capability that bridges immediate response and strategic transformation. This extends Teece's (2018) traditional framework of sensing, seizing, and transforming capabilities by addressing the specific challenges of sustainability transitions. Second, we develop a three-level framework for social value integration that provides a structured approach to understanding how organisations progressively embed social considerations into circular economy practices. Third, we provide insights into parent-subsidiary dynamics in sustainability implementation, contributing to understanding of how circular economy initiatives unfold in multinational contexts.

The paper is structured as follows: Section 2 reviews relevant literature on dynamic capabilities, circular economy transitions, and social value creation; Section 3 outlines our research methodology; Section 4 presents our findings regarding capability development and social value integration; Section 5 discusses theoretical contributions and practical implications; and Section 6 concludes with limitations and future research directions.

2. Theoretical Background

2.1 Dynamic Capabilities and Sustainability Transitions

Dynamic capabilities theory provides a valuable lens for understanding how organisations adapt and reconfigure their resources in response to environmental changes (Teece, 2018). The traditional framework identifies three key capabilities: sensing (identifying opportunities and threats), seizing (mobilizing resources), and transforming (continuous renewal). These capabilities enable organisations to "systematically solve problems, shaped by its governance and leadership skills" (Teece, 2018, p. 43).

Recent scholarship has extended this framework to sustainability contexts. Dentoni et al. (2021) argue that organisations pursuing sustainability require additional capabilities beyond the traditional three, particularly in contexts of high uncertainty and complexity. Khan et al. (2020) similarly identify how dynamic capabilities enable manufacturing firms to develop sustainability-oriented innovation, emphasizing the challenge of balancing immediate operational requirements with longer-term transformation goals. This tension is particularly evident in industrial settings where established practices may be deeply embedded (Inigo & Albareda, 2019).

While dynamic capabilities research has increasingly addressed sustainability transitions, there remains limited empirical investigation into how these capabilities specifically enable social value integration during circular economy implementation. Our research addresses this gap by examining how the traditional framework may need extension to fully capture the capabilities required for comprehensive sustainability transitions that balance environmental and social considerations.

2.2 Distinguishing Circular Economy, Sustainability Transitions, and ESG

Although often used interchangeably in practice, circular economy transitions, broader sustainability transitions, and ESG (Environmental, Social, and Governance) represent distinct, albeit related, conceptual frameworks with different historical origins and focuses.

Sustainability transitions involve multi-dimensional shifts across technological, organisational, economic, institutional, and socio-cultural domains toward more sustainable modes of production and consumption (Loorbach et al., 2017). These transitions encompass the triple bottom line of environmental, social, and economic

considerations, with an emphasis on systemic change and long-term transformational goals.

By contrast, circular economy transitions focus more specifically on transforming linear "take-make-dispose" economic models into closed-loop systems where materials and resources are maintained at their highest value for as long as possible (Korhonen et al., 2018). As Geissdoerfer et al. (2017) have noted in their comprehensive comparison, circular economy has historically emphasized environmental and economic dimensions, with less attention to social aspects. This has led to recent calls for more "socially inclusive circular economies" (Moreau et al., 2017) that address issues of equity, labor conditions, and community wellbeing alongside resource efficiency goals.

ESG represents a third distinct framework that differs significantly from both sustainability and circular economy approaches. Originating in the financial sector, ESG was primarily developed as a metrics-driven framework for assessing corporate performance on environmental, social, and governance factors for investment decision-making and disclosure purposes (Eccles & Klimenko, 2019). Unlike sustainability transitions or circular economy, which emphasize transformation of business models and systems, ESG has historically focused on measuring, reporting, and mitigating risks across these three dimensions. As Eccles et al. (2020, p. 118) note, "ESG was initially conceived as a risk management tool rather than a framework for business transformation," though its application has evolved over time.

The metrics-driven nature of ESG creates both opportunities and challenges for organisations pursuing deeper sustainability or circular economy transitions. On one hand, ESG requirements create standardized frameworks for disclosure that can drive initial action, particularly in publicly traded companies accountable to investors (Howard-Grenville, 2021). On the other hand, the focus on metrics and compliance can sometimes lead to superficial changes rather than the fundamental business model transformation required for genuine sustainability or circularity (Málovics et al., 2021).

These distinctions are important for our research context because automotive manufacturing organisations often begin their journey through ESG compliance requirements from customers or parent companies, then progress toward more comprehensive circular economy initiatives, and potentially toward broader sustainability transitions (Kjaer et al., 2019). As we will demonstrate, the development of appropriate dynamic capabilities is crucial for navigating this complexity and moving beyond metrics-driven approaches toward genuine transformation.

2.3 Social Value in Circular Economy

The concept of social value in circular economy extends beyond traditional sustainability metrics to encompass broader societal impact. Drawing from the UNEP social guidelines

(UNEP, 2020), organisations must consider multiple stakeholder groups: workers, value chain actors, local communities, society, and consumers. This multi-stakeholder perspective complicates the implementation of circular economy initiatives, particularly in manufacturing contexts where operational efficiency often dominates decision-making (Geissdoerfer, Vladimirova & Evans, 2018).

The integration of social considerations into circular business models has been identified as a significant challenge by several researchers. Pieroni et al. (2019) found that while technical and material aspects of circular economy business models are well-developed, social components remain underdeveloped. Murray et al. (2017) note that circular economy thinking has primarily focused on resource recovery and technological innovation while potentially neglecting social issues like equity, labour rights, and community impacts. Padilla-Rivera et al. (2020) proposed a framework for integrating social considerations into circular economy metrics but highlighted the significant implementation challenges faced by organisations.

Schroeder et al. (2018) examined the relationship between circular economy and the UN Sustainable Development Goals, finding that while circular economy practices contribute to numerous environmental and economic goals, their contribution to social goals is less clear and requires more intentional design. This gap is particularly evident in manufacturing sectors where the pursuit of technical efficiency may overshadow social considerations (Hofmann & Jaeger-Erben, 2020).

Recent studies have begun to address this gap by exploring how organisations can more systematically integrate social value creation into circular economy practices. Urbinati et al. (2019) identified three approaches in the automotive sector: add-on (peripheral social initiatives), integrated (social considerations embedded in core processes), and complex (comprehensive social value creation across business activities). However, they note that most organisations remain at the add-on stage, struggling to advance to more sophisticated approaches. Similar findings were reported by Kjaer et al. (2019) who identified the challenges automotive manufacturers face when attempting to address social impacts within global supply chains while transitioning to circular practices.

Despite this growing interest, there remains limited understanding of how organisations develop the capabilities necessary for this integration, particularly in manufacturing contexts where established practices may conflict with social value creation objectives. Our research addresses this gap through an in-depth case study of capability development during circular economy implementation.

3. Research Design and Methodology

3.1 Methodological Overview

This research employs a qualitative, exploratory single case study approach to investigate how manufacturing organisations develop dynamic capabilities for integrating social value during circular economy transitions. We selected this methodology for three key reasons: (1) the complex and context-dependent nature of organisational capability development (Yin, 2018); (2) the need for rich, in-depth data to understand the interplay between immediate stakeholder pressures and long-term transformation goals (Flyvbjerg, 2006); and (3) the suitability of case studies for theory extension in emerging research areas (Eisenhardt & Graebner, 2007).

Our research design followed a sequential approach comprising four main phases:

1. **Preparation phase**: Literature review and conceptual framework development
2. **Data collection phase**: Semi-structured interviews, document analysis, and site observations
3. **Analysis phase**: Coding, pattern identification, and theoretical interpretation using the Gioia methodology
4. **Validation phase**: Member checking with key informants and triangulation across data sources

This methodological approach allowed us to develop a rich understanding of dynamic capability development while maintaining analytical rigor through systematic data collection and analysis procedures.

3.2 Research Setting and Case Selection

Our study employs a single case study design, following established guidelines for theory building from case research (Eisenhardt & Graebner, 2007). The selected organisation, a UK-based automotive components manufacturer with over 160 employees and annual revenue in 2023 exceeding £45 million, represents a revelatory case of sustainability transition in a traditional manufacturing context. Its position as a subsidiary of a global Fortune 500 company provides additional analytical richness, offering insights into how sustainability initiatives are negotiated between local and global contexts.

The case was selected based on theoretical sampling criteria (Patton, 2015) including: (1) active engagement in circular economy initiatives with explicit consideration of social dimensions; (2) manufacturing context where traditional operational priorities potentially conflict with sustainability objectives; (3) position within a complex global supply chain with diverse stakeholder pressures; and (4) accessibility for in-depth research. These criteria

ensure the case provides appropriate insights for extending dynamic capabilities theory in sustainability transitions.

3.3 Data Collection

Data collection spanned twelve months (2023-2024) and incorporated multiple sources to ensure triangulation:

Semi-structured Interviews: We conducted in-depth interviews with all board members who were driving the ESG strategy implementation:

- ESG Advisor (strategic oversight)
- Product/Technical Lead (operational implementation)
- Sustainability Strategy Lead (corporate alignment)
- ESG Committee Member (employee engagement)
- Operations Lead (practical execution)
- Business Lead (strategic integration)
- Finance Lead (resource allocation)

Each interview lasted 60-90 minutes and was professionally transcribed, yielding over 200 pages of interview data. The interview protocol addressed four main themes: (1) sustainability transition drivers and challenges; (2) capability development processes; (3) social value integration approaches; and (4) parent-subsidiary dynamics. Follow-up interviews were conducted with key informants to clarify emerging themes and validate preliminary findings.

Documentary Evidence: We analysed both internal and external documentation:

- Organisation's public ESG commitments and progress reports
- Internal sustainability strategy documents
- Published targets and metrics related to climate action
- Social initiatives documentation
- Business model documentation including value proposition statements and operational guidelines

Site Visits: The research included day visits to the manufacturing facility, providing opportunities to observe various operations within quality check, marketing, product, and supply management teams. These observations were documented through field notes

which captured both operational practices and informal discussions with staff across different organisational levels.

3.4 Data Analysis

Our analysis followed the Gioia methodology (Gioia, Corley & Hamilton, 2013) to ensure qualitative research rigor. The process involved three distinct analytical stages:

First-Order Analysis:

- Initial coding of interview transcripts and documents using Excel software
- Excel coding to preserve respondent terminology and perspectives
- Identification of recurring patterns and themes
- Development of first-order categories (over 100 initial codes)

Second-Order Analysis:

- Theoretical categorization of first-order codes
- Development of second-order themes through researcher discussion and iterative analysis
- Mapping to dynamic capabilities framework (sensing, seizing, transforming)
- Analysis of social dimension implementation using UNEP guidelines
- Identification of patterns suggesting additional capability categories

Aggregate Dimension Development:

- Integration of second-order themes into aggregate theoretical dimensions
- Validation through researcher triangulation and comparison with existing literature
- Iteration between data and theory
- Development of process model showing relationships between identified capabilities

We ensured analytical rigor through several validation procedures including member checking with key informants, triangulation across data sources, peer debriefing with colleagues not involved in the research, and maintaining a clear chain of evidence between raw data and theoretical interpretations (Creswell & Poth, 2018).

4. Findings

4.1 Dynamic Capabilities Development

Our analysis reveals how organisations develop and deploy different capabilities during sustainability transitions. We identified four distinct capability types that together enable the integration of social value into circular economy initiatives. Table 1 summarizes these capabilities, their key characteristics, and representative evidence from our data.

Table 1: Dynamic Capabilities for Social Value Integration in Circular Economy

Capability Type	Key Characteristics	Representative Evidence	Stakeholder Group Focus
Sensing	Environmental scanning, Stakeholder monitoring, Issue identification	"We're constantly monitoring what our competitors are doing, what our customers are asking for, what new regulations are coming... it's about being ahead of the curve." (ESG Advisor)	External stakeholders
Reacting	Rapid response to immediate demands, Tactical solutions, Compliance orientation	"We started on this journey [implementing ESG strategy], in all honesty, because our customer told us to, our biggest customer told us to... There was an immediate need to respond." (Product Lead)	Direct stakeholders
Seizing	Resource mobilization, Process development, Opportunity exploitation	"Once we identified these issues [lack of ESG strategy], we had to develop new processes for supplier assessment... we diverted resources from other projects to establish a proper social audit procedure." (Operations Lead)	Value chain actors
Transforming	Organisational restructuring, Cultural change, Long-term vision	"What we're doing now is creating an organisation that thinks differently about value... it's not just financial anymore	Multiple stakeholders

		but also social and environmental." (Business Lead)	

Sensing Capabilities: The organisation demonstrates strong environmental scanning abilities, particularly in monitoring customer sustainability requirements and regulatory changes. This capability involves systematically collecting and analysing information from diverse sources to identify sustainability-related opportunities and threats.

For example, the ESG Advisor explained how they monitor customer requirements: "*Our biggest customer... they're very visible. Hence, they were starting to write various things [ESG compliance requirements]. And of course, like the big supermarkets and so on, they're able to sort of impose conditions on their suppliers.[procurement]*" This statement reflects how the organisation senses potential requirements by observing leading customers who are highly visible in sustainability domains and anticipating similar demands from other stakeholders.

The Sustainability Strategy Lead elaborated on their regulatory scanning processes: "*We have a dedicated person who monitors policy changes across our operating markets. When the UK Modern Slavery Act came into force, we were already preparing our response because we saw it coming through our scanning activities.*" This proactive monitoring helps the organisation anticipate social sustainability requirements before they become urgent demands.

Reacting Capabilities: A significant finding is the identification of a distinct capability for responding to immediate sustainability pressures, separate from longer-term strategic initiatives. This represents an extension to the traditional dynamic capabilities framework, reflecting the particular challenges of sustainability transitions where organisations must balance immediate stakeholder demands with systematic transformation.

The Product Lead described this dynamic: "*We started on this journey [ESG implementation], in all honesty, because our customer told us to, our biggest customer told us to.*" This quotation illustrates the reactive nature of initial sustainability efforts, driven by external pressure rather than internal strategic intention. The Operations Lead further explained: "*When a major customer suddenly required supplier social audits, we had to quickly develop an interim assessment process while we built a more comprehensive approach.*" This demonstrates how reacting capabilities enable organisations to address immediate stakeholder concerns while developing more robust capabilities.

The ESG Committee Member noted that these reactive responses were crucial for maintaining business relationships: "*One of our automotive clients threatened to remove us from their preferred supplier list if we didn't meet their new social sustainability requirements within six months. We had to react quickly while simultaneously building*

longer-term capabilities." This reactive capability serves as a bridge between immediate response and strategic transformation.

Seizing Capabilities: The organisation has developed mechanisms to mobilize resources for sustainability initiatives, though resource constraints remain a challenge. These capabilities involve establishing new processes, structures, and resource allocation mechanisms to support social value creation.

The Operations Lead noted: "*Far East suppliers required to have active SEDEX or BSCI audits... but we can't have much leverage over what they choose to do.*" This statement reflects the challenges in mobilizing resources and influence across complex supply chains, particularly when power dynamics limit leverage. However, the Finance Lead described how they overcame some resource challenges: "*We established a dedicated sustainability fund by capturing a small percentage of each project budget... this gave us resources to invest in social initiatives without constant budget battles.*"

The Business Lead explained their approach to seizing social value opportunities: "*We identified that investing in local workforce development both addressed our skills shortage and created social value in the community. By reframing it as both a business and social investment, we secured resources that might not have been available for a purely social initiative.*" This demonstrates how seizing capabilities involve creative approaches to resource mobilization.

Transforming Capabilities: Evidence of organisational transformation includes structural changes and new processes for sustainability integration. These capabilities involve fundamental shifts in organisational thinking, culture, and operations to support comprehensive social value creation.

The Business Lead reflected: "*What we haven't done at this point is almost created an ESG vision, which I think would be useful actually, to say, well, actually this is what we want to ultimately get to.*" This statement acknowledges the ongoing nature of transformation and the need for clearer long-term vision to guide systemic change. The Sustainability Strategy Lead described structural changes: "*We've embedded sustainability representatives in each functional team rather than keeping it as a separate department. This helps integrate social considerations into everyday decisions.*"

The ESG Advisor explained the cultural dimension of transformation: "*We're seeing a shift in how managers evaluate success... three years ago it was purely financial metrics, now they're considering social impacts in their decision-making*." This indicates deeper transformation beyond superficial process changes, reflecting the development of genuinely new organisational capabilities.

4.2 Social Value Integration Framework

Our research identifies three levels of social value integration that reflect increasing comprehensiveness and strategic integration. These levels build on but extend existing frameworks (like Urbinati et al.'s 2019 typology) by specifically focusing on the capability development process and integration mechanisms rather than just the outcomes. Table 2 summarizes the key differences from existing literature.

Table 2: Contribution of the Social Value Integration Framework

Integration Level	Key Focus	Existing Literature	Our Extensions
Operational Integration	Day-to-day practices, Employee engagement	Typically focused on compliance and risk mitigation (Hofmann & Jaeger-Erben, 2020)	Emphasis on capability building through practice and experimentation
Strategic Alignment	Metrics integration, Decision-making processes	Often limited to reporting structures (Schroeder et al., 2018)	Development of integrative mechanisms that connect social value to core business strategy
Ecosystem Engagement	Multi-stakeholder collaboration, System transformation	Usually conceptualized as separate from business activities (Padilla-Rivera et al., 2020)	Positioning ecosystem engagement as extension of organisational capabilities rather than separate domain

1. Operational Integration:

- Employee engagement through carbon literacy training (achieving 79% certification)
- Mental health support infrastructure
- Workplace safety programs
- Day-to-day sustainability practices

The ESG Committee Member highlighted the importance of employee engagement: "*We try and do something at least once a month to encourage colleagues to get together and socialise.*" This operational integration creates practical mechanisms for engaging employees in sustainability transitions. Beyond social events, the organisation implements

structural supports, as the ESG Advisor explained: "*We've trained mental health first aiders in each department to provide immediate support and connect people to professional resources when needed.*"

These operational integrations represent a departure from the compliance-oriented approaches often described in the literature (Hofmann & Jaeger-Erben, 2020). Rather than simply meeting requirements, the organisation uses operational practices as capability-building opportunities. The Product Lead noted: "*The carbon literacy training wasn't just about awareness; it equipped employees to identify social and environmental improvement opportunities in their daily work*."

2. Strategic Alignment:

- Integration of social metrics in decision-making
- Development of supplier evaluation frameworks
- Clear linkage between social initiatives and business objectives
- Performance measurement systems

The Finance Lead emphasized the dual benefits: "*If you want to improve the efficiency within your workforce, you have to look after the health of the workforce.*" This statement reveals how the organisation aligns social value creation with strategic business objectives, moving beyond treating them as separate domains. The Business Lead elaborated: "*We've integrated social value metrics into our balanced scorecard, which means executives' performance evaluations now include social outcomes alongside financial targets.*"

This approach extends beyond the reporting-focused alignment often described in literature (Schroeder et al., 2018). The organisation has developed mechanisms that embed social considerations into core strategic processes. The Sustainability Strategy Lead explained: "*Our stage-gate product development process now includes social impact assessment at each review point, with clear criteria that must be met to proceed.*"

3. Ecosystem Engagement:

- Community involvement programs
- Supply chain capability building
- Stakeholder collaboration mechanisms
- Cross-sector partnerships

The ESG Advisor described their community approach: "*We engage with certain parts of the community for different activities... We provide football kit for a couple of local children's football teams.*" While this example represents a basic form of community

engagement, the organisation has developed more sophisticated ecosystem approaches. The Operations Lead described their supplier development program: "*Rather than simply dropping suppliers who don't meet our social standards, we've established a capability building program to help them improve their practices.*"

This ecosystem engagement represents an extension of capability development beyond organisational boundaries. Unlike approaches in existing literature that position community engagement as separate from business activities (Padilla-Rivera et al., 2020), our framework shows how ecosystem engagement emerges as a natural extension of organisational capabilities. The Business Lead noted: "*Our most successful social initiatives now involve multiple stakeholders—suppliers, community organisations, local government, and sometimes even competitors working on pre-competitive sustainability challenges.*"

5. Discussion

5.1 Theoretical Contributions

Our research makes several important contributions to theory, each building on existing literature while extending understanding in significant new directions:

Extension of Dynamic Capabilities Framework: The identification of 'reacting' as a distinct capability extends dynamic capabilities theory by explaining how organisations manage immediate pressures while building long-term capabilities. This bridges a gap in existing theory between rapid response and strategic transformation. While traditional dynamic capabilities literature conceptualizes capabilities as primarily strategic and forward-looking (Teece, 2018), our research demonstrates the importance of reactive capabilities in sustainability transitions.

This finding aligns with recent calls for more nuanced understanding of dynamic capabilities in sustainability contexts. As Inigo and Albareda (2019, p. 8) note, "sustainability transitions often require organisations to respond to immediate pressures while simultaneously developing new capabilities." However, we extend this understanding by conceptualizing reacting not as a limitation or failure of strategic planning, but as a distinct capability that serves as a bridge to more comprehensive capabilities.

Our findings support Schaltegger et al.'s (2016) argument that sustainability-oriented organisational change often begins with reactive responses that gradually evolve into more strategic approaches. However, we contribute a more detailed understanding of how this evolution occurs through capability development. As Khan et al. (2020, p. 125) have observed, "reactive sustainability responses can create valuable learning opportunities that contribute to longer-term capability development," a pattern clearly evident in our case study.

Social Value Integration Model: Our three-level framework provides a structured approach to understanding how organisations create and measure social value during sustainability transitions. These advances understanding of the social dimension in circular economy implementation. While previous research has primarily focused on typologies of social value approaches (Urbinati et al., 2019) or barriers to implementation (Murray et al., 2017), our framework contributes a process perspective that explains how organisations develop increasing sophistication in social value integration.

This contribution responds to Geissdoerfer et al.'s (2018, p. 405) observation that "the integration of social considerations into circular business models remains one of the most significant challenges facing manufacturing organisations." Our framework extends beyond identifying this challenge to offering a structured understanding of how organisations can systematically address it through capability development at operational, strategic, and ecosystem levels.

The framework builds on Pieroni et al.'s (2019) work on business model innovation for sustainability by demonstrating how social value creation can be progressively integrated into circular business models. However, while Pieroni et al. focus primarily on the design of business models, our research contributes understanding of the capability development processes that enable effective implementation—addressing what Hofmann and Jaeger-Erben (2020, p. 222) describe as the "critical gap between sustainability-oriented business model design and execution."

Parent-Subsidiary Dynamics: The study offers insights into how subsidiary organisations balance local sustainability initiatives with global corporate strategies, contributing to our understanding of sustainability implementation in multinational contexts. While previous research has examined sustainability strategy in multinational corporations (Christmann, 2004; Surroca et al., 2013), less attention has been paid to how circular economy initiatives specifically are negotiated between global and local contexts.

Our findings reveal complex dynamics that extend beyond the simple top-down implementation often assumed in sustainability literature. As Christmann (2004, p. 747) notes, "subsidiaries often face conflicting institutional pressures from parent companies and local stakeholders," a tension clearly evident in our case organisation's sustainability journey. However, we extend this understanding by demonstrating how subsidiaries can leverage local social value creation to influence parent company strategies – what Surroca et al. (2013) term "reverse diffusion" of sustainability practices.

This contribution responds to calls for more nuanced understanding of how sustainability transitions unfold in complex organisational settings. As Loorbach et al. (2017, p. 605) argue, "sustainability transitions require understanding multi-level interactions across organisational boundaries," a perspective our research advances through detailed examination of parent-subsidiary negotiations around social value creation.

5.2 Practical Implications

For practitioners, our research offers several insights:

Capability Development: Organisations should recognize the distinct nature of reacting capabilities and their role in sustainability transitions. Rather than viewing reactive responses as strategic failures, managers should understand their potential as stepping stones toward more comprehensive transformation. As our case demonstrates, initial reactive responses to customer demands can create valuable learning opportunities that contribute to longer-term capability development (Khan et al., 2020).

Resource Allocation: The findings emphasize the importance of dedicated resources and clear organisational structures for managing sustainability initiatives, rather than treating them as peripheral activities. Our research shows that successful social value integration requires intentional investment in capability development rather than relying on ad hoc responses to stakeholder pressures (Hofmann & Jaeger-Erben, 2020).

Stakeholder Management: The three-level framework provides guidance on managing different stakeholder groups while maintaining strategic focus on sustainability objectives. This approach aligns with Schaltegger et al.'s (2016) recommendation that organisations develop "capabilities for stakeholder integration" that enable them to balance diverse expectations while pursuing coherent sustainability strategies.

6. Conclusion

As organisations increasingly face pressure to adopt circular economy principles and create social value, understanding how to develop appropriate capabilities and transform business models becomes crucial. Our research contributes to this understanding by providing both theoretical frameworks and practical insights that can guide organisations through these complex transitions.

The findings suggest that successful sustainability transitions require not only technical and operational changes but also the development of new organisational capabilities and approaches to value creation. The identification of reacting capabilities as a distinct category extends the traditional dynamic capabilities framework and provides a more nuanced understanding of how organisations navigate immediate pressures while building longer-term capabilities (Inigo & Albareda, 2019). This extension is particularly relevant for manufacturing organisations that face both customer-driven sustainability demands and the need for systematic transformation.

Our social value integration framework offers a structured approach to understanding how organisations can progressively embed social considerations into circular economy initiatives. By distinguishing between operational integration, strategic alignment, and

ecosystem engagement, the framework provides a roadmap for organisations seeking to move beyond superficial social initiatives toward more comprehensive approaches (Pieroni et al., 2019). The case study demonstrates how these levels build upon each other, with operational practices creating foundations for strategic integration and eventual ecosystem engagement.

The research also illuminates the complex dynamics between subsidiaries and parent companies in multinational contexts. As demonstrated in our case, local sustainability initiatives can both respond to and influence global corporate strategies, creating opportunities for "reverse diffusion" of social value approaches (Surroca et al., 2013). This understanding is crucial for practitioners navigating the tensions between local implementation and global sustainability objectives.

Several limitations should be acknowledged. The single case study design, while providing rich insights, limits generalizability across different industry contexts. Future research could adopt comparative case studies across multiple manufacturing sectors to validate and refine the frameworks developed here. Additionally, longitudinal studies could provide deeper understanding of how capabilities evolve over extended sustainability transitions.

Despite these limitations, our research makes significant contributions to understanding how manufacturing organisations can develop the capabilities necessary to integrate social value creation during circular economy transitions. As sustainability pressures continue to intensify, these insights will become increasingly valuable for organisations seeking to balance immediate stakeholder demands with long-term transformation goals.

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Collaborative business models for a sustainability transition: insights from two cases in Europe

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Extended abstract

Context and objective

In a context of successive (environmental, political, social, economic) crises, collaborative-based solutions, being considered as a key for innovation (Woolthuis et al. 2005), are increasingly pushed forward as a driver for the sustainability transition (Adger, 2010). While research on sustainable business models has overwhelmingly focused on the firm-centric organisational level, collaborative multi-actor business models have received less attention, despite their importance for jointly addressing sustainability challenges and their potential for inducing change at a system level (Pedersen et al., 2020; Planko & Cramer, 2021). Collaborative Business Models (CBM) include joint activities of actors from diverse organizations (public, not-for-profit, industry, research), from different positions of the value chain and from different action levels (niche, regime and landscape), whose aim is to co-create sustainable value (Rohrbeck et al., 2013; Jonker et al., 2020; Donner et al., 2021; Faber et al., 2023). If sufficiently large in scale, they can change the ecosystem and induce a transition (Derks et al., 2022).

Our objective was to get insights into different collaborative business models involved in the sustainability transition in the blue economy and food domain. Our core question was'*what are joint, sustainability visions, inclusive types of governance structures, and value co-creation processes that contribute to this transition and how?*'.

Methodology

We analysed in-depth two different collaborative business model cases, from France and Finland. Data were mainly collected via semi-structured interviews with different actors, from the private sector to the funders and management team. In total, 10 interviews were conducted for each case, lasting in between one and two hours, half on them online and the other half face-to-face, combined with on-site visits. A cross-comparison was identified as the most suitable method for this study, using a unified coding system.

The first case is the French Innovation Cluster Pôle Mer Méditerrannée (PMM), created in 2005. It covers two regions of the South of France and aims to sustainably develop the coastal and maritime economy in the different sectors composing the blue economy. PMM counts more than 500 members from four different actor groups (big companies, SMEs, research & education centres and the larger ecosystem), who share a common sustainability vision[1].

The second case, Foodwest[2], is a medium-sized private company, offering broad services from the formulation of new food recipes and packaging designs to studies on consumer behavior. Foodwest is not a classical enterprise since it is more a shared, and unique, service platform of national interest, driven by a partnership of universities, public institutions, and companies. Foodwest provides tools, solutions, and knowledge; its owners/customers are stating the objectives, and are involved in a diverse set of research and innovation actions.

Results and discussion

Sustainability vision

The core value proposition of both PMM and Foodwest is to create links between companies and research institutes, with public support, to foster cooperation and innovation while sharing similar sustainability objectives. The two CBMs are strongly focused on private sector actors, and have an innovative technology and product vision. However, they differ in their sustainability vision. For PMM, the blue economy is an already well-accepted sustainability concept. It has appeared as a necessity by on-the-ground interviewed actors sharing the same space (the Mediterranean Sea) and looking directly at the (positive or negative) impacts on their environment and society. In the case of Foodwest, interviewees reported that Finnish people have a deep and long-lasting consideration for sustainability as part of their culture; they are also frontrunners in bioeconomy strategies. Thus they did not need to promote their sustainability focus. This implies that CBM can adopt both top-down formalized and bottom-up informal sustainability visions (including cultural and behavioural aspects). This study also reveals that, whatever vision adopted, if partners recognise their interests and values in the functioning of a CBM, it seems to increase the level of 'belonging to' the CBM and foster transition.

Governance model

[1] https://polemermediterranee.com/notre-vision/

[2] https://foodwest.fi/en/front-page/

Considering the governance models, Foodwest and PMM adopted very different ones – yet some common points emerge. A first observation is related to the legal status of the CBM and its funding model. Foodwest is a private company, and now nearly 100% self-financed by offering its services while respecting the objectives stated by their owners/members. PMM, however, is an association serving private and other sectors; it receives most of its funds from regions, but needs to acquire additional project funding. Another common point concerns decision-making processes that deal with general strategies and administration of the partnership. In the case of PMM, partners' representatives and partners are involved in the decision-making processes right from the start of the initiative. For Foodwest, its board is composed of one type of actor (namely the business managers) which has final decision power, even if partners are consulted for their inputs. In both cases, no difference is made between small and bigger structures, each member has an equal voice. Also, the interviews showed two different ways of consulting and implicating partners to decide on actions within the CBM; these are going from less to most inclusive actions:

- Involving the partner's representatives that have been elected before by each partner from the different sectors;
- Favoring informality in exchanges to collect partners' feelings and transfer these to the board.

It is thus important to clarify where formal processes are necessary, where informal exchanges are favorable, and, how it may accelerate or slow down activities. Therefore, both PMM and Foodwest act as a kind of intermediairies between their partners/members, acting like the orchestrator that is essential for sustainable governance models (Donner et al., 2024).

Value-co creation processes

For the value co-creation processes, also synergies have been observed. For PMM and Foodwest, a major output is the direct contribution to the economic stabilities of their partners/members. Another benefit is the creation of knowledge, for their members and for other actors; the integration of knowledge in education programs is hereby underlined. An indirect impact of the CBMs is their inspirational character for other (future) projects and actors. This point is particularly interesting because it implies that the form and functioning of a partnership could serve as examples for others; this may result in a snowball effect that will be beneficial for the society at different scales. In that way, CBMs contribute to the transition by upscaling individual initatives to the systems level (Derks et al., 2022).

Conclusion

The main insights from this study are that for designing a collaborative business model for a sustainability transition, it is important to define and share a sustainability vision, a capacity to innovate technologically and organisationally, and to have a well-organised governance structure. The CBM cases explored cover niche (through research & innovation topics), regime (public sector activities) and landscape (co-created sustainability visions combining social, environmental and economic dimensions) levels, whatever their scale of operation (regional and regional/national). Appropriate context-specific, inclusive co-

creation processes and governance models are imperative elements for the long-term robustness of CBM to enable contributions to the transition of systems.

Keywords

collaborative business model, sustainability, governance, co-creation

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The dynamics of stricter environmental regulations supporting the implementation of circular economy business models: A building industry case study

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Abstract

The circular economy is high on the political agenda as a solution to minimize raw material use and carbon footprints across socio-economic systems. Each country must follow its path to achieving circularity, and businesses must seek new types of sustainable and circular business models. This study aims to analyze the Icelandic building industry as a case study from a systems perspective to identify the systemic forces influencing the adoption of circular strategies and business models. Based on insights from industry stakeholders, the study aims to formulate dynamic hypotheses regarding implementing circular strategies, represented as causal loop diagrams (CLDs). Qualitative methods including semi-structured interviews and group model building are utilized. The dynamic hypotheses proposed, illustrated by CLDs, explain the system´s internal behavior that drives its dynamic. The dynamic hypothesis suggests that the building industry's environmental impact pressures the government to adopt policies. Stricter regulations can motivate project owners to adopt circular approaches, increasing their use and reducing environmental harm. The study's theoretical contribution is advancing the knowledge of implementing circular strategies and their impact on business models by providing a systemic perspective. A practical contribution is providing business leaders and policymakers with an analysis of how endogenous factors influence the implementation of circular strategies in one industry, supporting the transition toward a circular economy.

Keywords

Circular economy, strategy implementation, causal loop diagram, building industry, stakeholder, business model.

Acronyms

CE – Circular Economy

LCA – Life Cycle Assessment

CLD – Causal loop diagram

UN- United Nations

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Introduction

The European Union (EU) is on a path to making Europe climate-neutral by 2050, but this necessitates implementing the European Green Deal, the "fit for 55"´ legislative package (*Fit for 55: Delivering on the Proposals - European Commission*, 2023) and the circular economy action plan (European Commission, 2020). The circular economy concept has emerged as a response to the search for new sustainable business models that alter traditional production models (Kirchherr et al., 2023; Yang, et al., 2023). Companies are increasingly integrating the principles of the circular economy into their business models to improve resource use during the whole life-cycle of products and services, from design and raw material extraction to end-of-life, to obtain more sustainable operations (Ferasso et al., 2020; Lüdeke-Freund et al., 2019; Pieroni et al., 2019).

Circular business models have been classified into three main categories. The first one centers on closing resource loops as a fully circular system without waste, the second on slowing resource loops by extending the lifetime of the products, and the third focuses on narrowing resource loops by using fewer resources (Lüdeke-Freund et al., 2019). Businesses may integrate sustainability or circular strategies, either partially or fully, without changing their entire business model, as they can apply circular or sustainable practices to their operations to varying degrees. Sustainable business model strategies have been conceptualized by Geissdoerfer et al., (2018) listing nine different sustainability strategies, which are: 1) maximizing material and energy efficiency, 2) adopting a stewardship role by protecting natural systems, 3) delivering functionality rather than ownership, 4) repurposing for society or the environment, 5) substituting with renewables and natural processes, 6) developing sustainable scale-up solutions, 7) inclusive value creation, 8) encouraging sufficiency, and 9) closing resource loops. Circular strategies have been conceptualized through the 9R framework, which describes ten circular strategies (from 0-9), outlined in decreasing order of circularity: refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover (Ellen MacArthur Foundation, n.d.; Kirchherr et al., 2017; Potting et al., 2017).

This paper focuses on the dynamics of implementing circular and sustainable strategies for transitioning toward the circular economy, hereafter called circular strategies. Researchers have identified common barriers across industries (de Jesus & Mendonça, 2018; Tura et al., 2019). In the building industry, eight specific categories of barriers have been identified (Försterling et al., 2023). These include challenges with organizational processes, business models, strategies, and leadership; financial barriers concerning costs and profits; and technological barriers of the organization's capabilities, technology, and knowledge. External barriers include market dynamics, political and regulatory barriers. Societal and consumer dynamics are related to consumer demand and the availability and prevalence of solutions. Ecological barriers linked to raw material use, greenhouse gas emissions, waste, and pollution from operations. The supply chain and network barriers were connected to the complexity of the industry and the need for coordination and

collaboration between parties within the supply chain to optimize performance. These barriers illustrate the multifaceted challenges faced in adopting circular strategies within the building industry. A system dynamic study has shown that strict regulations and targeted taxation can effectively drive market behavioral shifts and foster the adoption of circular business models and green financing on the supply side. At the same time, these measures enhance the appeal of circular lifestyles for consumers, particularly among older and wealthier people (Neves & Marques, 2022). A study on the relationship between circular economic drivers within a single sector found that economic attractiveness and customer demand are consistently recognized as causal drivers for circular economy implementation (Gue et al., 2020).

1.1 Analytical framework

System dynamics are methods developed for studying complex systems using both qualitative and quantitative approaches. The qualitative approach enables the development of causal loop diagrams (CLDs) to create mental models (Forrester, 1995; Sterman, 2000) and develop dynamic hypotheses. A dynamic hypothesis explains the causes of a system´s behavior over time. It suggests how the structure of a system and its endogenous variables drive behavior over time by focusing on identifying feedback loops, delays, and accumulations that influence the system's dynamics, seeking to explain complex, time-dependent behaviors (Sterman, 2000). A system can refer to a business, a sector, an industry, or a country dependent on the research scope.

Developing causal loop diagrams includes two main steps: problem articulation and the formulation of a dynamic hypothesis (Sterman, 2000). The process involves identifying stakeholders and endogenous variables, setting the system boundary, and formulating the causal relationships between these variables (Sterman, 2000). Modelers collect, refine, and revalidate data multiple times using a qualitative approach, including literature reviews, observations, interviews, and consultation with stakeholders (Ford & Sterman, 1998). During the formulation of the dynamic hypothesis, or step two of the CLD process, the problem dynamics are explored (Sterman, 2000), a phase also called conceptualization of the dynamic hypothesis (Randers, 1997) or system conceptualization (Richardson & Pugh, 1997).

CLDs are presented graphically to provide an overview and help explain the relationships between variables. A negative or balancing relationship is marked with a minus sign (-), indicating that one variable has an opposite causal effect on another. A positive relationship between two variables is indicated with a plus sign (+), showing that an increase (or decrease) in one variable causes an increase (or decrease) in another variable in the same direction. These signs describe the nature of the interactions between variables without implying any value judgment. When two or more variables form a loop through their causal relationships, a causal loop diagram (CLD) is created. The loop can have either a balancing

(negative) impact or reinforcing (positive) feedback on the system (Sterman, 2000). This paper will refer to these feedback loops as reinforcing and balancing loops.

1.2 Research aim

This study employs a system dynamics approach to explore the Icelandic building industry as a system and identify endogenous variables within that system and the relationships between them. By examining the internal dynamics of the industry, the research aims to understand how endogenous behavior from within the industry impacts the implementation of circular strategies and business models. Based on insights from industry stakeholders, dynamic hypotheses are formulated and represented as causal loop diagrams. This qualitative approach combines the case study method, interviews, group model building, and system dynamics analysis. The research questions set out to fulfill the aim are:

RQ1. What regulatory and policy variables are at play when implementing circular strategies in the Icelandic building industry?

RQ2. How are these variables causally related to each other?

RQ3: What are the implications of causal relationships within the Icelandic building industry for implementing circular business strategies?

Understanding the dynamics within the building industry can help policymakers and business owners make more informed decisions to achieve better outcomes for transitioning toward the circular economy.

The paper is structured so that section 1 introduces the research and theoretical context and outlines its aim and purpose. Section 2 outlines the research methods employed. Section 3 presents the results from interviews and the group model-building sessions, describing the dynamic hypothesis through a CLD. Section 4 discusses the fulfillment of the research aim and how the results align with existing literature. Section 5 summarizes the paper's main conclusions and theoretical, policy, and practical implications, highlighting the study's limitations and identifying future research opportunities.

2 Research methods

Given the exploratory nature of the research, a case study methodology was chosen (Dul & Hak, 2008), where the Icelandic building industry is selected as a case, representing a high-impact industry in a European context, described in section 2.1. Semi-structured interviews (Adams, 2015) were conducted with industry stakeholders to explore the implications of regulations and policies for the circular economy transition for the building industry, described in section 2.2. Dynamic hypotheses through the causal loop diagrams (CLDs) were

developed through group model-building sessions (GMBs) with industry stakeholders, as articulated in section 2.3.

2.1 The case study

The building industry is recognized as a high-impact sector, and in Iceland it is responsible for 49% of solid waste generated (Building Greener Future, 2023). Of the carbon dioxide emissions from the Icelandic building sector, 45% come from building materials, 13% from the construction phase, 12% from maintenance and repair, and 30% from the use phase (Building Greener Future, 2023), as calculated using life cycle assessment (LCA) methods (Pennington et al., 2004). The "Green Building Council," (GBC), an Icelandic NGO founded in 2010, serves as a platform for collaboration within the industry (GBC, 2024) by bringing together professionals to reduce the environmental impacts of buildings and improve societal well-being through sustainable design. To address building-related environmental impacts, government institutions, the GBC, and industry associations collaborated under the initiative, Let´s Build a Green Future (BGF), which aims to reduce greenhouse gas emissions, setting time-specific reduction targets throughout all phases of the building´s life cycle, with a roadmap toward improved sustainability by 2030 (Building Greener Future, 2023).

2.2 Semi-structured interviews

A purposeful sampling method was followed (Hennink et al., 2020) to select interviewees for the study. The aim was to interview at least one person from each of the primary stakeholder groups HMS defined for the Icelandic building industry (Building Greener Future, 2023). These include designers, contractors, real estate developers, owners and residents, financial institutions, public administration, educational institutions, manufacturers, suppliers, and service providers (Building Greener Future, 2023). The stakeholder groups and interviewee identifiers are listed in Table 1, where each interviewee has been given an identifier (A-M) to ensure confidentiality. Interviewees signed a consent form and were informed about the research project and how their confidentiality is secured.

A semi-structured interview framework was designed, including open-ended questions (Adams, 2015). Questions were listed according to the following categories: environmental, social, economic, and organizational aspects, supply chain implications, regulatory requirements, and technological aspects of implementing circular strategies, as these categories are critical within the research literature (Tura et al., 2019). During the interviews, emphasis was placed on identifying those with decision-making power for choosing designs and variables influencing the motivation to implement circular strategies. The fourteen interviews were conducted in person, lasting between 50 and 80 minutes, and performed from October 2022 to March 2023.

The interviews were transcribed, and the content was sorted, coded, and compared throughout the research process following grounded theory methods (Charmaz, 2014),

identifying trends, themes, categories, and actions. Variables influencing the implementation of circular strategies were listed and served as inputs for the group model-building sessions described in section 2.3.

Table 1. The interviewee identifier and the stakeholder groups relevant to data collection.

Interviewee identifier	Stakeholder group
A	Public administration
B	Service provider
C	Designer
D	Real estate developer
E	Service provider
F	Municipality
G	Manufacturer and supplier
H	Contractor
M	Contractor
I	Educational institution, designer
E	Financial institution
K	Financial institution
L	Contractor
M	Owner and resident

2.3 CLD development

Dhirasasna and Sahin, (2019*)* divide the formulation of CLDs into two steps. Step 1 involves problem articulation, where modelers identify research problems along with key variables and concepts. In this research, the semi-structured interview process focused on this step, as described in 2.2. Step 2 involves formulating a dynamic hypothesis to explain the relationship between variables and the resulting dynamic behaviors relevant to implementing circular strategies. Group model building (GMB) sessions were conducted to formulate the CLDs. GMB has been described as a helpful, collaborative learning method for co-creating causal loop diagrams (Vennix et al., 1997). The modeler followed guidelines

on eliciting knowledge from specialists and stakeholders on mental models (Ford & Sterman, 1998), following instructions from Andersen et al. (1997).

In the GMB sessions the whole life cycle of buildings was explored, from the planning and design phase, construction, use phase, and end-of-life. However, the stakeholders mainly emphasized the planning and design phase. Design decisions influence the environmental impacts of other phases, particularly the materials chosen, which have the most significant environmental impact. Furthermore, the end-of-life phase has been highly regulated, demanding a waste management scheme for recycling building materials (Ministry of the Environment, 2021). Participants for the GMB sessions were purposefully selected (Hennink et al., 2020) to ensure expertise across multiple building life cycle phases. Designers and project owners involved throughout building design, construction, operations, use, and demolition were identified as key stakeholders. To ensure a comprehensive perspective, experienced industry specialists and public administrators were included, reflecting the industry´s higly regulated nature. As a result, a diverse group of skilled industry specialists and public administrators were selected to participate in the GMB sessions. The six stakeholders were divided into the two groups listed in Table 2.

Table 2. Stakeholder group representation in the GMB sessions.

Stakeholder group 1
Public administration with design education and experience.
Public administration with design education and experience.
Service provider with design education and experience.
Stakeholder group 2
Public administration with design education and experience.
Public administration and service provider.
Public administration with planning education and experience.

Two GMB sessions were run parallel in two meeting rooms at the local university in February 2024, each lasting two hours. The sessions started with a shared introduction to creating causal loop diagrams to ensure a common understanding of the methodology. Each variable from the interviews was listed on a post-it note, and the notes were shared with participants. Participants were then asked to establish causal connections between variables. In addition, they were encouraged to add variables when needed. They did not have to choose all variables, only those they felt were important. A group facilitator helped

participants draw the CLD(s), using a blue marker and a minus sign to demonstrate balancing connections and a red marker and a plus sign to exhibit positive connections between variables, with annotations added to a whiteboard in front of all participants.

Session 1 articulated the lack of strict regulatory policies and the conservative culture of the industry as two problems, drafting the dynamic hypotheses illustrated in CLDs in Figure 1. After the sessions, each group presented their CLD to the other group, commencing more discussion and feedback. A photo of each CLD was taken, and the modeler translated the variable from Icelandic to English and transcribed the CLDs electronically using Kumu and Stella Architect software.

The next step for the modeler was to merge the two CLDs, incorporating insights from the interviews described in section 2.2. The merged CLDs were emailed to participants for their approval and feedback. Follow-up interviews with one participant from each group were conducted to gather oral input and approval, and after this merger, participants and interviewees are collectively referred to as stakeholders. This led to an iterative process of refining causal relationships based on the data and revalidating it multiple times. As a result, a dynamic hypothesis was formulated and represented in section 3.1 and as a CLD in Figure 1.

3 Results

The interviews revealed that project owners are the primary decision-makers in shaping environmental strategy determining whether to adopt a linear or circular approach for designing new buildings, maintaining existing ones, and managing building operations. The causal relationships described by participants and interviewees, along with the resulting causal loop diagram in Figure 1, are explained in this section. Fourteen variables were used to describe these relationships. Each variable is first outlined, followed by an explanation of its causal connections, supported by interview data.

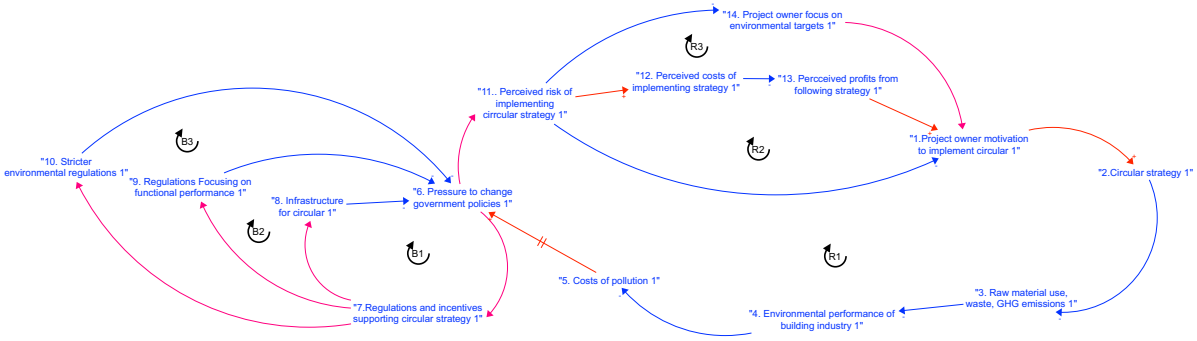


Figure 1. Dynamic hypothesis of the need for stricter environmental regulations and policies CLD (own illustration created in Stella Architect).

3.1 The causal loop diagram

Variable 1: Project owner motivation to implement circular strategies positively influences adoption of circular strategies - variable 2.

Interviewee A explained that building project owners hire and direct designers, typically providing instructions for the design approach. In most cases, the owners are large contractors constructing buildings to sell or rent. Government and municipalities are also project owners, often involved in large projects. However, project owners can also be smaller businesses and individuals building offices or private homes. Since project owners hold decision-making authority, designers receive instructions based on their preferences. Interviewees C, G, I, and H explained.

Variable 2: Following a circular strategy reduces raw material use, waste, and GHG emissions, indicating a balancing relationship—variable 3.

Interviewees A, E, and I explained how circular strategies for the building industry business models can enhance environmental performance by reducing the need for raw materials and lowering waste generation. Less demolition preserves land, while eco-certified recycled materials have a lower carbon footprint. Interviewees A, B, D, and H noted that flexible building designs allow adjustments during t the lifetime of buildings, and proper maintenance reduces the need for demolition.

Variable 3: Raw material use, waste, and GHG emissions balance the environmental performance of the building industry—variable 4.

Interviewee A, B, H, K and L claim that decreasing raw materials, waste, and GHG emissions improves environmental performance,

4. The environmental performance of the building industry has a balancing relationship with the cost of pollution – variable 5.

Interviewee H noted that waste generation from the building industry is costly, with toxic material removal being particularly expensive. Interviewee B explains that landfilling and recycling are costly and time-consuming, emphasizing that less waste means lower expenses. Interviewees D, C, and L stressed the need for more knowledge, infrastructure, and financial incentives to motivate project owners.

Variable 5. Costs of pollution reinforce the pressure to change governmental policies, because of increasing costs and instability and toxic waste - variable 6.

As noted by interviewees A, B, and I, pollution costs are high and expected to rise with linear strategies. They highlight a delayed response since harm takes time to manifest. This

pressures governments and institutions to adjust regulations as costs grow. Toxic waste handling is particularly expensive, landfill space is becoming scarce, and water pollution, especially in rivers, is a significant concern.

Variable 6. Pressure to change governmental policies reinforces perceived risk of implementing circular strategy - variable 11.

Interviewees H, M, and L describe circular strategies as risky and costly, with limited skills for implementation. Interviewee B notes an oversupply of used materials compared to demand. Interviewees A and B suggest that stricter regulations could reduce the perceived risk of employing circular strategies. Interviewee G adds that only leading companies adopt such strategies, viewing them as high-risk due to costs, lack of demand from building users, knowledge gaps, and infrastructure challenges. Interviewee C noted that building regulations set minimal quality standards. At the same time, the Swan eco-label ensures better air, insulation, and acoustic quality, serving as an eco-label and a "quality label". Interviewees H and K added that Swan-labeled products are less toxic and safer for workers, reflecting societal pressure for higher standards.

R1) Variable 11 balances the project owner's motivation to implement circular - variable 1.

According to interviewee B, project owners can choose between a linear strategy, commonly viewed as less risky and costly, and a circular strategy, which is less familiar and perceived as more expensive. B explains that higher risk in implementing a circular strategy reduces motivation, indicating a balancing relationship.

R2) Variable 11. Perceived risk of implementing circular strategy reinforces the perceived costs of implementing circular strategy – variable 12

All interviewees agree that cost minimization and profit maximization drive most businesses. Interviewees A, B, H, and K explain that eco-labeled materials cost more than linear ones, but the selling price for the building remains unchanged as customers resist paying a premium for eco-labels or circular housing. Interviewee D adds that most customers prefer new materials, rejecting reused options, especially when relocating offices.

Variable 12. Perceived costs of implementing circular strategy directly reduces the perceived profits from following circular strategy -variable 13

Everybody knows the direct relationship between costs and profits; more costs mean lower profits, interviewees H and M explained.

Variable 13. Perceived profits from following circular strategy reinforce the project owner´s motivation to follow circular strategy, variable 1.

Interviewee D explains that the company's board focuses on sustainability. However, when sustainability is more expensive than linear strategy, they choose the cheaper option because they need increased profits.

R3) Variable 11. Perceived risk of implementing circular strategy balances project owner focus on environmental targets – variable 14

As interviewee F stated, setting specific environmental targets for businesses is voluntary. Interviewee K highlighted a limited buyer demand for circular strategies, discouraging project owners. However, with lower risk associated with circular strategies, this empowers the project owner to focus on environmental targets.

Variable 14 project owner focus on environmental targets reinforces the project owner motivation to implement circular – variable 1

Interviewees L and G shared that their companies committed to environmental targets at the owner´s request. Interviewee G mentioned a goal of carbon neutrality by 2030, aligning with the Paris Agreement and with the management team responsible for strategy development. Interviewee L added that their company can demand stricter environmental performance from sub-contractors due to the municipality´s strict environmental policies.

Variable 6. Pressure to change governmental policies reinforces regulations and incentives supporting circular strategies - variable 7.

Interviewee A explains that the environmental performance of the building industry directly influences Iceland's environmental health, mainly through waste generation, carbon footprint, land, and water use. The interviewees agreed that more encouragement is needed for project owners to choose circular strategies, as buyer demand for circular buildings is currently zero according to interviees E and K. Suggestions including a carbon cap per square meter as Interviewee A suggested, banning demolition due to high embodied GHG emissions as noted by interview C. Interviewee K, suggest mapping building materials for future reuse. Interviewee B suggests a requirement for recycled and reused materials for new constructions. Interviewee F discusses how the design of buildings should be more flexible. Interviewee E suggested adapting regulations to lower environmental harm, such as reducing cement in low-strength walls without compromising quality.

B1) Variable 7, regulations and incentives supporting circular strategy reinforces - variables 8

Interviewee A explains that when government regulations support circular strategies by improving infrastructure, such as implementing quality assurance and a marketplace for used materials, as interviewee B discusses. The availability of used materials increases, with a delay because building new infrastructure takes time.

Variable 8 Infrastructure for circular balances the pressure to change government policies – variable 6

Interviewee B explains that no further government support is needed when the infrastructure supporting circular strategies is as strong or stronger than that supporting linear strategies. ,

B2) Variable 7, reinforces regulations focusing on functional performance- variable 9

Interviewee E discussed that regulations and policies should be adapted toward reducing emissions and environmental impact. This involves prioritizing reducing emissions and pollution without compromising building quality, further lowering the risks for project owners implementing circular strategies, noting that this needs proper preparation.

Variable 9 regulations focusing on functional performance balance the pressure to change government policies – variable 6

Interviewee G explains that the government can focus on the lowest-hanging fruits in this respect and only focus on the largest emitters, like cement and reusing building materials.

B3) Variable 7, reinforces stricter environmental regulations - variable 10.

Interviewees I and E stated that stricter environmental regulations and mandatory circular strategies would compel businesses to implement circular strategies and encourage designers and contractors who currently favor linear methods to transition to circular. Interviewees A and B describe stricter environmental regulations such as banning the demolition of buildings, implementing carbon taxes, carbon roof requirements, or mandating reuse percentages, which also help balance the perceived risk of implementing circular strategies.

Variable 10. Stricter environmental regulations balance the pressure to change governmental policies – variable 6

Interviewee K explains that stricter environmental regulations level out the playing field because they apply equally to the whole industry, the industry will adapt to changing.

3.2 The dynamic hypothesis

The dynamic hypothesis from the causal look diagram created by interviewees and stakeholders during the GMB session explains how stricter environmental regulations reduce the perceived risk of implementing a circular strategy and improve environmental

performance through three balancing loops (B1 – B3) and three reinforcing loops (R1-R3), a short description of each loop is provided in Table 3.

Table 3. The six loops involve environmental regulations and policies.

Sign	Name	Short description
	B1	Pressure to change governmental policies reinforce governmenta to adopt new regulations supporting circular strategy, such as supporting infrastructure facilitating circular strategy implementation, that again balance the pressure to change government strategies, creating a balancing loop relationship.
	B2	Pressure to change governmental policies reinforce governmenta to adopt new regulations supporting circular strategy, such as focusing on functional performance, without compromising quality. This again balances the pressure to change government policies, creating a balancing loop relationship.
	B3	Pressure to change governmental policies reinforce governmenta to adopt new regulations supporting circular strategy, that reinforces tricter environmental regulations, whch again balanes the pressure to change policies, creating a balancing loop relationship.
	R1	Project owner motivation to implement circular has a reinforcing relationship with implementing circualar strategies. This balances the use of materials, waste and carbon footprint, that has a balancing relationship with environmental performance of the building industry, that again balance the overall costs of pollution. Cost of pollution on the other hand reinfores the pressure to change government policies, that reinforve the perceived risk of implementing circular strategy. The risk of implementing circular strategy has a balancing relationship with project owner motivation to implement circular strategy, thus creating a reinforcing loop relationship.
	R2	Same as in R1 until the perceived risk of implementing circular strategy, which also reinforces the costs of implementing the strategy, that balances the perceived profits. This has a reinforcing relationship with project owner motivation to

		implement circular strategy, thus creating a reinforcing loop relationship.
	R3	Same as in R1 until the perceived risk of implementing circular strategy, which also balances project owner focus on environmental targets, that has a reinforcing relationship with project owner motivation to implement circular strategies, thus creating a reinforcing loop relationship.

The dynamic hypothesis explains that the building industry's environmental performance and pollution costs pressure the government to change and adapt policies. In summary, it suggests that implementing stricter environmental regulations reinforces the motivation of project owners to adopt circular approaches, increases the number of such approaches, and reduces environmental harm from the building industry.

Three reinforcing loops influence the project owner's motivation: (R1) the lower risk of implementing circular strategies, (R2) lower costs associated with circular approaches, and (R3) increased focus on environmental targets.

Three balancing loops are described when government policies and regulations respond to this pressure with regulations and incentives supporting circular strategies. (B1) interviewees indicate that implementing regulations and incentives to supporting infrastructure development for circular strategies, (B2) implementing regulations supporting functional performance, and (B3) stricter environmental regulations balances the pressure for further polcy change.

4 Discussion

This research focuses on the endogenous behavior of a single industry and the regulatory implications of implementing circular economy business strategies. It analyzes the industry as a system, exploring how endogenous variables within the system are causally related, how this influences the system's dynamic behavior, and in this case, the transition toward a circular economy within the Icelandic building industry.

First, the dynamic hypothesis addresses RQ1 by identifying three main categories of regulatory adaptations within the building industry, stricter environmental regulations, supporting infrastructure for circular approaches, and more functional regulations and policies. These finding contribute to the understanding of barriers for implementing circular strategies in the building industry (AlJaber et al., 2023; Salazar et al., 2022), by explaining how the lack of environmental regulations balances the implementation of needed changes

and by causally relating infrastructure (Hjaltadóttir & Hild, 2021), functional regulations (Kanters, 2020), and stricter environmental regulations (Zu Castell-Rüdenhausen et al., 2021) to the perceived risk of implementing circular strategies, and how currently the lack of regulations and incentives has a balancing impact on project owner motivation to implement circular strategies.

Second, RQ2 is addressed by identifying the endogenous variables constituting the system under study, fourteen variables, and their causal relationship exhibited in the CLD in Figure 1, explained in section 3.1. The causal relationships between the variables explains the dynamic behavour of the industry, stricter environmental regulations reduce the perceived operational risk of implementing circular strategis. These results build upon the existing literature by illustrating how stakeholders' perceptions shape the role of government in driving environmental performance within the building industry (Ghufran et al., 2022; Hjaltadóttir & Hild, 2021). This research also supports the fact that stakeholders often view it as the responsibility of policymakers to improve environmental standards by implementing stricter regulations and supportive policies (Zu Castell-Rüdenhausen et al., 2021).

A lack of governmental support has been identified as a barrier to implementing circular strategy (Kirchherr et al., 2018). At the same time, governmental policies have been identified as a key driver for circular implementation within the construction sector (Zu Castell-Rüdenhausen et al., 2021). According to the dynamic hypothesis, implementing stricter environmental regulations reinforces the motivation of project owners to implement a circular approach, increases the number of circular projects, and reduces environmental harm from the building industry. This addresses RQ3 by exploring the implications of stricter environmental regulations on adopting circular business models and strategies within the Icelandic building industry.

5 Conclusions

The study provides theoretical insights into dynamic hypotheses concerning the implementation of circular strategies and business models within the Icelandic building industry. First, it provides novel insights into the theoretical aspects of circular strategy implementation by providing a holistic view and integrating systems thinking, which were illustrated with dynamic hypotheses using CLDs. It highlights how balancing feedback loops can drive the industry towards greater or lesser circularity, emphasizing the value of a systems approach in developing theory and managing circular economy implementation and transition. Second, it advances the understanding of circular transitions by causally linking barriers and drivers for implementing circular strategies within one industry.

The study´s identifies critical areas for policymaking, emphasizing that mandatory government policies can reduce risks of adopting circular strategies by encouraging stricter environmental regulations, functional policies and supportive infrastructure. Aligning with the Paris Agreement, such targets can accelerate the shift toward a circular economy. The study also identifies delays in the system that policymakers should consider when assessing effectiveness.

This paper offers practical insights for business leaders by analyzing a single industry through stakeholder perspectives. It highlights how stricter environmental regulations can reduce the implementation of risk and costs while improving environmental performance. The paper also emphasizes setting specific targets for more effective results than general goals.

The study has several limitations. First, the CLD model primarily reflects the participants´ perceptions of the Icelandic building industry and is neither comprehensive nor final. The CLDs do not distinguish between stocks and flows, and delays are not drawn. As is the case with all models, it approximates reality influenced by the perspectives of its creators. To mitigate this bias, interviewees representing all stakeholder groups were included in the study. Based on this research, a system dynamics stock-and-flow simulation model could be developed to test the efficacy of various policies and strategies, providing valuable insights for researchers studying the transition toward a circular economy, policymakers, and business leaders. Such models could also be applied in other industries and nations to support decision-making processes and help policymakers to test policy effectiveness.

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Circular business models for a sustainable blue bioeconomy

The case of two seafood nations: Norway and Iceland

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Abstract

Advancing circularity in the blue bioeconomy entails new approaches for seafood value chains. Circular business models are a way for companies to create, deliver and capture value in ways that both advance circular economy objectives but also improve the sustainability performance of organizations. Norway and Iceland are traditional seafood nations and in both countries seafood industries are an important pillar of the economy. There is increased recognition among industry and government actors that value added activities to achieve full utilisation of seafood is an important objective for sustainability. Yet, the implementation of circular business models has in general been slow partly because of the dependence of businesses on linear models and partly because of resistance to change. This study seeks to understand how companies can adopt circular business models to enhance value creation, sustainability performance, and competitive advantage. The study will build on previous research analysing barriers to circularity in the seafood industries of Iceland and Norway and will: (a) analyse current business models, including exemplary circular business models, and (b) review and critically evaluate strategies and policies that encourage the transition to circular business models. The analysis will be based on interviews, focus groups, and the application of a qualitative system dynamics approach. Results are expected to elucidate crucial leverage points, important governance actors and

enabling policies and strategies to underpin the transition to a more circular and sustainable blue bioeconomy.

Extended abstract

A sustainable bioeconomy is the renewable segment of the circular economy (COM, 2018). It relies on biological resources to produce goods and services and involves all sectors and systems which depend on biological resources such as agriculture, forestry, fisheries, aquaculture and biotechnology, among others. The blue bioeconomy, comprising aquatic resources and ecosystems, is a critical component for nations whose economies are heavily reliant on these resources. For both Iceland and Norway aquatic resource utilization has substantial economic and cultural importance and is thus often part of societal and political debate (Gunnlaugsson & Valtysson, 2022; Bjørkan & Eilertsen, 2020). Both nations are also well-positioned to advance circularity and sustainability in the blue bioeconomy (Strand et al., 2024).

The overarching circular bioeconomy (CBE) principles are resource efficiency, optimizing value of biomass over time and sustainability (Stegmann, Londo & Junginger, 2020). A transition towards a circular economy for the blue bioeconomy can contribute to resource efficiency gains which are integral to sustainable development. At the same time, it can also stimulate increased profit by turning waste streams or lower value products into value or higher value streams.

The transition thus entails new approaches for seafood industries both the primary sectors and also the supporting industries that have been built around them. To achieve this aim companies will need to reconsider their value creation and adopt strategies that promote circular economy objectives. The concept of a circular business model has been developed to advance these objectives. A circular business model is a way for companies to create, deliver and capture value in ways that both advance circular economy objectives but also improve the sustainability performance of organizations and provide competitive advantage (Richardson, 2008). Some strategies for circular business models can be realised at the firm level but others will likely require multi-firm and multi-actor collaborations for business model alignment.

Richardson (2008) defined the major components of a business model as (i) value proposition, (ii) value creation, and (iii) value capture, while Linder and Williander (2017) defined a circular business model as a business strategy in which the conceptual logic for value creation is based on utilizing the residual economic value of products post-use in the production of new offerings. Similarly, Bocken et al., (2013) discuss business model strategies that support both slowing and closing resource loops - involve capturing value from what would otherwise be considered “waste” in a linear business. However, as Bocken and Short (2021) pointed out sectoral progress on business model innovation has been

insufficient to address much of the social and environmental harm caused by, or facilitated by industry, and progress towards the SDGs goals has been disappointing. In addition, various path-dependencies f.e. due to previous investments of large industrial actors can hinder change in sectors (Gubrandsdottir et al., 2021).

For seafood by-product valorisation, consideration of the use and implementation of enabling technologies and approaches is needed and the sustainability of interventions and actions needs to balance the economic and environmental needs of society and business operators (Cooney et al., 2023). The implementation of circular business models has in general been slow partly because of the dependence of businesses on linear models. Apart from some R&D investments, development of the bioeconomy is mainly left to the market which can sometimes undermine broader sustainability goals so it's important to critically assess policies and strategies and whether they enable or hinder the development of circular business models (Saviolidis et al., 2023). One of the main hindrances has also been the overreliance on circular business model development which relies on niche innovations but ignores the inertia in a system dominated by powerful actors which often leads to regime resistance (Gudbrandsdóttir et al., 2021).

Methods

This study will build and expand on previous research which analysed the barriers to increasing circularity in the seafood industries in two seafood nations: Iceland and Norway. Taking a two-pronged approach this study will a) analyse current business models including exemplary cases of circular business models (e.g. seafood industry partnerships for the production of value-added products) and b) review and critically evaluate strategies and policies that encourage and enable the transition to circular business models in the blue bioeconomy. Interview and focus group data with seafood value chains collected in 2021-2023 will be used to realise the first objective and further interviews with policy-makers will be conducted to realise the second objective. Desk research of sustainability reports (strategies) and white papers (policy) will supplement the primary (qualitative) research data. The findings will be analysed by structural thinking and diagramming tools to better understand the dynamics of new business model development and to identify motivation or resistance to system change to underpin policy (Gudbrandsdottir et al., 2025).

Expected Results

The implementation of a more sustainable circular approach will need concerted efforts and collaboration among primary industry actors but also across primary, secondary and the whole ecosystem of service industries that have been built around the primary industries. Previous research showed that improvements need to happen in tandem with improvements in other related and supporting industries across the whole value chain which calls for new strategies and governance structures. We expect the results to reveal

crucial leverage points, important governance actors and enabling policies and strategies to underpin the transition to a more circular and sustainable blue bioeconomy.

Conclusion

Iceland and Norway both have long fishing traditions and recognize the potential of marine ecosystems, not only for food production, but also for renewable energy, pharmaceuticals, and novel materials (Refsgaard, 2021; Saviolidis et al., 2020). The circular blue bioeconomy, therefore, represents a critical pathway towards economic diversification and a sustainable future for these countries.

Keywords

Blue bioeconomy, circular business models, sustainability transition, qualitative system dynamics

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From Waste to Value: Circular Business Models for Extending, Sharing, and Looping EV Batteries Using Key Criteria

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Abstract

The transition to net-zero emission vehicles depends on effective circular strategies for managing electric vehicle (EV) batteries, particularly through second-life applications and recycling. This study identifies and conceptualizes viable archetypes of circular business models (CBMs) that support battery circularity within the EV ecosystem. Despite increasing urgency, many firms struggle to transition from linear to circular models due to limited practical insights into how circularity can be operationalized. Based on data from 24 semi-structured interviews and 22 workshops with 15 companies across the EV battery ecosystem, the study identifies three overarching CBM archetypes—extending, sharing, and looping—comprising eight sub-archetypes: product life extension, refurbishing, battery as a service, charging infrastructure as a service, gap-exploiter model, remanufacturing, total energy management solutions, and recycling. These archetypes are mapped across three key criteria—circular resource strategies, collaboration architecture, and ownership structure—offering a structured framework for understanding how circular value is created, delivered, and captured. By presenting these distinct archetypes, the study provides actionable insights for businesses, policymakers, and stakeholders aiming to accelerate sustainable energy transitions. It also contributes to the broader theory of circular business models, with specific relevance to the evolving EV battery ecosystem.

Keywords

Business model innovation, battery circularity, second-life batteries, circular economy, circular transformation.

Introduction

The transition to a circular economy is essential to addressing two of today's most pressing global challenges: resource scarcity and climate change. In this context, the battery industry plays a critical role, particularly due to its centrality in transportation and energy storage systems. With the global electric vehicle (EV) fleet projected to surpass 145 million by 2030 (IEA, 2021), the volume of lithium-ion batteries reaching end-of-life is expected to increase dramatically. While these batteries typically retain 60%–80% of their capacity, safety regulations often prohibit their continued use in vehicles once capacity declines by 20%–40% (Groenewald et al., 2017). This raises a key question: how can we extract value from end-of-life EV batteries that still contain vital materials such as lithium, cobalt, and graphite?

Harnessing the residual value of retired batteries through circular business models (CBMs) is essential to achieving net-zero emission targets and climate-neutral transportation. Approaches such as reuse, refurbishment, repurposing, remanufacturing, and recycling not only extend battery life but also mitigate environmental impact while generating new revenue streams (Bocken et al., 2016). Research indicates that over 85% of EV batteries are suitable for a second life (Martinez-Laserna et al., 2018), with potential operational spans of an additional 5 to 15 years depending on the application (Zhu et al., 2021). Second-life batteries are particularly promising in stationary energy storage systems for industrial, residential, and commercial use—supporting grid stability, backup power, renewable energy integration, and peak shaving (e.g., Iqbal et al., 2023; Haram et al., 2021; Chirumalla et al., 2023). In the face of rising electricity demand and grid volatility, second-life battery solutions are poised to become critical components of future energy infrastructure.

Despite their promise, second-life applications and battery circularity remain underutilized in practice. A key barrier is the difficulty firms face in developing viable CBMs that enable a shift from traditional linear "take–make–dispose" models to circular alternatives (Wrålsen et al., 2021; Sopha et al., 2022; Martinez-Laserna et al., 2018). Designing and scaling CBMs requires firms to reconfigure how they create, deliver, and capture value (Jiao, 2019; Reinhardt et al., 2019; Chirumalla et al., 2022). This process often involves collaboration with unfamiliar ecosystem partners and is further complicated by the increasing technical diversity of EV battery chemistries, formats, and configurations (Júnior et al., 2023; Chirumalla et al., 2024; Reinhardt et al., 2020; Stefan & Chirumalla et al., 2025). Effective implementation also demands systemic coordination across actors who are not typically

integrated in current value chains (Frishammar & Parida, 2021; Albertsen et al., 2021; Chirumalla et al., 2022).

Although prior research has established a theoretical foundation for CBMs within the circular economy (Geissdoerfer et al., 2020; Kirchherr et al., 2017; Ludeke-Freund et al., 2019), there remains a significant lack of empirical insight into how these models are implemented in real-world industrial settings. This gap limits the ability of stakeholders to design and scale effective circular solutions for EV batteries. Moreover, limited attention has been given to identifying key criteria for systematically mapping viable CBMs for EV battery circularity—particularly in the context of the operational and organizational complexities these models entail.

To address this, the purpose of this paper is twofold: first, to identify and analyze practical CBM archetypes that support battery circularity; and second, to map these archetypes using key design criteria. By doing so, the study provides actionable guidance for stakeholders across the EV battery ecosystem, contributing to both the theory and practice of CBM development.

The remainder of the paper is structured as follows: The next section presents key theoretical insights relevant to the study's focus. This is followed by the research method, which outlines how the study was conducted. The results section then introduces the three key criteria for mapping CBMs, describes the identified CBM archetypes and sub-archetypes, and presents the mapping of these models according to the criteria. Finally, the paper concludes with a discussion of the findings and final reflections.

Theoretical background

Numerous firms are increasingly prioritizing sustainability through CBMs, which focus on co-creating value by applying circularity principles such as reducing, reusing, optimizing, and recycling to minimize resource consumption across the product lifecycle (Geissdoerfer et al., 2020; Ludeke-Freund et al., 2019). CBMs typically involve collaboration with ecosystem partners to innovate and deliver sustainable value (Frishammar & Parida, 2021; Chirumalla et al., 2022). In particular, CBMs for EV batteries are gaining traction as a critical enabler of circularity. The second-life model, which repurposes EV batteries for extended use rather than discarding them after their initial application, represents a promising innovation (Bonsu, 2020; Chirumalla et al., 2023). This approach not only prolongs battery lifespan and enhances resource efficiency but also contributes to broader circular economy goals by reducing environmental impacts (Bocken & Ritala, 2022; Martinez-Laserna et al., 2018). Furthermore, it creates new economic value by generating revenue from used batteries across a range of industries (Zhu et al., 2021).

Research on CBMs for second-life batteries and circularity has expanded significantly, with scholars proposing diverse CBM types. For example, Olsson et al. (2018) introduced four conceptual business model scenarios for second-life batteries, including linear models, optimized recycling, and two circular models involving battery repurposing and state-of-the-art recycling. Wrålsen et al. (2021) utilized the Delphi method to propose three CBMs with high potential for batteries: remanufacture, product life extension, and resource recovery. Schulz-Mönninghoff and Evans (2023) identified three main CBM options applicable to end-of-life batteries: refurbishment, cascading, and recycling. Helander and Ljunggren (2023) analyzed the battery as a product-service system, considering multiple reuse and recycling loops for lithium-ion battery subpacks. Reinhardt et al. (2020) explored sustainable business model archetypes for the battery second-life market, identifying strategies such as maximizing material efficiency and promoting inclusive value creation. Jiao (2019) identified typologies for battery second-life business models, including standard, collaborative, and integrative models. Albertsen et al. (2021) examined CBM strategies for EV lithium-ion batteries among European manufacturers, emphasizing repair, refurbishment, and repurposing. However, further research is needed to explore the implications of these CBMs for the design of value propositions, value creation and delivery mechanisms, value capture strategies, and the roles of ecosystem actors within the EV battery system.

The implementation of CBMs for second-life often fails to scale beyond technical pilots due to the persistence of knowledge rooted in linear models of the take-make-waste paradigm (Bocken et al., 2018; Toorajipour et al., 2024). There is a pressing need for updated business model innovation frameworks that clarify how firms can create, deliver, and capture value sustainably in collaboration with industrial partners. Numerous studies have outlined challenges related to value creation, delivery, and capture in second-life business models (Olsson et al., 2018; Sopha et al., 2022; Jiao, 2019; Toorajipour et al., 2024). For instance, Olsson et al. (2018) highlighted barriers such as cognitive resistance to new models, limited perceived value in second-life solutions, and organizational obstacles including investment risks and legal uncertainties. Sopha et al. (2022) identified issues related to technology, infrastructure, supply chain operations, and management. Jiao (2019) pointed to battery ownership, inter-industry collaboration, and policy support as key enablers of second-life CBMs. Finally, Toorajipour et al. (2024) identified nine key challenges for implementing CBMs for second-life batteries, including organizational immaturity, battery quality, commercial feasibility and business uncertainty, partnerships and responsibilities, handling and logistics, cost-effectiveness, battery variants and technology, battery volume, and policies and legislations.

In light of the challenges outlined above, scaling CBMs for second-life batteries requires a fundamental shift in business thinking and the alignment of incentives among both new and existing actors within the industrial ecosystem, including providers, partners, and customers (Frishammar & Parida, 2021; Stefan & Chirumalla et al., 2025). Several studies

emphasize that addressing this challenge demands new ways of working and greater involvement of customers and ecosystem partners in the CBM development process (Parida et al., 2019; Albertsen et al., 2021; Martinez-Laserna et al., 2018). For example, Chirumalla et al. (2024) found that companies can apply a range of collaborative strategies—open, semi-open, or closed—to scale CBMs within the battery ecosystem. These strategies determine the depth and breadth of collaboration needed to optimize resource flows, share knowledge, and collectively advance battery circularity. More broadly, Bocken and Ritala (2022) propose six strategic CBM archetypes, based on two key dimensions: the resource strategy—narrowing, slowing, and closing—and the innovation strategy—open or closed. These result in six configurations: open-narrowing, open-slowing, open-closing, closed-narrowing, closed-slowing, and closed-closing. This framework further highlights the importance of aligning collaboration modes with specific resource strategies in the design of effective CBMs.

Research method

This study adopted an exploratory research design with a qualitative approach, as recommended by Makri and Neely (2021) and Richard (2018). Such a design is appropriate when investigating emerging phenomena that lack precise definitions and have not been extensively studied (Stebbins, 2001; Saunders et al., 2009). This approach is particularly useful for understanding ongoing developments, generating new insights, and uncovering underlying motivations and strategies (Saunders et al., 2009; Makri & Neely, 2021). The study employed qualitative methods for empirical investigation, which are especially suited for identifying and interpreting CBMs in real industrial contexts (Denzin & Lincoln, 2003). The use of qualitative methods in exploratory research is well-supported in the literature (Edmondson & McManus, 2007; Saunders et al., 2009; Easterby-Smith et al., 2002).

This study is part of the four-year RECREATE project, which focuses on the second-life management of electric vehicle (EV) batteries. The project involves collaboration with five core partner companies: a heavy-duty equipment and vehicle manufacturer with its own remanufacturing unit, a train manufacturer, two energy utility companies (one of which includes a recycling unit), and a material supplier specializing in battery components. In addition, ten other companies were included in the empirical investigation to capture a comprehensive perspective from various ecosystem actors within the EV battery domain. Altogether, the fifteen participating companies represent a diverse cross-section of industry, including three EV Original Equipment Manufacturers (OEMs), three energy utility companies, two recycling firms, two remanufacturing and refurbishing entities, a battery manufacturer, an engineering system integrator, a material supplier, a construction and housing company, and a public transportation provider.

The primary methods of data collection in this study were interviews and workshops. A total of 24 in-depth semi-structured interviews were conducted with 25 informants, along with 22 workshops involving 26 informants. These sessions reflected a diverse range of stakeholders within the EV battery ecosystem. Interviews typically lasted between 75 and 120 minutes, while workshops ranged from 90 to 180 minutes. All sessions were recorded, and the resulting audio or video files were transcribed for analysis. Workshops were conducted in two formats: individual company workshops and joint workshops involving multiple companies. Cross-functional managers participated in both formats. The number of participants ranged from 1 to 4 in interviews and from 2 to 5 in workshops. Informants held managerial roles across various functions, including R&D, technology, engineering, innovation, portfolio management, strategy, sales, marketing, business development, sustainability, remanufacturing, and digitalization. Participants were selected based on their expertise, relevance to the research topic, and the contextual fit of their roles.

Thematic analysis was applied to the data collected from both interviews and workshops, following the processes of data reduction, data display, and conclusion drawing as outlined by Miles and Huberman (1994) and Braun and Clarke (2006). Triangulation was employed to enhance the validity of findings by comparing data from the two methods, with a focus on specific thematic topics. Data reduction and display involved a thorough review of interview and workshop transcripts, along with field notes. The findings related to key criteria and CBM archetypes were subsequently shared with project partner companies to verify accuracy and ensure the quality and credibility of the results.

Results

The empirical findings indicate a shift toward circular business models (CBMs) among companies operating within the EV battery ecosystem. These companies are increasingly exploring ways to extend the value of batteries beyond their first life by adopting new approaches to value creation, delivery, and capture.

Key mapping criteria

Three Key To categorize and better understand these evolving business models, the study identified and grouped CBMs into archetypes based on three key criteria: circular resource strategies, collaboration architecture, and ownership structure. These three criteria were selected to enable a structured and practical mapping of CBM archetypes, grounded in both operational reality and contextual dynamics. Together, they offer a comprehensive lens for analyzing and comparing CBMs across real-world industrial settings. By using these dimensions as the basis for classification, the study moves beyond abstract typologies to develop a grounded, actionable framework for identifying viable CBM archetypes. This

approach supports a more practical and context-sensitive understanding of how circularity is being implemented and scaled within the EV battery ecosystem.

Circular resource strategies: This criterion refers to how a business model manages the flow and use of materials, components, and batteries across their lifecycle—whether by extending product life, enabling reuse, or closing material loops through recycling. It captures strategies such as maintenance, reuse, refurbishing, remanufacturing, repurposing, and recycling, which collectively aim to improve resource efficiency, reduce waste, and minimize environmental impact. By mapping CBMs against this criterion, it becomes possible to differentiate business models based on how they intervene in the lifecycle of battery materials and components—whether through high-value retention approaches like reuse and refurbishment or end-of-life strategies like recycling and material recovery.

Collaboration architecture: This criterion refers to how companies engage with internal and external stakeholders—such as OEMs, suppliers, dealers, customers, recyclers, and third-party service providers—to co-create, deliver, and sustain circular value. Collaboration architecture assesses both the openness of these relationships (e.g., open, semi-open, or closed) and the intensity of engagement (from transactional partnerships to deeply integrated networks). It evaluates who collaborates, how deeply, and through what mechanisms—such as joint ventures, co-development agreements, open platforms, or contractual arrangements. The criterion distinguishes CBMs based on the breadth of stakeholder involvement (dyadic vs. multi-actor) and the depth of interaction (informational exchange vs. strategic co-creation). It reflects the reality that CBMs cannot operate in isolation and must be supported by well-structured ecosystem partnerships capable of sharing knowledge, optimizing resource flows, and sustaining long-term collaboration.

Ownership structure: This criterion refers to the strategic arrangement of ownership and control over key assets—such as batteries, infrastructure, and data—across stakeholders in the value network. It captures how ownership is distributed, centralized, transferred, or retained throughout the product lifecycle and how these configurations influence value creation, delivery, and capture in CBMs. Ownership configuration is especially relevant in CBMs that shift from traditional product sales to service-based models (e.g., leasing, product-as-a-service), where asset ownership no longer rests solely with the end user. It highlights how governance structures and control mechanisms shape incentives, responsibilities, and revenue models. For example, whether batteries are owned by OEMs, customers, third-party service providers, or joint ventures significantly impacts the ability to coordinate maintenance, enable reuse, or ensure product return for second-life applications or recycling. This criterion also reveals underlying power dynamics within the ecosystem, affecting how risk, accountability, and decision rights are distributed.

Together, the three criteria provide a comprehensive and coherent framework for analyzing and mapping CBMs. Each criterion aligns with a core business model function: value creation (resource strategy), value delivery (collaboration), and value capture (ownership). They also reflect different levels of analysis: operational (how resources are managed), relational (how stakeholders collaborate), and governance (how ownership is structured).

Circular business model archetypes

Using the three criteria outlined above, the identified CBMs for enabling EV battery second life and circularity are categorized into three main archetypes and eight sub-archetypes, as illustrated in Figure 1. The three main CBM archetypes are: Extending, Sharing, and Looping.

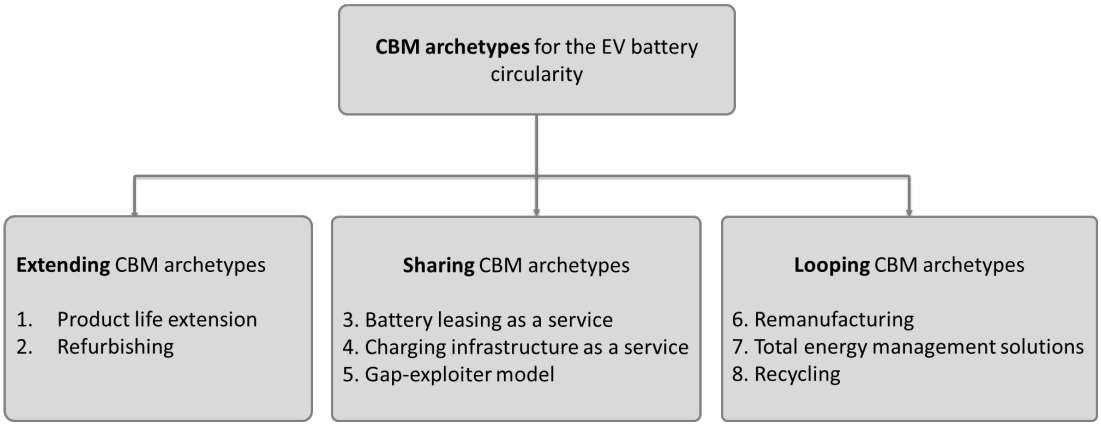


Figure 1. CBM archetypes and sub-archetypes for advancing battery circularity.

Extending CBM archetype aims to prolong the useful life of batteries and their sub-components during both first-life and second-life applications. This is typically achieved through activities such as maintenance, repair, upgrading, and refurbishing. These models help minimize waste and reduce the need for new resource extraction by maximizing the lifespan of existing battery assets.

Sharing CBM archetype focuses on maximizing the utilization of underused batteries or battery-related systems. They rely on strategies such as shared access, shared ownership, shared responsibility, and product-as-a-service models. By optimizing use without increasing new production, these models contribute to resource conservation and system efficiency.

Looping CBM archetype is designed to keep batteries, components, and materials within closed or extended loops for as long as possible. These models enable firms to retain maximum value from the original product, component, or material through processes such as remanufacturing and recycling.

In total, the analysis identified eight sub-archetypes of CBMs that advance battery circularity within these three main archetypes, as illustrated in Figure 1. These sub-archetypes include: (1) product life extension, (2) refurbishing, (3) battery as a service, (4) charging infrastructure as a service, (5) gap-exploiter model, (6) remanufacturing, (7) total energy management solutions, and (8) recycling.

Extending CBMs sub-archetypes: Our analysis identified two sub-archetypes for extending CBMs for the EV battery second life and circularity.

(1) **Product life extension**

This sub-archetype focuses on extending the lifespan of batteries or their components—both during their first life and after repurposing. In the case examined, the train manufacturer (an OEM) implements this model through two distinct collaboration arrangements: (1) partnering with a third-party system integrator and (2) establishing a joint venture with a complementary asset provider.

In the first arrangement, the OEM does not retain ownership of the batteries but supports train operators through three key strategies: 1) Extending battery lifespan during first-life use via maintenance and repair services provided in-house, 2) Collaborating with third-party integrators to collect retired batteries and repurpose them for second-life use in the same train applications, and 3) Maintaining and repairing second-life batteries during their operational phase to ensure ongoing performance.

In the second arrangement, the OEM forms a joint venture between its maintenance and repair division and a complementary asset provider. Again, the OEM opts not to own the batteries but works collaboratively to support train operators in both first-life and second-life operations. The joint venture assumes full responsibility for extending battery life in first-life use, developing second-life batteries, and managing their ongoing maintenance. This approach enables the OEM to provide long-term value to its customers while minimizing material waste and avoiding direct asset ownership—highlighting the flexibility and adaptability of the Product Life Extension CBM in industrial applications.

(2) **Refurbishing**

This sub-archetype involves the refurbishment or rejuvenation of a product or its components to extend operational life and maintain functionality. In this case, the analysis highlights the role of a material supplier—an SME—in delivering refurbishing services to a battery manufacturer. The supplier is responsible for assembling and supplying cables and harnesses used in batteries owned by the manufacturer. In addition to their assembly role, the supplier provides maintenance and repair services aimed at extending the batteries' first-life performance. Furthermore, they offer refurbishment services by replacing worn-out cables and harnesses—both during first-life operation and when batteries are retired.

This ensures that the batteries or their components can be reused or prepared for second-life applications, contributing to extended use and reduced resource consumption.

Sharing CBMs sub-archetypes: Our analysis identified three sub-archetypes for sharing CBMs for the EV battery second life and circularity:

(3) **Battery as a service**

This business model involves offering batteries to customers on a lease or rental basis, rather than selling them outright. Customers pay a fee to use the batteries for a defined period or until a specified level of usage is reached. Our analysis reveals that a heavy-duty vehicle manufacturer applies the Battery as a Service CBM through battery-swapping solutions in collaboration with its dealer network. The manufacturer owns the batteries and customizes them for its vehicles by sourcing battery cells from an external supplier. Vehicles, along with batteries, are leased to local dealers, who in turn lease them to construction site or vehicle customers. When batteries reach the end of their first life, they are collected from swapping stations by the dealers. These retired batteries are then processed into second-life batteries by the manufacturer's remanufacturing unit, which is part of a larger corporate group. The remanufactured batteries are redistributed to customers via the same dealer network. The swapping stations themselves are owned and operated jointly by the OEM and local dealers. To ensure uninterrupted service, the OEM has established two additional partnerships: one with an energy utility company to supply consistent electricity to the battery swapping stations based on fluctuating demand, and another between the battery pack manufacturer and the remanufacturing unit to guarantee a steady supply of battery packs for the swapping infrastructure.

(4) **Charging infrastructure as a service**

In this business model, companies provide charging infrastructure for EVs as a service. This includes the installation and maintenance of charging stations in locations such as public areas, sports arenas, construction sites, and residential complexes. Users access these charging services through subscription or pay-per-use models, offering convenient and flexible charging solutions. Our analysis shows that an energy utility company implements this CBM for a sports and event arena, supplying electricity for public EV charging. The utility comprises two distinct business units: one that owns and operates the electric grid and another focused on power generation. In collaboration with the infrastructure provider and a battery manufacturer, the power generation unit also acts as a BESS (Battery Energy Storage System) system integrator and provider. This unit integrates second-life batteries—sourced from OEMs and trading platforms—into its energy storage pool. It leases a BESS to the arena to supply electricity for EV charging stations. When batteries reach the end of their first life, they are collected by the power generation unit and sent to the battery manufacturer for creating second-life batteries, which are then reintegrated into the BESS. Meanwhile, the electric grid unit works with the infrastructure provider to offer

maintenance and repair services for BESS users, ensuring reliable and continuous service. This model highlights how second-life batteries can be embedded into infrastructure-as-a-service offerings to support circularity and energy resilience.

(5) **Gap-exploiter model**

This business model involves identifying and capitalizing on inefficiencies or unaddressed needs within existing markets or business processes. Companies adopting this model seek to fill structural or value gaps by offering services or solutions that other actors in the ecosystem have not yet addressed. Our analysis reveals that two energy utility companies have adopted Gap-Exploiter CBM by transitioning into the role of energy aggregators, targeting value gaps in both the frequency market and the broader energy sector. Leveraging their extensive customer base, these companies act as intermediaries—pioneering a novel business model that facilitates the integration and redistribution of energy resources. The Gap-Exploiter model in this context builds on opportunities created by the business activities of other actors, akin to third-party facilitators in the ecosystem. Examples of such third-party roles include middlemen, battery-sorting services, and battery condition analysis providers. The electric grid units of the utility companies source electricity from a diverse mix of providers, including battery suppliers, external power producers, second-life batteries from OEMs and trading platforms, photovoltaic (PV) systems from both utility companies, and a cloud-based wind power provider. As aggregators, these companies supply the consolidated electricity to the national power board, which then distributes it to regional grids—helping alleviate peak load issues. Retired batteries, upon reaching the end of their first life, are processed by the battery manufacturer to create second-life batteries. These second-life batteries are subsequently reused within BESS managed by the utility companies' grid units, further closing the loop in the energy ecosystem.

Looping CBMs sub-archetypes: The empirical analysis identified three sub-archetypes of looping CBMs in the EV battery ecosystem:

(6) **Remanufacturing**

This business model involves restoring used or worn-out products or components to a like-new condition. The process typically includes disassembly, inspection, replacement or repair of worn parts, and reassembly to meet original specifications and performance standards. Our analysis indicates that a heavy-duty vehicle manufacturer can implement Remanufacturing CBM in collaboration with its dealer network. The company offers battery leasing services to customers, and when the batteries reach the end of their first life, they are collected by dealers and sent to the manufacturer's dedicated remanufacturing unit. There, the batteries are processed into second-life units and redistributed to customers through the same dealer network. These remanufactured batteries are not limited to vehicle applications—they can also be repurposed for non-vehicle uses such as Battery

Energy Storage Systems (BESS). The business model includes partial collaboration between the battery cell and battery pack manufacturer and the remanufacturing unit, primarily for knowledge exchange and resource sharing when needed. In cases where batteries are deemed unsuitable for remanufacturing, the unit shifts into a Recycling CBM mode. In such scenarios, the remanufacturing unit either forwards the batteries to a recycling facility or returns them to the original battery cell or pack manufacturer for further processing. This dual-pathway approach enhances resource recovery and reinforces circularity across the battery lifecycle.

(7) **Total energy management solutions**

This business model involves comprehensive strategies and systems designed to optimize energy use across organizations or multiple entities, such as construction sites. These solutions integrate technologies, practices, and policies aimed at maximizing energy efficiency, reducing consumption, and minimizing environmental impact. Key features include the monitoring, control, and optimization of energy flows across operations—often enabled by digital tools and remote services. Our analysis reveals that a heavy-duty vehicle manufacturer has developed a battery-based power unit to support total energy management solutions for construction sites and vehicle customers. These solutions provide lifecycle care for battery infrastructure—covering both vehicle batteries and power unit batteries—and support network development. The offering is enhanced by digital technologies that enable data capture, storage, and remote monitoring, allowing for real-time performance tracking and optimization. The OEM envisions these solutions as meeting growing customer demands for sustainability and operational efficiency. They can be strategically deployed near customer sites or across urban areas to enhance productivity in a sustainable manner. This CBM also reflects the concept of a sustainable product location, where energy resources are localized and managed effectively.

Both the battery-based power units (i.e., BESS) and vehicle batteries are leased to customers through the OEM's distribution network. When batteries reach end-of-life, they are returned to the OEM's remanufacturing unit via the same network. To expand its circular offerings, the remanufacturing unit has established a joint venture with a complementary asset provider. This collaboration broadens their scope to include retired and second-life batteries from external OEMs, non-vehicle applications, and other renewable energy sources such as photovoltaic (PV), wind, and hydro systems. With access to a large pool of batteries through these joint and external partnerships, the OEM also operates a digital marketplace—co-owned with its distribution network. This platform provides detailed information on the availability of retired batteries, second-life units, and power systems (BESS) at regional and local levels. It serves both internal OEM functions and external customer needs. Finally, the joint venture also engages in recycling activities when batteries are deemed unsuitable for second-life use. In such cases, batteries are directed to

recycling channels to extract valuable raw materials, thereby closing the loop and reinforcing the circularity of the energy management model.

(8) **Recycling**

This business model involves the collection, sorting, processing, and reintegration of materials from discarded products or waste streams back into the production cycle. In the context of EV batteries, recycling focuses on recovering valuable raw materials—such as lithium, cobalt, nickel, and graphite—from batteries that are no longer viable for second-life use. By closing the material loop, this model helps reduce reliance on virgin resource extraction, lower environmental impact, and support the sustainability of the battery value chain.

Mapping CBM archetypes via key criteria

To provide a structured understanding of how circular business models (CBMs) are designed and differentiated, we map the three identified CBM archetypes—Extending, Sharing, and Looping—against three analytical criteria: Circular Resource Strategies, Collaboration Architecture, and Ownership Structure. These criteria reflect the operational, relational, and governance dimensions critical to enabling battery circularity. By examining how each archetype aligns with specific configurations within these dimensions, we establish a comparative framework that highlights the strategic design of CBMs in the EV battery ecosystem. This mapping contributes both to theoretical development and to practical guidance for firms aiming to shift from linear to circular models of value creation, delivery, and capture.

Extending CBMs focus on prolonging the use of EV batteries through repair, maintenance, and upgrades during both first-life and second-life stages. These models typically operate through semi-open or strategic partnerships, often structured as one-to-one collaborations or joint ventures—such as between an OEM and a complementary asset provider. Ownership in these models is usually retained by customers or OEMs, who often avoid direct ownership of the batteries themselves while offering support through service-based extensions.

Sharing CBMs aim to maximize the utilization of underused battery assets through temporal or spatial sharing strategies, including leasing models and infrastructure-as-a-service solutions. These models depend on open or semi-open collaboration across diverse stakeholders—such as OEMs, dealers, energy utilities, and customers. Ownership is typically centralized (e.g., with the OEM or a third-party provider), while usage is decentralized, prioritizing access over ownership.

Looping CBMs are designed to enable the continuous circulation of materials, components, and batteries through remanufacturing, recycling, and integrated energy lifecycle

management. These models operate within closed-loop systems or highly integrated ecosystems involving manufacturers, recyclers, and end users. Ownership is often centralized or transitions between actors to ensure the controlled recovery and reintegration of materials into the value chain.

Table 1 maps the three CBM archetypes—Extending, Sharing, and Looping—against three key criteria: Circular Resource Strategies, Collaboration Architecture, and Ownership Structure. This CBM Archetype-Criteria Matrix offers a structured framework for systematically classifying, analyzing, and designing CBMs based on their underlying operational, relational, and governance characteristics.

Key criteria	Extending CBMs	Sharing CBMs	Looping CBMs
Circular Resource Strategies	Focused on maintaining and prolonging battery life through repair, maintenance, and upgrades.	Maximizes utilization through leasing, shared infrastructure, and services.	Enables full material/product loops via remanufacturing and recycling.
Collaboration Architecture	Semi-open partnerships, often dyadic or joint ventures for service provision.	Open or semi-open networks; multi-stakeholder collaboration (OEMs, dealers, utilities).	Tightly integrated or closed-loop systems; value chain collaboration crucial.
Ownership Structure	Ownership is often retained by OEM customers; OEMs support without direct ownership.	Centralized ownership with distributed access; customers pay for use not ownership.	Ownership often returns to central entity (OEMs or recyclers) to enable material recovery.

Table 1. The CBM Archetype-Criteria matrix

Discussion and conclusions

Facilitating the transition toward battery second life and circularity requires the identification of suitable Circular Business Models (CBMs) to ensure the commercial viability of emerging solutions. In response, this study delineates three primary CBM archetypes—Extending, Sharing, and Looping—alongside eight empirically grounded sub-archetypes: product life extension, refurbishing, battery as a service, charging

infrastructure as a service, gap-exploiter model, remanufacturing, total energy management solutions, and recycling. By offering a structured framework, we provide actionable CBM configurations tailored for second-life utilization of EV batteries within the broader battery ecosystem.

To support both theoretical clarity and practical application, we introduced the CBM Archetype–Criteria Matrix, which maps the three CBM archetypes against three key criteria: Circular Resource Strategies, Collaboration Architecture, and Ownership Structure. This matrix enhances the interpretive value of our findings by offering a structured way to evaluate and design CBMs based on their operational characteristics and ecosystem alignment. It serves as a comparative framework that supports firms in assessing existing models or designing new, context-sensitive strategies aligned with circularity principles.

Theoretical contributions

This comprehensive understanding of CBMs offers a foundation for advancing both academic research and industry practices in navigating the complex landscape of EV battery second life and circularity. Our contributions to theory and practice span three key domains: (1) CBM archetypes for EV battery circularity, (2) Clarifying CBM archetype structures in the circular economy, (3) The CBM Archetype–Criteria matrix as a comparative framework.

Primarily, our study furnishes a detailed understanding of viable CBM archetypes and sub-archetypes for EV battery utilization in their second life and circularity. This insight offers new perspectives on how CBMs can be developed and integrated to facilitate circularity in EV battery systems. We identify three primary CBM archetypes—extending, sharing, and looping—alongside eight sub-archetypes, each connected to key business model elements that support second-life implementation. While previous literature on CBMs—such as Costa et al. (2022), Júnior et al. (2023), Wrålsen et al. (2021), Schulz-Mönninghoff and Evans (2023), Reinhardt et al. (2020), and Bonsu (2020)—has addressed this topic, only a limited number of studies have specifically explored different types of CBMs for EV battery second life (e.g., Albertsen et al., 2021; Olsson et al., 2018; Wrålsen et al., 2021; Reinhardt et al., 2020; Jiao, 2019). These studies often present CBM archetypes conceptually, take a broader or generalized perspective, combine multiple business model types, or focus on CBM elements at a high level. In contrast, our study adds value by presenting a comprehensive CBM archetype structure composed of three main archetypes and eight empirically grounded sub-archetypes, specifically tailored for advancing battery circularity.

Secondly, this study makes a significant contribution to advancing the understanding of CBMs and their archetypes, building on existing research by scholars such as Bocken and Ritala (2022), Geissdoerfer et al. (2020), Lewandowski (2016), Lüdeke-Freund et al. (2019), and Reim et al. (2021). Despite the substantial body of literature on CBMs, their types, and

archetypes, inconsistencies and overlaps in interpretation persist. Different categorizations and strategic frameworks are often emphasized, leading to conceptual fragmentation and confusion within the field. To address these challenges, this study proposes a clear and practice-oriented CBM archetype structure comprising three main archetypes: extending, sharing, and looping. These archetypes are conceptually aligned with the circular economy principles of reducing, reusing, and recycling. Furthermore, the study adds granularity by identifying eight empirically grounded sub-archetypes, derived from in-depth interactions with 15 companies in the EV battery ecosystem. This structure not only enhances theoretical clarity but also offers practical relevance for guiding the development of CBMs in industrial contexts.

Thirdly, a key theoretical contribution of this study is the development of the CBM Archetype–Criteria Matrix, which offers a structured means of comparing business models based on their alignment with circular economy principles. By integrating circular resource strategies, collaboration architecture, and ownership structure as core analytical dimensions, the matrix serves as a practical tool for researchers and practitioners to evaluate, design, and scale CBMs effectively. This framework moves beyond high-level typologies by providing a systematic, operational perspective on how CBMs function within complex industrial ecosystems—such as the EV battery domain—where multi-actor collaboration, resource loops, and governance structures critically shape circular outcomes.

Managerial implications

The insights gathered from this study are highly relevant for practitioners across the EV battery ecosystem, including professionals in managerial, engineering, and developer roles spanning functions such as technology, supply chain, strategic business development, ecosystem design, innovation, portfolio management, marketing, sustainability, and digitalization. Given the study's focus on battery circularity and lifecycle management—from design and manufacturing to operational deployment, second-life use, and recycling—its findings are applicable across both intra-organizational teams and inter-organizational collaborations. A key practical contribution is the CBM Archetype–Criteria Matrix, which provides ecosystem actors with a structured tool to evaluate, compare, and design CBMs based on three key criteria. Practitioners can use this matrix to: Assess their existing business models against circularity principles; Identify opportunities for extending battery life, enabling shared use, or closing material loops; Plan partnerships by aligning collaboration modes with value creation goals; Clarify ownership roles to reduce risk and improve asset lifecycle control; and Strategically design CBMs that are scalable, viable, and tailored to specific organizational or ecosystem contexts. By applying these criteria, companies can better align their operations with circular economy goals, foster ecosystem-wide collaboration, and develop sustainable, future-ready business models for battery value chains.

Limitations and future work

This study has engaged with a comprehensive array of key actors, notably involving 15 companies representing diverse roles across the EV battery value chain. While the research covered pivotal positions within the ecosystem by collaborating with 10 different sets of companies, certain relevant stakeholders—such as insurance providers, logistics firms, and public sector bodies—may have been underrepresented. Future studies could broaden the stakeholder scope to examine how the inclusion of such actors might influence the applicability, dynamics, and evolution of the proposed CBM archetypes.

Moreover, this study employed an exploratory research design grounded in qualitative methodology, which was appropriate given the emergent nature of the topic. Nonetheless, this approach introduces limitations in terms of generalizability and depth of validation. Future research could apply more detailed case studies or comparative analyses across regions or sectors to refine the understanding of CBM archetypes, and the associated key criteria. Longitudinal research tracking the entire EV battery life cycle—from production and use to second-life applications and end-of-life recycling—would also offer deeper insights into the evolving business models and ecosystem dynamics.

Another important limitation concerns the CBM Archetype–Criteria Matrix itself. While it provides a useful conceptual and practical framework for comparing and designing CBMs, its application remains largely interpretive and based on qualitative assessment. Future research could work to operationalize the matrix further by quantifying or scoring alignment between business models and each of the three criteria. Doing so would enable benchmarking across cases and increase the matrix's utility as a diagnostic and strategic planning tool for firms.

Finally, subsequent studies should explore the intersection of CBMs archetypes and digital technologies to determine which tools (e.g., IoT, blockchain, digital twins, AI) best support the optimization of circular value propositions, co-creation processes, delivery mechanisms, and capture strategies. This line of inquiry can further enhance the commercial viability and scalability of CBMs, aligning business innovation with the broader goals of climate-neutral electrification and sustainable energy transitions.

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Sustainable Business Models in Agriculture – a Scaling Tale ‘In Spe’

Short article presenting a research proposal for capturing business models that enhance agricultural transformation

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Abstract

The Green Deal requires EU member states to regulate emissions by agricultural activity; leading to different innovations that are currently still small scale. This contribution proposes a research agenda for investigating scalability and impact of new agricultural business models aimed at reducing harmful emissions.

Keywords: new agricultural business models, scaling, impact, emission-reducing supply chains, cooperative business models

Introduction

The European Green Deal (EU, 2020) calls upon member states to implement legislation for slowing down climate change and preventing ongoing biodiversity loss, with the initial aim to become a climate-neutral continent by 2050. From a business perspective, all sectors in all EU member states must contribute to reduce or capture, amongst others, CO2, NOx, and NH3 emissions.

In the debate on reducing emissions agriculture stands out as an important sector for various reasons. First of all the primary value offer of agriculture – feeding a growing world population - is essential for humanity. This is acknowledged by national governments; agriculture is often exempt from regulations put on industry. Secondly, agriculture is currently responsible for a large share of harmful emissions. If these are to be reduced, we need to rethink established agricultural production manners. However, measures for downsizing emissions by agriculture differ per European member state.

Observing various promising pilots by farmers in different European countries, we feel the need to discuss both scale and impact of new agricultural business models for reducing and capturing harmful emissions. In recent years there has been growth in contributions on sustainable agricultural business models, and a number of archetypes have been identified (Donner et al., 2020; Barth et al., 2021; Rodrigo et al., 2022; Salvador et al., 2023). Investigating this literature we find two things that stand out: 1. Archetypes are typically based on a number of small scale implementations of business models that often have no requirement of profitability, 2. There are large differences between countries when it comes to maturity in implementing circularity and in relevant legislation relating to new organizational archetypes, on national and EU level.

From both academic and practice-based perspectives it seems vital to investigate what happens when sustainability-oriented agricultural business models are scaled. With reference to the scaling and transformation literature we should ask; does the business model *grow*, can it be *replicated* in different contexts, can it be connected to other initiatives (*accumulation* or cross sector collaboration), and does it transform by leading to society-wide changes (*transformation*) (Naber et al., 2017; Sondal et al., 2024). Sustainable agricultural supply chains contribute to the circular economy. According to the Ellen MacArthur foundation (2023) production for the circular economy requires a distributed and interconnected network of local and global partners; multidirectional flows of information, goods, and revenues; and circular inputs based on non-virgin and/or regeneratively grown products and materials.

Establishing a stable supply chain that contributes to reducing emissions requires production methods – and consumption patterns- focused on collective impact regarding those emissions as well as indicators for monitoring progress and impact. Given the agricultural context, cooperative models emerge as potential business models for reducing and capturing emissions. In order to understand whether and how innovative approaches in agriculture contribute to reducing and capturing emissions, it is essential to deepen our knowledge on collective organizational models. However, there is limited experience with scalable cooperative or other collaborative models that integrate a significant part of the value chain while aiming for sustainable impact. Additionally, the bio-based sector involves the development and market entry of novel crops and products, necessitating a contemporary, value-driven adaptation of involved traditional business models, whether cooperative or not. Interest in (collaborative) organizational models for sustainable impact is gradually increasing in both academia (Gray & Purdy, 2018; Igalla et al., 2019; Jonker & Faber, 2021) and industry, but prosperous practical examples on an industrial scale remain scarce in Europe. Considering different national policies to address emissions capture, an obvious choice is to investigate and compare business models anticipating national policies that support and promote sustainability targets. Our proposal complements existing and emerging projects, programs, and pilot studies, which largely address the operational and policy-related aspects of bio-based raw material cultivation, processing, and application.

As is often the case when it comes to agriculture, the Netherlands and Denmark stand out as interesting countries within which to search for relevant cases. Both countries have large agricultural sectors in dire need of legislation targeted towards reductions in CO2, NH3, NOx, and other emissions, next to various other sustainability-related targets.

The cases of Denmark and the Netherlands

Dutch and Danish agriculture are similar on most parameters. Since WWII the strategy has been to optimize agricultural production with a focus on cost reductions, resulting in large scale production of meat, dairy, eggs and livestock fodder. Agricultural innovation is traditionally directed towards upscaling farms, efficiency in production, and increasing output per acre. The downside of this manner of production is that agriculture has become a prime contributor to air pollution and biodiversity loss with NH3 emissions and NOX emissions running high compared to the levels of many other countries.

The importance of the agricultural sector, regulations and finance in favor of existing large-scale agriculture, minimal support for small-scale agriculture that is regarded as inefficient, and the relatively large environmental consciousness in both countries, means

that on one hand they have some of the worlds most efficient dairy and pork production systems in the world (World Resource Institute, 2020). On the other hand they have critical levels of nitrogen deposits (NH3 & NOx) on terrestrial and aquatic ecosystems. Additionally, processing products and transport add to CO2 levels. This means that both countries need to find new solutions – and they must find them without shifting the burden of CO2 and other emissions to other countries, e.g., without causing a shift in meat and dairy production to countries with higher carbon costs.

Due to production methods in both countries, with little reliance on grazing-based systems and using land for feed production, they are both receptive to high tech solutions, but also need to extensify their agriculture to save aquatic ecosystems and biodiversity. Technological extensification may sound as an oxymoron, but it is a puzzle that both countries are working on solving – although in different ways. Both in Denmark and the Netherlands, multiple pilots are conducted related to sustainable and circular agricultural systems that contribute to the Green Deal. To illustrate the variety we discuss some major contemporary efforts below.

Taxing livestock and introducing pyrolysis (biochar)

In 2022 Denmark introduced a uniform CO2 tax of 100 Euros/t CO2e across all industries to be implemented from 2025-2030 with only a few exceptions – among them agriculture. In 2024 it was agreed to introduce the CO2 tax on agriculture as well, starting from 2030 – including a tax on CO2e emissions from livestock, calculated as a fixed amount per animal with some incentives – e.g., a reduction when feed additive that reduces emissions is used. For the farmer, legislation introduces a method for reducing CO2 taxes since production of biochar is regarded as negative CO2 emission. This is a somewhat controversial legislation since the pyrolysis process is not yet fully controlled, and since documentation of the time perspective of CO2 storage is still to be documented (some say 100 years, others say eternally). From a business model perspective, the case is interesting since it not only makes room for new types of business models, it also opens up for new forms of collaborative or cooperative business models.

Piloting the regional bio-economy

Dutch agricultural activity has become a prime contributor to air and soil pollution with NH3 and NOx emissions hindering permits for, amongst others, construction projects and roadworks. In 2023 the National Approach for Biobased Construction was launched (Rijksoverheid, 2023). The aim of this approach is to grow crops for industry, with a focus on fibre crops for building materials. This offers sustainable perspectives for various actors in the supply chain of building materials. Instead of producing harmful emissions as a side

effect of agriculture, farmers capture emissions for long-term use in construction, thus also reducing construction emissions. This policy has sparked various experiments and pilots that are still in an early stage. A common denominator in these pilots is the aim for establishing regional supply chains using collaborative or cooperative business models where farming, producing building materials, and construction meet, aiming for large scale (social) housing projects, solving the current housing crisis while contributing to the Green Deal.

Business Model Scalability from a Sustainability Perspective

In business model literature scaling is a buzz word often referring to exponential increasing returns to scale (Nielsen & Lund, 2018; Stampfl et al., 2013)), but in a context of sustainability it needs to mean something different. A good starting point for discussing sustainable scalability is the work of Stützel (1958) and Schellings (1978) since they both discuss unintended behavior of a system at the macrolevel following from behavior at a micro level that is not motivated by the macro outcome (thus Schellings title: Micromotives and Macrobehavior). Stützel introduces the concept *size effects* (Saldenmechanik) and gives the example of advertising: the need for advertising depends upon the level of advertising by others – you always need to be one step ahead of competitors. Schelling has the renowned example of racial segregation where people prefer to live in mixed neighborhoods but end up living in segregated neighborhoods due to unintended scaling or size effects. A scaling effect may take the form of a network effect, but it emphasizes feedback from macro to micro level. When designing business models – or designing policy initiatives for promoting certain types of business models, such scaling effects need to be considered. When you scale a business model, will there be any feedback from the macro level limiting the positive impact of the individual business project? Are there any inhibition factors built into the scaling itself?

Since sustainable business modeling is primarily directed towards the impact a certain business model has on its environment, researching scalability in this context is primarily about scaling impact, not scaling profits (Lam et al., 2020; Woltering et al., 2019). This research project is then a search for:

1. behavior or governance structures that have the potential to accelerate or decelerate the diffusion of sustainable business models, understood as a method for creating more value for society at large or for using less resources (including minimizing negative environmental or social impacts).
    a. Sustainable business model may change power relations between causing big farms to crowd out small farms. This may impact landscapes and living conditions in rural areas (Swaffield et al., 2019).

Further increases in farm concentration may also have negative side effects.

b. Stakeholders in sustainable business models may have different time perspectives. Farmers need to look 25-30 years ahead when investing in sustainable solutions, whereas political initiatives often have a time span of 4-10 years. Farmers need assurance that legislation will remain favorable to their investments (Niskanen & Magnusson, 2021).

2. Sustainable business models that may turn less sustainable once they are scaled – unless authorities and other stakeholders are careful to design the right governance structures that can prevent e.g., opportunistic behavior or overexploitation of the business model.

    a. An example of opportunistic behavior is the case of wood pellets made of waste from foresting or the wood industry. Once this waste earned a market price, agents started using scarce resources to produce waste, i.e., deforestation of large areas and loss of biodiversity with the sole purpose of making wood pellets.

    b. An example of overexploitation of a sustainable business model could be their market impact. If extensification of agriculture leads to price increases on world food markets, repercussions for the poor could be intolerable. If European countries stop producing meat without changing meat consumption habits, environmental problems would just move outside Europe.

3. To what extend do the business models rely on regional and/or local capacity? How difficult is it to replicate elsewhere? (Barth et al., 2021). Identification of internal and external success factors (Velten at al., 2021)

    a. Regarding crops for industry, there is an expected demand for fibres for construction and sugars for polymer production. However, as long as that demand is not structurally growing, farmers are hesitant to invest in new crops and production methods. Simultaneously, industry and construction demand stability and quality in supply while farmers have only just started piloting.
    b. Research into crop-produce combinations, production methods and use is still developing while farmers are expected to invest in new crops, new collaborations, and impact-oriented business models.

4. To what extent do the business models rely on collaborative efforts, and are governance structures and legislation supportive of collective business models? (Derks et al., 2022; Velten et al., 2021; Niskanen & Magnusson, 2021).

    a. With CO2 taxing of livestock beginning in 2030, Danish farmers are eager to participate in collective ownership of biogas + pyrolysis plants – but legislation does not regard investments in pyrolysis as a farm activity, making it difficult to finance such investment within the current business organization.

    b. Risk sharing is also an important aspect to consider. In forming cooperative waste management systems (biogas or pyrolysis), partakers are often signing up for delivering certain amount of waste for a longer time period. But uncertainties about market developments and future changes in policy make the individual farmer reluctant to make such promises. On the other hand, getting finance for such projects is difficult without certainty about supply.

Research Question, suggested Methods, and Open Invitation

We propose an international, interdisciplinary research agenda at a pivotal moment when EU policy, market demand, and technological innovations are converging to support the development of national solutions for both agriculture and industry. By investigating new agricultural business models that anticipate Green Deal priorities, we aim to accelerate the transition toward resilient, sustainable, and economically viable bio-based production systems.

The purpose of the here proposed research project is to collect, connect and systematize the currently fragmented experiences from organizations applying new business models in agriculture in response to government policy related to the Green Deal. The research focuses on new business models in agriculture aimed at diminishing and capturing harmful emissions by growing and processing crops for industry or energy at a profitable and scalable basis. The research question we aim to address is *What organizational models for establishing emission-reducing agricultural supply chains are scalable?*

To answer this question we propose a an international research program that integrates both academic and practice-based research methods for:

- Mapping value chains and identifying necessary partners
- Identifying success and failure factors for sustainable value chain collaboration.

- Developing impact models from a multiple value perspective related to revenue models
- Researching collective (cooperative) organizational and transaction models, governance structures, accountability frameworks, and financing mechanisms (literature review and empirical research)
- In addition, collecting and monitoring data during international comparative research will enable the monitoring of various impacts of bio-based value chains

We aim to disseminate knowledge to the research community as well as to the practice of emission reducing value chains in agriculture. Such dissemination could ease replication and accumulation of new business models in agriculture and inform future political initiatives and its stakeholders. We welcome your feedback and are interested in partners involved in similar research directions.

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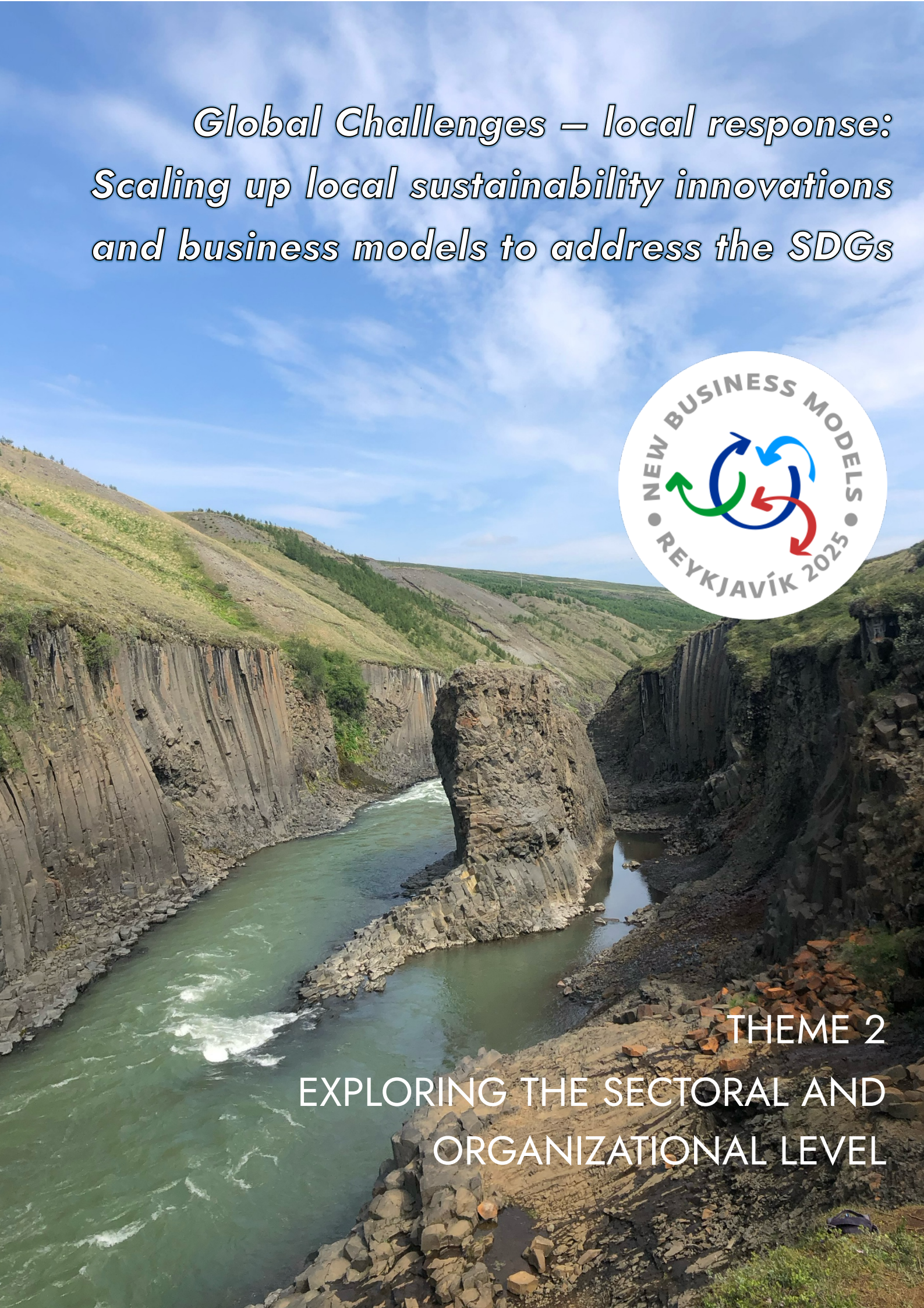
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Global Challenges – local response: Scaling up local sustainability innovations and business models to address the SDGs



THEME 2

EXPLORING THE SECTORAL AND ORGANIZATIONAL LEVEL

EXPLORING THE SECTORAL AND ORGANIZATIONAL LEVEL

Artificial intelligence-driven sustainable business model innovation: A systematic literature review

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Extended abstract

To promote a sustainable future, the European Commission has set the objective of leveraging digital technologies to drive systemic transformations toward a greener economy, encapsulated in the vision of the twin transition (European Commission, 2021). The twin transition refers to the interconnected and simultaneous pursuit of green and digital transformations to reduce companies' carbon footprints (Rehman et al., 2023).The European Green Deal (European Commission, 2019) underscores the need to address digital and green transitions together, as their integration can amplify and accelerate benefits. It highlights the role of digital technologies in achieving an environmentally sustainable transformation, framing this synergy as a digitally enabled sustainable transition (European Commission, 2024).

However, the success of the twin transition also depends on addressing its social dimension, ensuring that opportunities and challenges are distributed fairly across all sectors of society. The Triple Transition framework, which integrates digital, green, and social aspects (European Commission, 2022), provides a comprehensive approach to driving equitable and inclusive economic transformation.

Achieving a green, digital, and inclusive economy requires the involvement of several stakeholders within industrial ecosystems (SMEs, start-ups, NGOs, corporations, or governments) as well as a fundamental rethinking of traditional business models and strategies. This approach offers pathways to greater competitiveness, resilience, and long-term sustainability. Accordingly, it represents a paradigm shift in sustainable business model innovation (Aagaard & Vanhaverbeke, 2024).

Business Model Innovation (BMI) is the process of transforming existing business models to gain a competitive advantage by altering the terms of competition (Boons & Lüdeke-Freund, 2013). It involves reconfiguring the fundamental elements of a business model —value creation, delivery, and capture—to implement market strategies influenced by innovations in processes and products.

Consequently, Sustainable Business Model Innovation (SBMI) is described as “innovations that create significant positive and/or significantly reduced negative impacts for the environment and/or society, through changes in the way the organisation and its value network create, deliver value and capture value (i.e., create economic value) or change their value proposition” Bocken et al., (2014, p. 44).

Digitalisation is pivotal in advancing sustainable business models (SBM) across various value functions. It facilitates value unlocking by enabling informed decision-making and enhancing access to sustainable offerings. (Lüdeke-Freund et al., 2024). Digital technologies contribute to value sharing through platforms that improve stakeholders' socioeconomic conditions (Broccardo et al., 2023). They also support value creation, delivery, and capture within sustainable entrepreneurship (Fuerst, Sanchez-Dominguez & Rodriguez-Montes, 2023). Digitalisation can drive innovation in SBM and enhance resource efficiency, supply chain management, and stakeholder engagement (Kalluri, 2023).

Particularly, artificial intelligence (AI) is emerging as a fundamental driver of innovation in business models across various sectors, such as manufacturing, logistics, tourism or agriculture (Ben Youssef & Mejri, 2023). Technologies such as machine learning and natural language processing have the potential to transform operational processes, optimise decision-making, and foster innovation (David Olanrewaju Olutimehin et al., 2024).

Recent research underscores the transformative potential of AI in reshaping business models by introducing novel value propositions (Deep technology researcher, data analytics supplier, AI product and service supplier), harnessing innovative data applications, and redefining traditional business paradigms (Lee et al., 2019; Riya Widayanti & Lista Meria, 2023). The successful implementation of AI in BMI necessitates a comprehensive understanding of organisational capabilities, existing business models, and the dynamics of the ecosystem. (Reim, Åström & Eriksson, 2020). AI serves as both an originator and facilitator of innovation. It can generate novel ideas and solutions while also supporting and enhancing existing innovation processes (Brem, Giones & Werle, 2023). For instance Brem, Giones & Werle, (2023) explain that AI systems contribute to idea generation by analysing large datasets and identifying patterns to generate new service or product ideas. They also assist in the prototyping and testing of these new products, facilitating their rapid development. Other examples include the support AI provides in decision-making and strategy. According to David Olanrewaju Olutimehin et al. (2024), AI-driven insights enhance strategic planning and help organizations determine which innovations to pursue and how to allocate resources effectively. This includes conducting potential risk analysis and identifying opportunities associated with innovations, helping organizations make more informed decisions. Nevertheless, its effective integration requires strategic foresight, cross-functional collaboration, and addressing challenges such as data governance, talent acquisition, and ethical considerations.

Moreover, despite its potential, the current literature lacks a clear framework on how business models could be transformed and how managers could reconfigure them to create and capture value through AI (Jorzik et al., 2024b). (Jorzik et al., 2024b) also highlight the need to explore the interdependencies between environmental changes and adopting new business models. This gap presents a research opportunity to explore the strategic implications of AI-driven business models and their potential to

foster innovation in creating and capturing sustainable value, including their impact on social and environmental domains (Jorzik et al., 2024a).

To address this gap and as part of an ongoing PhD research project, a systematic literature review (SLR) is performed. The objective of this SLR was to explore the role of AI in driving SBMI and the resulting sustainable business model typologies. To structure the SLR, four research questions were defined:

RQ1: Which AI-driven SBM typologies exist?

RQ2: How can AI-driven BM innovation create, deliver and capture sustainable value?

RQ3: How can AI support innovation processes and strategic decision-making in SBM innovation?

To respond to these research questions, the SLR followed the 'Preferred Reporting Items for Systematic Reviews and Meta-Analysis' (PRISMA) guidelines. (Page et al., 2021). The search was conducted in two different literature indexers, namely Scopus and Web of Science (Wos). The search query included "sustainable*" AND "business model*" AND "artificial intelligence" OR "AI" in the title, keywords, or abstract of the articles. As a result, 285 articles were identified 179 in Scopus and 106 in WoS, which were reduced to 124 after removing duplicates, limiting them to the English language, and only considering articles and reviews. For the initial screening titles, abstracts, and keywords were evaluated, resulting in 88 articles selected for further in-depth analysis using content analysis. The Atlas.ti (https://atlasti.com/) qualitative research tool will be used to support the coding and enhance data visualisation.

The expected results of the SLR include:

1. A descriptive analysis of the final sample of articles (e.g. publication years and trends, countries of publication, application sectors, authorship, research topics, and gender distribution).
2. Identification and classification of existing AI-driven SBM typologies.
3. Insights into AI-driven BMI and its ability to create, deliver, and capture sustainable value, leading to measurable environmental, social, and economic impacts.
4. Understanding the role of AI in supporting and enhancing SBMI processes, including the steps, activities, and tools involved.
5. Exploration of AI-driven decision-making tools and their contribution to assisting industrial companies in developing SBMI.

This SLR aims to contribute significantly to the advancement of research in the field of sustainable business models, providing valuable insights into their development and the role of AI in driving BMI. Furthermore, it seeks to provide actionable knowledge that can guide companies in adopting sustainable practices and transforming their business models. By leveraging the advancements in AI and its role in driving SBMI, this research aligns with the objectives of the twin transition, fostering the

integration of digital and green transformations to achieve long-term environmental, social, and economic benefits.

Keywords

Twin transition, digital transition, green transition, AI, sustainable development.

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Data-driven Circular Business Models - Overcoming barriers to sustainable innovation

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This paper uses Design Science Research to explore the challenges of implementing data-driven circular business models in specific industries. It develops a prototype digital management system to enhance data sharing between stakeholders for successful Circular Economy adoption.

Abstract

Background – Producers are responsible for the entire life-cycle of their products, including end-of-life handling after use. While Circular Business Models (CBMs) call for reduced waste and closed-loop recycling, most of the world's plastic is incinerated or landfilled instead of reused. A key barrier to CBM adoption is the lack of data-sharing between stakeholders in recycling processes.

Purpose – This paper uses sustainability theories to explore barriers to data-driven CBMs and how improved data transparency can facilitate collaboration between different stakeholders of manufacturers and recyclers.

Research method – Using Design Science Research (DSR) methodology, 22 interviews with stakeholders and experts in the construction and plastic packaging industries were conducted to identify challenges and solutions.

Findings – A prototype digital management system was developed to enhance data sharing, and improve collaboration and data transparency to encourage CBM adoption. The data dimension between Business-to-Business (B2B) is a crucial motivator to incentivize the display of costs and CO_2 savings, while offering a discount mechanism.

Business impact – Beyond the financial aspects, details on cost-benefits and incentives highlights the importance of data collection via a digital tool to enable material traceability, fostering transparency in data sharing and incentives.

Value – The study shows that economic viability is essential for recycling adoption. Data-driven CBMs improve material traceability and information exchange. The digital management system helps companies track materials and incentivises sustainable behavior. While the findings focus on construction and plastic packaging, the approach can inspire similar efforts in other industries, driving the transition to a Circular Economy.

Keywords

Sustainable transformation, Stakeholders, Data-driven business models for sustainability, Data sharing

1. Introduction

The transition towards a Circular Economy (CE) is essential for promoting sustainability and resource use to increase raw material efficiency (Smol et al., 2024). Crucially, Circular Business Models (CBMs) are gaining significant attention, as they offer innovative ways for companies to minimize waste, reduce resource consumption, and enhance the value of products through reuse, recycling, and remanufacturing (OECD, 2021). As the European Union enforces Extended Producer Responsibility (EPR), producers are increasingly accountable for their products across their entire lifecycle, including post-consumer waste (OECD, 2021).

Despite the potential benefits of CBMs, businesses face significant challenges in their practical implementation. For many manufacturers, the advantages of adopting CBMs remain unclear, as secondary materials often carry higher costs and inconsistent quality. For instance, only 9% of plastic waste is recycled globally, with 22% mismanaged (OECD, 2021), which underscores the need for improved recycling practices. Additionally, the complex nature of circular transitions - requiring new sourcing partnerships, material data-driven CBMs can help testing, and product approvals- can further hinder progress.

This chapter examines the role of data-driven CBMs in overcoming these barriers. It argues that by leveraging digital tools and improving data sharing among stakeholders such as manufacturers, recyclers, and other critical actors, companies can optimize decision-making in CBMs, enhancing traceability and transparency in the recycling process as well as effective collaboration in circular ecosystem. Theorethically, the chapter contributes to CBM scholarship by highlighting the key role of traceability and transparency for overcoming the business challenges posed by sustainability goals.

2. Key Concepts

The paper builds on and expands the field of CE (Ghisellini, P. et al., (2016), Giorgi, S. et al. (2022) and Hossein et al. (2020), focusing on three concepts that are important to understanding the barriers to the transition to circularity at industry and organizational levels:

1) CBMs: aim to create, deliver and capture added value while aligning with CE principles (Smol et al., 2024). To be effective, they need to retain and create value from resources without compromising profitability (Ortiz-de-Montellano and van der Meer, 2022). Closed-loop systems offer cost savings and new value creation (Ghisellini et al., 2016), enabling the profitable reuse of products and materials (Bocken et al., 2016). As focus shifts to the ”operationalization phase” (Bocken et al., 2019), implementation requires new material flow processes.

Successful CBM adoption depends on stakeholder collaboration (Leder et al., (2023), especially through data collection and sharing. This paper focuses on the construction and plastic packaging industries to examine how data-driven exchange can support the direct reuse of rooftop materials by producers, bypassing traditional recycling routes like regrinding and online plastic waste marketplaces (Jong and Mellquist, 2007).

2) **Recycling**: Closing the loop through recycling is a subset of a CBM. Lüdeke-Freud et al. (2019) describe six main patterns of CBMs, one of which involves recycling to separate, collect, and reprocess, materials for new products. In the B2B industrial production process, there is a time gap between production choices and recycling years later.

3) Stakeholders play a crucial role in implementing CE principles, particularly in industries such as construction or plastic packaging. Here the flow of materials is crucial to sustainability. In plastic waste and recycling, manufacturers and recyclers emerge as key stakeholders who significantly influence CE practices:

a) **Manufacturers** produce materials for the construction or plastic packaging industries and can drastically improve waste collection outcomes. Brand owners can drive the demand for sustainable materials by choosing those that are more easily recycled. However, challenges like sustainable sourcing, high cost and limited availability of secondary plastic material persist. To address these, manufacturers need digital tools that enhance data transparency and support collaboration with recyclers.

b) **Recyclers** (or waste collectors) deal with the aftermath of end-of-life of a product or construction and demolition. They recycle materials when possible or dispose of waste in landfills or incinerate it. They often collaborate with construction and demolition companies and are regulated by waste management policies.

Current challenges to circularity and sustainability include low awareness (López Ruiz et al., 2020), poor communication (Hossain et al., 2020) and insuficient participation incentives (EU 2021, Gálvez-Martos et al., 2018).

3. Research Gap

CBMs aim to extend the life-cycle of products and materials, thereby increasing their circulation and retained value (Lüdeke-Freund et al., 2019). While much of the recent literature focuses on conceptual studies of CBM, there is a need for granular insights into their practical implementation (Pietrullac& Frankenberger, 2022). Data-driven CBMs can create value by using data to support circular practices, but this depends on accessable data (Ghoreishi, 2023). Currently, data gaps exist across a construction project's lifecycle, including the end-of-life recycling phase (Yuang et al., 2021). Existing literature fails to

address the specific needs of businesses, resulting in overly general guidance and a lack of clarity on what data should be shared.

Reducing **data uncertainty** along the recycling value chain and improving data sharing will help manufacturers and recyclers to reach new and effective circular solutions (Azizi et al., 2023). A key gap remains in how stakeholders—particularly recyclers and manufacturers—can make informed decisions on resource use and material recirculation based on transparent data. The study addresses this gap by examining behavior and incentives, and the role of cost-benefit transparency. It builds on findings from industries like plastic packaging (Borner & Eisenbart, 2024) and Swedish manufacturing (Reim et al., 2021), which highlight the need for industry-specific insights.

To address these challenges, this paper investigates how a prototype digital management system can support data-driven circular CBMs. Through an in-depth analysis of two industries, it presents a tested artefact designed to improve B2B data sharing, enhance data quality, and support decision-making in recycling.

While Bocken et al. (2019) provided a comprehensive overview of CBM tools in the ideation and design phase, this research deepens insights into the complexity of CBM implementation with contribution for CBM **operationalization** in the ”implement and test” and ”evaluate and improve” phases, and connected them to data-driven aspects of CBM.

4. Methodology to Explore the Topic

This study used the Design Science Research (DSR) methodology to explore information exchange and decision making among B2B stakeholders in the production and recycling value chain. Research design and data collection and analysis are described below. DSR is a problem-solving paradigm that seeks to enhance human knowledge via the creation of innovative artefacts (vom Brocke et al., 2020a) in the information system research cycle (Hevner et al. (2004).

The research design followed the four-phase model of DSR outlined by Hevner et al. (2010): (1) Awareness – identify problems and requirements in transitioning to a CE based on literature and interviews, (2) Suggestion – verify and priortize requirements through interviews, (3) Development – built prototype digital management system based on outcome of suggestion phase, and (4) Feedback and Evaluation – get feedback via interviews and a workshop on the digital prototyp and compared to existing theory to define similarities and variances.

Data collection took place between 2023 and 2024 through two rounds of 22 semi-structured interviews with stakeholders and experts in the two selected industries. The interviews lasted 30-40 minutes and were audio-recorded and transcribed. They were

conducted within the network of two Swiss manufacturing companies, differing in size and industry, but facing similiar challenges on material data transparency and facilitating collaboration that could benefit from improved data sharing. One is a multinational manufacturing company in the construction industry (specialising in plastic roof membranes), while the other is a family-owned SME in the plastic packaging industry (specialising in reusable plastic packaging).

The representative sample included various hierarchies and functions (such as CEO, President, Director, Project Lead, Application Trainer, Construction Workers) and functions (such as, R&D Department Lead Sustainablity, R&D Recycling Process Responsible, Technology Sustainable Leader, Head Sustainability, Sales Managers) to reflect different perspectives relevant to study the implementation of data-driven CBM on different levels.

This consisted of ten recyclers, seven manufacturers, and five sustainable industry experts: a consultant and a researcher from the private sector, two professors, and a researcher/project manager in higher education.

Interview questions regarding challenges to enhance transparancey through data sharing focused on four groups of challenges identified from literature: a) gathering data, b) obtaining data during waste collection, c) stakeholder behavior, and d) current technologies and methodologies.

The data analysis involved handling audio recordings and field notes, transcription, and coding using the Atlas.ti software based on Mayring, P. (2000). Data were organised by stakeholder groups using a code scheme to identify patterns, themes, inconsistencies, and outliers. A cross-analysis with the literature identified key recycling challenges in data-driven CBMs and informed the development of the prototype digital management system.

5. Findings

Four key challenge areas for enhancing transparency through data were identified from the literature (summarized in Table 1):

- Challenges in gathering data: The absence of detailed information on plastics and their composition complicates recycling (Hsu et al., 2022). Systematically collecting information about the membranes can mitigate the challenges in the recycling process. Research is mainly focusing on off-site sorting techniques (Alassali et al., 2021).

- Difficulty in obtaining data during waste collection: Lack of labels complicating the segregation process and making effective waste management more challenging (Hsu et al., 2022)

- Stakeholders behavior contributing to data collection: The construction industry faces a significant challenge due to the absence of incentives (Gálvez-Martos et al., 2018). One key barrier to waste management is insufficient communication with clients, designers, and subcontractors (Hossain et al., 2020).

- Process for data collection and tracking: Heterogeneous materials and their potential mixing is a challenge during the recycling process (Ghisellini et al., 2018). Unstable and insufficient supply of recovered materials complicates planning (López et al., 2020).

All four were confirmed by interviewees, highlighting the need to address these stakeholder-related challenges to enable effective data sharing. The developed prototype addressed these challenges by facilitating improved data transparency, incentivizing end-of-life decision-making, and aligning stakeholders' interests.

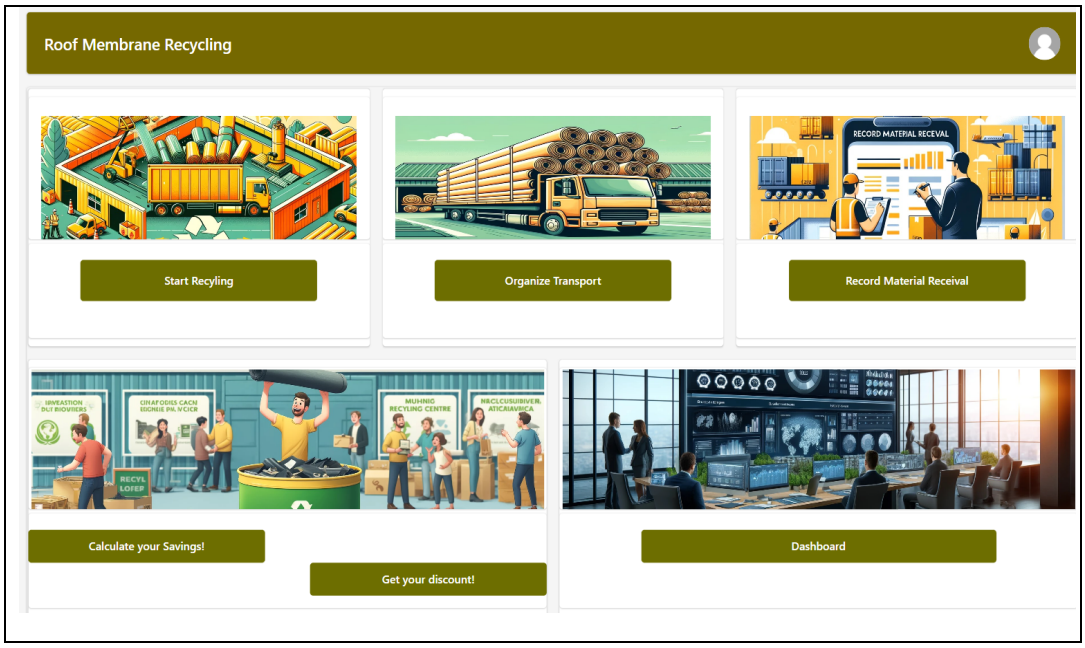
Table 1: Challenges, requirements and prototype, Source: Own contribution

Challenges	**Requirements and characterstics from literature and confirmed by interviews**	**Literature**	**Prototype buttons and functionality derived from requirements**	**Prototype variables behind the digital buttons**
Challenges in gathering data	• Missing knowledge of material composition • Lack of material traceability • Awareness and instruction gaps	(Hsue et al., 2022) (Alassali et al., 2021)	Start recycling	• Project ID • Street, zip code, location • Size of roof membrane (m^2) • Product ID (linked to roof membrane, year) • Reason for demolition
Difficulty in obtaining data during waste collection	• Unclear labelling to identify and sort	(Hsue et al., 2022)	Record material receival	• Project ID • Street, zip code, location
Stakeholders behavior contributing to data collection	• Stakeholder resistance and incentives • Communication and Coordination challenges	(Gálvez-Martos et al., 2018) (Hossain et al. 2020)	Calculate your savings (incentive) Get your discount (incentive) Dashboard	Calculate savings • Zip code • Size of roof membrane (m^2) = Calculation savings • - Labor cost • - Transportation cost = Total savings = CO_2 equivalents Discount for recycled materials Dashboard • Break-down of different material type • Sum ordered by quantity of roof membrane (m^2) • Sum ordered by year of roof

Process for data collection and tracking	• Inefficiencies and variability in process flow • Allocation and supply chain challenges	(Ghisellini et al., 2018), (López et al., 2020)	Organize transport	• Project ID • Pick-up date • Transport container

A digital tool could strengthen cost-benefit analyses to evaluate the financial viability of recycling initiatives. Closing the loop through increased recycling and reuse requires piloting and experimentation to validate these models and ensure positive outcomes for manufacturers. The interview findings supported the functionality of the prototype, which was developed and tested via Microsoft Power Apps – see Figure 1.

Figure 1: Developed artefact; Source: Own contribution



The prototype's different buttons, such as "Start recycling" or "Organize transport" contribute to better data sharing and ease decision-making at the product's end-of life. To support key financial incentives, it also includes:

a) "Calculate your savings": estimates CO_2 savings and costs based on the roof's zip code and membrane size (in m^2), including transport to the nearest incineration plant and additional recycling labor. It enhances cost transparency, helping manufacturers and recyclers compare financial outcomes.

b) "Get your discount": incentives are automatically applied based on stakeholder participation in recycling, promoting sustainable end-of-life strategies. In construction, especially for large industrial roofs near recyclers, fewer incentives may be needed compared to smaller or remote sites.

6. Discussion, Conclusion, and Further Research

This study underscores the importance of data-driven CBMs in fostering collaboration to increase data sharing and transparency among key stakeholders of manufacturers and recyclers. This facilitates the shift toward CE practices in the construction and plastic packaging industries, with potential applicability to other sectors, driving the transition to a Circular Economy.

Data is a key resource for sustainable business practices (Loureiro et al., 2021) and CE strategies. In order to make suitable decisions on resource usage, material flows, and recirculation of materials, accessable and sharable data plays a significant role in CE (Ghoreishi, 2023). The data dimension is a crucial motivator for recycling efforts, especially for recycling market actors, and extends the theoretical framework of CBMs to data-driven circular CBMs. This study suggests that **better data handling and accessibility** can significantly influence recycling outcomes. Using Hartmann et al.'s (2016) internal–external data taxonomy, further studies could distinguish data types and investigate how data is collected, processed, and transformed into actionable insights (Yang et al., 2023).

The research proposes a unique digital tool to adresses industry challenges by incentivizing industrial stakeholders to display costs and CO_2 savings, while offering a discount mechanism to encourage adoption. Further piloting and experimentation are needed to assess the costs and benefits in more detail. While this study demonstrates the potential of the digital prototype tool, further research is needed to extend it into a **comprehensive digital recycling system.** Such a system should integrate data from different key stakeholders and provide detailed information on material quality and traceability. This would enable the transition from end-of-life to recycling, help identify hazardous materials, reduce inefficacies, lower handling costs, and improve stakeholder coordination.

Future work chould also examine ethical data practices (Heikkilä, 2025) and organisational capabilities needed for implementation (Straub et al., 2023), including team-level competencies for leveraging digital tools effectively. It could explore data-driven CBMs with real-time communication, and knowledge management (Huang, Y. et al. (2021) under the aspect of integration of material, knowledge and service flows (Lit et al., 2024).

With the shift of manufacturers towards use of secondary materials, further investigation is needed into sourcing strategies, product testing, regulatory approvals, and the role of collaborative data sharing. Especially in construction, understanding the legacies of installed materials and improving transparency in material volume, quality, and geographical flow—especially waste streams—will be critical to resource efficiency and CE adoption.

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Complementing or Constraining? Artificial Intelligence and the Dynamics of Business Model Innovation

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Abstract

This study examines how Artificial Intelligence (AI) adoption influences Business Model Innovation (BMI) capabilities. While research has explored AI's organizational impact and BMI's strategic importance separately, the relationship between AI and BMI capabilities remains understudied. Drawing on various perspectives, we develop propositions linking AI adoption to five critical BMI capabilities. We propose several key relationships: an inverted U-shaped relationship between AI adoption and experimentation orientation; a positive relationship between AI adoption and environmental anticipation capability, moderated by environmental complexity; a temporal duality in AI's impact on performance sustainability; a positive relationship with resource utilization effectiveness; and a negative relationship with collective commitment. Our work seeks to provide a nuanced understanding of AI's role in BMI capabilities, moving beyond technological determinism to consider contextual factors and adoption stages, while establishing a foundation for future empirical research.

Keywords

Artificial Intelligence, Business Model Innovation, Capabilities, AI, BMI

Introduction

Business Model Innovation (BMI) has emerged as a critical strategic imperative for organizations seeking competitive advantage in increasingly volatile and complex business environments. As firms face escalating pressure from technological disruption, market fragmentation, and shortened product lifecycles, the ability to reconfigure their value creation, delivery, and capture mechanisms has become essential for sustained performance and growth (e.g., Foss and Saebi, 2017; Menter et al., 2023). However, despite its significance, the field remains conceptually fragmented, characterized by divergent scholarly perspectives on its fundamental nature, scope, and implementation (Miller et al., 2021).

While empirical evidence increasingly supports BMI's pivotal role in organizational performance (e.g., Foss and Saebi, 2017; Menter et al., 2023), significant challenges persist in its implementation. Recognizing these difficulties, scholars have identified several critical organizational capabilities that facilitate successful BMI initiatives. These capabilities – which often extend beyond Teece's (2010; 2018) traditional dynamic capabilities framework – include orientation towards experimentation, ability to anticipate environmental changes, capacity to sustain performance during transformations, effective resource utilization, and fostering collective commitment (e.g., Doz and Kosonen, 2010; Achtenhagen et al., 2013). Understanding these capabilities and the factors that enhance or inhibit them has thus become increasingly important for both scholarship and practice.

Concurrently, Artificial Intelligence (AI) has emerged as a transformative technological paradigm with profound implications for organizational capabilities and competitive dynamics. Contemporary commercial AI applications – concentrated in machine learning (ML), natural language processing (NLP), and machine vision – offer unprecedented computational abilities to process complex, high-dimensional data and perform sophisticated tasks previously reserved for human cognition (Babina et al., 2024). As AI adoption accelerates across industries, organizations face fundamental questions about how these technologies might reshape their capabilities, particularly those related to BMI.

Despite growing scholarly interest in AI's organizational impacts, a significant research gap remains in comprehensively understanding how AI adoption influences organizational capabilities often associated with successful BMI (e.g., Sjödin et al., 2021a; Sullivan and Fosso Wamba, 2024). This study seeks to address this critical gap by developing propositions that explicate the complex relationship between AI adoption and key BMI capabilities. With our work, we propose that AI's impact on these capabilities is neither universally positive nor linear, but rather contingent on adoption levels, environmental complexity, and temporal dimensions of implementation.

Literature Review

Business Model Innovation

Since Magretta's (2002) seminal description of business models (BM) as stories that explain how companies operate, literature has evolved into a multifaceted field extending into adjacent domains, integrating insights from strategy, innovation, and organizational theory. This evolution draws on diverse theoretical perspectives, including transaction cost economics, the resource-based view, and strategic, network, and change theories (Massa et al., 2017). Over time, scholarly consensus has increasingly aligned with Teece's (2010) definition of BMs as the design or architecture of value creation, delivery, and capture mechanisms, while the field has expanded to examine related dimensions, including its conceptualization, design, innovation, and performance implications (van de Ven et al., 2023).

To investigate the current state of knowledge on BMI, we conducted a systematic review (Siddaway et al., 2019). We followed a three-step process: first, we searched for the keywords *"business model innovation"*, *"business model change"*, and *"business model reconfiguration"* in the title, abstract, or keywords of publications listed in Scopus and ISI Web of Science (WoS) databases between 1990 and 2024 – as previous reviews (e.g., Wirtz et al., 2016) identified the 1990s as the emergence period for the concept. This query yielded 804 relevant results from Scopus and 752 from WoS. Next, we consolidated results by removing

duplicate entries and restricted our review to leading academic and practitioner-oriented business and management journals as specified by the 2024 ABS Journal Ranking List (4*, 4, and 3 star publications) (CABS, 2024). Finally, following prior reviews (e.g., Foss and Saebi, 2017; Massa et al., 2017; Zott et al., 2011) we screened these publications to identify articles that investigate BMI in a substantive way. This process yielded a final list of 71 high quality peer-reviewed publications examining different aspects of BMI, including: (1) definition and scope, (2) drivers and barriers, (3) process dynamics, (4) influencing factors, and (5) performance implications.

The literature shows important theoretical advancements over the past two decades as the development of novel BMs plays a pivotal role in organizational performance (Foss and Saebi, 2017; Zott et al., 2011). Yet, research on BMI still appears to be still in early stages (Foss and Saebi, 2018; Vaska et al., 2021). Many studies in the field do not offer an explicit definition of the concept and, in cases where explicit definitions are provided, these differ and lack of specificity (e.g., Andreini et al., 2021; Foss and Saebi, 2017; Trischler and Li-Ying, 2022). The concept is most often related to changes/reconfigurations to an existing BM. This lack of clarity regarding the nature of BMI is also pronounced on the concept's scope. Scholarly opinions differ in the extent of changes that has to occur in order for the BM to be considered innovative (Geissdoerfer et al., 2018). Some scholars suggest that changing a single component is sufficient (e.g., Amit and Zott, 2012; Menter et al., 2023; von Delft et al., 2019), whereas others maintain that multiple components must change for BMI to occur (e.g., Berends et al., 2016; Clauss, 2017; Gerasymenko et al., 2015).

Despite these conceptual ambiguities, several scholars have progressed in understanding BMI's impact on organizational performance through empirical investigations. For example, Cucculelli and Bettinelli (2015) studied the BMI – performance linkage on SMEs. They found that BMI has a positive effect on performance. This is further corroborated by Bhatti et al. (2021) in the IT sector. Visnjic et al. (2016) focused on a particular type of BMI – servitization. They found that a product-oriented BM demonstrates higher profit margin compared to a product-only BM, and a customer-oriented BM a higher profit compared to a

product-oriented BM. Futterer et al. (2018) also found that BMI enhances internal corporate venturing performance. Contrary to the above, Desyllas et al. (2022) found that BMI has little effect on performance and U-shaped effects appear when accounting for past performance and innovative activity. Menter et al. (2023), on the other hand, provide evidence that BMI has a positive but lagged effect on performance. They also identify substitutive and complementary effects across BM dimensions and that concentrated BMI efforts outperform dispersed ones.

The promising effects BMI has on performance (Andreini et al., 2021) has led scholars to immerse on what fuels and impedes BMI (Zhang et al., 2021). Some scholars maintain that substantially new offerings typically demand new BMs (e.g., Johnson et al., 2008; Sitoh et al., 2014). Björkdahl (2009) and Kavadias et al. (2016) identify new firm technologies as drivers for the emergence of novel BMs. Sosna et al. (2010) maintain that severe organizational crises or poor performance can initiate deep reflections on the current BM and lead to BMI. Other scholars focus on the external factors driving BMI. Clauss et al. (2021) attest that an exogenous crisis, like COVID-19, leads to temporary BMI. Likewise, Saebi et al. (2017) maintain that firms are more likely to change their BM under a perceived threat. Casadesus-Masanell and Zhu (2013) and Cozzolino et al. (2018) identify a new market entrant as a triggering event for changes on incumbents' BMs. Finally, Cozzolino et al. (2018) and Paiola and Gebauer (2020), among others, argue that new technology trends can trigger BMI.

While BMI is vitally important for organization rejuvenation, it is not easy to materialize (e.g., Chesbrough, 2010; Christensen et al., 2016). Several barriers exist in the form of physical and cognitive impediments. Physical constraints include conflicts and the firm's strategic orientation (e.g., Bocken & Geradts, 2020). For instance, conflicts may arise between the existing and the newly conceived BM, which leads to managers' resistance, as they fear adverse effects to the ongoing value of the firm (e.g., Berends et al., 2016; Chesbrough, 2010; Chesbrough, 2007; Rezazade Mehrizi and Lashkarbolouki, 2016; Sosna et al., 2010). Saebi et al. (2017) found that the more firms are oriented towards a cost leadership strategy, the more unwilling or unable they become to change their BM in the face of threats or

opportunities. Likewise, Bogers et al. (2015) investigate the case of a family-owned airline and argue that the firm's cost focus orientation limited its exploration and experimentation over the years – thereby limiting its ability for BMI – on the basis that exploration and experimentation are crucial for BMI initiatives (e.g., Chesbrough, 2010; Sosna et al., 2010; von Delft et al., 2019). Firms not only come across physical constraints but also cognitive barriers. Sjödin et al. (2021b), for instance, refer to the adherence of manufacturers to their product-dominant innovation logic and their firm-centric value-capture logic as important barriers while trying to engage in digital BMI. Likewise, Bohnsack et al. (2014) maintain that incumbents are cognitively constrained by path dependencies that create the need to stay close to the present BM. In the words of Clayton Christensen and associates (2016: 33) BMs *"become less flexible and more resistant to change as they develop over time"*.

Understanding these barriers has led scholars to investigate the capabilities required for successful BMI, resulting in the identification of several key enablers that often extend beyond the traditional dynamic capabilities framework (sensing, seizing, and transforming) – frequently cited as important driver for successful BMI (Teece, 2010; 2018; Zhang et al., 2021). Demil and Lecocq (2010) refer to the importance of "dynamic consistency" - that is, the ability to anticipate changes and adapt the BM accordingly for performance maintenance or restoration. Doz and Kosonen (2010) highlight the significance of strategic agility in reconceiving a firm's BM. They identify three meta-capabilities, namely: (a) strategic sensitivity (i.e. sharpness of perception, intensity of awareness and attention to strategic developments), (b) leadership unity (i.e. ability of the top management team to make bold decisions fast), and (c) resource fluidity (i.e. ability to reconfigure capabilities and redeploy resources rapidly). Wirtz et al. (2010) mention that firms should possess sensing capabilities to identify changes in their environment, while Achtenhagen et al. (2013) identify three critical capabilities for achieving BM change for sustained value creation: (a) orientation towards experimentation, (b) balanced use of resources, and (c) coherence between leadership, culture and employee commitment. In a similar vein, Felin et al. (2020), Bocken and Snihur (2020) and Sinfield et al.

(2012) also highlight the role of experimentation. Andries et al. (2013) further add distant search (i.e. altering multiple BM elements in each experimentation cycle). McDonald and Eisenhardt (2020) propose a theoretical framework of parallel play (i.e., the process where cognition, action and timing intersect to enable entrepreneurs to effectively design a new BM). Following prior studies, imitation and experimentation emerge as important aspects of their framework. Bruni and Comacchio (2023), on the other hand, depart from imitation and focus on conceptual combination (i.e., creation of a new concept by the combination of different sources) that coupled with experimentation leads to novel BMs. Table 1 synthesizes key capabilities that scholars consistently identify as critical enablers of successful BMI along with their definitions and operationalizations.

Table 1. Key capabilities enabling successful business model innovation

Capability	**Definition**	**Operationalization**	**Relevant Literature**
Orientation towards experimentation	The organizational propensity and ability to systematically test new ideas, value propositions, and business model configurations through trial-and-error learning, prototyping, and piloting initiatives	Lee et al. (2004)	(e.g., Achtenhagen et al., 2013; Bocken and Geradts, 2020; Chesbrough, 2007; Doz and Kosonen, 2010)
Ability to anticipate environmental changes	The capacity to scan, monitor and interpret external signals, trends, and disruptions that might affect the business model, enabling proactive rather than reactive responses to market dynamics.	Barringer and Bluedorn (1999)	(e.g., Achtenhagen et al., 2013; Demil and Lecocq, 2010; Doz and Kosonen, 2010; Wirtz et al., 2010)
Ability to sustain firm performance while changing the existing business model	The capability to maintain operational effectiveness and financial stability while simultaneously implementing business model transformations, managing the tension between exploration and exploitation.	Markides and Charitou (2004)	(e.g., Achtenhagen et al., 2013; Demil and Lecocq, 2010)

Ability to use available resources effectively	The capacity to optimize and leverage existing organizational resources to maximize value creation, delivery and capture within both current and new business model configurations.	Sirmon et al. (2007)	(e.g., Achtenhagen et al., 2013; Velu, 2017)
Ability to foster collective commitment	The capability to build shared understanding, alignment, and buy-in across organizational levels and stakeholders to support business model innovation initiatives and overcome resistance to change.	Herscovitch and Meyer (2002)	(e.g., Achtenhagen et al., 2013; Bocken and Geradts, 2020; e.g., Doz and Kosonen, 2010)

Artificial Intelligence

The term artificial intelligence, coined by John McCarthy, a young mathematics professor at Dartmouth, describes machines capable of using language, forming abstractions, solving problems typically reserved for humans, and improving themselves over time (McCarthy et al., 1955). Today, commercial applications of AI are concentrated in three core areas: machine learning (ML), natural language processing (NLP), and machine vision. These core techniques are distinguished by their ability to execute complex, non-routine tasks such as prediction, detection, and classification. Unlike traditional data analysis methods, AI techniques can process and learn from vast quantities of high-dimensional data – including text, speech, and images – leading to significantly enhanced predictive accuracy (Babina et al., 2024).

AI's potential to transform business has made it a key focus in organizational research, particularly in understanding its impact on performance and innovation metrics. Some studies have established positive relationships between AI technologies and organizational outcomes. For instance, Mikalef and Gupta (2021) found that AI capacity has a positive effect on organizational performance. Chen et al. (2022) corroborate this finding. Kumar et al. (2024) suggest that AI not only enhances R&D performance but also supports both explorative and exploitative innovation. Similarly, Fosso Wamba (2022) reports that AI adoption improves firm

performance, while Babina et al. (2024) highlight how AI-investing firms experience higher growth in sales through product innovation. Ho et al. (2022) further emphasize that the use of AI strengthens firms' performance in challenging environments. However, the relationship between AI and organizational outcomes is not universally positive. Lui et al. (2021) found that AI adoption negatively impacts firms' market value, contradicting previous findings and studies on IT investments that typically show positive (or neutral) effects. This discrepancy highlights the complexity of AI adoption and suggests the need for further research into the contextual factors influencing its success.

A very limited number of studies have also examined the association between AI and certain firm capabilities. For instance, Mikalef and Gupta (2021) and Chen et al. (2022) found that AI capacity has a positive effect on organizational creativity. Fosso Wamba (2022) identified a positive association between AI adoption and organizational and customer agility. Yu et al. (2024) investigated the effect of AI adoption on organizational resilience (i.e., the firm's flexibility before and during critical events) and found that AI positively affects firm resilience. More recently, Sullivan and Fosso Wamba (2024) found a positive association between AI capacity and the firm's ability to respond to market changes.

While the literature has increasingly recognized the transformative potential of AI, there remains a notable scarcity of conceptual and empirical studies examining AI's impact on capabilities directly linked to BMI. Consequently, this study aims to address this critical gap by developing propositions that elucidate the complex relationship between AI adoption and key capabilities that scholars consistently identify as critical enablers of successful BMI (Table 1).

Proposition Development

Orientation towards experimentation

AI adoption has the potential to reduce the uncertainty of experimentation and streamline the learning process, which yields further experimentation and the creation of novel value offerings or BM configurations (Cockburn et al., 2018). First, computational simulations and ML

algorithms may reveal novel value offerings before real-world testing. Philyra (Symrise, 2024), a partnership between IBM Research and Symrise illustrates how AI adoption can transform traditional creative processes. Their AI system engages in virtual experimentation in fragrance development, analyzing vast datasets of historical formulas, consumer preferences, and market performance to identify novel combinations and predict successful formulations. Philyra's AI processes thousands of formulas and ingredients, evaluating their molecular structures, historical success patterns, and potential interactions before physical testing begins. This approach significantly reduces experimentation cycles in perfume creation while expanding the creative possibilities available to perfumers.

Second, AI adoption can enhance digital experimentation (Mariani et al., 2023). Digital experiments often use A/B/n tests, in which a single feature of a product/service is modified to determine the version that performs best compared to a control group (A represents the original version, while B, C, etc., represent the variations). Although analytical techniques, like conjoint analysis (Green et al., 2001), can evaluate multiple variables simultaneously, they usually lack scalability and demand substantial time and effort from respondents, especially as the number of variables increases (Mariani and Nambisan, 2021). AI can advance this by making traditional A/B/n testing more efficient, particularly when multiple variables are involved as AI-driven models allow simultaneous testing of numerous variations, dynamically adjusting based on real-time data. This helps quickly find and prioritize the best-performing options in real-world conditions without overwhelming users (Deep et al., 2024; Kellog Insight, 2024). Through NLP and ML, AI can also enhance conjoint analysis by automating the analysis of participant feedback and preferences, extracting insights faster and allowing firms to scale experiments across larger datasets. Overall, AI can lower experimentation costs and allow firms to run more experiments simultaneously, thus expediting product/service development cycles and boosting novelty capacity.

Apart from the direct effects of AI on experimentation, AI adoption can fundamentally reshape organizational attention patterns by automating activities that traditionally consumed significant cognitive resources. According to the attention-based view of the firm (Ocasio,

1997), decision-makers demonstrate limited attentional capacity (Ocasio and Joseph, 2005) and hence attention is inherently subject to opportunity costs. The limited attentional capacity decision-makers have, signals the importance of focus (Ocasio, 1997). AI can serve as a powerful mechanism for attention redistribution from activities associated with exploitation (Babina et al., 2024) to activities associated with experimentation (Cai and Canales, 2024).

Another line of reasoning suggests that the adoption of AI can diminish the firm's orientation towards experimentation through some mechanisms that reshape experimental practices and organizational members' mindsets. First, algorithm path dependency can fundamentally alter a firm's experimental orientation, as AI's reliance on historical data potentially creates what Leonard-Barton (1992) terms "core rigidities" which constrain the scope and nature of experiments considered viable. For instance, when organizations rely heavily on AI-driven experimentation, they often gravitate towards testing minor variations of existing solutions rather than exploring radically new approaches. Drawing on March (1991) exploration-exploitation framework, this algorithmic bias systematically reduces an organization's propensity to experiment with truly novel approaches that lack historical precedent, leading to what Levinthal and March (1993) describe as the "myopia of learning" in experimentation. This manifests in experimental practices that increasingly favor data-rich domains over unexplored territories, fundamentally altering the firm's experimental scope.

Further, the reduced role of human intuitive input in experimentation may erode the firm's experimental culture. For example, instead of encouraging wild ideation sessions or intuition-driven experiments, organizations might increasingly defer to AI-suggested experimental designs, excluding the invaluable role of human intuition which often drives breakthrough discoveries. This shift in experimental practices can transform the organizational culture from one that celebrates creative experimentation to one that prioritizes algorithmic validation.

Finally, organizations may develop a risk-averse experimental orientation due to AI's preference for data-supported choices, leading to what Levitt and March (1988) describe as superstitious learning. This manifests in experimental practices that increasingly favor safe

incremental tests over bold experiments, fundamentally altering the organization's risk appetite for experimentation. This bias aligns with Tushman and O'Reilly (1996) observations about ambidexterity challenges, where organizations' experimental orientation becomes increasingly biased toward exploitation rather than exploration. The cumulative effect creates organizational routines that fundamentally reshape experimental orientation from bold discovery to conservative optimization, potentially limiting an organization's capacity for breakthrough innovation through experimentation.

Based on the above benefits and drawbacks of AI on the orientation towards experimentation, we draw on the resource-based view of the firm, and particularly on complementation vs. substitution through AI (Krakowski et al., 2023) to indicate how these benefits and drawbacks vary across different degrees of AI adoption (i.e., from complementation to total substitution).

At low levels of AI adoption, firms will experience a complementary effect where AI enhances rather than replaces human capabilities (Sjödin et al., 2023). This phase fosters a stronger orientation towards experimentation by reducing the uncertainty and costs associated with testing new ideas. AI can rapidly analyze large datasets, predict outcomes, expand creative possibilities and overall accelerate innovation cycles, making the experimentation process more efficient and less resource-intensive, thus encouraging firms to engage in more frequent and ambitious experimentation.

As AI adoption deepens, its role will likely shift from complementing human efforts to substituting them, which can diminish the orientation towards risky experimentation. High reliance on AI-driven decision-making leads to algorithm path dependency, where organizations are limited to the experimental avenues AI can validate based on historical data. This can result in a narrow experimental scope, focusing on risk-averse, incremental variations of existing products/services rather than risk-taking experimentations in pursuit for radical innovations. Further, as AI assumes a greater share of decision-making, it may also erode the role of human intuition in experimentation. While the importance of tacit knowledge in driving innovation efforts is highlighted, AI’s emphasis on data-driven insights ignores the intuitive,

spontaneous experimentation that humans bring. This shift may transform a once dynamic experimental culture into one engrossed on algorithmic validation, limiting the creative ideation necessary for pioneering developments.

Overall, the benefits of AI adoption are expected to increase up to a certain point (i.e., point where substitution effects start taking over), while related drawbacks will be low at first (complementation phase) but increase exponentially with increasing levels of AI adoption (substitution phase). Taken together, the interactions suggest a curvilinear inverted U-shaped relationship between AI adoption and orientation towards experimentation.

> **Proposition 1:** AI adoption will exhibit an inverted U-shaped association with the orientation towards experimentation in BMI. At low levels of AI adoption, experimentation efforts will increase as AI complements human capabilities. However, as AI adoption intensifies and begins to substitute human competencies, experimentation efforts will eventually decline.

Ability to anticipate environmental changes

An organization's ability to anticipate environmental changes is directly linked to its sensing capacity (Kump et al., 2019). Sensing refers to the firm's ability to acquire knowledge (Jantunen, 2005), scan the environment (Danneels, 2008), and identify and assess threats, opportunities, and customer needs (Teece, 2019). Consistent environmental scanning enhances the likelihood of identifying emerging markets, trends, and technological advancements, enabling new market opportunities or better alignment between the firm and its environment (Barringer and Bluedorn, 1999).

Enhanced information processing capacity can improve a firm's sensing capacity (e.g., Daft and Weick, 1984; Huber, 1991) and AI systems are viewed as novel information processing tools that inherently enhance information processing capacity (e.g., Yu et al., 2024). By leveraging AI's pattern recognition, analytics, and predictive capabilities, firms can more effectively monitor, interpret and respond to signals from their external environment

(Sullivan and Fosso Wamba, 2024). Indeed, AI systems can rapidly process vast amounts of structured and unstructured data, identify emerging trends, and anticipate potential disruptions, providing organizations with valuable insights to proactively adapt (Sullivan and Fosso Wamba, 2024). Based on the above, we propose the following:

Proposition 2: AI adoption has a positive relationship with the firm's ability to anticipate environmental changes.

This positive relationship between AI adoption and the firm's ability to anticipate environmental changes is moderated by the level of environmental complexity (Kumar et al., 2024). In low-complexity environments with relatively stable and predictable states, AI's enhanced information processing capabilities can significantly strengthen a firm's anticipation abilities (Benbya et al., 2020). Pattern recognition and predictive analytics enabled by AI are particularly effective in these settings, allowing organizations to stay ahead of market changes and competitive dynamics. Conversely, in high-complexity environments characterized by numerous, rapidly changing, and often unpredictable events, the positive effect of AI on environmental anticipation diminishes (Benbya et al., 2020). The exponential uncertainty introduced by such environments can challenge predictive models, reducing their accuracy and rendering them less effective at anticipating disruptive events or unforeseen market shifts.

Proposition 2a: The positive relationship between AI adoption and the firm's ability to anticipate environmental changes is positively moderated by low-complexity environments.

Proposition 2b: The positive relationship between AI adoption and the firm's ability to anticipate environmental changes is negatively moderated by high-complexity environments.

Ability to sustain firm performance while changing the existing business model

AI adoption and the firm's ability to sustain performance during BM change displays a temporal duality. As firms adopt AI technologies, they typically experience negative effects, including organizational disruptions during novel system integration, efficiency losses due to steep learning curves, and increased complexity from additional modifications to BM components (e.g., Edmondson et al., 2001; Massa and Tucci, 2014). Moreover, integrating AI systems into core activities demands significant managerial attention (Ocasio and Joseph, 2005; Ocasio, 1997) and other resources, potentially diverting critical non-scale free resources from current operations. Consequently, at early stages, AI adoption is expected to temporarily diminish firm performance. However, as AI use becomes institutionalized, positive effects on the firm's ability to sustain performance during BM change begin to accrue through enhanced operational optimization, improved decision-making capabilities, and more efficient resource allocation (e.g., Babina et al., 2024; Kumar et al., 2024; Sullivan and Fosso Wamba, 2024). Based on the above, we propose the following:

> **Proposition 3a:** Initially, AI adoption negatively affects the firm’s ability to sustain firm performance while changing the existing BM.

> **Proposition 3b:** Upon institutionalization, AI adoption positively affects the firm’s ability to sustain firm performance while changing the existing BM.

Ability to use available resources effectively

AI adoption enables organizations to more effectively structure, bundle, and leverage their resource pool (Sirmon et al., 2007) through enhanced sensing and analytical capabilities. This enhanced resource utilization manifests through several mechanisms such as AI's advanced analytics capabilities that enable more precise matching of resources to value-creating

opportunities (Amit and Han, 2017), the use of ML algorithms that can identify complex patterns in resource utilization and assist in optimizing operational efficiency (Babina et al., 2024), and predictive capabilities that enable proactive resource (re/co) deployment rather than reactive allocation (Yu et al., 2024). We, thus, propose the following:

> **Proposition 4:** AI adoption positively affects the firm's ability to use available resources effectively.

Ability to foster collective commitment

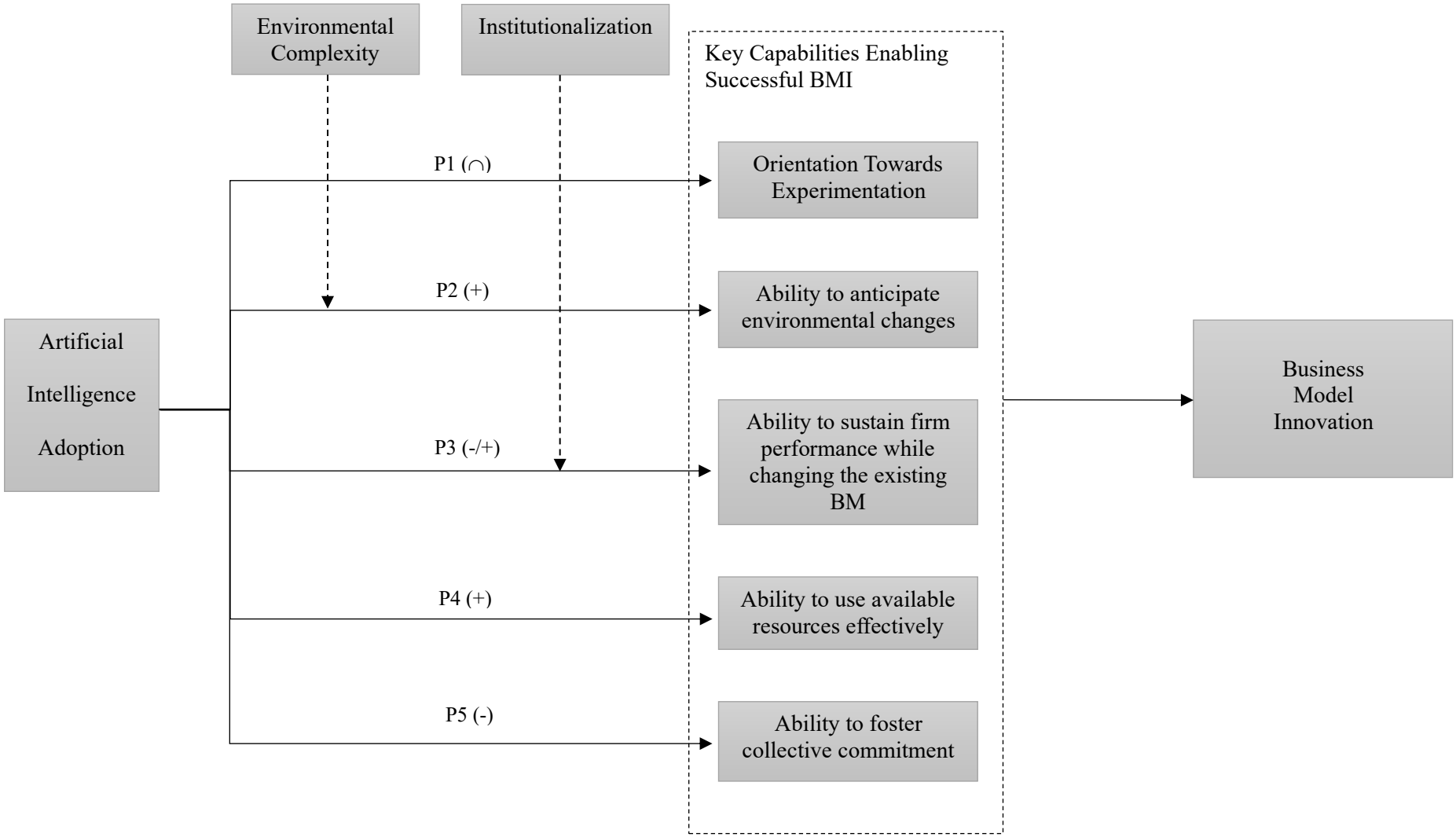
AI adoption significantly impacts an organization's ability to foster collective commitment (Herscovitch and Meyer, 2002) by generating substantial resistance among organizational members. As AI capabilities threaten to automate existing positions, organizational members will experience heightened job displacement anxiety, while simultaneously facing learning anxiety as AI systems require new competencies that may render current skills obsolete (Li and Huang, 2020). Additionally, role uncertainty intensifies as AI adoption blurs traditional job boundaries and responsibilities, disrupting sensemaking processes (Goto, 2022; Weick, 1995). Furthermore, perceived loss of autonomy emerges when AI systems assume decision-making roles previously held by humans, challenging professional identity and self-determination (Strich et al., 2021). These resistance factors are amplified during BMI efforts, as employees face dual transformation anxiety – simultaneously coping with technological and BM uncertainties. This combined effect creates change fatigue and strains organizational members' capacity for collective commitment to the transformation initiatives (Bernerth et al., 2011). We, therefore, propose the following:

> **Proposition 5:** AI adoption negatively affects the firm's ability to foster collective commitment.

Discussion and Conclusion

This study offers a comprehensive, multi-dimensional perspective on AI's role in BMI capabilities. By proposing non-linear, context-dependent relationships between AI adoption and critical capabilities associated with successful BMI, we move beyond simplistic technological determinism. The developed propositions (see Figure 1 for a summary) reveal a sophisticated interplay between AI and BMI capabilities where AI's impact is not uniformly positive but varies across different organizational contexts and adoption stages. While the propositions provide valuable theoretical insights, its primary contribution lies in establishing a foundation for future empirical research. The proposed propositions invite systematic investigation through quantitative and qualitative methodological approaches. Researchers can employ the operationalizations provided and empirically test the proposed relationships across diverse organizational contexts. Subsequent empirical work could validate these propositions, explore sector-specific variations, and develop more granular understandings of AI's adoption in driving BMI.

Figure 1. Summary of propositions



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Managing The Sustainability Impacts Of Corporate Digitalisation: A Qualitative Exploration Of Manager Perceptions On Drivers, Barriers And Actions

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Extended abstract

In the face of record global atmosphere temperatures, increases in extreme weather events and severe biodiversity loss, citizens across the globe are increasingly aware of the importance of sustainability (WEF, 2024). As societies search for ways to decouple economic activity from planetary degradation, they oftentimes pursue technological innovations to increase production efficiencies and reduce anthropogenic emissions and resource use, alongside changing consumption patterns and lifestyle norms (IPCC, 2023). Pursuing digitalization as a technological development route is commonly proclaimed to facilitate a transition towards sustainability. Indeed, for decades governments and institutions contented that the widespread implementation of technologies such as artificial intelligence, cloud computing and big data analytics would allow for a rapid transformation of industry and a dematerialisation of its impacts (Hilty et al., 2006), a promise still affirmed today (Neri et al., 2023).

Within business, digitalisation is oftentimes framed as having the potential to increase corporate sustainability through, for example, increases in process efficiencies (Rosário & Dias, 2022), improved traceability of resources throughout supply chains (Liu et al., 2020) and the potential for sustainable business model innovations such as servitisation and

increased circularity (Bocken, 2023; Ferrigno et al., 2023). Indeed, the interlinking of digitalisation and the green transformation of societies would lead to a so-called 'twinning' of both transitions which are characterised by, in even stronger phrasing, a mutual interdependence of success (Beier et al., 2020; EC, 2022). In light of government support, the potential for new revenue streams, changing customer demands and the risk of being outperformed by digitalised competitors, companies perceive a 'digital imperative' and increasingly commit to a disruptive digital transformation of their activities and business model (Bennich, 2024; Brenner, 2018). Here, manager decision-making plays a critical role in giving digitalization pathways their strategic orientation (Ko et al., 2022; Omrani et al., 2024; Tangwaragorn et al., 2024).

Corporate sustainability is characterized by "a great deal of ambiguity", and as human rationality is bounded, this limits managers' ability to comprehensively consider corporate sustainability (Hahn et al., 2014). Research delving into the effect of digitalisation on sustainability management tends to focus on opportunities of digitalisation for improving sustainability (management), rather than how sustainability management integrates and handles digital impacts (Schöggl et al., 2023). Indeed, there is a need for (empirical) research on how business actors consider and manage the interlinkage between sustainability and digitalisation (Brenner & Hartl, 2021; Guandalini, 2022). This research gap forms the focus of this study, which can be positioned within a larger effort to gain insight into the interlinkage between digitalisation and sustainability in corporate environments (Ologeanu-Taddei et al., 2025).

This research gap was empirically addressed through a qualitative research approach. Twenty-one semi-structured interviews with corporate sustainability managers and IT managers in medium to large companies in Belgium, which resulted in important insights into managerial perceptions of drivers and barriers to sustainable digitalisation. Interview transcripts were coded according to grounded theory coding guidelines, following a sequence of initial (open) and focused coding (Charmaz, 2006; Patten & Newhart, 2018). As such, this explorative research approach allowed for the development of a theoretical model of how the sustainability impacts of digitalisation are included in corporate sustainability management.

The results led to a categorization of important barriers to the integration of digital sustainability impacts into corporate sustainability management as perceived by the partaking managers. Internal barriers such as challenges to data collection, issues with the decentral nature of IT management and negative trade-off balances, as well as external barriers such as lacking legal obligations and lacking data provision from consumers and suppliers, could be distinguished. Drivers for the consideration of sustainable digitalization consisted of regulatory pushes, financial incentives, cost reduction and talent attraction and retention. In terms of measures taken for sustainable digitalization, managers deployed

a variety of actions among which awareness raising among employees and the roll-out of recycling, reuse and regifting practices were the two most frequent.

Only a small segment of managers reported including emissions from digital infrastructure, with indirect emissions accounting scoring even lower. While a large part of interviewees did mention concrete actions for sustainable digitalisation, indirect and systemic impacts such as rebound and induction effects remain unaddressed. Furthermore, while managers play a pivotal role in balancing trade-offs related to sustainable digitalisation, the results indicate that economic priorities often overshadow environmental and social sustainability concerns. Although many managers align practices for sustainable digitalisation with frameworks such as the Corporate Sustainability Reporting Directive (CSRD), a lack of standardized guidance and legislation was shown to impede a comprehensive assessment and reporting of digital sustainability impacts. As such, this study underscores a need for integrated decision-making tools and legislation specifically targeting sustainable digitalisation.

Overall, this study provides important insights into managerial perceptions on integrating sustainability into corporate digitalisation and structured current drivers and barriers to the consideration of both transitions. This research forms an important contribution to the New Business Models Conference 2025 - track 2.1 “Innovation through artificial intelligence and data-driven business models for sustainable transformation.”, in which it provides an empirical inquiry into managerial perspectives on the twinning of the digital and sustainable transitions in corporate sustainability management.

Keywords

Sustainable digitalization, sustainable ICT, bounded rationality, sustainability management

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The disruptor's dilemma: ecosystem dynamics on the road towards sustainable transport

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Abstract

New actors entering an industry often face the so-called disruptor's dilemma: the tension between being dependent on support of incumbents, while at the same time aiming to stand up against them through their business model. Given the growing importance of ecosystems in business model innovation, it is relevant to explore the disruptor's dilemma from an ecosystem perspective. In our study we examine in more detail how new entrants with sustainability ambitions aim to transform the transport sector through the introduction of electric autonomous trucking. We aim to unravel what strategies can be used to overcome the disruptors dilemma (by the new entrants), how ecosystem actors respond and how ecosystem dynamics evolve. In the freight transport sector sustainability goals are not reached yet. Therefore, there is a high urgency to understand how new actors – next to established ones – can play a role in achieving these objectives. With this extended abstract we aim to contribute to discussions at the New Business Models Conference regarding new technologies, ecosystem dynamics and sustainable business models.

Keywords

Business model innovation, Sustainability, Legitimacy, Disruptors Dilemma, Ecosystem

Extended abstract

Introduction

Scholars have investigated how organizations can innovate their business model in order to stay competitive (e.g. Burström et al., 2021; Guo et al., 2022; Albats et al., 2023) and contribute to a more sustainable economic system (Geissdoerfer, et al., 2018). Business model innovation research has focused on how incumbents can respond to new entrants that challenge their business models (Cozzolino, et al., 2018; Mao, et al., 2020). A different stream of business model innovation research focuses on new entrants that the incumbents must respond to (Herold, et al., 2023). According to the 'disruptor's dilemma' new entrants face a tension between being dependent on support of incumbents, while at the same time aiming to stand up against them (Ansari, et al., 2016).

The ecosystem perspective acknowledges that various stakeholders interact to align value creation for gaining competitive advantage (Adner, 2017; Jacobides, et al., 2018). However, it is shown that aligning value creation at the ecosystem level and value capture at the organizational level can lead to tensions (Oskam, et al., 2021). Given the growing importance of ecosystems in business model innovation, it is relevant to explore the disruptor's dilemma from an ecosystem perspective. Investigating questions like 'What are strategies new entrants deploy?', 'What are strategies other ecosystem actors deploy in anticipation of this disruptor's dilemma?' and as a consequence 'Whether and how do ecosystem dynamics evolve towards more sustainable business models?'

In our study we examine in more detail how new entrants with sustainability ambitions aim to transform the transport sector. We aim to unravel what strategies can be used to overcome the disruptors dilemma (by the new entrants) and how ecosystem actors respond and how ecosystem dynamics evolve. By doing so, we contribute to understanding of the disruptor's dilemma (Ansari et al., 2016) and especially how other ecosystem actors anticipate this, sustainable business model innovation in complex ecosystem contexts (Oskam et al., 2021), and business model innovation enabled by innovative technologies (Burström et al., 2021).

Methodology

Research context

We adopted a process research approach and investigate through a case study how a new entrant enters the road transport sector aiming to improve sustainability and how it shapes its business model in the ecosystem *over time* (Langley, 1999; Langley et al., 2013).

The road transport sector faces multiple challenges. First, CO_2 emissions must be reduced to meet the targets of the 2015 UN Paris Climate Agreement (United Nations, 2015).

Furthermore, traffic safety is under pressure with growing transport volumes (Hoen & Zondag, 2015) and the transport and logistics sector face a major labour shortage.

Electric autonomous transport is one of the potential innovations that can mitigate these challenges (Dong et al., 2021; Graf & Anner, 2021). The technology itself is still in development and business models have not matured yet. Next to that, the regulatory context is not mature either (regarding admission of autonomous trucks to public roads) and differs across and within regions (USA, Europe, Asia). Traditionally, the automotive sector is characterized by incumbent Original Equipment Manufacturers (OEMs) that have been manufacturing trucks for a century. Also, the transport sector itself is characterized by incumbent logistics service providers (LSPs) that are diverse in terms of fleet size. Since the 2010's new technology-driven start-ups emerged and aim to play a role in the transition towards electric and autonomous trucking.

We are studying a new entrant that encounters the disruption dilemma. It is a frontrunner in industry and therefore provides an important setting to study our research questions. Data collection is ongoing. With this case we aim to contribute to discussions at the New Business Models Conference regarding new technologies, ecosystem dynamics and sustainable business models.

Data collection

We conduct an in-depth inductive case study. As part of a larger study into business model innovation in sustainable transport ecosystems, we conducted semi-structured interviews with representatives of OEMs, LSPs and new entrants. Currently we are in the process of complementing our existing dataset with interviews with a new entrant and its ecosystem actors: clients, collaboration partners, competitors, and industry experts. We supplement this material with secondary data: we conducted an explorative patent analysis of the new entrant to map its technological innovations and we analysed sector articles and press releases to follow developments over time.

Expected results and contributions

Based on the data collected thus far, we observe the following:

- Typically, new entrants partner up with incumbent OEMs to produce electric autonomous trucks.
- One of the new entrants takes a slightly different approach by directly offering sustainable transport services to shippers. In doing so, they partner up with incumbent LSPs.
- Through these sustainable transport services, this new entrant collects data and develops capabilities that in the future potentially weakens the position of those incumbent LSPs (and might create lock-ins for shippers).

- For new innovative vehicle concepts with higher levels of autonomy it seems that in some regions, legislation is favoring the technological design of incumbent actors in the ecosystem. New entrants are not bound by the dominant design that evolved over the decades in industry which provided advantages in terms of development costs. Yet, it might turn out to be a limiting factor in terms of public road admission.

Questions that will be further unraveled in the upcoming period are:

- What are important milestones or events in the ecosystem that require new entrants to adjust their business model? How do business model (re-)alignment processes look like?
- What is the perception of other ecosystem actors (a.o. clients, competitors, partners, and industry experts) on the disruptiveness and legitimacy of new entrants' various business models? To what extent do new entrants create lock-in and are incumbents aware of this? How do incumbents anticipate potential disruptors and what are their strategies to cope with the disruptor's dilemma?

Expected contribution to conference tracks

By exploring this case in more detail, we expect to contribute to discussions on the ecosystem of actors in support of sustainability and innovation through data-driven business models for sustainable transformation.

- In terms of achieving sustainability objectives, it is of interest to gain more insight into how new actors can get a foothold in established ecosystems. From the disruptor's dilemma we know that new entrants face conflicting tensions that might hinder them succeed. What strategies can new entrants deploy to achieve their sustainability objectives? And how do existing ecosystems anticipate this? In the transport sector sustainability goals are not reached yet. Therefore, there is a high urgency to understand how new actors – next to established ones – can play a role in achieving these objectives.
- The new entrants do not operate in isolation, they enter established ecosystems and might even transform or extend these ecosystems in new directions (a.o. by using new digital technologies). By exploring this in more detail we expect to learn how different actors (re)align value creation, capture, and delivery in innovating their business model both on an organization and ecosystem level, using new technologies.

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How can digital technology use and innovation contribute to sustainable transformation of business models in the agri-food sector?

A systematic literature review

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Extended abstract (700-1200 words)

Problem description

Digital technologies (such as artificial intelligence, digital platforms, robots, decision support tools and related hardware) are expected to become major instruments in supporting sustainable agricultural development (Lajoie-O'Malley et al. 2020). Nevertheless, some authors call for a better understanding of the impact of digitalization, as it can lead to detrimental environmental, social and economic consequences (Plumecocq

et al. 2018). The links between digitalization and sustainability in the agrifood sector have been recently explored in some literature reviews (e.g. Myshko et al. 2024); however, the way in which digitalization induces new business models in agri-food value chains is barely studied (Klerkx et al., 2019), as is the capacity to integrate principles leading to sustainable practices.

In general, the growth of digital technologies has raised new questions about how businesses can deliver value (Teece, 2010). In the agri-food sector, the link between sustainability and digital technologies is often viewed through either a mere economic or technological lense. On one hand, precision agriculture is seen as providing a way to reach efficient agricultural practices by utilising technological solutions (Shafi et al., 2019). On the other hand, business model innovation is principally based on a 'profit first' or economic value orientation (Joyce and Paquin, 2016).

The main objectives of this literature review were to discover the state of the art of the research in the use of digital technologies in business models in agri-food value chains, to analyse the links between digitalization and the innovation of agrifood business models towards sustainability, and to make recommendations for future research.

The research questions were:

1. How do digital technologies lead to innovations of the different agrifood business model canvas components (value creation, proposition, delivery, capture)?
2. What are the drivers, benefits and drawbacks of the utilization of digital technologies in agri-food businesses?
3. How can the use of digital technologies by agri-food businesses contribute to sustainability?

Methodology

In order to bring concepts together/develop a theoretical framework and to advance knowledge, performing a literature review is conducive. The PRISMA tool was used as it is a common approach for selecting articles and is associated with more complete reporting of systematic literature reviews (Page et al, 2021). As inclusion criteria, articles had to comply with having a focus on digitalization and business models in agri-food value chains, had to be in English and a peer-reviewed article. The following search terms were used: ("digi*" OR ict) AND "business model" AND (food OR agr*food). Some publications were excluded based on the following criteria, if the publication:

- Does not link the food sector, business models and digital technologies together
- Is a literature review
- Is solely focused on the agricultural aspect of the food system (farmers)
- Is focused on consumers instead of businesses

After selection, 39 articles from Scopus and Web of Science were included in this study, and analysed both in a quantitative and a qualitative way (with an emphasis on qualitative results).

Results and discussion

According to the small quantity of articles that had been identified as suitable for the review, digital technology use by agrifood business models linked to sustainability seems to be scarcely studied. Nonetheless, the included articles provide interesting perspectives.

Firstly, the articles discuss different types of digital technologies. Yet, a few digital technologies stood out. The results show that agri-food businesses use digital platforms, digital marketing (social media), blockchain technologies, AI, cloud computing and IoT; in most cases combining several of these tools together. Digital communication technologies like block chain and digital platforms need additional technologies such as cloud computing, AI and IoT, and partnerships to be able to create value in a collaborative friendly way (Amaral and Orsato, 2023). They can change business models in value chains through their connective properties.

Nevertheless, most articles give an unbalanced view on benefits and drawbacks of digital technologies, and speak about restrictions to the adoption of digital technologies instead of the disadvantages. Yet, downsides exist, as human interaction can be minimized or even lost (Kawane et al., 2024). In this case, COVID-19 has driven change in digital technology use, but this change did not necessarily stay.

The majority of papers (51%) are focused on case studies in the global north (mainly Europe) without connecting them to value chains coming from other countries, specifically for the chains originating in the global south (e.g. coffee, cacao). These results showed that publications centre on one part of the value chain and business models are rather seen as entities on their own instead of a network. Even if one large business manages to use digital technologies in a successful way other parts of the value chain might not share in the success.

The broader (international) chain impacts of digital technologies are rather guessed instead of known. The business model concepts with a more system-based and multi-actor perspective approach such as ecosystem-based (Michelini et al., 2023) business models are in general less used. Sustainability as a concept is mentioned in most articles, but primally centred around the survival of the business. Additionally, the circular economy e.g. in terms of agricultural waste valorisation (21%) and agro-ecology (3%) are not mentioned often while they are associated with sustainable agrifood business models (Donner et al., 2020). This means that digital tools are not necessarily linked to sustainable business transformation, especially if the business does not implement green values.

As to develop a theoretical framework towards these perspectives, this study urges to bring in concepts of value co-creation and open innovation in future business model analysis. This is the case as only few publications (15%) mentioned these concepts and only one paper links the two together, while the more openness a firm displays, the more likely it is to be able to collaborate with a variety of external actors in order to produce innovation with the help of digital technologies (Bigliardi & Filippelli, 2022).

Conclusions

This review paper has brought new insights on the use of digital technologies in agrifood business models, their drivers, benefits and drawbacks as well as contribution to sustainability. It argues that even though digital technologies can enhance social interaction, the human element can be lost during this process. Even if one business makes successful use of digital technologies, others in local and international value chains might not profit. This urges us to look at agri-food value chains through a network perspective, instead of only at the individual business level. Businesses are obliged to look at the societal and environmental consequences in order to develop social, economic and environmental sustainability of business models. Digitalisation is one way to contribute, but not the only way, so its importance does not have to be overemphasised.

This paper recommends for future research and management practice to use a framework that looks through a value co-creation and open innovation perspective to both the business model level and the interaction between (sustainable) business models in local and global food systems.

Keywords

Digitalisation, business models, sustainability, agri-food sector, systematic literature review

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Context-Aware Machine Learning and Language Creation for Business Model Innovation for Sustainability

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Abstract

This early-stage research employs a mixed-methods case study research design to investigate how organizations utilize artificial intelligence (AI), including machine learning (ML), natural language processing (NLP), and contextualized language construction for business model innovation focused on sustainability, emphasizing the use of business model tooling (BMT). It combines quantitative methods, such as NLP (mapping review) and surveys, with qualitative methods such as content analysis on semi-structured group interviews with advisors. The main objective is to examine how AI and ML facilitate the development of a contextualized shared language for business model innovation in sustainability by utilizing business model tools, thereby enhancing communication, collaboration, and decision-making. A key challenge in sustainable business model innovation is a standardized language that aligns sustainability principles with stakeholders' perspectives. NLP and AI tools can help bridge this gap by offering contextual insights and creating a shared sustainability lexicon. These technologies enhance decision-making and help organizations manage sustainability transitions more effectively. The study is in its early phases, with focus groups refining problem articulation and the role of language creation in defining a shared project domain. Preliminary findings indicate that structured language creation is vital for integrating sustainability into business models. The survey was launched on January 14, 2025, and is currently ongoing. This manuscript presents the preliminary findings from our mapping review, group interviews, and survey results (n70).

Introduction

This research uses a mixed-method research design to examine how data-driven insights help create a contextualized and shared language that promotes effective Business Model Innovation for Sustainability (BMIfS) through Business Model Tooling for Sustainability (BMTfS).

Small and Medium-Sized Enterprises (SMEs) face challenges in transitioning their business models (BMs) towards sustainability, as this often involves complex

change processes and business model innovation (Moursellas et al., 2023; Pinkse et al., 2023). This difficulty primarily arises from the wicked nature and context-dependent challenges that require innovative approaches to value creation. Collaboration with various stakeholders is often limited by constrained resources and a lack of expertise transformations (Pinske, 2023). A major challenge for small and medium-sized enterprises (SMEs) is determining the right demarcation of the various sustainability objectives. Sustainability is a multifaceted concept explored by numerous scholars and encompasses various frameworks, including, but not limited to, circular economy principles, Environmental, Social, and Governance (ESG), multiple value creation, Corporate Social Responsibility (CSR), blended or hybrid value creation (Emerson, 2003; Geissdoerfer et al., 2020; Joyce and Paquin, 2016; Midgley and Arya, 2022). This concept's unclear and fragmented interpretation hinders sustainable transitions, resulting in further fragmentation of the sustainability dimensions. Additionally, numerous domains offer tailored templates, tools, and strategies aimed at particular sustainability aspects (Koers-Stuiver et al., 2023). These conceptual silo's contribute to a less rapid sustainable transition. While SMEs are vital for reaching sustainability objectives, there is a significant lack of research focused on them (Carlsson and Nevzorova, 2025; Khoja et al., 2022; Salvador et al., 2023).

Business models for Sustainability (BMfS) incorporate environmental, social, and economic values into an organization's core framework (Evans et al., 2017; Minatogawa et al., 2019) aiming to generate long-term value while mitigating environmental and societal harm (Bocken et al., 2014). They balance profitability with ecological and social responsibility, ensuring sustainable corporate practices that contribute to long-term viability and stakeholder well-being (Aagaard and Tucci 2024; Koers-Stuiver et al. 2023). BMfS act as catalysts for sustainable transitions (Bocken et al., 2019), yet SMEs face challenges implementing them due to the multifaceted nature of the sustainability construct (Kanda et al., 2018; Velter et al., 2022). Navigating these transitions requires effective tools and a common ground for understanding. A contextualized and shared sustainability language is necessary to bridge these gaps and enhance BMIfS.

BMI for sustainability (BMfS) facilitates change in balancing and creating multiple values (Evans et al., 2017). This entails simultaneously seeking long-term social, ecological, and economic value while taking into account all relevant stakeholders (Aagaard, 2024; Koers-Stuiver et al., 2024; Ritala et al., 2021). This complex and multidimensional process involves challenging applications that require diverse approaches and contextual insights across disciplines, as different perspectives influence the understanding of sustainable BMT (Haynes and Alemna, 2022; Velter et al., 2022). Contextual insights refer to information related to specific situations, individuals, objects, and entities necessary for understanding them (Messmer et al., 2024). This leads to a demand for interdisciplinary practical tools and strategies to effectively implement Business Models for Sustainability (BMfS).

Business Model Tools (BMT) help create a shared language for sustainability, aiding innovation. Nevertheless, their effectiveness relies on users' understanding the terminology. (Szopinski et al., 2022). Language shapes individuals' understanding and adaptation to change (Bera et al., 2014; Holmes and Wilson, 2022; Spivey et al., 2012; Wen and Taylor, 2021) forming a foundation for articulating ideas across

texts and media (Audet, 2016). A well-structured shared language ensures clear communication and standardized sustainability assessments (Bhatnagar et al., 2022; Sancak, 2023). Stakeholders must grasp sustainability contexts and business model components (Lara Machado et al., 2024; Williams et al., 2021) with language clarity depending on cognitive abilities, language proficiency, and prior knowledge ((Baron 2006; Koers-Stuiver 2020).Contextual language development influences user engagement with business model tools for sustainability (BMTfS).

Variations in understanding sustainability concepts can cause misinterpretations, hindering effective communication, collaboration, and the transition to sustainability. This is particularly critical when employing BMTfS, as their success depends on how well users understand the relevant terminology (Elmore, 2023). Failing to consider these interactions may result in misunderstandings that hinder sustainability transitions (Gibbs and Beavis, 2020; John et al., 2017; Lecomte et al., 2023; Moratis et al., 2018; Szopinski et al., 2022b)Yet, further research is needed to examine data-driven insights that facilitate contextualized shared language construction and promote effective BMIfS through BMTfS.

Data Science (DS), an interdisciplinary field drawing from mathematics, statistics, computer science, and domain knowledge, offers potential solutions. Methods such as Artificial Intelligence (AI), Machine Learning (ML), and Natural Language Processing (NLP) are increasingly recognized for their ability to provide contextual insights, drive decision-making, and advance sustainable transitions. AI encompasses ML for data-driven analysis and NLP for language comprehension. These technologies have shown value in optimizing resource management, enhancing biodiversity conservation efforts, improving supply chain optimization, analyzing sustainability communications, and strengthening predictive capabilities regarding environmental impacts. Likewise, AI, ML, and NLP applications have been found to enhance sustainable value creation and can stimulate BMI (Aagaard and Tucci, 2024; Divyashree et al., 2024; Moghrabi et al., 2023).

Despite these advancements, a research gap exists. While the application of DS, AI, ML, and NLP in optimizing operations and analyzing sustainability reports is well-documented, their specific role in facilitating shared language construction to improve BMIfS, particularly through BMTfS, is less researched. Existing literature has focused more on operational enhancements, with limited exploration into how these methods can help contextualize terminology and foster shared understanding among diverse stakeholders engaged in business model innovation.

By exploring the intersection of context-aware machine learning, language creation, and business model innovation, this study aims to contribute valuable insights. It seeks to bridge the identified language gap, offering a pathway for leveraging AI and ML to create more effective, context-sensitive tools and frameworks that support organizations in their vital transitions toward sustainability (Chavhan et al., n.d.; Khatri, 2023; C. Lauro et al., 2017; Messmer et al., 2024). This presents an opportunity for further investigation into how DS, AI, ML, and NLP can contribute to shared understanding and collaboration in business model innovation (Hechler et al., 2020).

Background

Business models for sustainability (BMfS) integrate environmental, social, and economic values into the foundation of an organization (Evans et al., 2017; Minatogawa et al., 2019) while creating long-term value while reducing environmental and social harm (Bocken et al., 2014). They balance profitability with ecological and social responsibility, ensuring sustainable corporate practices that contribute to long-term viability and stakeholder well-being (Aagaard and Tucci 2024; Koers-Stuiver et al. 2023). BMfS act as catalysts for sustainable transitions (Bocken et al., 2019). However, SMEs encounter challenges in implementing sustainability initiatives, partly due to the complexity of the sustainability construct (Kanda et al., 2018; Velter et al., 2022).

Business model tools (BMT) facilitate the construction of shared sustainability language, supporting innovation processes. Business model innovation (BMI) takes place when an organization's key components and business logic are deliberately modified, influencing how it generates, captures, and provides value (Amit and Zott 2012; Foss and Saebi 2017). BM overviews often include the value proposition, resources, key activities, cost and revenue model, value chain, and target market(Aagaard 2024; Massa et al. 2017; Osterwalder and Pigneur 2010; Teece 2010). BMI can result in creating completely new BMs, diversifying into different ones, acquiring new models, or shifting from one model to another (Geissdoerfer et al. 2018). Tools are often used to navigate this complexity. However, BMTs effectiveness depends on users' comprehension of the terminology (Szopinski et al., 2022a). This highlights the importance of straightforward, user-friendly BMTs that can be customized to meet contextual demands and stakeholder needs(Bhatnagar et al., 2022; Kanda et al., 2018).

Shared Language

Language shapes individuals' understanding and adaptation to change (Bera et al., 2014; Holmes and Wilson, 2022; Spivey et al., 2012; Wen and Taylor, 2021) forming a foundation for articulating ideas across texts and media (Audet, 2016). A well-structured shared language ensures clear communication and standardized sustainability assessments (Bhatnagar et al., 2022; Sancak, 2023). Stakeholders must grasp sustainability contexts and business model components (Lara Machado et al., 2024; Williams et al., 2021). Clarity of language depends on cognitive abilities, language proficiency, and prior experience knowledge. (Baron 2006; Koers-Stuiver 2020). Contextual language development influences user engagement with business model tools for sustainability (BMTfS). Failing to consider these interactions may result in misunderstandings that hinder sustainability transitions (Gibbs and Beavis, 2020; John et al., 2017; Lecomte et al., 2023; Moratis et al., 2018; Szopinski et al., 2022b). Yet, further research is needed to examine data-driven insights facilitating contextualized shared language construction, promoting effective BMIfS through BMTfS. Discrepancies in understanding can lead to misinterpretations, obstructing sustainable transition efforts. Organizations, data, and digital technologies are crucial for facilitating and enhancing these transformations.

Language diversity further intensifies this complexity, impacting both individuals and groups and possibly hindering the interpretability of tools and value-creation concepts (Lecomte et al., 2023). Language can function as a system of meaning

essential for understanding organizational, social, and global contexts (Sanden, 2016). Sanden (2016) further asserts that language transcends mere communication; it embodies both identity and power, influencing organizational structures and power dynamics. Neglecting the impact of linguistic diversity can lead to inefficiencies, hinder collaboration, and reduce productivity. Therefore, understanding how a shared language's development and context's impact affect intermediaries and their clients in utilizing BMT is essential.The context and how language is created significantly affect user interactions with SBM tools; however, this area remains underexplored. Data science methods, such as AI, ML, and NLP can help close this gap.

Data science methods

Data science (DS) is an interdisciplinary discipline that generates knowledge and value from raw data and uses knowledge and skills from mathematics, statistics, computer science, and domain-specific knowledge (Hazzan and Mike, 2023; Kang et al., 2020; Reddy et al., 2022). DS is crucial for organizations integrating sustainability objectives into their business models (Jorzik et al., 2024). Methods such as artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) can offer contextual insights, drive decision-making, and advance sustainable transitions so(Aagaard and Tucci, 2024; Sipola et al., 2023; So et al., 2020).

AI focuses on developing intelligent systems, encompassing ML for data-driven analysis, NLP for human language comprehension, and generative AI (Gen AI) for producing original content such as text and images(Cazzaniga et al., 2024; N. C. Lauro et al., 2017).AI-powered sustainability solutions optimize resource management, precision agriculture, and waste management by enhancing efficiency and minimizing environmental impact(Sipola et al., 2023). Additionally, AI contributes to biodiversity conservation, climate modeling, and pollution monitoring, furthering global sustainability efforts(Rane et al., 2024). Integrating IoT sensors with AI-driven analytics enhances predictive maintenance, energy efficiency, and supply chain optimization(Aagaard and Tucci, 2024; Madsen et al., 2023; Mahdavinejad et al., 2018). Researchers found that ML strengthens predictive capabilities by forecasting resource consumption, emissions, and environmental effects, enabling proactive interventions, where AI-powered drones enhance conservation efforts by monitoring deforestation and poaching(Udeh et al., 2024). Researchers have used NLP in sustainability communication by analyzing corporate sustainability reports, extracting key insights, and detecting emerging trends(Telukdarie et al., 2024). Furthermore, the method has enabled businesses to evaluate industry practices and refine sustainability strategies through phrase comparison and sentiment analysis(Gamlath et al., 2023; Jamwal et al., 2022).

Machine learning techniques such as NLP support sustainability reporting, enabling organizations to evaluate and enhance their performance according to regulatory standards and Sustainable Development Goals (SDGs)(Cho, 2022; Feng, 2024; Feroz et al., 2021a; Gamlath et al., 2023; Telukdarie et al., 2024). In addition to environmental factors, DS method insights' can enhance social sustainability by encouraging inclusivity and tackling socio-economic issues such as inequality and

poverty, thereby supporting community development and society's overall well-being(Fernandes et al., 2022; Holzmann and Gregori, 2023). Despite advancements, challenges remain, for instance, integrating data across organizations to maximize benefits beyond specialized teams (Medeiros et al., 2020). Similarly, while extensive research has examined the relationship among data, digital technologies, and sustainability, the methods for utilizing these elements to facilitate sustainable business transitions remain fragmented and lack cohesive, practical guidance(Das et al., 2024; Fernandes et al., 2022; Feroz et al., 2021b; Holzmann and Gregori, 2023).

Method

We are conducting a year-long study following two Dutch advisors and their SME clients, which started on November 1, 2024, and will conclude on November 1, 2025. Our study employs a mixed-methods approach to examine how language construction and context influence BMTfS in the advisory process of two Dutch advisors (Creswell and Clark, 2007; Gerring, 2007). Our research integrates participatory principles, ML methodologies, and content analysis to deepen our understanding of this process. (Burns et al., 2021; Creswell, 2003; Tashakkori and Teddlie, 1998).

Case Organization

Both organizations function as intermediaries, assisting SMEs in incorporating sustainability principles throughout their operations. These organizations are located in the eastern part of the Netherlands. With considerable expertise in SME collaborations, these organizations share a focus on generating positive social and environmental value. While Eshuis Accounting en Adviseurs emphasizes CSRD, and de Betekenisfabriek concentrates on Identity marketing, changemakers facilitating SMEs in the complex shift towards sustainability. Their specialized knowledge allows them to accurately identify organizational challenges and needs, facilitating the development of tailored solutions. This project started in November 2024.

Group interviews

As part of our year-long research, we are engaged in an iterative process of collecting qualitative data through semi-structured group interviews(Wilkinson, 1998). Please see Table 1 for the scheduled group interview dates with the advisors and its objectives, duration, and key concepts.

Table 1. Partner meeting overview

Date	Focus	Duration	Type	Available documentation
13-12-2024	Kick-Off	90 minutes	Physical	Preparation materials, minutes
11-03-2025	Refinement research scope	60 minutes	Online	Preparation materials, minutes, transcript

04-04-2025	Refinement RM	60 minutes	Online	Preparation materials, minutes, transcript
End of April	Data analysis pipeline	Tbd	Tbd	n.a

Mapping review using NLP methods

We utilize ML and NLP to perform a mapping review of the literature relevant to our research question (Asmussen and Møller, 2019; Duriau et al., 2007; Munn et al., 2018; Tricco et al., 2018), exploring how context influences and shapes the interpretation and operationalization of the key concepts.

Our review focuses on the context-dependent aspects of developing shared language, context, sustainable business model innovation, advisors, and identifying related synonyms for these key concepts.

Our research has encompassed the collection of over 900 documents, containing utilize ML and NLP to review literature. This process involves gathering and analyzing over 900 scientific articles and books, as shown in Table 2. We used purposive sampling to identify keywords linked to our queries and examined related documents and citations. The databases for our investigation included Scopus, Web of Science, Google Scholar, SpringerLink, undermine.ai, and typeset.io for additional sources. Each document was assessed based on its title, keywords, and abstract, with selection criteria focusing on the concepts, methodologies, research gaps, and future directions. Selected documents were converted to .txt for efficient processing and organized with titles containing Year, First Author, and Title, using an algorithm to detect duplicates.

To find the contextual meaning of the key terms, we created a comprehensive folder of 933 relevant documents, categorized into subfolders by specific keywords. This led to overlaps, as documents may belong to multiple thematic categories like ESG, NLP, SUS, and BM. We are currently analyzing the subfolders.

Table 2. Document folder based on themes

Folder	Keywords	N Docs
ESG (Environmental, Social, Governance)	ESG, Environmental, Social, Governance, CSR, Corporate Social Responsibility, CSRD, Corporate Social Responsibility Directive, Blended Value, People, Planet, Profit, Triple Bottom Line, Triple Layer	90
BM (Business Model)	Business Model, Business Models	289
BMT (Business Model Tool)	Business Models Template, Business Model Canvas, Business Model Method, Business Model Model, Triple Layer Canvas, Business Model Tool, Business Model Taxonomy, Business Model Framework, Business Model Method, Business Model Taxonomy	61
SUS (Sustainability)	Sustainability, Green, Ecological, Environmental, Circular	286

INT (Intermediary AND sustainability OR ML)	Intermediaries, Advisors, Consultant(s), Agent, Management Consult*,	54
LANG (Language)	Language, Narrative, Language Creation, Shared Language, Language Construction, Conversation, Semantic	61
ML (Machine learning	Machine learning, Artificial Intelligence, NLP, Natural Language Processing, Topic Modeling, Text Mining, Text Analytics	217

Topic modeling

Latent Dirichlet Allocation (LDA) was utilized through Gensim's LdaModel to identify hidden thematic structures within the corpus. The sparse matrix was transformed into Gensim's corpus format via Sparse2Corpus for compatibility. Preliminary exploratory analysis guided the setting of the number of topics and other hyperparameters. The outcomes of topic modeling were visualized using pyLDAvis, which provides an interactive interface to explore topic distributions and key terms associated with each topic.

Furthermore, we employed the BERTopic framework to analyze the results (Grootendorst, 2022). BERTopic is a topic modeling approach that utilizes pre-trained transformer-based embeddings and class-based TF-IDF (c-TF-IDF) to produce interpretable topics. In contrast to traditional models like LDA, BERTopic enables a more sophisticated semantic analysis of documents by using contextual embeddings (all-MiniLM-L6-v2 from SentenceTransformers) to group semantically similar text segments. Following the initial modeling, we optionally reduced the number of topics to enhance coherence and interpretability. Topic labels were created from the highest-ranked terms for each topic and were consistently applied across all visualizations. We examined temporal trends by matching each document chunk with its original publication year and utilized BERTopic's topicsovertime method. Visualizations such as UMAP projections and similarity heatmaps were also produced to investigate topic relationships and their distribution.

Data preparation en preprocessing

Our study employed NLP techniques to examine texts aligned with our research goals. The workflow included loading texts, cleaning data, lemmatizing, vectorizing, and performing topic modeling through BERTopic (And LDAVIS). We gathered documents from a designated folder filled with .txt files. For each document, we recorded metadata such as document IDs and estimated publication years, derived from filenames using regular expressions. Text preprocessing began with ASCII encoding to remove non-standard characters, followed by tokenization using nltk.wordtokenize and eliminating punctuation and stopwords.

We created a custom stopword list by merging standard English stopwords sourced from NLTK. Words underwent lemmatization with WordNetLemmatizer, applying POS tags from NLTK's postag to align them with WordNet categories. The processed texts were transformed into document-term matrices using CountVectorizer from scikit-learn. Topic modeling was then performed with the BERTopic framework, which combines transformer-based embeddings with clustering algorithms like HDBSCAN to yield interpretable topic representations. The resulting topics were visualized and saved for further analysis.

Survey research

Our research also includes distributing a survey to better understand how AI, ML, and NLP contribute to sustainability. The survey examines how data and digital technologies support achieving sustainable objectives within organizations. It specifically focuses on applying AI techniques (ML, NLP). Participants were asked about their organization's use of digital technologies, internal and external data sources, and how AI is utilized across different business functions. The questionnaire further explored how organizations perceive and communicate sustainability internally and externally, highlighting the importance of language in defining, tracking, and assessing sustainability objectives. The data provide insights into organizations' potential benefits and obstacles in implementing data-driven and AI-driven strategies to enhance sustainability transitions.

We developed and distributed our survey via Qualtrics. Launched on January 14, 2025, it initially targeted Dutch organizations before expanding internationally and requiring translation into English using Prolific.com. The current response rate is N41 for the Dutch sample and N45 for the international sample.

Software used

For topic modeling and content analysis, we use Python. At the beginning of our research, we initially used RStudio (4.13). However, in early April 2025, we switched to Jupyter Lab (Python 3.10) because the processing time in RStudio became too cumbersome for our analysis. These analyses are performed in Python, utilizing libraries such as nltk, pandas, scikit-learn, matplotlib, and bertopic. The environment was managed with conda, ensuring that key dependencies were installed as needed. The survey data are initially analyzed using SPSS (19).

Preliminary Findings

Mapping Review

In the following section, we present a part of our analysis, concentrating on two subsets (ESG and LANG) to exemplify the analytical potential.

BERTopic

This section presents a subset of our findings. We are currently working on refining the parameters; consequently, these visualizations may be subject to updates.

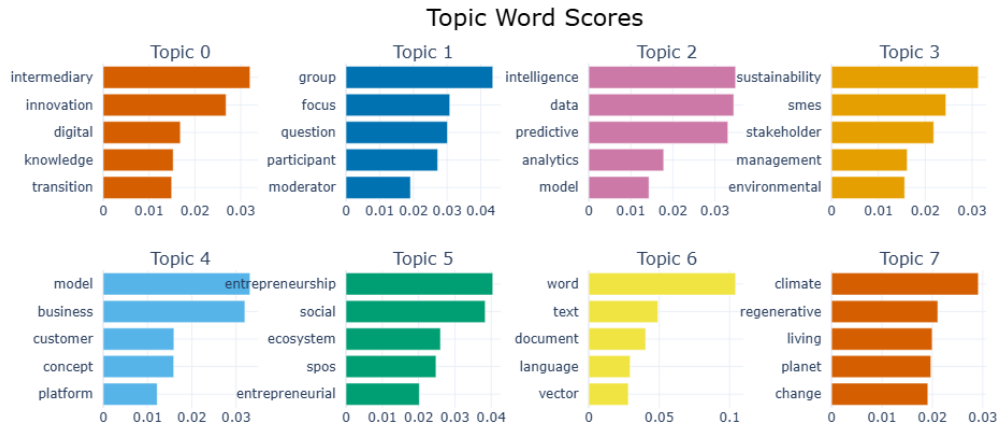


Figure 1 INT Sample BERTopic Barchart

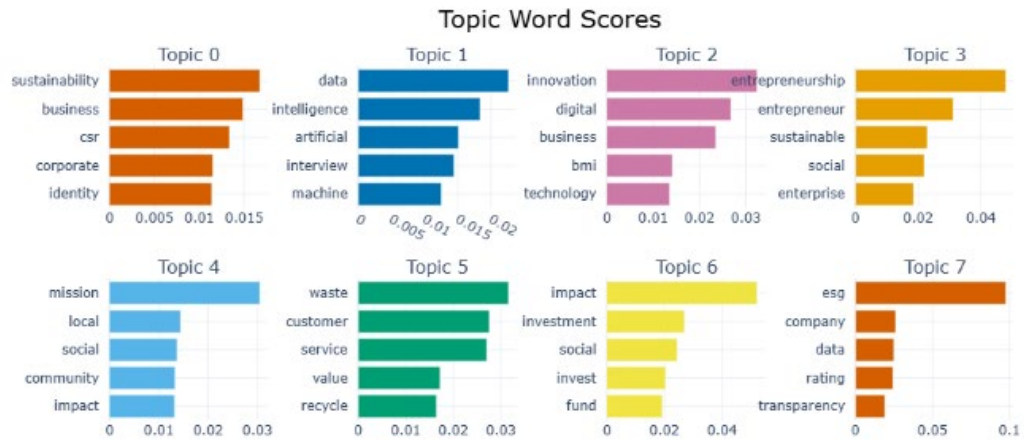


Figure 2 ESG Sample BERTopic Barchart

The INT sample captures broader conceptual themes of intermediaries, innovation, group collaboration, and sustainability transitions. The topics imply a strategic perspective, with terms like knowledge, transition, ecosystem, and entrepreneurship highlighting systems-level thinking. Topic 1 seems to focus on the role intermediaries have in change processes. Topics 2 and 6, which focus on data and intelligence, words, text, and language, highlight the literature on ML and NLP in sustainability transitions concerning intermediaries. The diversity among the topics

emphasizes the exploratory and multi-stakeholder characteristics of intermediary discourse.

In comparison, the ESG sample appears more focused and applicable. It emphasizes particular sustainability areas such as CSR, identity, and investment effects and circular economy practices such as waste management, recycling, and services. Terms such as rating, transparency, company, and data underscore performance-driven, compliance-oriented strategies often used in conjunction with ESG and CSR(D) reporting and governance. Similarly, funds and value indicate a significant connection to policies, financial instruments, and outcome evaluations in the ESG domain. This uniformity suggests a robust, application-oriented discourse in ESG literature and practices.

Although both datasets address sustainability and entrepreneurship, the INT sample seems to present a more abstract and systemic perspective, which can be suited for conceptual exploration and collaborative frameworks. In contrast, the ESG sample is connected to measurable outcomes, regulatory compliance, and investment rationale. This distinction highlights the need for context-aware ML and NLP strategies when developing tools or insights for diverse audiences, specifically for strategic advisory targeting intermediaries and policy, along with performance enhancement in ESG settings.

LDAvis

To enhance the interpretability of the LDA model, we utilized the interactive visualization library pyLDAvis. This tool allows users to explore topics via a two-dimensional representation derived from multidimensional scaling, where the distance between topics indicates their semantic similarities. Each topic is depicted as a circle, with the size representing its overall prevalence in the corpus. The right-side panel offers a detailed view of the most relevant terms for each topic, which are dynamically ranked using a relevance metric that considers both term frequency and exclusivity. We employed the gensimmodels interface of pyLDAvis for seamless integration with the LDA model constructed using Gensim. This visualization method provided essential insights into the identified topics' structure, overlap, and uniqueness, aiding both qualitative interpretation and model enhancement.

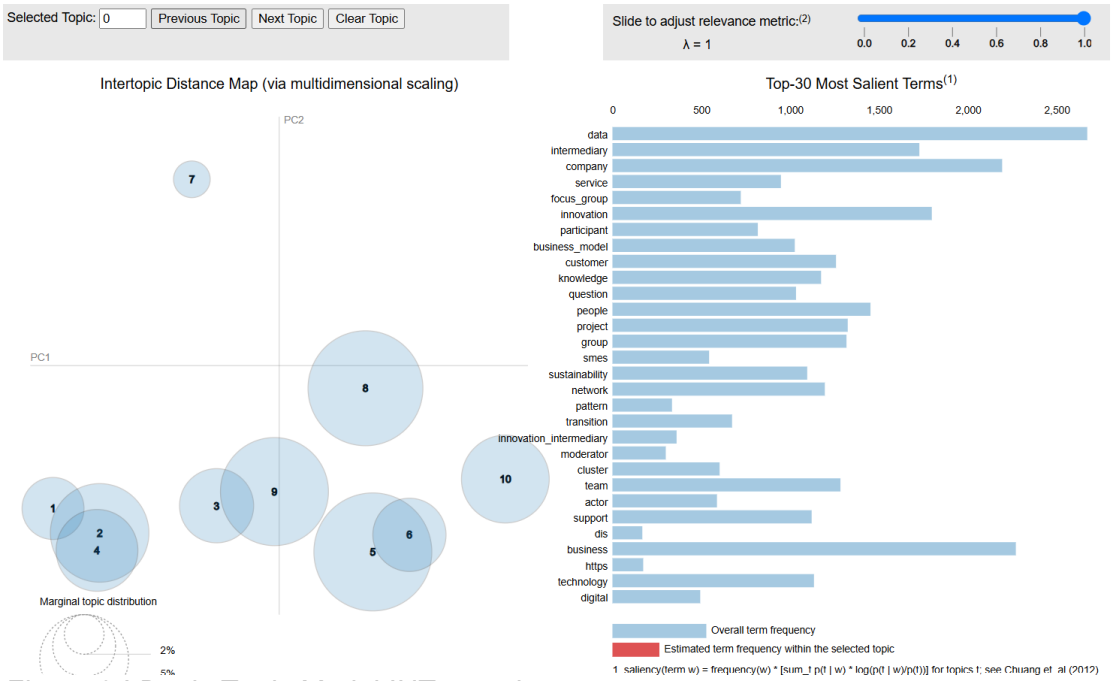


Figure 3 LDavis Topic Model INT sample

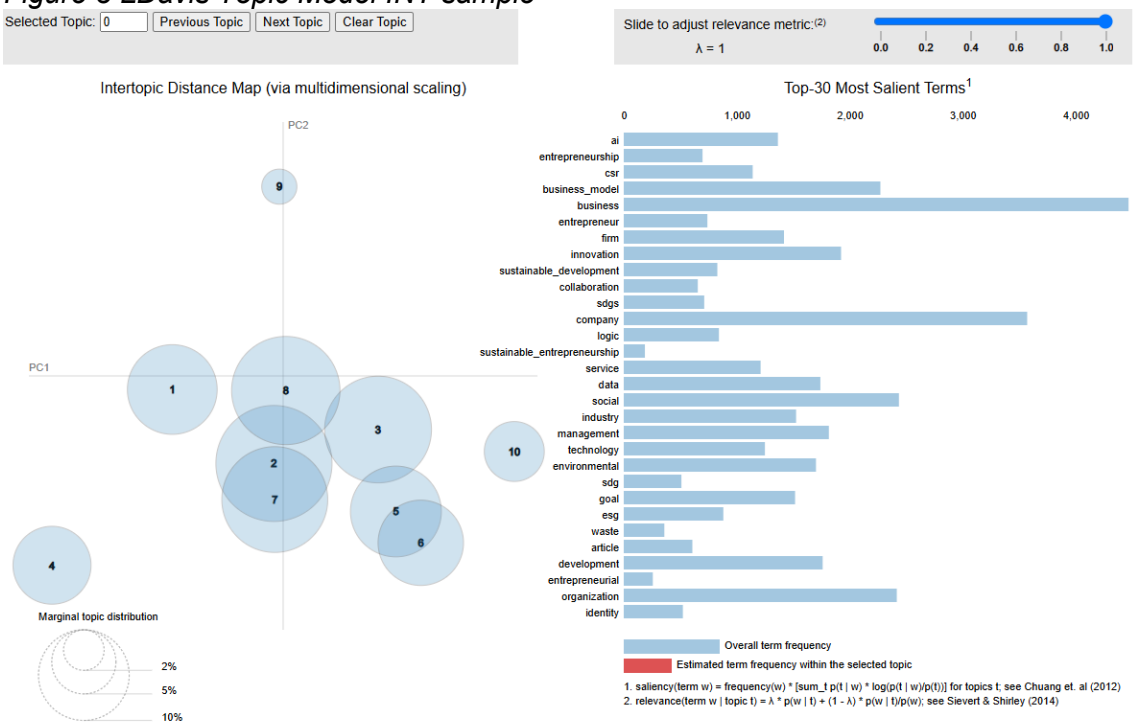


Figure 4 LDAvis Topic Moded ESG sample

The LDA visualizations illustrate the thematic structures of the ESG and INT corpora. Within the ESG dataset, the intertopic distance map displays a compact cluster of topics that partially overlap. Key terms such as business model, entrepreneurship, csr, innovation, sustainable development, and data reflect a strong focus on organizational sustainability, corporate responsibility, and data-informed strategies.

Moreover, terms such as AI, technology, waste, and ESG underscore an emphasis on digital innovation and environmental impacts in ESG initiatives. The proximity of topics in the ESG model further suggests a closely interlinked discussion centered on practical sustainability and enterprise-led transformations.

In contrast, the INT sample displays a more diverse topic arrangement, featuring several distinct clusters that encapsulate broader conceptual themes. Significant terms such as data, intermediary, focus group, participant, customer, network, and innovation highlight a greater emphasis on stakeholder engagement, participatory research, and innovation ecosystems. Additionally, terms such as team, cluster, and support emphasize collaboration and organizational dynamics, while sustainability appears to be less pronounced in this context. The wider distribution of topics in the INT visualization suggests a more varied discourse, likely reflecting the diversity of contexts and methodologies present in international or interdisciplinary research environments.

These variations in topic distribution and significance underscore the differences between the two datasets: the ESG sample highlights a focused, application-driven narrative on sustainability and corporate performance, while the INT sample offers a wider, more exploratory perspective on stakeholder dynamics and innovation processes.

ESG-related terminology within samples

To explore the frequency of ESG-related terminology, we conducted a frequency analysis using a curated list of 17 ESG-related terms drawn from two document samples, one focusing on ESG (the ESG sample) and another from a broader intermediaries (INT) sample (see Figures 6-7). The results indicate a marked difference in term frequency between the two datasets. In the ESG sample, terms such as social, sustainable, and business model were the most common, with each appearing over 5,000 times. In contrast, the INT sample contained much lower frequencies across all terms, with the highest term, social, exceeding just 2,200 mentions.

Both samples displayed some overlap in commonly used terms, particularly social, sustainable, and impact, reflecting a fundamental relevance of ESG discussions even in non-ESG-focused texts. However, the ESG sample emphasized terms like green and business model more heavily, showcasing a stronger focus on sustainability narratives and frameworks. Rarer terms like CSRD, business model tool, and sustainable transition appeared infrequently in both datasets, likely due to their specificity or recent emergence in ESG conversations.

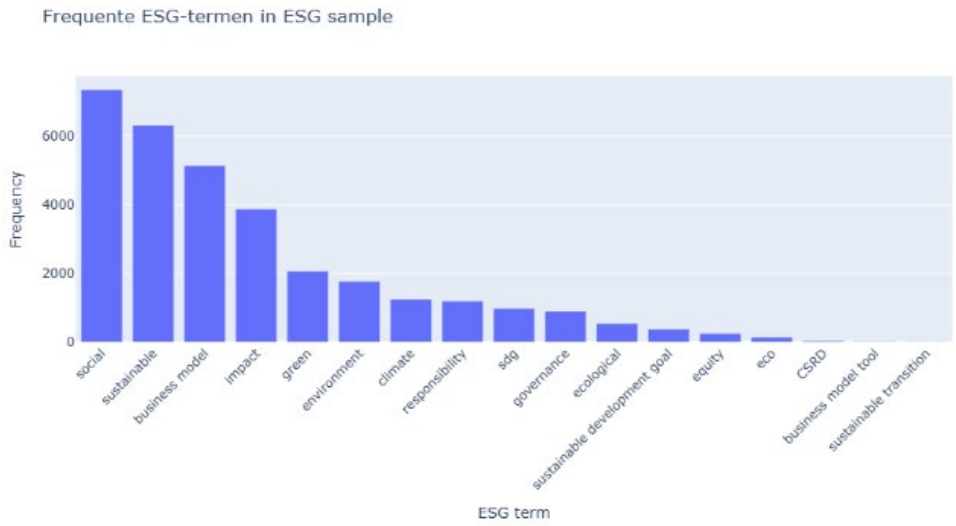


Figure 5 ESG Term Frequency in ESG Sample

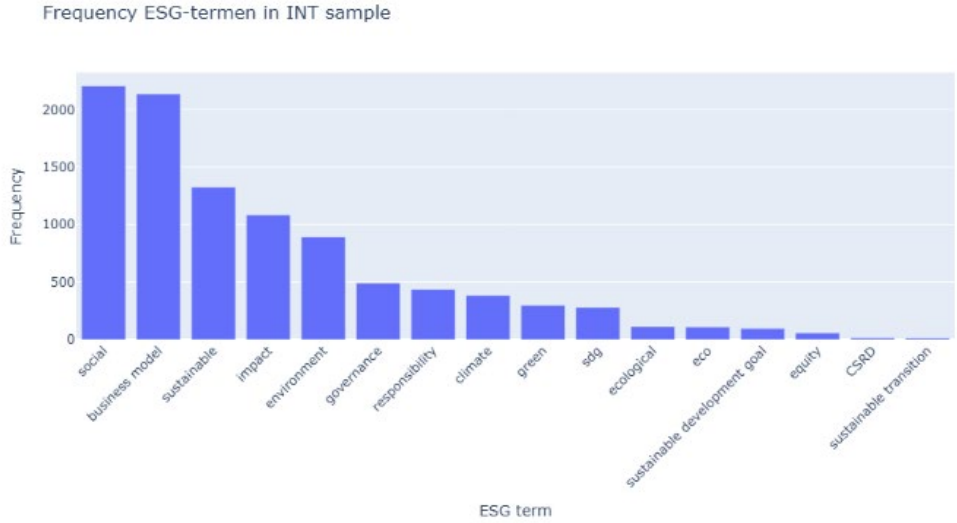


Figure 6 ESG Term Frequency in INT Sample

Overall, the findings confirm that ESG-specific terminology is substantially more prevalent in ESG-labeled documents, supporting the effectiveness of the dataset segmentation and highlighting key thematic emphases within the ESG discourse.

Group Interviews

The analysis of the three meeting transcripts revealed several interrelated thematic areas that enhance the collaboration among partners developing AI tools for sustainable business transformation.

Framing has emerged as a key concept in project discussions. Participants from De Betekenisfabriek highlighted the importance of identity frames, issue frames, and role-expectation frames as structures that affect organizational self-view and stakeholder engagement. While framing was already part of their practice, it was suggested that its function as a formal advisory tool, particularly regarding CSRD implementation, could be further explored with partners like Eshuis. This sparked a

discussion about the various application areas for this concept, making it less suitable in highly structured environments where changes adhere to standardized criteria.

A notable thematic distinction exists between De Betekenisfabriek's emphasis on framing methods and Eshuis's compliance-oriented approach concerning the Corporate Sustainability Reporting Directive (CSRD). Although both organizations function within language-abundant settings, their interpretive backgrounds and intervention strategies differ widely. These differences highlight the importance of a shared vocabulary and a cohesive analytical framework to facilitate interoperability across various organizational sectors.

During the meetings, partners recognized a distinction between language considered content, subject to analysis, and language models perceived as methods, such as NLP and topic modeling. This differentiation was crucial for aligning the project's epistemological framework with its methodological goals. The discussions highlighted the necessity of distinctly identifying language as a phenomenon that affects advisory processes, in contrast to language models, which act as technical tools for data analysis.

In meetings, the term "tool" was used differently, referring to conceptual supports and actual ML-driven applications. It also pointed to interventions aimed at changing components of business models, whether these were communicated directly to clients or indirectly through the interpretation of processes by intermediaries. A shared understanding developed around the concept of BMT as a flexible and structured framework combining semantic, linguistic, organizational, and technological elements to assist sustainability transitions in SME organizations.

During the session, participants concentrated on developing a data pipeline for the project. They proposed utilizing machine learning methods like topic modeling, hierarchical clustering, and semantic similarity mapping to uncover underlying frames, sentiment structures, and behavioral typologies from textual data, which included daybooks, INK sessions, and websites. Initial demonstrations indicated that annotated corpora could support creating classification systems and predictive models based on organizational language use.

The partners recognized that successful ML techniques need both exploratory (unsupervised) and deductive (supervised) methods. This involves creating annotated datasets to train machine learning models on relevant aspects of sustainability. Prototypes utilizing factor-based clustering and dimensional mapping were demonstrated to illustrate how these models can enhance advisory practices. The ability of machine learning to create domain-specific typologies and assist in reframing processes was affirmed, depending on the supply of well-structured and high-quality input data.

These initial findings indicate that integrating narrative frameworks with data-driven modeling effectively enhances BMIfS in the advisory process. They also emphasize the importance of explicit language and collaborative language construction, given that interpretation and jargon heavily depend on context. Visualizations have proven to be a valuable asset in building this shared language framework during these meetings. The integration of distinct disciplines provides the empirical and theoretical foundation for the tool under development in this project.

Preliminary Survey Findings

Descriptive statistics.

After cleaning the datasets, we found 70 total responses. We inquired about their active industries. Information and Communication (code 10) was the most prevalent sector, accounting for 34.3% of respondents (n = 24). Following this, Advisory, Research, and Specialized Business Services (code 13) comprised 12.9%, while Construction (code 6) represented 11.4%. Other sectors included Manufacturing (code 3, 8.6%), Education (code 16, 7.1%), and Health and Social Care (code 17, 5.7%). A few organizations reported involvement in Trade and Vehicle Repair (4.3%), Finance (4.3%), and Other Services (5.7%). Less frequently noted were sectors like Transport and Storage, Hospitality, Real Estate, and Public Administration, each representing 1.4% of the sample. Overall, the distribution indicates strong participation from knowledge-intensive and digital sectors, while traditional agriculture, mining, or utilities showed limited involvement in these industries.

We also inquired about the duration of their organization's establishment. The largest segment, 35.7% of respondents (n = 25), reported that their organization has operated for over 30 years. Other significant categories included organizations functioning for 6–10 years (17.1%), 11–15 years (14.3%), and 0–5 years (11.4%). A smaller percentage indicated being active for 21–25 years (10.0%) and 16–20 years (8.6%), while only 2.9% of organizations had been running for 26–30 years. These findings reveal a broad spectrum of organizational longevity age, though the sample leans toward mature organizations with established histories.

We also asked about the respondents' roles and how many years they have worked in those positions. The data illustrates the variety of professional functions among survey participants. There is a notable diversity of roles, including high-level positions like CEO, CTO, and Director, as well as specialized roles such as Data Scientist, Consultant, IT Manager, and Engineering Manager. The most commonly reported role was Manager at 5.7%, with other frequently mentioned positions including Advisor, CTO, Director, Owner-Managing Director (DGA), and Chairperson, each accounting for 2.9% of the sample. More than 50 respondents identified unique or specialized titles, reflecting the varied nature of technology and sustainability responsibilities across organizations.

Most respondents had been in their positions for 0–4 years (45.7%) or 5–9 years (37.1%). A smaller group had served for 10–14 years (15.7%), while only one respondent (1.4%) reported being in their role for more than 20 years. These results indicate that the majority of respondents have spent less than 10 years in their current roles, suggesting that many of these functions may be relatively new or have been recently redefined, possibly in response to the growing emphasis on sustainability and digital transformation initiatives.

AI application Business Activity

This table illustrates the business activities where the respondents' organizations employ AI. The question allowed multiple selections for answers.

Business Activity	**n**	**%**
Marketing and Sales	40	57.1%
Human Resources Management (HRM)	30	42.9%
Production	23	32.9%
Risk Management	14	20.0%
Strategy and Corporate Finance	22	31.4%
Research and Development (R&D)	30	42.9%

Service Operations	20	28.6%
Supply Chain Management	17	24.3%
Algorithmic Trading	12	17.1%
Autonomous Driving	9	12.9%
Recruitment and Selection	24	34.3%
Other (open-ended, 1st entry)	9	12.9%
Other (open-ended, 2nd entry)	3	4.3%

The findings indicate that AI is primarily utilized in marketing and sales (57.1%), followed by human resources management and R&D (both at 42.9%). Traditional operational areas, including production and service operations, are mid-range (32.9% and 28.6%). Strategic and high-risk uses, such as algorithmic trading (17.1%) and autonomous driving (12.9%), seem less prevalent. A limited number of participants used open-ended responses to mention other activities (12.9% and 4.3%), suggesting that the provided categories were adequate, primarily.

AI Deployment Objective

This table displays the objectives or outcomes the respondent's organization seeks to attain through AI implementation. Respondents had the option to choose several answers.

	n	%
Increase efficiency	58	82.9%
Increase productivity	52	74.3%
Predict service and interventions	24	34.3%
Analyze and improve customer service	36	51.4%
Increase profitability	35	50.0%
Support the sales process	27	38.6%
Improve service activities	33	47.1%
Improve products and product features	25	35.7%
Develop new products (or services)	27	38.6%
Identify sustainability opportunities	20	28.6%
Provide personalized offers	16	22.9%
Identify new customers	24	34.3%
Identify new markets	22	31.4%
Identify new collaboration opportunities	16	22.9%
Automate customer contact moments	25	35.7%
Improve administrative processes	28	40.0%
Detect fraud and errors (administrative organization)	15	21.4%
Other (open-ended)	3	4.3%

Sustainable Value Objectives

The table illustrates the frequency with which respondents identified specific sustainability objectives in their organizations. The findings reveal notable differences in the objectives most actively pursued.

Implementing energy-efficient technologies in production and operations	36	51.4%
Designing products for reparability to extend lifespan	20	28.6%
Designing products for durability to extend lifespan	20	28.6%

Using biodegradable or compostable materials to minimize waste and resource use	24	34.3%
Applying closed-loop models to minimize waste and resource use	19	27.1%
Providing employment or training opportunities for vulnerable groups	29	41.4%
Facilitating access to work for disadvantaged youth	20	28.6%
Supporting community initiatives and investing in social projects	30	42.9%
Developing products that encourage sustainable consumption	20	28.6%
Running campaigns that offer feedback mechanisms to help customers save resources	14	20.0%
Using gamification or reward programs to stimulate sustainable customer behavior	14	20.0%
Investing in R&D for resource-efficient and environmentally sustainable technologies to reduce pollution	20	28.6%
Investing in R&D for resource-efficient and environmentally sustainable technologies to enhance sustainability	22	31.4%
Creating sustainability certifications and labels to highlight environmental and social benefits	15	21.4%
Running campaigns to communicate the benefits of sustainable products/services	16	22.9%
Collaborating with stakeholders to create social value and address societal challenges	28	40.0%
Other (open-ended)	6	8.6%

The objective cited most often is adopting energy-efficient technologies in production and operations (51.4%). This may emphasize cost reduction, technology enhancement, and direct environmental impact mitigation. Additionally, supporting community initiatives (42.9%) and facilitating employment access for marginalized groups (41.4%) are frequently noted, highlighting a commitment to social responsibility. Collaboration with stakeholders to generate social value (40.0%) is also reasonably common, indicating an outward focus on sustainability.

Organizational Perspectives on Sustainability
This table illustrates how organizations view and organize their sustainability initiatives. Responses were categorized using a Likert scale ranging from 1 to 5. The Cronbach's alpha for this item is 0.900.

-	Valid N	Mean	Median	Mode	SD	Skewness	Kurtosis
Sustainability is a key focus in my organization.	69	3.45	4.00	3.00	1.24	-0.40	-0.74
My organization has defined what sustainability signifies to us.	67	3.31	4.00	4.00	1.31	-0.44	-0.88

My organization knows the socio-ecological impact of its business activities.	68	3.41	4.00	4.00	1.30	-0.35	-1.02
My organization responds to sustainability matters reactively.	63	2.90	3.00	4.00	1.29	-0.10	-1.17
My organization sees sustainability as an obligation.	63	3.43	4.00	4.00	1.38	-0.59	-0.83
Our organization employs frameworks like CSRD and ESG to incorporate sustainability.	62	2.92	3.00	4.00	1.39	+0.04	-1.28
In my organization, there is a department dedicated to achieving sustainability goals.	59	3.05	4.00	4.00	1.54	-0.2	

Overall, the highest average scores are for the statements “Sustainability is a key focus in my organization” (M = 3.45, SD = 1.24) and “My organization sees sustainability as an obligation” (M = 3.43, SD = 1.38). This indicates that respondents largely believe sustainability is both a major priority and a normative requirement. The statement “My organization knows the socio-ecological impact of its business activities” achieved a relatively high mean (M = 3.41), showing that most organizations acknowledge their broader environmental and social impact. However, this acknowledgment does not necessarily translate into proactive actions: the item “In my organization, there is a department dedicated to achieving sustainability goals” received a lower mean (M = 3.05, SD = 1.54) and had the highest standard deviation, indicating significant variability in responses. Additionally, the use of formal frameworks (such as CSRD and ESG) to integrate sustainability resulted in a modest score (M = 2.92), indicating an implementation

gap. Notably, the statement “My organization responds to sustainability matters reactively” received the lowest mean (M = 2.90), suggesting that most organizations do not agree with this notion and perceive themselves as more proactive or strategic rather than merely reactive.

Language Utilization for Sustainability

This table shows how respondents' organizations utilize language to set, monitor, and evaluate sustainability objectives. Items were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Responses differed for each item because of missing data.

The internal consistency of the 9-item scale was excellent, demonstrated by a Cronbach’s alpha of .968 (standardized alpha = .972). This suggests the items effectively measure a unified construct of language-based sustainability engagement. A Tukey's test for nonadditivity was conducted to determine if the nine items on language use regarding sustainability efforts could be combined into a single score. The results were non-significant ($F(1,79) = .027$, $p = .869$), implying that the items exhibited additivity and could be effectively merged. The grand mean for all items was 3.22, indicating moderate language-based engagement with sustainability within organizations.

Item	N	Mean	SD
My organization frequently utilizes specific sustainability terminology in internal communications.	63	3.02	1.30
All departments in my organization have a common understanding of sustainability terminology.	65	3.03	1.24
My organization encourages a shared sustainability vocabulary among its employees.	64	3.09	1.31
Communication regarding sustainability is clear within my organization.	63	3.14	1.34
In my organization, we tailor sustainability language for various audiences, such as frontline employees and senior management.	62	2.65	1.32
Our sustainability policy encourages employees to engage in sustainable practices.	65	3.12	1.24
In sustainability performance reports, the focus is on using clear and transparent language.	62	3.00	1.33
Our organization frequently discusses and clarifies various interpretations of sustainability language.	62	2.71	1.34
Other (open-ended)	12	2.92	2.02

Discussion

This study's preliminary findings offer a comprehensive view of how organizations interact with sustainability and language, both theoretically and practically, focusing on the role of AI. Several key patterns and tensions have surfaced using topic modeling, group interviews, and survey data, providing initial validation of the project’s analytical framework and identifying areas warranting further exploration and enhancement.

The initial results from the group interviews highlight the essential concepts and methodological challenges in creating a context and language-sensitive BMTfS to

facilitate transitions in SMEs. One key insight surfaced was the dual role of language: serving both as a means for organizational sense-making and as an analytical tool for ML applications. Participants stressed the importance of carefully managing this duality, especially since interdisciplinary teams have different assumptions concerning language's role and function in advisory contexts.

Language interpretation diverged when it was seen as both a discursive practice and a technical tool. Participants from De Betekenisfabriek emphasized the significance of framing, particularly concerning identity, issues, and roles, as essential for shaping organizational identity and involving stakeholders. Conversely, Eshuis prioritized regulatory frameworks like the Corporate Sustainability Reporting Directive (CSRD), focusing on language use in compliance and formal communication. This difference emphasized the necessity for a common vocabulary and a clear analytical framework to foster effective interdisciplinary collaboration. Throughout the discussions, terms such as language, tool, and model showed varied interpretations, ranging from abstract concepts to specific machine learning applications. Despite this, a consensus gradually developed around BMT as a hybrid structure that combines linguistic, organizational, and technological aspects.

This mutual understanding clarified the tool's objective: to link organizational narratives to measurable sustainability aspects via interpretable ML outputs. Acknowledging the difference between language as influence (framing, sense-making) and language as method (data modeling, NLP) was crucial for achieving epistemological alignment across various fields. The group unanimously agreed that the effective execution of this tool relies not just on technical viability but also on its significance to advisory practices.

Participants suggested integrating supervised and unsupervised modeling techniques, such as topic modeling, hierarchical clustering, and semantic similarity mapping. These approaches were regarded as technical tools and ways to validate current framing models and sustainability heuristics. By aligning topic clusters generated inductively with categories established deductively (e.g., CSRD criteria, ESG dimensions, language frames), the project aims to develop a data-driven and theory-based classification system.

Notably, the research highlighted the importance of validating findings in real-world settings. Although integrating AI techniques into advisory processes shows potential, their effectiveness relies on producing actionable insights, facilitating frame alignment, and enhancing strategic decision-making for both clients and advisors. Prioritizing contextual sensitivity and conducting live tests within organizational contexts are vital next steps for tool advancement.

A key insight from the analyses using BERTopic and LDA is the distinct thematic structures found between the ESG and INT samples. The ESG corpus features application-focused language highlighting compliance, performance, and measurable sustainability results. This is demonstrated by the prevalence of terms related to governance, reporting, and financial instruments. In contrast, the INT sample adopts a more abstract and systemic perspective, emphasizing collaboration, knowledge transfer, and stakeholder dynamics. These findings underscore the necessity of customizing language technologies, such as NLP models and data visualizations, for specific strategic or operational purposes. For instance, tools designed for ESG reporting should enhance precision and transparency, while those intended for intermediaries might be more effective with exploratory and context-aware language frameworks.

The analysis of ESG term frequency reinforces the success of dataset segmentation. A significant difference in the usage of sustainability-related terms between the ESG and INT samples highlights the limited scope of ESG discussions. However, the common terms (such as social, sustainable, impact) indicate shared conceptual foundations in both areas. This observation emphasizes the need for adaptable ontologies that integrate domain-specific language and wider sustainability vocabulary.

The survey results provide detailed insights into how organizations view, organize, and implement sustainability, as well as their integration of AI in business operations. Multiple trends surface, revealing advancements and ongoing challenges in shifting toward sustainability-focused, AI-enhanced practices.

Survey findings about organizational perspectives reveal that while sustainability is widely acknowledged as a strategic priority and a normative expectation, its official integration, such as dedicated departments or structured frameworks, remains inconsistent. The respondents' low adoption of CSRD and ESG frameworks suggests a gap between sustainability objectives and their practical implementation. Another explanation is that their role does not require this knowledge. Furthermore, significant variations in organizations' understanding of internal coordination and terminology signal that many are still working to develop a shared language around sustainability, which could hinder the effective execution of strategies.

The examination of language usage revealed a moderate level of engagement in sustainability communication, highlighting considerable opportunities for enhancement. The lower ratings in audience-specific tailoring and interpretive discussions indicate a necessity for a more deliberate linguistic approach. This emphasizes the project's fundamental premise: that a common language and clearly defined semantic structures are vital for effective communication and serve as crucial elements in creating sustainability governance and advisory tools.

Collectively, the preliminary findings highlight the promise of merging language framing with ML and NLP methods to facilitate sustainability transitions using BMT for SMEs. Shared language creation provides a framework for understanding how organizations create meaning, while ML and NLP techniques enhance scalability, organization, and pattern detection in complex datasets. These methods offer more context-sensitive, actionable tools that connect qualitative insights with data-driven analysis(Messmer et al., 2024). Developing these hybrid tools advances sustainability advisory practices and wider dialogues on how language and machine learning can foster social and ecological change collaboratively.

Limitations and Future Research

Our analysis has only recently begun, and we are refining our topic models' model and parameters. Therefore, the preliminary findings are mainly descriptive and should not be interpreted as generalizable. Moreover, we plan to conduct a comparative analysis of these subfolders to explore the semantic differences related to context and contrast them with the comprehensive folder that includes all documents. Furthermore, the next step involves thoroughly examining these results and their comparison with existing scientific literature to gain a deeper understanding, as they currently act only as reflections.

The survey had a response rate of 70 participants, which is sufficient for exploratory analysis, yet it limits the generalizability of the findings results. The sample heavily favored knowledge-intensive and digital sectors, especially in information and communication. Meanwhile, agriculture, mining, and public administration sectors were underrepresented, potentially masking differences in sustainability practices

across various industries. Additionally, interviewees and respondents may have experienced memory recall or hindsight bias. Hindsight bias is defined as "people's tendency to alter their perception of the inevitability of an event once they know the outcome of the event" (Christensen-Szalanski & Willham, 1991, p. 147). On the other hand, recall bias is described as the "systematic error due to differences in accuracy or completeness to recall to memory of past events or experiences" (John, 2001, p. 153).

Conclusion

This study's preliminary findings highlight the importance of combining shared language construction, contextual understanding, and ML and NLP techniques in enhancing advisory practices through BMTfS. The results indicate essential epistemological differences regarding language interpretation and usage within organizations, emphasizing the need for unified frameworks to address these disparities. This research lays empirical and theoretical groundwork for a BMT that merges linguistic insights with machine learning capabilities by employing group interviews, topic modeling, and term frequency analysis.

The comparative analysis of ESG and INT corpora reveals that ESG-focused texts demonstrate greater thematic cohesion and alignment with regulatory and operational frameworks. In contrast, INT texts present a broader, more exploratory discussion. This indicates that language-centric ML can uncover domain-specific insights and facilitate reframing processes in advisory roles, provided these models are trained on high-quality, contextually rich data. It is important to acknowledge the extent to which the selection criteria impact the outcomes and subsequently influence the results.

The preliminary survey results reveal a mixed yet encouraging landscape concerning organizations' strategies for sustainability, language, context, and AI. Although sustainability is primarily seen as a key strategic goal, its realization through established protocols, shared language, and cohesive frameworks varies significantly. AI is frequently used to enhance efficiency and productivity; nonetheless, its potential for fostering sustainable outcomes is not fully realized. The moderate use of sustainability-focused language across different departments highlights a need for enhanced internal communication and consistent terminology. These results underscore the importance of integrated tools and frameworks linking strategic objectives with operational practices, enabling organizations to utilize AI and language more effectively to achieve meaningful sustainability improvements.

Moreover, preliminary survey findings emphasize the vital role of context in influencing the understanding and implementation of sustainability and AI within organizations. Factors such as sector, organizational maturity, functional roles, and internal language practices all affect how sustainability is prioritized and put into action. The interpretation of sustainability, its communication, and the role of AI in supporting it can vary significantly based on these contextual elements. This underscores the necessity for adaptable frameworks and tools that are attuned to organizational environments, cultures, and stakeholder dynamics. Instead of relying on generic solutions, effective strategies must consider the specific circumstances in which sustainability initiatives occur, whether in policy-driven, innovation-led, or compliance-focused contexts.

As we progress, we aim to enhance our datasets, refine classification models, and test prototypes in real-world advisory contexts. Equally important is our focus on interpretability and user adoption to ensure that ML/NLP outputs are understandable and actionable for practitioners. We also plan to enlarge our survey sample size to

increase the generalizability of our findings. Additionally, we need to critically assess the results and triangulate our insights with current literature on the key themes of our study. Ultimately, this research adds to the growing field focused on using language for sustainable transitions, supported by data-driven and conceptually robust tools.

Keywords

Data Science, Business Model Innovation, Sustainability, Contextual Knowledge, Shared Language Construction

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Data-Driven Simulation for Evaluating Profitability During the Growth Phase of PaaS Businesses

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Extended abstract

Circular Economy (CE) has garnered worldwide attention as an economic model capable of both expanding economic activity and reducing environmental impact. Among its various approaches, Product-as-a-Service (PaaS) models—where companies retain ownership of products and offer their functionalities as services to users—have been rapidly gaining traction across a range of industries (Bocken et al., 2016). Nonetheless, several issues have been identified in scaling PaaS businesses, one of which is ensuring profitability during the growth phase. Since PaaS businesses must own their product assets, they must invest in procuring products to meet new customer demand during this period. It takes a considerable amount of time for the associated revenue to outpace these investments, which brings profitability into focus from a cash-flow perspective and renders it a critical element for business continuity.

In addition, PaaS businesses are expected not only to be profitable but also to achieve high resource efficiency. Generally, increasing product utilization in a PaaS model leads to greater resource efficiency and reduced environmental impact. As a means of improving profitability, one option is to procure low-cost products such as used items. However, because these tend to have shorter lifespans and higher failure rates, they may result in lower resource efficiency. Conversely, procuring new, higher-priced products can enhance resource efficiency but may undermine

profitability. Balancing profitability with resource efficiency therefore requires accurately understanding consumer usage patterns and formulating product supply strategies that maintain optimal inventory levels (Eggert et al., 2014; Kumar et al., 2018).

Previous research has proposed various simulation-based methods for evaluating the profitability and environmental performance of PaaS businesses. For instance, in product design (Franco, 2019; Panarotto et al., 2017; Bal and Badurdeen, 2022) or business model design (Franco, 2019; Panarotto et al., 2017; Bal and Badurdeen, 2022; Koide et al., 2023), simulations have been used to replicate business operations and offer insights useful for corporate strategies. However, these studies often assume steady demand after the growth phase, leaving profitability and environmental performance during the growth phase insufficiently explored.

This study aims to develop a strategy formulation tool intended for use during the growth phase of PaaS businesses, where surging customer demand places heightened importance on procurement. The objective is to accurately capture customer demand while attaining high levels of profitability and resource efficiency. The proposed approach is validated for its reliability and applicability in product supply strategy formulation by applying it to a used PC rental business.

Our simulation is composed of two main models: a user decision-making model and a resource circulation model. For the user decision-making model, we adopt a structural estimation technique and employ a static discrete choice model tailored to the characteristics of PaaS businesses (Berry, 1994; Berry et al., 1995). We estimate utility function parameters using real-world data to model decision-making. To model product circulation, the supply chain is divided into five sections—“Maintenance/Repair,” “Demand Generation,” “Product Procurement and Allocation,” “Transportation,” and “Failure Confirmation”—replicating operations on a daily, event-driven basis. Together, these two models collectively reproduce demand and supply conditions that closely reflect actual business operations.

In the case study, we targeted a used PC rental business. Multiple rounds of interview-based surveys were conducted, in addition to acquiring real transaction

data, inventory data, procurement data, and failure data. For the user decision-making model, given the specific nature of the business, we combined a Conditional Logit Model with Latent Class Analysis to capture user heterogeneity. In modeling product circulation, each section was precisely configured based on real data and insights from the interviews.

To verify the reproducibility of our simulation, we compared actual daily sales data to the simulation results. In standardized terms, the mean squared error was 0.2179 and the mean absolute error was 0.3262, indicating the simulation can reasonably replicate historical sales trends based on past data.

Moreover, in assessing the value of our simulation for pre-evaluating product supply strategies, two major effects were confirmed. First, by retaining a substantial number of relatively new products in inventory while offering them at the same price as lower-end models, firms could reduce long-term inventory risk while achieving high profit margins and utilization rates. Second, introducing a fixed number of new products was shown to maintain both profitability and resource efficiency.

Hence, this simulation method demonstrates that a data-driven approach can replicate surging demand and the aging of products in PaaS businesses during their growth phase, thereby enabling quantitative evaluation of how different strategies impact profitability and resource efficiency. One contributing factor is our user decision-making modeling approach, which leverages real data and allows for precise demand reproduction. Traditional conjoint analysis has been criticized for discrepancies from actual consumer behavior and issues like limited sample size or sample bias (Mansuy et al., 2020; Allenby et al., 2019). By contrast, our method mitigates these problems through the use of real data, enhancing demand reproducibility within the simulation.

Looking forward, more sophisticated user decision-making models and the incorporation of competitive dynamics represent important challenges. PaaS businesses also face the potential for rebound effects, such as increased transportation or shifting usage patterns, which could impact environmental footprints; this highlights the need for integrating environmental indicators like greenhouse gas emissions. By including these aspects, we can achieve more

comprehensive and accurate strategy evaluations, thereby contributing to the development of sustainable PaaS business and furthering the adoption of a circular economy in society.

Keywords

Circular Economy, Product-as-a-Service, Simulation Modeling

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An Extended Abstract Submitted to the NBM Conference 2025

Data-Driven Farming: Implementing Smart Product Service Systems for Sustainability

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Extended abstract

Introduction

The integration of servitization and digital technologies in agriculture presents a transformative opportunity to enhance traditional farming practices. Although servitization has primarily been explored in industrial manufacturing (Baines et al., 2009; Tukker, 2004), its application in agriculture remains under-researched, making our study on AgriWater's remote monitoring services particularly valuable. Our study utilizes the concept of Big Data Value Chains (BDVC) to illustrate how data-centric processes can transform agricultural business models. By referring to innovative agricultural solutions through utilization of Internet of Things (IoT) and Artificial Intelligence (AI) technologies, our research contributes to the literature on sustainable Smart Product Service Systems (SPSS), emphasizing ecological sustainability and enhanced customer value. In thius regard, our Research Question for this research is: "How can digital servitization and AI-driven Smart Product-Service Systems (SPSS) enable sustainable value creation and customer engagement in agriculture?". Our research aligns closely with the conference track, as the track explores

how AI, big data, and digital transformation reshape business ecosystems and value creation, which directly corresponds to our study's focus on integrating digital servitization and AI-powered remote monitoring in agriculture. By establishing how BDVC and predictive analytics enhance sustainability and customer engagement in the agricultural sector, our research contributes to the broader discussion on data-driven business model innovation and ecosystem development for sustainability.

Theoretical Background

Digital Servitization in Agriculture

Servitization enhances core offerings by incorporating services to create additional customer value (Raddats et al., 2019). These combined offerings, known as "product-service systems" (PSS), help companies distinguish themselves, increase customer loyalty, and influence future purchases (Baines and Lightfoot, 2012; Kamp and Parry, 2017; Matthyssens and Vandenbempt, 2008; Tukker, 2004)2008). Kohtamäki et al. (2019) define digital servitization as the "transition toward smart product-service-software systems that enable value creation and capture through monitoring, control, optimization, and autonomous functions". Agriculture recognizes digital servitization's potential to stimulate growth and improve perceptions of local farming activities (Vidickiene and Gedminaite-Raudone, 2019). Farms and suppliers have recently broadened their services, to manage modern agricultural systems' complexities through the utilization of digital technologies (Corti et al., 2015; Giarini, 1976; Giarini and Stahel, 1993). In this regard, use of big data and big data analytics make the value chain more data-centric, leading to processes such as the BDVC (Gröger, 2018). This shift also enhances collaboration of stakeholders and a firm's intellectual capital by generating intangible assets, such as relational capital from external relationships.

Sustainable SPSS and Co-Creation of Value in Agriculture

Sustainable SPSS combines sustainability and smart technology within PSS. Implementing sustainable SPSS in agriculture significantly contributes to sustainable development by addressing the negative externalities of the industrial linear model through service-based solutions. Co-creating agricultural solutions with clients challenges the traditional economic model, allowing for sustainable environmental treatment without increasing production quantities (Nefussi, 2007). This approach promotes innovations that prevent or remedy environmental and socio-economic damage (Desmarchelier et al., 2020). Sustainable SPSS is increasingly implemented in areas such as enhancing animal health and water quality management.

On the other hand, co-creation of value in digital servitization is critical due to the interdependence between firms and their ecosystems. It requires extensive collaboration across firm boundaries (Bustinza et al., 2015; Rabetino et al., 2018; Raddats et al., 2019; Salonen and Jaakkola, 2015; Sklyar et al., 2019). This collaboration is essential for creating and integrating smart solutions that interact seamlessly within the broader ecosystem. Co-creation in agriculture occurs through collaboration between farmers, technology providers, and service experts to develop and implement innovative solutions, such as precision farming techniques and sustainable practices, tailored to specific farm needs.The co-creation of value between agricultural partners can drive digital servitization, integrating advanced technologies and collaborative practices across the agricultural value chain.

Methodology

Our study integrates servitization and digital technologies in agriculture, focusing on a remote monitoring business model involving sustainable SPSS. We conducted a year-long case study with AgriWater, a provider of agricultural solutions in the Netherlands. Our research addresses servitization as an opportunity for growth and improving customer loyalty (Jang et al., 2021). Our research uses a mixed-method approach, combining qualitative and quantitative methodologies to analyze numerical data and qualitative insights. The study is conducted in two phases. The first involves exploratory research through in-depth interviews, identifying servitization options, with big data and remote monitoring emerging as feasible solutions. The second phase focuses on developing a

business model for remote monitoring, collecting data through sensors to detect water contamination and recommend additive levels in real-time. Big Data is not yet widely used in agriculture, unlike in manufacturing. To explore its role in servitization and sustainability, we also compared three manufacturing SMEs with one from the agricultural sector

Findings and Discussion

Our research found that customers prioritize water quality and stable hygiene for animal health. Technologies like remote water monitoring sensors, smart wearables, and behavior analysis cameras are valuable. The value for customers lies in saving time, providing expertise, and ensuring consistent water quality. The proposed business model includes value-based pricing with subscription and one-time fee options. These insights help AgriWater implement remote monitoring services to enhance customer loyalty and generate sustainable revenue. The cross-sector analysis revealed that agriculture is rapidly catching up in its sophisticated use of Big Data, in some cases even surpassing other sectors. It became evident that Big Data plays a key role in enabling servitization and in linking servitization to sustainability.

Theoretical Contributions

The concept of BDVC is essential for understanding how data-centric processes can transform traditional business models. AgriWater's research aligns with this framework, identifying key data points such as pH levels, biofilm, and turbidity. Seamless sensor integration into existing farm infrastructure supports technological adaptability in BDVC, aligning with Gallouj (2021) emphasis on the role of service providers in modern agriculture. Different actors play distinct roles within the value chain: farmers generate data, AgriWater aggregates and analyzes it, and technology partners provide the necessary infrastructure. AI and BDA are significant, enhancing data interpretation and providing actionable insights beyond simple monitoring. This supports Sklyar et al.'s (2019) notion of digital servitization, where digital technologies shift business models from product-centric to service-centric. AI's ability to interpret complex data and predict issues, like water quality deviations, shows its potential in creating value through servitization.

Managerial Implications

The proposed remote monitoring-based business model for AgriWater enhances customer value by providing real-time data on water quality and animal health, optimizing operations, and ensuring animal well-being. Continuous monitoring allows predictive maintenance and timely interventions, improving farm productivity. Our remote monitoring-based business model integrates various firm-level theories into a comprehensive digital servitization strategy, emphasizing sustainable SPSS. This positions the company as a leader in agricultural innovation through utilization of IoT sensors and AI-driven water quality monitoring where the model uses competitive dynamics and internal capabilities. Additionally, real-time data analytics and predictive maintenance reduce costs and improve efficiency. This integration enhances competitive advantage, operational efficiency, sustainability, and customer value.

Keywords

Smart Product Service Systems, Artificial Intelligence, Co-Creation of Value, Digital Servitization

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Towards sustainable agricultural ecosystems with data and AI ecosystems

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Extended abstract

Data and artificial intelligence (AI) are considered the main means to achieve sustainable agriculture (Bhagat, Naz F & Magda, 2022). Based on a systematic literature review according to (Webster & Watson, 2002) and (Brocke et al., 2009) in progress, this paper analysis main obstacles, solutions, and gains from data-driven and AI based sustainable business models in agriculture. The literature review considers published case studies on application of data and AI in agriculture (see for example the published cases in Södergård et al., 2021) that are published in journal articles, conferences as well as books and book chapters. A special focus is set on data-driven, and AI based agricultural ecosystems.

Main Definitions

First the main phenomena under consideration are defined as a basis for selection of the respective keyword for the search and structuring of the literature review. Anggraeni, Hartigh, & Zegveld (2007) provide a classification and systematization of definitions of **business ecosystems**. As one of the most comprehensive definitions they cite Peltoniemi (2005) as follows: "*Business ecosystems consist of a large number of participants that can be business firms and other organizations. They are interconnected in a sense that they have an effect on each other. This interconnectedness enables various interactions between the members. These interactions can be both competitive and cooperative. This interconnectedness leads to a shared fate. The members are dependent on each other, and the failures of other actors can result in failures of a certain firm. The members of business ecosystem are capable of conscious decisions on their own part. … Thus, business ecosystem is fundamentally a dynamic structure that evolves and develops in process of time.*"

In analogy, **agricultural ecosystems** are defined as complex systems that integrate biological, physical, and social components to produce food, fibre, and other goods while

maintaining ecological balance and health. These ecosystems rely heavily on various ecosystem services, which are the benefits that humans derive from natural processes, such as pollination, nutrient cycling, and soil fertility maintenance (Power, 2010; DeClerck et al., 2016).

A **data-driven agricultural ecosystem** is a special type of agricultural ecosystems and refers to a comprehensive framework that integrates:

- various agricultural companies operating on and using data as main common value creation resource,
- companies collecting, processing, analyzing, managing, and providing data,
- companies providing data related technologies such as for example soil sensors or other Internet of Things (IOT) solutions (i.e., Kim, Lee, & Kim 2020) for data collection.

At the core of a data-driven agricultural ecosystem is the utilization of vast amounts of data generated from multiple sources, including soil and other sensors, satellite imagery, and weather forecasts (see for example Kim, Lee, & Kim, 2020 or Södergård et al., 2021). These data sources are the foundation of the application of different AI based data analysis that enable farmers to monitor for example crop health, soil conditions, and environmental factors, facilitating informed decision-making that can lead to improved crop yields and resource efficiency (Palileng, 2024; Mehrabi et al., 2020; Pandey, 2024). Figures one provides an overview of potential players and their relationships in data-driven agricultural ecosystems:

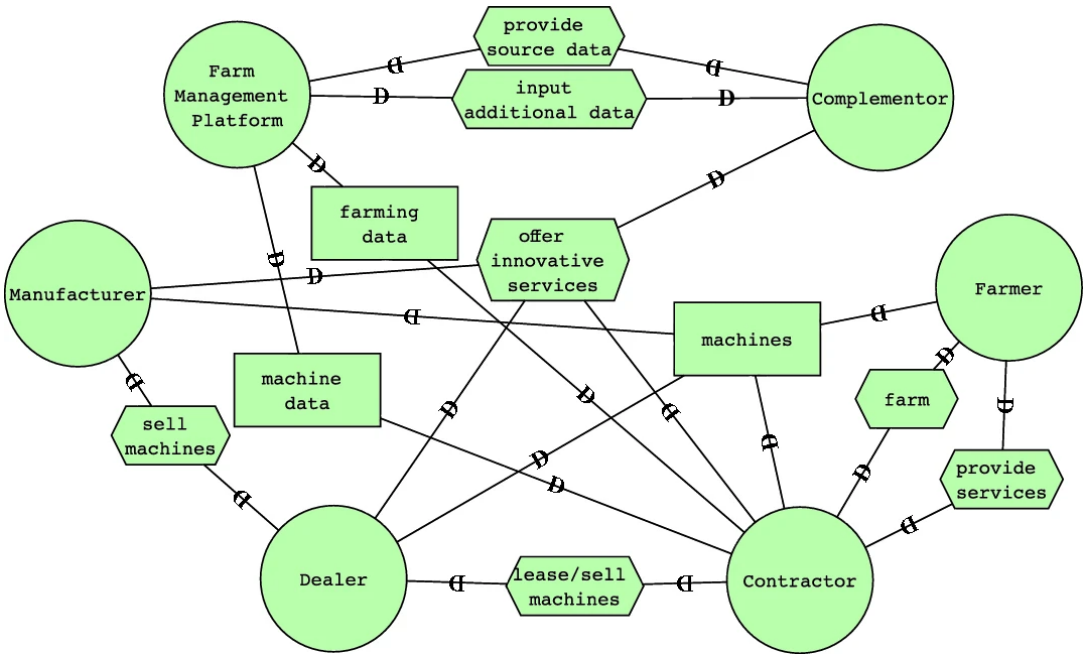


Figure 2: An example of players and their relationship in a data-driven agricultural ecosystem (Koren et al., 2021)

Preliminary Results

The first results of the analysis of thirty published case studies of application of data and AI in agriculture can be summarized as follows:

- Data-based and AI solutions for agriculture are complex and involve the whole value chain from data collection, data management, data integration and analytics as well as data visualization.
- Data analysis is based on complex AI solutions that involve various models and algorithms. For example, visual analysis of satellite data, analysis of weather data, prediction, analysis of soil data and similar. For end-to-end solutions often several different solutions are required.
- Application of data and agriculture requires new knowledge about these technologies, that farms do not have.
- Application of AI in agriculture requires farming data of high quality that can be used for training AI models. In many cases there is no tradition of farms collecting data. Various Thus, investment in AI requires first investment in un-biased data with sufficient quality before AI can be applied with farm specific data.
- Besides internal and own farm data, application of AI in farming requires external data as weather data, market data and similar.
- There are open questions regarding data ownership and privacy related to sharing of data.

As preliminary findings two types of data-driven agricultural ecosystems can be identified: Data-driven agricultural ecosystems can consist of a single farm that uses services of various data-based machinery (i.e., agriculture machinery that collects data while applied on the fields); data-providing companies such as satellite data providers, and data-processing companies such as various analytics providers for agricultural data. In this case the single farm might form a new ecosystem with companies providing data and AI services. It can also consist of several agricultural farms and or companies that co-create value for their customers based on data sharing and co-creating relationships with data collection, processing and managing companies. In this case the agricultural ecosystems are connected to a technical ecosystem providing data and AI services.

Based on these first findings, it can be concluded that end-to-end data and AI solutions in agriculture can be achieved only if complex data and AI solutions can be provided by specialized data and AI ecosystems, or data and AI pipelines in form of specific services. Such data and AI ecosystems might involve:

- several data collection solutions such as soil sensors, drones for collection of crop data or weather information
- support for different approaches for data management
- support for different approaches for data analysis based on AI.
- Protocols for sharing data among the ecosystem's participants.
- trained AI models that might be specifically designed for a certain region of agricultural ecosystem.

Overall, at this stage of the research data and AI-driven agricultural ecosystems can only be achieved with access to data and AI ecosystems proving complex solutions.

Keywords

Data-driven agricultural ecosystems, AI in agriculture, Data and AI ecosystems, AI business models, Data-driven business models

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A Community-Driven Sustainable Business Models

Integrating Local Needs with Innovative Co-Creation Approaches

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Abstract

The Sustainability Knowledge Co-Creation Model, developed under the Horizon Europe's Sustainable Horizons (SHEs) project, exemplifies a community-based approach to fostering sustainable regional development. This model emphasizes co-creation between higher education institutions (HEIs), municipalities, regional authorities, companies and associations, directly addressing sustainability challenges.

By leveraging the co-creation framework, communities serve as dynamic intermediaries between local knowledge and innovative entrepreneurship. The model's six-phase structure—ranging from defining joint visions to implementing evaluation systems—ensures inclusivity, regional alignment, and adherence to global sustainability goals like the UN SDGs. Central to its design is an inclusive partnership framework, integrating local expertise with academic research to co-create solutions for challenges such as climate resilience, resource management, and biodiversity conservation.

The model's adaptability across regional contexts was demonstrated through six successful pilot projects, implemented during the project time. These pilots enhanced community well-being, reduced environmental impact, and each of them aligned with one or more SDGs. Partnerships also extend to social innovations, such as enhancing regional competitiveness through upskilling and circular economy initiatives.

While rooted in regional collaboration, the model is also highly adaptable for global contexts, fostering partnerships with Global South stakeholders, who were associated partners of the project. This alignment ensured relevance and impact across diverse socio-economic and environmental landscapes.

Ultimately, this co-creation model supports the development of sustainable business ecosystems by enabling continuous feedback, fostering resource efficiency, and creating shared value. It offers a replicable framework for addressing local and global sustainability goals while bridging academia and society.

Keywords

collective value creation, community-based business model, sustainability co-creation, systemic business model

Introduction

Regional development is boosted by entrepreneurial creativity: this is a well-known fact among the scholars of regional studies (Stathopoulou et al. 2004; Freire-Gibb & Nielsen 2014; Korsgaard et al. 2015). Bridging the external sources with the local creativity and bonding local human capital for common goals are the cornerstone components of entrepreneurship for regional development (Sørensen 2016).

A community approach is inevitable, as rural society and social environment are built on the community as the unit of formation of the society (Müller 2016). Collaboration and co-creation are the base of the relationship dynamics within the community and therefore, a new form of the business model had to be emerged (Buratti et al. 2022).

Sustainability Knowledge Co-Creation Model, developed through the Horizon Europe SHEs project, focuses on the mission of higher education institutions (HEIs), which is serving society. This mission encompasses community engagement and social responsibility, economic development, cultural and environmental contributions, and knowledge transfer and co-creation. HEIs engage in public service, lifelong learning, social development initiatives, and stimulate local economies through innovation, industry collaboration, and

workforce development. They enrich communities culturally and environmentally through events and sustainability projects. Knowledge transfer and co-creation are central, involving academic research dissemination and collaborative problem-solving with community stakeholders. (Sustainable Horizons 2024)

However, delving into the community requires a particular type of research method to get access to the relational dynamics of the research object. The innovative research method we have used provides useful insights for future scholars interested in phenomena.

Objectives and Methodology

The paper aims to introduce the Sustainability Knowledge Co-Creation Model, developed through the Horizon Europe SHEs project. The purpose of the project was to create a replicable framework for sustainable regional development, bridging the gap between academia and society, and contributing to both local and global sustainability goals. The reason behind this is the complexity and abstract nature of sustainability, which makes it difficult to implement practical and effective solutions for regional development. Sustainability encompasses a wide range of environmental, social, and economic factors, and integrating these into cohesive and actionable strategies can be daunting.

Kurt Lewin is regarded as a founder of action research (AR). In 1940's he started to advocate approaches for achieving change through practically meaningful research. Two key interpretatons of AR are that it is for the solving practical problems, but it also has synonymous with community development (Townsend, 2013). Somekh & Saunders (2007) add, that action research integrates research and action and is conducted by collaborative partnersip of participatns and researchers. Townsend (2013) and McNiff & Whitehead (2006) underline that when conducting AR focused on practices, the first indication is that practices are the main focus and the second implication is that AR involves changing action as a part of the process. This paper is following the developing practices through research, where researhcers, authors of this paper, are in partnerhsip with practicioners, in this case with non-academic partners. Selection of the action research method is due to the fact that this study chose to describe a project implementation, over a period of 21 months, where the earliest data are from October 2022 and the final month of analysis was August 2023

and both researchers acting as active participants. In this AR it was first to identify an approach within a project/project plan and to give researchers an opportunity to take part in solving the problem by applying the AR method. Subsequently, by defining the context and purpose it was assisted to support and the need for the research and the problem situation. Then, the theoretical fundamentals were defined, and the action research phases were structured (Mello et al., 2012; Vasconcellos et al. 2021).

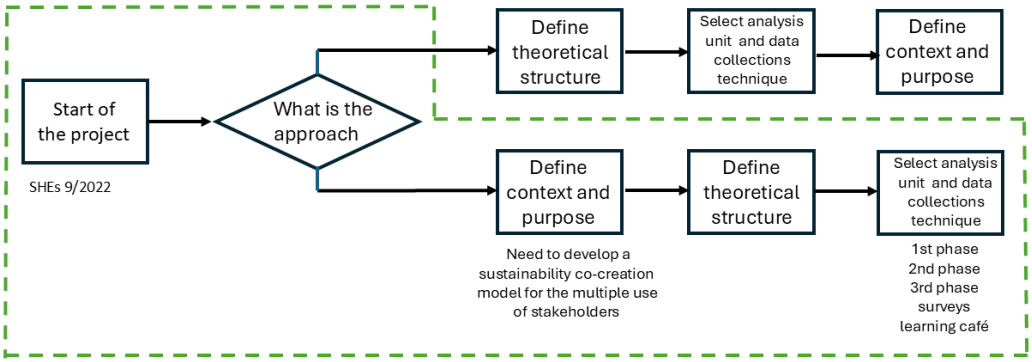


Figure 1. The paper's AR approach. Applied from Mello et al., 2012; Vasconcellos et al. 2021.

This three-phase AR, where research is processing in the development and innovation (RDI) project, followed a structured approach to foster sustainable regional development through community-driven business models. Each three phases had own objectives and methodology.

1) the objective of the 1st development phase was to gather comprehensive data on existing campus partnerships and their sustainability implementations. The used methodology was to conduct a detailed survey among partner universities to assess the role of regional development in teaching and R&D activities. The survey should cover types of non-academic partners (authorities, associations, companies, NGOs), levels of cooperation (regional, national, international), forms of cooperation (project work, internships, theses, RDI projects, visiting lectures, excursions) and then analyze the survey data to identify key non-academic partnerships and their contributions to

sustainability. The output of this phase are the findings to highlight the alignment with the United Nations' Sustainable Development Goals (SDGs).

2) the objective of the 2nd development phase was to test and refine the sustainability model through practical, small-scale pilot projects. The methodology consisted of three parts a) *Feasibility assessment* was done by conducting a three-step review process – analysis, decision preparation, final decision - to evaluate the viability and sustainability of potential pilot projects. b) *Pilot execution* was to Implement the selected pilot projects, ensuring they are dynamic, time-limited, and have specific organizational structures. The pilotswere to address local needs and involve social learning and co-construction of knowledge. c) *SDG Integration* was to utilize a sustainability tool to integrate relevant SDGs into the project success criteria. In practice, this started by brainstorming sessions to assess the starting point of the sustainability situation within the partnership and set targets for sustainability progress and finally evaluate the achieved progress at the end of the pilot.
3) the objective of the 3rd development phase was to finalize the Sustainability Knowledge Co-Creation Model and prepare for broader implementation. The used methodology had three activity parts. First, it was organize a final meeting and workshop using the learning café method. The participants- were divided into groups to focus on collaboration with different types of non-academic organizations (cities, municipalities, regional authorities, associations). Second, recommendations and refinement were done by gathering insights and practical experiences from the workshop to refine the model. It is crucial to ensure that the model is comprehensive, grounded in real-world collaboration, and adaptable to various contexts. And, third, to establish mechanisms to monitor and evaluate the impact of collaborative projects. It is essential to regularly track project outcomes to ensure alignment with local community needs and adapt to changing circumstances.

Key Literature

The key sustainability challenges have been formalised in 17 United Nations (UN) sustainable development goals (SDGs) calling for new collaborative solutions by

governmetns, businesses, researchers and civil society organisations. To add, actors operate at multiple levels—at the individual, community level, country or regional level, and the multilateral level e.g., UN, European Union level (George et al., 2016). Acoording to Mazzucato (2024) the EU innovation policy within the Horizon program has selected five mission areas. Those broad mission areas map neatly onto several of the UN Sustainable Development Goals (SDGs), mobilizing those goals as the navigational stars guiding and illuminating mission maps. But they also break down into specific, concrete missions in the company level.

The co-creation approach is increasingly recognised as an essential tool for innovation, but the current literature lacks a single established concept that combines innovation and sustainability (Maziliauske, 2024). On the other hand, Arnold (2015) introduced that the new basic principle is called ‘co-creation’ or ‘open innovation’, which is a process combining external and internal competences in the innovation process by using different tools e.g., innovation workshops. Erbguth et al. (2022) report about the Geneva Macro Labs, which brought together a diverse group of professionals from various sectors, all committed to the long-term objectives of sustainable development. They utilized a systems-oriented approach, integrating the insights and perspectives of numerous stakeholders. This collaborative effort aimed to achieve a comprehensive understanding of how different elements of an innovation methodology could be effectively combined. Brinks’ study (2016) raises questions toward the relation between ”knowledge” and “value.” The paper widens the scope toward an equal (pragmatic) understanding of knowledge as deeply practical and experience based.

Sustainability as a concept connecting economics, environment and society as a triple-bottom line started with the seminal research of Elkington (1998). Since then, the sustainability of the business became the growing theme of research, followed by research of Bocken et al. (2014) about the archetypes of sustainable business models. The business model innovation can contribute to societal transformation and offer a framework for integrating sustainability transitions with business models (Aagard et al. 2021).

As highlighted by Geissdoerfer et al. (2018a; 2018b), when we go closer to sustainable business models (SBMs), which are described as extension of conventional business models

that integrate sustainability goals and principles into the value proposition, value creation and capture, we meet challenges like how to integrate the sustainability ”in a sustainable way” i.e. considering the society widely. Sustainable business models are now on the focus of the academic literature, and also among business practitioners and policy makers dealing with the ecological and social impact production and consumption systems (Bocken et al., 2019). Business model innovation for sustainability means that innovation isn't solely driven by advancements in technology, products, or services. It also stems from transforming the business model itself. This transformation involves altering stakeholder relationships and governance structures, adopting a broader and more sustainable perspective. It shifts from a transactional approach to one that fosters trust-based, mutually beneficial, and lasting relationships with key internal and external stakeholders (Evans et al., 2017). Stal et al. (2022) define business model innovation for sustainability as follows: ” *…it integrates environmental, social, and economic value creation, and appropriation … This triple-bottom-line integrates sustainability as a core concern of the business model”.* Brozovic’s (2020) definition for the strong business model assists in outlining, evaluating, overseeing, and conveying a company's sustainable value proposition to its customers and all stakeholders, the methods by which it generates and delivers this value, and the ways it captures economic value while preserving or restoring natural, social, and economic capital beyond its organizational boundaries.

To utilise the sustainable business model's analytical, strategic, and communicational potential to integrate sustainability considerations on the organisational level, three mayor elements have to be added: sustainable value creation, more pro-active management of a more comprehensive set of stakeholders, and a long-term perspective (Geissdoerfer et al., 2018a; 2018b). In the study of Bocken et al. (2019) it was found out that business experimentation for sustainability is a systematic approach to identifying, testing and learning about value creation strategies that could be adopted by a business.

Related to this, development of the sustainable business models, it is worth to point out that knowledge created in communities does not simply diffuse into pre-existing markets but rather forms markets (O'Mahony & Lakhani, 2011). To be successful in the long run, any business must have a track-record of responsiveness to community needs. Ensuring safe

and clean drinking water is an example, where there is indeed a critical social aspect of water cooperative companies managing home water and sewage water in Finland (Tuomala, 2024). Bocken et al. (2019) exploration of the topic demonstrates that even if the sustainable business model innovation is initiated by a company, but it will quickly involve other stakeholders such as customers, suppliers and partners, NGOs, and the government, who jointly shape the new business model.

Action researchers have an important role to play in putting sustainable development commitments into practice. One form of developing systemic features of the outcomes of action research can be means of enhancing sustainability of change and the second one is involvement of people in the change process (Townsend, 2013). Snapp et al. (2023) reported about the participatory action research (PAR), which they used as a new approach generating knowledge, which they see crucial to achieve the UN SDGs to build on and expands the scientific process through engagement of scientists (ecological, agricultural, and social) with stakeholders in a systematic manner. According to the report, they have two decades of PAR experience in rural communities in Malawi. According to Keahey (2021) PAR can be regarded as a social justice methodology that calls for intensive grassroots participation in the pursuit of knowledge democratization and emancipatory social change and it is closely informed by Global South theories of power.

Systemic business model has a relation to the positioning of the company. The term ’ecosystem’ generally refers to a group of interacting companies that depend on each other’s activities. Jacobides et al. (2018) posit that ecosystems are distinctive both because of their structure, and because of the way in which they allow the coordination challenge to be resolved. And, ecosystems as the result of a (partly designed) process. Ecosystemsdo not just “emerge” spontaneously. They are at least in part the result of deliberate experimentation and engineering from different parties. A company has a few options in creation of business model: new activities and/or new content, linking activities in novel ways or changing one or more parties that perform any of these activities – governance (Martín-de Castro & Amores-Salvadó, 2014). Drawing from Edwards’ (2017) conclusions, company’s positon would benefit from consideration of different social actors’ interests being essential in developing company’s sustainability performance.

The key literature review provided a theoretical background for the conducted sustainability co-creation model development. Next, the model development phases are introduced in more detail in the following three chapters. As the action-reflection cycle is of central import to all action research traditions (Keahey, 2021), this represents a baseline indicator for research validity.

1st Development Phase of the Model

In the first model development phase it was conducted a survey in December 2022 by LAB University of Applied Sciences which gathered data from six partner universities of the Sustainable Horizons (2022-2024) project: University of Algarve (UAlg) Portugal, University of Huelva (UHU) Spain, University of Life Sciences "King Mihai I" from Timisoara (BUAS) Romania, LAB University of Applied Sciences (LAB) Finland, Ludwigshafen University of Business and Society (LUBS) Germany, and Tomas Bata University in Zlín (UTB) Czechia. The survey assessed the role of regional development in teaching and R&D activities, types of non-academic partners, levels of cooperation, and forms of cooperation.

The survey report "Campus Partnerships and Sustainability Implementation" analyzed how higher education institutions (HEIs) within the SHEs consortium engage in partnerships to promote sustainability. Each university provided detailed summaries of their key non-academic partnerships, highlighting the types of organizations they collaborate with, the duration of these partnerships, and the activities involved: UAlg focuses on inclusivity and creativity in sustainability, with partnerships in areas like marine biology and related tourism. UHU engages in multidisciplinary partnerships, including green energies and water management, contributing to multiple SDGs. BUAS emphasizes mutual research projects and traineeship programs to support economic and social growth and entrepreneurship especially in agriculture. LAB integrates sustainability into its strategy, focusing on circular economy, innovation, design, and well-being and keeping the entrepreurship is a transversal topic in activities with the stakeholders. LUBS prioritizes regional development and sustainability through research projects and student activities having special emphasis on the entrepreneurship. UTB aims to strengthen its role in regional development and

sustainability through strategic projects with companies and public-society partnership development.

Each partner also nominated five main sustainability collaborators in their regions and divided them in four different groups, authorities, associations, companies and NGOs.

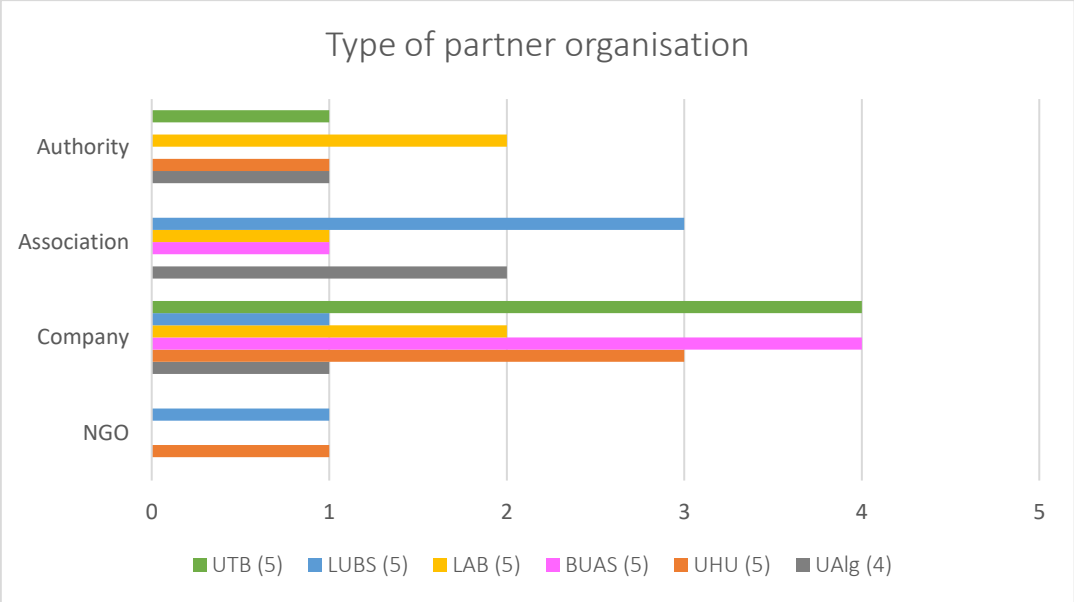


Figure 2. Organisation types of sustainability partners in HEIs' locations

The report also analyzed how these partnerships contribute to the United Nations' Sustainable Development Goals (SDGs).

Table 1. Number of SDG mentions in the SHEs' partnerships

SDG		TOTAL	UAlg	UHU	BUAS	LAB	LUBS	UTB
SDG 1	No poverty	1		1				
SDG 2	Zero hunger	3		1	2			
SDG 3	Good health and well-being	5		2			1	2
SDG 4	Quality education	9	2	1		3		3
SDG 5	Gender equality	0						
SDG 6	Clean water and sanitation	4		2	1			1
SDG 7	Affordable and clean energy	4		2			2	
SDG 8	Decent work and economic growth	5		1		1	1	2
SDG 9	Industry, innovation, and infrastructure	12		2		1	4	5
SDG 10	Reduced inequalities	2		2				
SDG 11	Sustainable cities and communities	17	3	2	3	3	5	1
SDG 12	Responsible consump-tion and production	7	1	1		1	2	2
SDG 13	Climate action	9		2	2	1	4	
SDG 14	Life below water	2	1	1				
SDG 15	Life on land	4	1	2	1			
SDG 16	Peace, justice, and strong institutions	0						
SDG 17	Partnerships for the goals	6	2				2	2
		90	10	22	9	10	21	18

The findings showed that most partnerships align with SDG 11 (Sustainable cities and communities) and SDG 9 (Industry, innovation, and infrastructure). HEIs often follow regional strategic priorities, focusing on specific SDGs relevant to their local contexts and the table shows the alignment of partnerships with sustainability goals.

2nd Development Phase of the Model

The second phase consisted of pilot projects, which partner HEIs implemented in their locations. A pilot, even a smaller scale pilot project, is a dynamic and time-limited system. It aims at determined results, it must have its own resources, it has a fixed start and end date as well as specific organisation structure, but within SHEs they selected in way that their progress after the project ending was assured.

The overall approach in SHEs project for the pilots was that partners provide support to innovative project approaches and capacity development to respond to the needs of the society with the non-academic partners. Selection of pilots has an approach, which suggests social learning and co-construction of knowledge where all parties are involved in, and transformed by the new knowledge, the process has reflexivity and co-learning between actors and the pilot makes progress for the sustainability science. The pilot implementation was done in two stages. The first stage included feasibility assessment, which is the three-step-process, illustrated below:

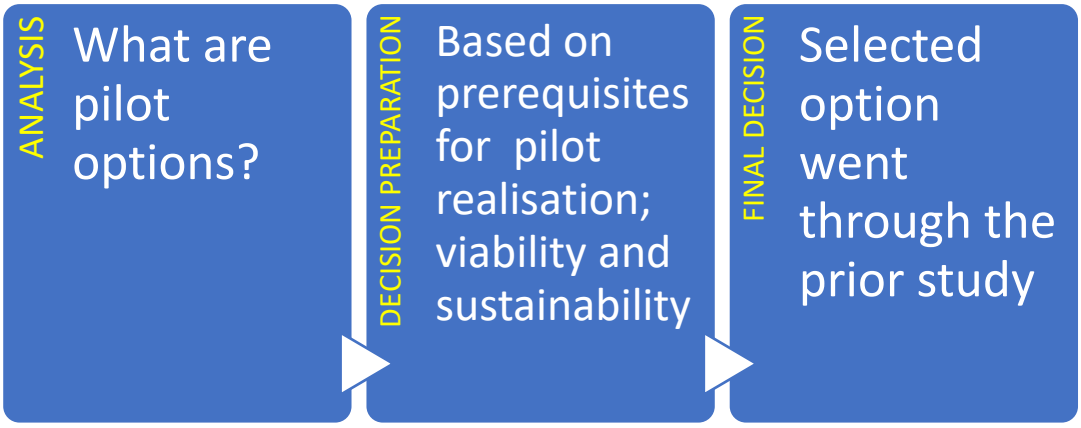


Figure 3. Three-step review process before the implementation.

The idea of the sustainability tool to integrate UNs' SDGs integration into the project success was created in international collaboration between partners. The tool is applicable to assess the impact of the single action/activity or project as a whole. The most relevant SDGs for the case are used, not all of them. In the feasibility stage it is organized the

brainstorming, where the project group makes a collective assessment of which SDGs to select, what is the starting point/current situation of the sustainability and sets the target for the progress. In the end phase the group makes a new assessment about the achieved progress of the sustainability. The quadrant illustration helps involved people to understand the position of the SDGs in the beginning and finalization phase of the project.

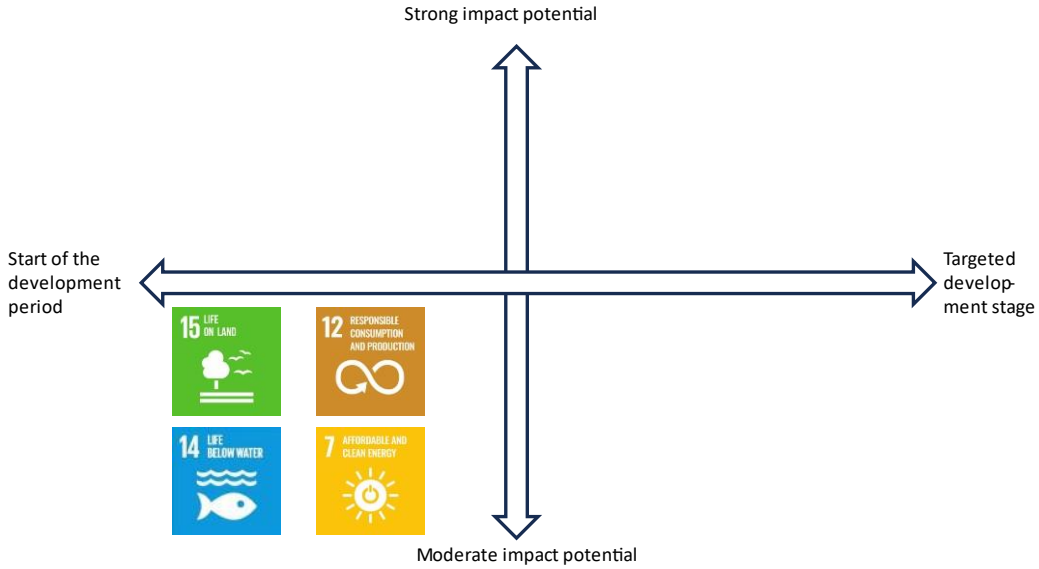


Figure 4. SDGs integration into the project success (Tuomala A-M)

The picture is a theoretical example, not representing SHEs project or any pilot of it. In the example all the relevant goals are assessed to have currently moderate impact goals. In practice, the project activity/tasked must be designed as such, to be able to make sustainability progress. And, certainly, the selected goals to be relevant for the case.

On this background we consider pilot project also as an approach, which allows reducing possible harm, estimate and evaluate feasibility of the project before any remarkable investments or moving to the next level of the implementation (local-national-international).

The following table gives an overview of the implemented pilots of the Sustainable Horizons project.

Table 2. Pilots overview

Pilot's name and location	**Nr of non-academic stakeholders**	**Target group(s)**	**Timing**	**SDG**
Ecosystem Eco-bike & BikeMe, UAlg, Portugal	1	UAlg students and community widely	2019 – 2023	6
Circular Economy - Opportunities for a quality employment course, all regions, Spain	7	UHU students	May – June 2023	5
Awareness of the importance of writing financial proposals to obtain funds for sustainable agriculture and environmental protection, BUAS, Romania	1	BUAS students (future agricultureal entrepreneurs)	1.4.-31.5. 2023	8
Basics of Natural Stone Industry in Circular Economy online course, all regions, Finland	2	students in Finland, Stone from Finland association and its member companies	1.3.-31.5. 2023	4
Clean Up Day, LUBS, Germany	2	pupils of two schools, LUBs students and teachers, local media	5.4.2023	4
Environmentally friendly whey hydrogels help restore forests around Buchlov Castle, 2 regions, Czech Republic	4	six different types of organisations	2019-2023	2

The pilots highlight the importance of the consideration of the local needs. They are not comparable in timing, duration, stakeholder, or target group wise etc. It was observed that

customized and flexible pilot project selection gives benefits to the SHEs project as they help committing future with the pilot stakeholders. The other benefit of piloting was to test the model on a smaller scale and be able to review its suitability and test the practicalities before more extensive implementation of the model.

In conclusion, the pilot studies demonstrate the feasibility of utilizing various sustainability projects, contributing to the companies, associations, authorities, students, and staff, widely to the community. These results have informed the possibility of designing a larger collaboration, to go from local level to the national level or from national level to the international level.

Finalizing the Sustainability Co-creation Model

The final meeting and workshop was organised in Lahti, Finland on February 13, 2024. The workshop was implemented using the learning café method. Participants were divided into three groups, each with representatives from all SHEs partners. The Learning café themes focused on collaboration with three different types of non-academic organisations: cities and municipalities, regional authorities, and associations. The recommendations below are crucial as they stem from insights gathered during a learning café with partners, reflecting a collective wisdom and practical experiences. They served as last-minute hints for the creation of the Sustainability Co-Creation Model, ensuring that the model is both comprehensive and grounded in real-world collaboration. By incorporating these suggestions, partners can foster stronger, more dynamic partnerships, enhance inclusivity, drive regional innovation, and ensure sustainable impact, thus bridging the gap between academia and broader community needs.

1. By deepening engagement and exploring new areas of cooperation, these partnerships can be more productive and impactful. Additionally, facilitating knowledge sharing among SHEs partners is essential. Regular exchanges of best practices and experiences can foster innovation and help address common challenges more effectively, creating a more dynamic and responsive network of collaborators.

2. Promoting inclusive and participatory approaches is key to ensuring that collaborative projects are relevant and impactful. This can be achieved by engaging diverse stakeholders, which includes residents, students, and industry representatives.
3. Developing strategic projects that have long-term impacts on regional development and competitiveness can create sustainable growth and opportunities. These initiatives can position regions to better meet future challenges and capitalize on emerging opportunities
4. Innovation and experimentation with new model of cooperation are vital for attracting and retaining high-skill talent and addressing complex regional issues. Piloting innovative approaches, such as funding post-doc researchers and creating external chairs, can support high-skill individuals to remain in the region and contribute to its development.
5. To ensure that collaborative projects are meeting their goals and contributing to regional development, it is essential to monitor and evaluate their impact. Tracking project outcomes through established mechanisms can provide valuable insights into the effectiveness of initiatives and identify areas for improvement. Regular evaluation helps ensure that projects are aligned with the needs of local communities and can adapt to changing circumstances, maintaining their relevance and effectiveness over time.

The outlined co-creation model below is planned to fit with collaborations involving non-academic partners and institutions in local, regional and international levels including the Global South. it is adaptable in all kinds of organizations, in commercial and non-commercial ones.

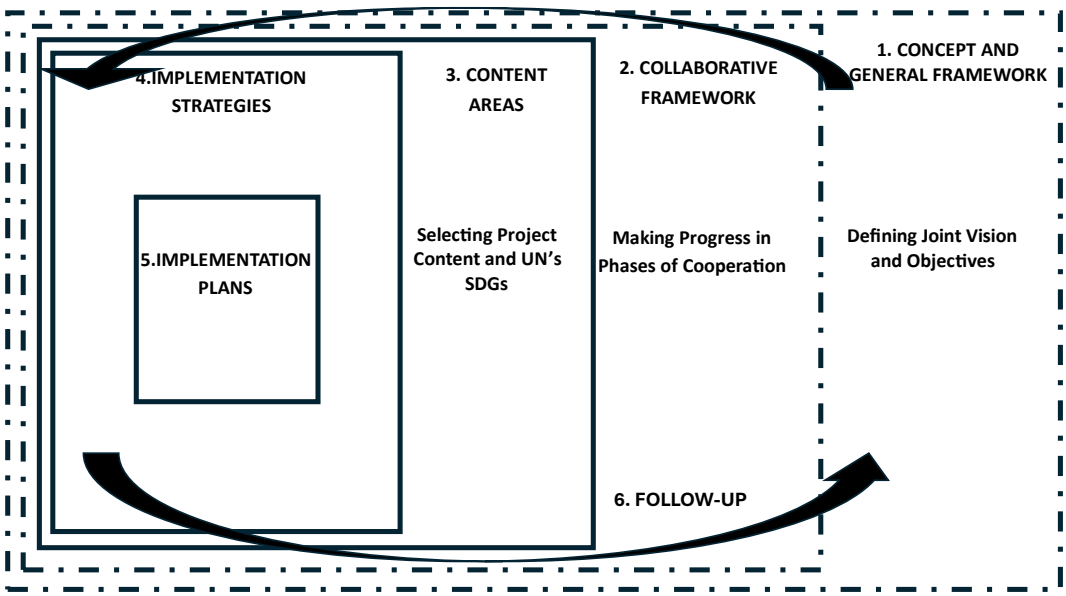


Figure 5. Sustainability Knowledge Co-Creation Model (Tuomala A-M).

The model is implemented by proceeding as shown in the picture, starting from the right (steps 1-6). Collecting feedback is important to include as part of the method, because there is no quality without sustainability and continuous improvement is the principle of this.

Results

Townsend's (2013) exploration of the action research topic demonstrates that by sharing the outcomes there are three imperatives, participatory, community and collectively reflexive. The outcomes of this research are of community imperative where they are shared beyond the immediate community of collaborators. This broader community is the seemingly ever-growing groups of people learning from each other's experiences.

By combining the analysis of the literature and data from the three development phases and the sustainability knowledge co-creation model is proposed, combining the discussions on collective value creation, community-based business model, sustainability co-creation, and systemic business model. HEIs - but not only them - can operate for the RDI, business and in other activities at multiple sustainability levels—at the individual, community level, country or regional level, and the multilateral level inside and outside the EU.

Often, academic research on sustainability does not translate into practical applications that benefit local communities. This model aims to facilitate knowledge transfer and collaboration between researchers and societal stakeholders. The model promotes community involvement in the development of business models that are sustainable and tailored to local contexts. Achieving sustainability at a regional level requires coordinated efforts across various sectors and stakeholders, including business. The model provides a structured approach to integrate these efforts, ensuring that sustainability goals are met in a holistic and inclusive manner and it is applicable in different contexts and coordination can be agreed accordingly. Sustainability solutions need to be flexible enough to be applied in different regions with varying needs and challenges. The model is designed to be replicable and adaptable, allowing it to serve as a framework for diverse purposes and contexts.

Conclusions

The SHEs consortium faced challenges in coordinating diverse interests, resource constraints, and the complexity of sustainability issues. Effective communication, interdisciplinary collaboration, and robust monitoring are essential for overcoming these challenges and achieving widespread impact. In doing so, we try to bring initial discussion on how these constructs are interconnected.

This study presents a novel framework, Sustainability Co-creation Model, which create positive impact for the sustainability development across networks of organisations. The created model also enables asystemic form of sustainable business model experimentation and further development, which contributes to the regional development of the involved municipalities.

The validity of the paper is based on four main factors. First, the paper employs action research (AR) as its primary methodology, which is well-suited for practical problem-solving in business and community development. The structured three-phase AR approach ensures a systematic process. Second, the model's validity is supported by six successful pilot projects implemented across different regions. These pilots demonstrated the model's adaptability and effectiveness in enhancing community well-being and aligning with the UN

SDGs. Third, the paper is grounded in a robust theoretical framework, drawing from established literature on sustainable business models, co-creation, and regional development. At the same time it provides practical insights and recommendations for implementing the Sustainability Knowledge Co-Creation Model in various contexts, ensuring its relevance and applicability. And, finally, the involvement of multiple HEIs and non-academic partners in the research and pilot projects adds to the credibility and validity of the findings. Anyhow, the paper should rather be read as a study that produced some interesting indications for future research concerning the relation between sustainable business models and community-driven innovation.

The paper makes a contribution to the conference goals by presenting a replicable and adaptable model for sustainable regional development that prioritizes inclusivity, diversity, and shared social value. Its validity is supported by a rigorous methodology, successful pilot projects, and a strong theoretical foundation. The paper contributes to the conference track 2.2: Community-led and community-based business models for sustainable development as the Sustainability Knowledge Co-Creation Model presented in the paper is a prime example of how community-led initiatives can be structured. This model involves higher education institutions (HEIs), municipalities, regional authorities, companies, and associations in a collaborative process to address sustainability challenges. This aligns perfectly with the track's focus on community-led business models.

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Maximizing wellbeing: transitioning to a post-growth business model

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Abstract

This study examines the transition of a conventional business into a post-growth business model through a case study of Las Cañadas, a community led agroecological cooperative in Mexico. Throught its iterative transformations, our research highlights how value functions—proposition, creation, delivery, and capture—can align with post-growth principles, emphasizing well-being and ecological restoration.

Keywords

Post-growth, wellbeing, business model, regeneration.

1. Introduction

Six of the nine planetary boundaries have already been transgressed (Richardson et al, 2023). Social inequalities keep millions of people from a just space that respects social well-being limits (Raworth, 2012). Despite all the efforts that are claimed by international governance organizations, nations, companies, and many others, both ecological degradation and social inequalities appear to increase instead of decrease. For some, this situation is not going to change unless we challenge our dependence on growth (Banerjee et al, 2021). On one hand, infinite growth is impossible on a finite planet. The neverending increase in production and consumption leads to more resource extraction, pollution, and waste. Decoupling growth from resource consumption fails to fully resolve the issue (Hickel & Kallis, 2020). On the other hand, keeping this growth regime reproduces inequalities, as growth usually relies on relations of domination, extraction, and exploitation between the capitalist center and periphery (Schmelzer, 2023).

Rather than pursuing incremental improvements, the imperative lies in implementing alternative paradigms to contemporary growth-centered development (Kallis et al., 2012; Kallis, 2015, Gerber & Raina, 2018), which includes organizations such as business (Khmara & Kronenberg, 2018; Nesterova, 2020; Froese et al, 2023). However, most studies regarding the conflicting relationship between business and post-growth mostly portray normative guidance or acknowledge that their empirical evidence has important limitations and does not fit many of the criteria for a post-growth business. As Kallis et al (2022) suggest, more real-existing post-growth examples are needed.

Cooperatives have been signaled as an example of organizational form potentially aligned to post-growth (Johanisova et al, 2013). Alternative forms of production and consumption can also be found in places other than traditional markets (Demaria et al, 2023). However, the question still remains of how existing conventional businesses could transition to post-growth principles. By using the business model (BM) lens, this study aims to contribute to this gap, reconstructing the iterative process of trial-and-error that our case study experiences from a conventional business to arrive at its current outcome of a BM fully aligned with post-growth principles. The research questions that drove our query were as follows: How does a business transition the four value functions—value proposition, value creation and delivery, and value capture—towards post-growth values?

2. Background

Post-growth is gaining attention and support (Demaria et al, 2013; Paulson & Büchs, 2022). This ideological framework encompasses a spectrum of viewpoints that counter the conventional reliance on GDP growth as the preeminent gauge of economic vitality. Variants such as sustainable degrowth, a-growth, steady-state, and post-development offer distinct propositions (Gerber & Raina, 2018). In a post-growth societal framework, the primacy of material accumulation is supplanted by emergent values (Gerber & Raina, 2018) such as care (Kallis, 2018), conviviality (Bradlet, 2018), sharing (Jarvis, 2019), simplicity (Alexander, 2015) and the commons (Helfrich and Bollier, 2015).

Despite extensive research directed towards envisioning a transition to a post-growth paradigm, the role of micro-level actors in effectuating the proposed transition has remained in the margins. Khmara & Kronenberg (2018) broke ground by introducing degrowth concepts into business literature. The authors established and operationalized criteria to gauge degrowth within business contexts, emphasizing a redefinition of economic activity, new drivers fueled by alternative objectives and values, collaborative value creation, democratic governance, and mitigation of environmental pressures. Subsequently, Nesterova (2020) expanded upon this foundation by defining a degrowth business as one in compliance with degrowth principles and its key premises of downscaling of production and consumption, orientation towards wellbeing and a radical shift in values (p. 4). To that end, businesses should operationalize degrowth by readjusting their operations in the categories of the environment (e.g. frugality, durability, simplified technology), people and non-humans (e.g. decrease productivity, democratization of decision-making), and deviation from profit maximization imperative (e.g. shift in values) (Nesterova, 2020).

Extending the discourse within businesses, Froese et al (2023) introduce post-growth concepts in the business model literature. Business models represent how an organization creates, exchanges, and captures value, and help to design and implement objectives and strategies, governance mechanisms, and articulate value-creating activities (Casadesus-Masanell and Ricart, 2010; Osterwalder and Pigneur, 2010, Teece, 2010; Wirtz et al., 2016). Through a systematic literature review, Froese et al (2023) proposed patterns of degrowth-

oriented organizational value creation, as well as some theoretical propositions to develop a degrowth theory of value. However, to our knowledge, there is not yet any research focusing on the transition from a conventional business model to a post-growth business model.

The business model literature has introduced sustainability elements through different conceptualizations (Schaltegger et al., 2016; Bocken et al, 2014; Lüdeke-Freund et al, 2018). However, critical perspectives contend that many of these approaches have predominantly aligned with the 'soft sustainability' paradigm unveiling shortcomings in addressing ecological degradation and social inequalities (Hahn et al., 2015). Consequently, 'strong sustainability' oriented approaches have surfaced, exemplified by the emergence of regenerative business models (Konietizko et al., 2023). These models are expressly designed to regenerate positive social-ecological impact while acknowledging issues related to carrying capacity, limits to growth and planetary boundaries (Landrum, 2018). A post-growth approach applied to business model literature would further extend our understanding of 'strong sustainability' approaches into the realm of alternative visions that contribute to building a society with a smaller metabolism that has a different structure and serves new functions (Gerber & Raina, 2018). Heeding the call for more 'real-existing post-growth experiences' (Kallis et al, 2022), we propose the following research question for this study: How does a business transition to a business model align with post-growth values?

3. Methodology

Given the incipient nature of post-growth business models within academic discourse, we opted for a retrospective analysis of a singular case study as the most suitable approach to conceptualize the transition of businesses towards alternative paradigms beyond growth. Defined as an empirical inquiry that delves into a contemporary phenomenon within its real-world context (Yin, 2003, p.16), case studies serve as a robust method to comprehensively explore inadequately understood phenomena and contribute to the advancement of existing theories by identifying and addressing gaps (Flyvbjerg, 2006). The case study centers on *Las Cañadas* (In English, "The Small Valley"), a Mexican organization located in Huatusco (Veracruz, Mexico) initially established as a conventional cattle farm which later transitioned into an agroecological cooperative. This transformation was not

immediate. Through a prolonged phase of trial-and-error inherent in its business model, the organization succeeded in regenerating 265 hectares of pristine cloud forest and democratized participation by forming a cooperative with its employees. Thus, this study conducts an in-depth analysis of *Las Cañadas* as an illustrative case, aiming to extrapolate insights into how select organizations can effectively adapt their business models and align themselves with the tenets of post-growth principles.

Data collection

Our data collection aimed to reconstruct pivotal events in *Las Cañadas'* extensive trajectory, elucidating the organization's response to these events and how they resulted in changes to the BM and its alignment with post-growth principles. As explained by Yin (2003), the construction of emerging theory necessitates reliance on diverse data sources. In this analytical pursuit, data were systematically drawn from three distinct yet complementary sources: (i) 13 interviews conducted with key stakeholders critical to *Las Cañadas*' evolution, comprising the organization's founder, his spouse, and multiple cooperative members; (ii) 14 files of archival data, encompassing internal documents, annual cooperative meeting minutes, financial records, public presentations, and the organization's extensive online repository; and (iii) direct observation extending over four full days, wherein two of the study's authors resided within the premises alongside cooperative members and course assistants during the summer of 2021. The authors conducted two subsequent online interviews with the organization's founder in 2022 and 2023, maintaining frequent correspondence through email during this period. The qualitative data obtained from interviews underwent transcription for subsequent analysis.

Data analysis

Adhering to the methodology advocated by Eisenhardt (1989) and Van de Ven (2007), our approach commenced with a sequential arrangement of the case history. The chronological evolution of Las Cañadas is presented using a phenomenological framework (Ricoeur, 2009), delineating four distinct temporal phases aligned with pivotal shifts catalyzing the adaptation towards post-growth principles. In the second stage of analysis, our aim is to apply an alternate template strategy (Langley, 1999), which will allow us to understand

which theoretical framework of business model transformation or innovation will suit better to unpack the data and deploy the richness of the case.

4. Preliminary findings

The case transitioned several times, modifying its business models, each time approaching more and more towards post-growth principles (See Table 1 for a brief summary of the organization's evolution). Next, we briefly explain each stage in the business model and the triggers for those changes.

The cattle farm era (1987–1998)

Las Cañadas was a 306-hectare cattle ranch. The farm generated revenue by selling meat and quality calves at livestock fairs but was still not turning a profit.

First business model transformation/ triggers

The farm owner resided alone on the farm for over five years embracing a modest lifestyle devoid of electricity, diligently applying the knowledge acquired during his university education as a zootechnical agricultural engineer. Reflecting on this period, the founder acknowledges, "those were critical years to me in many ways as it allowed me to integrate with the farm fully." The founder also observed signs of environmental deterioration, expressing alarm because "streams and rivers in the farm were turning brown, many hills had eroded considerably, and we barely had any trees left".

Quest for ecological stewardship (1998–2006)

The founder decided to voluntarily restrict land use to perpetually restore areas for a cloud forest. He sold all his grazing cows and diversified revenue streams to the production of organic milk and dairy products, a bio-intensive fruit and vegetable patch, a plant and tree nursery, and a sustainable wood production shed. Additionally, he built ecological huts for ecotourism and started to offer training in sustainable agricultural techniques. Finally, the founder decided to invite close friends and create an eco-village.

Second business model transformation/ triggers

The founder realized the limits of 'greening' the farm. After learning about the ecological footprint, he realized that replicating his lifestyle on a global scale would necessitate resources equivalent to three planets. He also conducted a comprehensive and critical reassessment of the approach of the farm: the eco-village concept was considered as a way to congregate with people exactly alike who were elite. The model did not improve the lives of the workers with whom the founder lived. The founder also questioned the incongruity that none of his workers actually consumed any of the organic food they produced and sold to premium segments.

Democratic governance and self-sufficiency (2007–2018)

The founder terminated the eco-village. Second, ecotourism was brought to an end due to a lack of transformational impact. Thirdly, organic milk production was discontinued because according to the founder they would have had to increase prices significantly to have a decent profit, which meant “not being able to provide milk for ourselves, rather just cater to the country’s ecological elite”. To address inequality, the founder proposed to his workers to become a cooperative. Regarding revenue-generating streams, the cooperative focused on becoming as self-sufficient as possible and providing comprehensive agroecological training. The cooperative adopted a modular organizational structure that combined the inherited service units and new modules tailored to address the cooperative's evolving requisites.

Third business model transformation/ triggers

Seeking self-sufficiency posed challenges for the cooperative according to their members. Isolating themselves from external dependencies risked neglecting crucial interconnections within the larger ecosystem, as the founder noted. Moreover, specific crop production costs often exceeded market prices, resulting in expensive yields, exemplified by their costly corn cultivation. This, coupled with losses across all modules, exacerbated financial dependence on agroecological training which was highly dependent on the founder. The cooperative grappled with demonstrating not just sustainable practices but also financial viability to students, questioning the practicality of advocating for a non-linear approach while acknowledging farmers reliant on diverse markets.

Shifting towards interdependence (2019–2023)

To cope with these challenges, *Las Cañadas* shifted to interdependency and began buying some of their prime needs from nearby agroecological markets at significantly lower prices. Modules also reached beyond the farm, notably the nursery, seed bank, and plants, sold flora across Mexico, yielding financial surpluses. The administration committee leveraged social media and the cooperative's webpage to promote all farm-produced items to the public. By 2019, educational services and events represented approximately 70% of external income, while agricultural production accounted for 20%, and carpentry, bamboo, dairy, and eco-technologies (e.g. dry toilets) constituted the remaining 10%. Most modules sustained costs, while financially successful ones supported those that incurred deficits, like the school.

Table 1 Stages and triggers for the transition between business models

	Stage 1 The cattle farm era (1987–1998)	**Stage 2** Quest for ecological stewardship (1998–2006)	**Stage 3** Democratic governance and self-sufficiency (2007–2023)	**Stage 4** Shifting towards interdependence
Main driver of the Business Model	Maximizing profit in the 306 hectare farm	Restore cloud forest and "green" the farm by producing organic products	Transforming into a cooperative, establishing income equality policy and becoming self-sustaining	Guarantee sustainable wellbeing for all members
Revenue streams	Selling meat and quality calves in livestock fairs	Organic milk and dairy products. Bio-intensive fruit and vegetable patch, a plant and tree nursery and a sustainable wood production Agroecological training Ecological huts for ecotourism.	Agroecological training Modular organizational structure for food production and other prime needs	Agroecological training All other modules were encouraged to efficientize and sell surplus outside of the farm Reducing costs by buying some items on a lower price
Main triggers for change	Founder lived on the farm for several years being able to integrate himself with the farm. Founder observed signs of environmental deterioration	Realizing the limits of 'greening' the farm Eco-village was a bourgeois approach. Inequality with workers Organic food produced and sold to premium segments. Inequality	Inefficiencies that jeopardized the community lifestyle	

5. Outlook

The narrative of *Las Cañadas* highlights how a conventional business transforms its business model to align with post-growth principles (see Table 2). The business model transitioned from selling meat and quality calves in livestock fairs to a broad market, to maximizing wellbeing conditions for members of the cooperative and the ecosystem by establishing two subsidiary value propositions to external clients that enable the internal system of the cooperative to operate. Several post-growth principles emerge in this renewed business model. Caring for people (D'Alisa et al., 2015; Kallis, 2018) and nature (Singh, 2019) appear as the most relevant objectives of the company. The business model is oriented to sustain the cooperative's quality of life based on simplicity and frugal abundance (Alexander, 2015, 2017; Lorek & Fuch, 2013; Banerjee et al, 2021). Finally, the functioning of the business is rooted in a democratic governance of the commons (Helfrich and Bollier, 2015).

Table 2 Stages and triggers for the transition between business models

	Value proposition	Value Creation and delivery	Value capture	Post-Growth principles
MAIN CLIENT Internal client (PROSUMERS)	To create a stable and cohesive community, one that transcended social classes and offered members a lifestyle of simplicity and abundance	Maximizing coooperative members' wellbeing (peace of mind, having all your basic needs covered, personal empowerment, and community	The cooperative functions as a constellation of semi-autonomous modules that work in symbiosis, to serve its own needs. Each module keeps a ledger of costs and volumes produced but without prices or margins.	Wellbeing/ Caring for people and the natural ecosystem Voluntary simplicity/ frugal abundance The commons and Democratic governance
SECONDARY CLIENT External client (GREEN LEARNERS)	Agroecological training to learn how to work the land in harmony with nature's needs	Training on permaculture through diverse on-site courses and experiential learning	Pricing policy seeks to strike a balance between capturing much-needed resources for the cooperative and making the services affordable to a broad public, subsidizing the participation of neighboring farmers	Conviviality, i.e., delivering tools that enable a more autonomous way of producing food, based on permaculture principles. Caring of the natural ecosystem
SECONDARY CLIENT External client (LOHAS)	Healthy and quality food, produced without chemicals in harmony with nature	Quality organic food	Traditional commercial logic. Goods and services "exported" outside the cooperative are priced to yield a positive net margin. Las Cañadas requires money for anything that cannot or should not be produced internally. Therefore, they produce and "export" the strictly necessary, controlling the impact that this has on ecological pressure and workload	Money is not an end, it is mean. It is equivalent to other flows needed by the system to work (e.g. sunlinght)

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LocalArctic: Exploring The Feasibility Of A Community-Based Business Model For MICE Tourism In Greenland

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Extended abstract

The Arctic has gained more and more interest among tourists in recent years. Greenland is one of the most isolated places on Earth and has become more and more popular among adventure and cruise tourists who want to explore the Arctic. Greenland is described as a place to visit to "experience climate change at first hand." (Bjørst and Ren, 2015:92). It is a paradox that Arctic tourism often involves the release of substantial GHG (Greenhouse Gas) emissions threatening the natural resources, tourists are coming for (ibid).

The Greenlandic government follows an ambitious strategy to expand its tourism activities including several large infrastructure projects. In November 2024, Nuuk the capital of Greenland, opened its new international airport, making it possible now to fly directly to the capital with large airplanes. Previously, passengers had first to travel to the American built airport in Kangerlussuaq and were then transferred on smaller airplanes to Nuuk. The new airport in Nuuk will make it possible for other international airlines to offer flights to Greenland during the summer months to increase tourism. United Airlines is planning first flights from New York to Nuuk from June 2025.

The Greenlandic government is in addition constructing two more airports. One in the largest city of South Greenland, Qaqortoq, which is currently only accessible via boat or helicopter. The second is to expand the airport in Ilulissat in the north, the most popular tourist destination in Greenland due to its Icefjord, which is also a UNESCO World Heritage Site. These two airports will open in 2026 in case the latest plans hold true.

Visit Greenland, a key entity for tourism owned by the government, follows an ambitious marketing structure. Their aim is to increase Greenland's visibility, and extend the tourism season, which is currently limited to a narrow peak of 3 summer months. Furthermore, Visit Greenland is planning to transform Greenland into an attractive meetings, incentives, convention, and exhibition (MICE) -destination (Visit Greenland, 2021:21). This will open a new market segment of tourism. However, the increased focus on tourism is not only viewed positively by the Greenlandic population. Greenland is an autonomous territory of the Kingdom of Denmark, and many tourist agencies are registered in Denmark and owned by Danes. The Greenlandic government has adopted a new Act on Tourism Activities that entered into force on 1 January 2025. This Act intends to make sure that more turnover from tourism stays in Greenland and is owned by Greenlandic companies. However, the new Act on Tourism has been criticized for preventing international investors. Greenland has a small population (app. 56 000 inhabitants) where investment is limited. Nevertheless, the current discourse shows that there is a need for more community-led and community-based tourism.

In this study, we explore the feasibility of an innovative locally anchored business model for increased MICE tourism activities in Greenland. The MICE industry is one of the fastest growing sectors in the tourism industry (Amanda et al., 2012). However, the MICE sector is also considered to be one of the most unsustainable forms of tourism since many people travel far to their conference destination and only stay a short amount of time. However, MICE tourists could contribute to community development by paying an extra fee in addition to their conference fee that would go to local sustainable projects. Hence, by supporting local projects in Greenland they would reduce some of their negative impacts.

In this presentation, we investigate the interest among stakeholders from the MICE industry in financing local sustainability projects in Greenland. We have carried out 9 semi-structured interviews with stakeholders from the Greenlandic/Danish MICE industry to study their interest. Preliminary results show that MICE stakeholders in Greenland are generally positive about the concept and its implementation and see a potential for this among their clients. However, they underline certain parameters that would have to be included in the business model design, to make it successful. First of all, projects should be transparent and locally anchored in the region where MICE stakeholders come to attend their conference. In the ideal case conference attendants should be able to visit and see the projects they pay for. The MICE stakeholders assume that this would increase willingness among their customers to pay for this. Second, there should be a portfolio of projects that different MICE tourists can choose from since their interest will vary depending on the sector they come from (e.g., MICE tourists from financial institutions will be interested in different projects than medical staff attending a medical conference). In the same way the amount that MICE stakeholders pay could be adapted to their financial capacity and sector. For our interviewed MICE stakeholders, it remains unclear who would be a suitable entity to run this community-based business model. Visit Greenland was

mentioned by several of them as a potential entity. Issues of trust were mentioned as crucial for an entity to run this community-based business model successfully.

We believe that this study will contribute to a discussion and more knowledge on developing new innovative community-based business models for the tourism industry that can foster sustainable development locally.

Keywords

Business models, community-based, tourism, MICE sector, Greenland.

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An Extended Abstract Submitted to the NBM Conference 2025

From Competition to Collaboration: A Community Model for Women Entrepreneurs at the Base of the Pyramid in Bolivia

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Extended abstract

Sustainability has emerged as a central goal for community ventures, particularly among communities situated at the Base of the Pyramid (BoP), also known as the Bottom of the Pyramid. This concept has received considerable academic attention since its inception in 1998, referring to the segment of the population living at the threshold of poverty but representing significant economic potential. This group constitutes a large rural and impoverished population residing in emerging markets (Prahalad, 2005), encompassing a significant portion of the global population (Chmielewski et al., 2020). Sales within this paradigm aim to enhance the well-being of this demographic through the production and distribution of culturally sensitive, sustainable, and profitable products and services (Prahalad, 2019).

In the Chiquitano region of Bolivia, particularly in the community of Quituqiña, women-headed households face substantial socioeconomic barriers that hinder their access to markets and financial resources. Despite possessing natural resources within their community, such as the copaiba tree, these women struggle to individually market the oil extracted from this tree. Their desire to improve their living conditions and achieve economic sustainability has prompted them to consider collaborative approaches. However, they continue to encounter structural challenges that limit their access to financing and entrepreneurial opportunities (Chilova et al., 2015).

This research is grounded in the ethical framework of Corporate Social Responsibility (CSR), which, when applied strategically, enables companies to create value innovatively and enhance resource use efficiency, benefiting them in the long term and securing a competitive advantage (Rexhepi et al., 2013). Moreover, it focuses on community-based and community-driven business models as a means to promote sustainable initiatives since these community actions have led to new successful models that address local challenges, particularly in rural areas where community interests are closely linked to sustainability and the preservation of social and environmental capital. Community-based business models represent a growing trend within the business realm and embody a form of collaborative production rooted in shared resources (Wolf & Troxler, 2016).

Therefore, this research aims to analyze how collaboration through a business model—both community-based and community-driven—can generate more opportunities for access to financing and markets for this community venture of copaiba oil by women entrepreneurs in the Chiquitana region of Bolivia compared to efforts made individually.

To address the research questions, a qualitative methodology will be utilized, incorporating participatory research methods. Data collection will involve semi-structured interviews, focus groups, and direct observations. Participants will consist of women entrepreneurs involved in the copaiba oil initiative, along with local actors who can provide insights into the socioeconomic dynamics of Quituqiña (Rosca et al., 2020).

The study anticipates revealing key findings regarding the effectiveness of community-based business models in promoting financial inclusion for women entrepreneurs. Collaboration is expected to improve access to financial resources, enabling women to overcome the limitations of individual efforts (Moreira et al., 2019; Sinkovics et al., 2014). Additionally, the research aims to identify best practices for implementing community initiatives in similar contexts by analyzing the factors contributing to their effectiveness. Furthermore, the findings will illustrate how the integration of CSR principles can amplify the social and economic impacts of these enterprises.

Thus, this research aspires to make a significant contribution to the discourse on community-based business models for sustainable development. By demonstrating how community initiatives can facilitate the financial inclusion of women at the BoP, this study seeks to provide practical insights and recommendations that can guide policymakers and stakeholders working towards sustainable economic development (Yadav & Unni, 2016). This integrative approach values both collaboration and community participation, as enabling Chiquitano women to engage in collective efforts aspires to create a ripple effect of empowerment, resilience, and sustainable growth that could serve as a model for similar initiatives in other women-led community entrepreneurships.

Keywords

Community-Based Entrepreneurship, Women Empowerment, Financial Inclusion, Sustainability, Base of the Pyramid (BOP)

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Collective Data Stewardship: Data Cooperative as an Inclusive and Sustainable Digital Innovation

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Extended abstract

Rapid technological development is reshaping industries and societies. Emerging technologies promise significant benefits and present solutions to complex challenges. However, they also raise important ethical, societal and governance concerns (Carbajal-Pina and Acur, 2024). In recent years, the development of generative artificial intelligence (GenAI) has sparked intense debate on the use of data. In response to this, an increasing number of studies have examined the use of data to train GenAI. Generative AI and automated decision-making systems based on algorithms and data are increasingly common, with profound implications for individuals, organizations, communities and society. Hence, data equity is a shared responsibility that requires collective action to create data governance systems that promote fair and just outcomes for all. Equitable data can result in improved outcomes for underserved communities.

Alternative data governance models, such as data cooperatives which have member-owned data management systems, can support responsible and collaborative use of data ensuring agency of participants, minimize extractive practices and support data sovereignty. Values such as solidarity, equity, and caring for the community and the planet, among others, are intrinsic to cooperatives.

Cooperatives have long been at the forefront of experimenting with innovative practices to improve and sustain their democratic governance. As such, cooperatives operate in line

with a set of 7 cooperative principles promoted by the International Cooperative Alliance (n.d.), which include democratic member control, autonomy and independence, equality, equity and solidarity. Democratic member control is perhaps the central feature distinguishing cooperatives (Van Dijk et al. 2019). As "laboratories for social innovation" (Novkovic 2008, p. 2168) cooperatives are a promising and influential alternative form of organizing (Mair and Rathert, 2021; Zamagni and Zamagni, 2010). Among their many benefits, cooperatives can help reduce inequality, safeguard citizens' interests (Battilana et al. 2022), and confer greater control to members over their personal data (Mannan and Pek, 2021). In parallel with a long history of cooperatively owned and governed enterprises supported by regulatory systems around the world, data cooperatives provide a technical, legal, and governance structure for the collective management and distribution of data on behalf of cooperative members (Fink, 2024).

The notion of a data cooperative refers to the voluntary collaborative pooling by individuals of their personal data for the benefit of the membership of the group or community. A data cooperative can manage, curate and protect access to the personal data of citizen members (Hardjono and Pentland, 2019). The motivation for individuals to get together and pool their data is driven by the need to share common insights across data that would be otherwise siloed or inaccessible (Hardjono and Pentland, 2019). For example, data cooperatives in healthcare provide a governance framework for data sharing and donations to enable precision health and balance socio-economic asymmetries (Hafen et al., 2014).

At the heart of this study is a crucial question: how can sustainable development be promoted through effective, equitable and inclusive data governance that ensures privacy, security and trust?

Trust is highlighted as a foundational pillar of effective data governance. Building systems that ensure data quality and integrity is essential for creating an environment where innovation can thrive while maintaining privacy and security (Broadband Commission, UNESCO). Scholars regard privacy as a public good, as the decisions of one individual can endanger another, and suggest the need for group coordination on privacy-related matters. There is also a growing sense that if data is an asset which can be used by technology companies to generate profits (Hardjono and Pentland, 2019), then it can also be leveraged by communities to have greater economic rights on the data they generate collectively. Pooling data rights to rebalance power in the data economy can be done through data stewardship, a set of governance and technological principles that can unlock the value of data while safeguarding rights of individuals and communities.

All activities that generate data require governance, which includes both technical and ethical dimensions (Cooper et al. 2023). Data governance refers to decision making across the data life cycle to ensure data integrity, availability, usability, and security. In many cases, those who generate data are not those making stewardship decisions about them (Cooper

et al. 2023). Data cooperatives are collective governance models in which members pool their data for the benefit of the membership as a whole and participate in the governance of its reuse (Mòdol, 2019). By diffusing power through decentralized decision making (DAO), individualized and shared control can be executed. Data cooperatives enable individualized control over one's data and participation in democratic governance over pooled data (Blasimme et al., 2018).

This paper hence aims to showcase the current research on collective stewardship and collaborative innovation in the form of data cooperatives, which are emerging as a promising model for data governance, particularly in healthcare, science, and banking. They enable individuals to control and benefit from their personal data while promoting data sharing for research and innovation (Hafen, 2019; Bühler et al., 2023, Lauer et al., 2024). These cooperatives can democratize research, accelerate scientific progress, and address socio-economic asymmetries in the digital economy (Blasimme et al., 2018; Bühler et al., 2023).

In this paper, we analyze multiple case studies of data cooperatives. The cases differ greatly in detail, but their common goal is to give the community full control of their data and provide a framework for secure data exchange, digital rights protection, and community-driven digital transformation. Using a collection of several case studies, we provide evidence of the patterns and reveal the contingencies involved in building systems that ensure data quality and integrity.

We propose two alternative models for improving equity in data governance, across various sectors and regions, given the rapidly evolving data and technology landscape. This people-centred models fosters innovation, enables trustworthy data flows, safeguards human rights, and promotes equity and inclusion, ensuring that the benefits of data governance reach all sectors of society, particularly vulnerable populations.

In an era where data is a crucial asset, solutions for governing data amid digital and AI revolutions need to be developed to encourage more ethical and effective data use. Also, innovative strategies should be implemented that ensure privacy and security, promote equity and inclusion, ultimately contributing to sustainable development (and international cooperation). Technology-driven innovations must embed values such as human dignity, equality, security and fundamental rights.

We seek to expand our understanding of innovations in data governance by synthesizing existing knowledge and generating new insights about collective stewardship that can serve as a source of inspiration and help align with global ethical and sustainability goals. When successful and competent, data cooperatives can be a powerful secure data management tool. It promises its users a better protection and control of their data, as compared to the traditional way of their handling by the data collectors (such as governments, big data

companies, and others). However, for the success of data collaborations, existing challenges with respect to data management systems need to be adequately addressed.

Keywords

Data governance, collective stewardship, cooperative business model, inclusive innovation, sustainable development.

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Supporting the Deployment of Rural Connectivity

Collaborative value creation and capture models as part of community-led business models

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Extended abstract

Despite the rapid technological developments that have taken place over the last decade in terms of digital connectivity, with concepts such as 6G or edge computing offering vastly more efficient and effective means of communication, we observe that rural communities are struggling to keep up with these developments (Salemink *et al.*, 2017). Consequently, rural communities are unable to participate in the digital economy and lack opportunities for inclusion, development and growth (de Clercq *et al.*, 2023). This is troublesome, as rural areas are home to important economic sectors such as agriculture, mining and forestry (McFarlane *et al.*, 2016) and up to 30% of the European population lives in rural areas (Stojanova *et al.*, 2022).

The slow proliferation of digital connectivity in rural areas is generally attributed to the 'rural penalty': rural areas are characterized by a greater distance to economic markets, have low population density, face geographical and spatial differences, and often lack access to common energy infrastructure (Malecki, 2003). Accordingly, rural connectivity calls for significant investment costs and customized solutions to cater to different end-user needs (Chaoub *et al.*, 2022). All-in-all, these characteristics lead to a risky and uncertain business case for service providers to invest in rural connectivity (Yaacoub and Alouini, 2020).

Overcoming this challenge requires rethinking current business models for connectivity. Here, business models based on a community-led approach, for which rural stakeholders

take charge to strive for joint value creation and capture, are advocated (Ashmore *et al.*, 2017). This shift in business models is theoretically significant, as it challenges conventional notions of market-driven solutions, and instead emphasizes a collaborative, community-driven approach to address infrastructural disparities. Strategies such as demand bundling can help rural stakeholders aggregate individual needs to create collective value propositions to better align the demand and supply for connectivity (Salemink *et al.*, 2017). Similarly, (financial) resource bundling can help rural stakeholders achieve economies of scale and support collective investments (de Man and Luvison, 2019). Considering the vast amount of stakeholders present in both rural and digital ecosystems (Russo and Wang, 2020), a variety of collaborations may exist, leading to different value creation and capture models. Investigating what collaborative value creation and capture models can be employed can help our understanding of how community-led business models can support the deployment of rural connectivity (Salemink *et al.*, 2017). Accordingly, our research objective is to *investigate the collaborative value creation and capture models available to support rural connectivity deployment*.

We address our research objective through a multiple-case study approach (Yin, 2017), examining what practical solutions were selected to real-world problems and their underlying motivation. We conducted our research as part of a large-scale European project that focused on fostering the deployment of digital connectivity in rural areas to achieve economic, social and sustainable impact. In this research context, we studied the business models developed by four Living Labs (LL) to support the deployment of local, rural connectivity-enabled solutions. Such LLs can play an important role in rural development, connecting local communities to multi-disciplinary research and new innovations to foster systemic change (Zavratnik *et al.*, 2019). Using thematic analysis (Braun and Clarke, 2012), we analysed the collaborative value creation and capture models part of the business models used by the LLs, examining the 1) *stakeholders involved* for the model and 2) the resulting collaborative *value creation and capture logic* (Freudenreich *et al.*, 2019). In addition, to obtain a deeper understanding of why a certain collaborative structure was selected, we conducted semi-structured interviews with stakeholders involved for the LLs. Table 1 provides an overview of the cases included and data sources for our study. The results of our analysis are presented in Table 2.

We identified three distinct, yet compatible collaborative value creation and capture models (Figure 1) used by our case studies to work towards a sustainable business case for rural connectivity:

1. **Value creation and capture through end-user collaboration**

In this model, end-users jointly support value creation through rural connectivity to enable (mutual) value capture by making shared investments. In this model, end-users recognize that the value captured through access to connectivity can be shared, yet face difficulties regarding investment costs required. Through collaboration, end-users can bundle

resources to overcome these barriers and therefore foster collective value capture (Salemink *et al.*, 2017). Generally, such collaborations are shaped through cooperative or association-based structures.

We observed the use of this model in LL Norway and LL Serbia. In Norway, forest owners often were part of associations with neighboring owners. Through this structure, collective investments for and sharing of connectivity-enabled solutions could take place. In Serbia, farmers as part of local communities made collective investments in mobile connectivity solutions which were rotated across farms to support subsequent value capture.

2. Value creation and capture through local government and end-user collaboration

In this model, the local government in collaboration with end-users fosters value creation through co-investments and subsidization of rural connectivity. This decision is motivated by governments recognizing that use of connectivity by end-users can lead to (macro-) economic, environmental or social impact, which in turn is deemed beneficial for the government. Accordingly, value capture by end-users leads to complementary value capture for the government.

We observed the use of this model in LL Luxembourg and LL Turkey. In both cases, use of connectivity-enabled solutions by end-users supported the rural sectors and helped to reduce the use of pesticides and fertilizer, contributing to significant sustainability impact. This impact incentivized governments to stimulate the use of connectivity-enabled solutions in practice.

3. Value creation and capture through private company and end-user collaboration

In this model, private companies (such as value chain partners, insurance companies) in collaboration with end-users support value creation through rural connectivity. This decision is motivated by private companies recognizing that use of connectivity by end-users directly can benefit private companies in return, for example through improved product quality, improved performance or through access to data.

We observed the use of this model in LL Turkey and LL Norway. In both cases, connectivity solutions could prevent negative impacts to the condition of forests and olive tree farms, reducing the amount of insurance payouts needed. This incentivized insurance companies to support rural connectivity access. In LL Turkey, we also noticed that the olive oil producer benefitted from improved olive quality as a result of using connectivity solutions, warranting co-investments with end-users.

Our work contributes to theory on community-led business models for rural connectivity (Ashmore *et al.*, 2017; Salemink *et al.*, 2017). Specifically, our work highlights the importance of fostering joint value creation and capture as part of local rural initiatives to overcome obstacles of rural connectivity deployment, looking at how connectivity can enable value potential value capture between different rural stakeholders. Accordingly, we

demonstrate the importance of taking an ecosystem or hub perspective on rural development, understanding how different stakeholders can collaborate to support (joint) value creation and capture in rural areas (Stojanova *et al.*, 2022). It also extends the work of Beckmann et al. (2023), illustrating how public or private institutions may work with end-users to overcome barriers towards digitalization. Our work contributes to practice by presenting collaboration options that rural stakeholders can leverage in supporting the deployment of rural connectivity, with an emphasis on enabling value capture for multiple stakeholders.

Keywords

Business models, rural connectivity, collaborative value creation and capture, community-led approach

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TABLE 1: RESEARCH DESIGN OVERVIEW

Case studies	Luxembourg	Norway	Turkey	Serbia
Context	LL focused on vineyard farming	LL focused on forest management and preservation	LL focused on olive tree farming	LL focused on agriculture
Connectivity-enabled solutions employed	Local network enabling use of weather stations and digital twin	Local network, enabling use of remote monitoring and drone-based surveillance	Local network, enabling use of weather stations and digital fly traps	Local network, enabling use of smart farming system
Stakeholders involved	Vineyard farmers, Connectivity provider, Viticulture service provider, National viticultural institute	Forest owners, Forest operators, Connectivity provider, Innovation service provider, Local government, Insurance companies	Olive tree farmers, Connectivity providers, Olive institute, Olive oil producer, Insurance companies	Farmers, Connectivity provider, Local government
Data source: Business model design	Business model workshop held with main representatives (November 2023)	Business model workshop held with forest owner, forest operator, connectivity provider and government (January 2024)	Business model workshop held with olive tree farmers, connectivity providers and olive institute (October 2023)	Business model workshop held with farmers, connectivity provider and local government (October 2023)
Data source: Semi-structured interview	Interview with LL lead stakeholders (connectivity provider and viticulture service provider) (September 2024)	Interview with LL lead stakeholders (connectivity provider and innovation service provider) (September 2024)	Interview with LL lead stakeholders (connectivity provider and olive institute) (October 2024)	Interview with LL lead stakeholders (connectivity provider) (October 2024)

TABLE 2: RESULTS OF CASE STUDY ANALYSIS

Characteristics Case studies	Collaborative value creation and capture models employed	Stakeholders involved	Value creation logic	Value capture logic
Luxembourg	1. Value creation and capture through local government and end-user collaboration	National viticultural institute; Vineyard farmers	National viticultural institute accounts for capital expenditures connectivity solution, requiring farmers to pay a reduced service fee.	Use of connectivity-enabled solution by vineyard farmers improves productivity and sustainability of farmers, which is valued by viticultural institute
Norway	1. Value creation and capture through end-user collaboration 2. Value creation and capture through private company and end-user collaboration	Collective of forest owners; Forest operators; Insurance companies	Forest owners and forest operators share investment and operational costs for connectivity solution. Insurance companies offer further financial support	Use of connectivity-enabled solution helps to improve forest management, benefitting forest owners. Moreover, solution can aid in forest fire prevention, meaning insurance payouts are less frequent, which is valued by insurance companies.
Turkey	1. Value creation and capture through local government and end-user collaboration 2. Value creation and capture through private company and end-user collaboration	National olive Institute; Insurance companies; Large-scale olive oil producer; Olive tree farmers	Olive institute subsidises use of connectivity solution, calling for a small service fee from farmers. Insurance companies and olive oil producer share operational costs with olive tree farmer	Use of connectivity-enabled solution improves productivity and sustainability of olive production, which is valued by olive institute and olive oil producer. Moreover, solution can help reduce spread of diseases, lowering insurance payouts which is valued by insurance companies.
Serbia	1. Value creation and capture through end-user collaboration	Collective of farmers	Farmers share capital and operational expenditures for connectivity solutions	Farmers can share / rotate use of connectivity-enabled solution, each benefitting from the same solution whilst overcoming high investment costs.

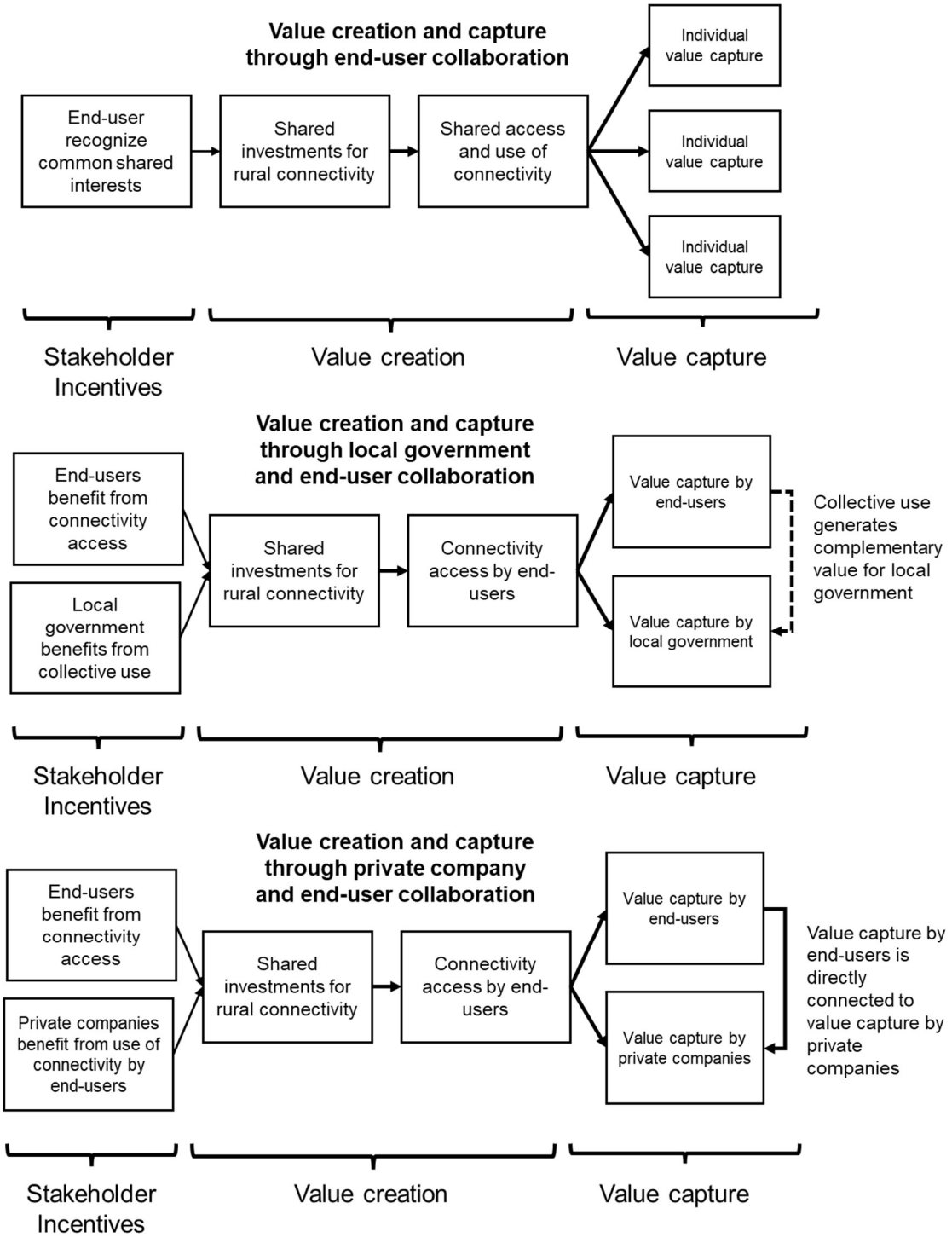


FIGURE 1: COLLABORATIVE INVESTMENT MODELS IDENTIFIED THROUGH CASE STUDY ANALYSIS

Designing community-based business model for forestry data ecosystems

Research in progress for a large Swedish forestry association

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Abstract

This research will design a data-driven and community-based business model for a large Swedish forestry association. Utilising stakeholder involvement and data, this study will identify the potential and applicability of these business models for member-owned forests. Ultimately, the expected business model will utilise available resources to offer maximised productivity, reduce costs and identify new business avenues for community members.

Keywords

Community-based business models, Data ecosystems, Agriculture and forestry data, Forestry Association

1. Introduction

1.1. Context and Research Problem

In the present data-centric business landscape, a dynamic synergy is emerging to involve the shared values and goals of communities and transform conventional business models to community-based ones. This transformation is exemplified by successful instances, such as Spotify and Linux, where community engagement and collective action significantly contribute to users' experience (Buda and Lehota, 2016) and attaining common goals (Goldman and Gabriel, 2005). In sectors such as smart

agriculture and forestry, data and community reshape the traditional approaches to doing business, by redefining sustainable practices, leveraging technology and shared knowledge to promote a brighter future for our planet. As many enterprises have shown increasing inclination towards implementing these models to share the benefit of involving the end-user in the process (Fadahunsi, Smallbone, and Supri, 2000), a research endeavour is warranted to explore and address the respective knowledge gaps in the implementation of such business models in agricultural and forestry domains, ensuring an equal distribution and integration.

1.2. Topic Justification

It is evident that peer support and collaboration of a community are also highly significant in agriculture and forestry, as to reduce risks, lower the costs and share the benefits. Thus, the need for such business models for agricultural and forestry data ecosystems cannot be overlooked. This research will focus on designing and testing community-based business models for a large forest owners association in Sweden. This will be done by engaging the stakeholders in the processes that will be tailored for forestry data ecosystems and by leveraging a number of data resources in order to promote value and ultimately uphold sustainability.

1.3. Research Gap

As argued by Wolf and Troxler (2016), monetary gain tends not to be the central emphasis in community-based business models, which partially explains why research attention has mainly been concerned with traditional business models. However, these traditional models often fail to address socio-environmental values (Joyce and Paquin, 2016). Hence, this research aims to fill the gap of designing a sustainable community-based business model that befit forestry domain, with data being its primary protagonist.
Another noteworthy aim of this research will be to offer data focused academic insights to an industry beneficiary in Sweden. As of the current research inquiry, no similar study has been conducted concerning this specific beneficiary group in Sweden, and no other forestry data-oriented community-based business model in this scale has been proposed by any researcher.

1.4. Research Questions

As this study will aim to devise and test new business models, it will answer the following inquiries:

Q1. What are the benefits and barriers of implementing community-based business models within forestry data ecosystems, and how can these benefits and barriers be identified and measured?

Q2. In what ways can customers/stakeholders act as sales and marketing agents, as well as service support entities, while reducing the cost of doing business, as supported by empirical studies?

Q3. What monetary and non-monetary benefits can community-based business models offer forest owners?

2. Literature Review

2.1. Community-based Business Models

In contemporary times, business models are well-established concepts. However, surprisingly, the precise definition of a business model remains a topic of considerable debate among different scholars. According to Teece (2010, p. 179), “A business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value”. In contrast to these traditional models, business models rooted in community involvement are intricately connected to a co-operative process which typically includes aspects of altruism, transparent knowledge exchange, and collective ownership of production resources and outcomes (Wolf and Troxler, 2016). Literature has proven that shared and community-based business models benefit customers and decrease transactional expenses and empower involved entities (Marques et al., 2023; Iles and Marsh, 2012), as well as creating value through community-based involvement and association (Ojuri, Mills, and Opoku, 2023; Krieger and Müller, 2003).

2.2. Agricultural and forestry data

With the emergence of IOT (Internet of Things), smart farming and forestry is feasible with real-time data collection and analysis. A concise exploration of present-day innovation-driven agricultural operations can unveil many use cases of data associated technologies, including sensors and drones, in conjunction with traditional farm machinery. These devices allow for gathering data on crops, trees, weather, precipitation and livestock, which consequently return increased “productivity” and “yields” when coupled with their appropriate precision farming techniques (Kamilaris et al., 2016, p. 442). The mutual contribution to farming through these techniques can also complement forestry efforts, resulting in tree and crop coexistence. The

connection between the two can consequently enhance resources utilisation and economic diversification. Overall, all the data attained from such technologies that can assist farmers and stakeholders in decision making processes that pertain to their business management and planning in agricultural domain can be defined as agricultural and forestry data. Therefore, leveraging this data via its related data mining techniques can lead to discovery of relationships between different environmental, economic and commercial factors (Issad, Aoudjit, and Rodrigues, 2019) that can subsequently promote desired beneficial outcomes.

2.3. Agricultural and forestry data ecosystems

In contemporary agriculture and forestry, the use of technological business solutions pave the way to the adoption of innovation. Agricultural and forestry data ecosystems are unified and innovative networks of multiple entities, comprising of business processes for farm management, including “planning processes”, “resource management”, “sales”, “certification”, or “taxes” (Kalmar et al., 2022, p. 281). When these elements are integrated, a consistent access to essential data would be available for involved stakeholders and contributors. As stated by Kalmar et al. (2022), this integration would significantly enhance the infrastructure and propel the process of digital transformation.

2.4. Exploring Similar Studies For Community Involvement In Business

While community-based business model is a fairly new notion, there have been a number of comparable studies that relate to our current research. (Müller, Vorraber, and Slany, 2019) highlight the importance of open communities, and propose them as possible new business models, instead of mere enablers and players. (Juárez and Chacón, 2013) also suggested that marketing initiatives could be replaced by community strategies, in case a community approach to conducting business is followed. In another notable study, (Karlsson et al., 2019) suggested that a successful creation of a network-level business model depends on fostering a mutually beneficial cooperation between multiple actors and stakeholders right from the outset of the initiative.

3. Theoretical Framing

3.1. Commons Theory: A Proposed Theoretical Framework

Based on the community-driven nature of the current research, a context-appropriate and relevant theoretical lens for it can be Commons Theory. This theory, often associated with Ostrom (2009), depicts how communities and groups can sustainably manage resources such as forests, aquaculture, pastures, and water bodies. It showcases the significance of collective action, teamwork, and sovereignty in ensuring the long-term sustainability of mutual resources. With more than 50000 stakeholders who constitute the largest private forest owners in Southern Sweden, the selected Swedish industrial beneficiary offers medium-sized collection of individuals with shared goals, who can contribute through peer production. Benkler and Nissenbaum (2006) define peer production as an emerging social production model combined with other models of production, namely contract- and market-based systems, managerial-firm-based models, and state-directed approaches, which stands out for its unique attributes: decentralisation and a strong reliance on social signals and motivation.
As for the current case, during an initial friendly meeting with Digital Market Manager at this Swedish forestry association, he remarked: “It seems we have more people eager to help and participate than we have chairs to accommodate them on-site!” This shows that these entities who have shared resources and are farmers or landowners, are ready to voluntarily offer their invaluable insights, and therefore collectively contribute to constructive outcomes.

3.2. Unlocking Prosperity: Commons Theory for Innovative Community-Based Business Model

This theory's emphasis on common resources and peer production resonates well with the central aims of this study. Moreover, the empirical success of Commons Theory in multiple other sociotechnical contexts, such as development of Linux or Wikipedia through peer collaboration, showcases its effectiveness in community-driven settings. This theory is especially well-suited for contexts in which communities have a central role in resource management, since it emphasises communal governance and decision-making (Pretty, 2003).
Accordingly, in the context of agricultural and forestry data ecosystems, the utilisation of Commons Theory provides a solid foundation for understanding how communities of stakeholders, farmers, forest owners and researchers can mutually contribute to, access, and leverage data resources. In current research, with a close-knit community including owners of family forests and farmers, multiple businesses with vested interests and a diverse consumer base, application of such framework will shed light on the development of community-based business models.

4. Methodology

4.1. Data collection

In order to answer the research questions, a mixed-methods approach will be applied throughout. Due to the scale of the current research, , a number of qualitative methods will be applied. Starting with a thorough systematic literature investigation, related benefits and barriers of community-based business models will progressively be identified.
After pinpointing necessary elements, in-depth interviews with various stakeholders and forestry domain experts will be conducted to measure the aforementioned factors. In addition, focus groups should be formed to discuss communal dynamics and governance structures. As for the quantitative approach in this study, a pilot survey will be devised and distributed among stakeholders and farmers that will later be coded and analysed in order to assess efficiency of the engagement method, in order to determine the cost reduction of businesses. This step will also be coupled with findings from a data analyses step that will be performed on the relevant datasets.

4.2. Analysis techniques

As the final step, Triangulation will be used to merge and contrast outcomes from both of the aforementioned methods, in order to validate the outcomes for current research questions. This research will undergo validation procedures, focusing on content and construct validity aspects (Lawshe, 1975). It should be noted that the offered methodology might undergo modifications as we progress.

5. Conclusion

This research will embrace a community-based approach rooted in Commons Theory, not only fostering a sense of collaboration but also offering concrete advantages. One of the outcomes of this research will be to empower a culture of peer support and shared responsibility within the industry, while utilising available resources to offer maximised productivity, reduce costs and identify new business avenues and innovative business approaches.

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Circular economies and social regeneration: a case study of a community bike rescue and repair programme

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Extended abstract

Introduction and problem statement

The circular economy is a regenerative economic system (Geisendorf & Pietrulla, 2018; Morseletto, 2020) which necessitates a paradigm shift to replace the 'end of life' concept with reducing, alternatively reusing, recycling, and recovering materials throughout the supply chain (Farooque et al., 2019; Geissdoerfer et al., 2016; Michelini et al., 2017). The aim of this paradigm shift is to promote value maintenance and sustainable development (Kirchherr et al., 2017; Ritzén & Sandström, 2017), creating environmental quality, economic development, and social equity, to the benefit of current and future generations (Kirchherr et al., 2017; Millar et al., 2019; Morseletto; 2020). Circular economies are enabled by an alliance of stakeholders (industry, consumers, policymakers, academia) and their technological innovations and capabilities (Corvellec et al., 2022; Kirchherr et al,, 2017; Pieroni et al., 2020).

In making sense of the definitions we draw on Johansson & Henriksson's (2020) high level categorisation of a weak and strong version of CE. The CE's "weaker" versions focus on actions such as reduce, reuse, and recycle without challenging economic growth or consumption patterns. In contrast, the "strong" CE calls for systemic transformation, integrating socio-ethical considerations, regenerative practices and the acknowledgment of ecological limits. In practice we often see the weaker version prevail. Furthermore, despite the wider contextualisation of CE as a sustainability initiative, it is often the environmental and economic dimensions of CE that are prioritised and the social impacts remaining largely underexplored

(Corvellec et al., 2022; Kirchherr et al., 2017; Millar et al., 2019; Murray et al., 2017). To address both of these shortcomings in our understandings of CE we wish to focus on the concept of social regeneration in the context of a circular economy project in action.

Social regeneration extends beyond traditional sustainability approaches by fostering community empowerment, welfare improvement, enhancing community cohesion, quality of life, and social capital (Ginsburg, 1999; Gutlove & Thompson, 2004). Social regeneration involves moving beyond traditional sustainability approaches towards transformative change for positive cycles of wellbeing enhancing the ecological, social, cultural and spiritual aspects of a community (Buckton et al, 2023; Mies & Gold, 2021). We suggest that social regeneration has the potential to offer a critical pathway for integrating social sustainability into (strong) CE initiatives (Mies & Gold, 2021; Colantonio & Dixon, 2011). However, understanding the relationship between social regeneration and CE is currently under theorised. This paper aims to address this gap.

There are few empirical exmaples of CE in action that detail the social regenerative aspects of CEBM (see Mies & Gold, 2021). We draw on a case of a bikes programme, run by a community based social enterprise to explore social regeneration in action. Social enterprises play a vital role by engaging marginalized groups in recycling and repurposing materials, aligning economic activities with social outcomes (Pitkänen et al., 2023; Luthin et al., 2022). Through drawing on a case study we can explore and address the question of **how circular economy initiatives can enable community social regeneration.**

Method

The study employs an action-research design, fostering collaboration between researchers and community participants to co-develop and test social regeneration metrics. This participatory approach aligns with CE's principles of inclusivity and systemic change, enabling the exploration of real-world applications and the refinement of measurable outcomes. This research examines the Southern Youth Development's Bike Rescue Programme in Aotearoa-New Zealand, a community-based youth centred social enterprise that has a programme to rescue and refurbishes bicycles destined for landfills. Operating under a waste minimization contract, the programme exemplifies how CE initiatives can simultaneously achieve environmental sustainability and foster social regeneration by engaging marginalized groups, developing skills, and promoting community inclusion

Initial and expected findings

The initial findings of the project are measured in terms of environmental and social impact. The environmental impact is perhaps the easiest measure with this programme. It is relatively easy to measure the amount of bikes and weight of

material that is prevented from entering into the landfill. These results can be extrapolated to understand the carbon benefits from the bikes programme. For example measures of environmental impacts can include:

The Bike Rescue Programme contributes to environmental sustainability through:

- Waste Diversion: capturing the number of bikes that have been assessed for refurbishment or dismantled for parts, reducing landfill volume and resource extraction.
- Carbon Footprint Reduction: measuring the carbon involved in refurbished bikes eg eliminates emissions related to production and distribution.
- Adding to sustainable transportation options: Cycling produces significantly lower carbon emissions compared to other transport modes

Similarly the social impact can be measured through young people working on the bikes and bikes that are re-used by community members. For example, through the SYD Bike Rescue Programme, young people develop practical bike mechanics skills by working alongside youth workers and mentors, thereby fostering confidence, a sense of achievement, and a clear purpose. Community engagement is enhanced through initiatives such as community “bike grabs,” where refurbished bicycles are offered for koha (donation), promoting inclusivity and delivering accessible transport solutions. Moreover, educational outreach efforts, established through collaborations with schools and universities, not only emphasise sustainability education but also empower students to maintain their bicycles, thus encouraging long-term behavioural change.

While environmental impacts, such as waste diversion and carbon reduction, are quantifiable, measuring social regeneration requires a multi-dimensional approach that captures its complex social, economic, and cultural elements. This study presents a framework that integrates qualitative and quantitative methods, offering practical recommendations for assessing and enhancing the regenerative aspects of CE initiatives . We examine ways of being able to measure the regenerative aspects of this programme. The results will involve a set of recommended measures for community social regeneration in a circular economy.

The SYD Bike Rescue Programme exemplifies how circular economy (CE) initiatives can integrate both environmental and social dimensions. By engaging youth and local communities, the programme fosters social impact through skill-building, community cohesion, and improved access to sustainable transport options, all of which are underpinned by environmental benefits such as reduced waste, lowered carbon emissions, and decreased consumption. In this way, the programme aligns with the “strong” CE model, promoting systemic change, addressing the root causes of unsustainability, and nurturing both social, community and environmental regeneration.

This paper focuses on measuring social regeneration within the CE framework. Drawing on existing methodologies used to quantify social regeneration, it develops a tailored set of measures suited to the CE context and tests their applicability through implementation in a CE programme.

Conclusion

This case study explores the potential of circular economy initiatives to advance social regeneration by fostering community inclusion, empowering marginalized groups, and reducing environmental impacts. Localised, community-driven models like the SYD Bike Rescue Programme have the potential to serve as practical examples of how CE can drive sustainability and social regeneration. This paper contrubutes through the development of key measures for being able to both conceptualise and meausure social regeneration in the CE context. Plus, we also strengthen the claims of the relationship between CE and sustainability by illuminating measures of social and community outcomes through a empirical case. These findings underscore the necessity of integrating social regeneration metrics into circular economy models, paving the way for more holistic approaches to achieving sustainability that equally prioritise environmental, economic, and social well-being.

Keywords

Circular Economy, Social Regeneration, Community Engagement, Sustainability, Waste Minimisation, Action Research

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An Extended Abstract Submitted to the NBM Conference 2025

Beyond the trend: Experimenting with business models to enhance garment durability and sustainability

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1. Introduction

With the Strategy for Sustainable and Circular Textiles (2022) the EU has put durable and long lasting garments at the center of the European textile and fashion industry's transition towards sustainability. However, there is an urgent need for a more nuanced understanding of how brands might create garments that are durable and long lived in use and what a business model with durability at the center looks like (Hasling & Ræbild, 2017; Kirchherr et al., 2023; Klepp et al., 2022; Sarokin and Bocken, 2024; Wiedemann et al., 2020). Business model experimentation for a circular economy (CBME) is an emerging field within the business literature (Blomsma et al., 2022), that might guide the transition towards incorporating durability into business models. Defined as an iterative approach to developing and testing circular and sustainable value propositions in real-life contexts, CBME involves rapid learning based on empirical data to assess the viability of these propositions (Bashir et al., 2020; Bocken et al., 2021).

Drawing on data collected during an explorative research project with 14 Danish brands, this paper will investigate how companies in the textile and fashion industry approach durability and how participation in a collaborative, exploratory research project can support

business model innovation for sustainability. Theoretically, this paper will contribute with a more nuanced understanding of the challenges and opportunities related to durability in garments. Methodologically, it will contribute to the literature on CBME, offering insights into the challenges and opportunities of business model experimentation across various types of textile and fashion brands. Finally, the paper will contribute to practice by discussing empirical examples of approaches to business model experimentation for sustainability.

2. Methodology

Empirically, this study draws on data collected during a one-year explorative research project on garments and durability. A total of 14 Danish companies, including fashion, children's wear, work wear, and a retailer took part in the project. The project included three key activities: semistructured interviews, a workshop series, and facilitated knowledge exchange and experimentation on durability (see Fig. 1: Timeline). Considerable effort was put into creating 'safe spaces' (Kambunga et al., 2023; Oswald et al., 2023), as engaging in conversations about strategies for durability is deeply related to the design and business model strategies of a company and therefore also potentially vulnerable information. For the workshop series and facilitated knowledge exchange, the research partners drew on existing tools for (business model) innovation (e.g. the Business Innovation Kit and Planetary Dreaming: Designing the Future), but own frameworks were also developed to promote and support exploration into durability. Throughout the facilitated knowledge exchange, participating companies were encouraged to use various tools in an iterative process to broaden their understanding of existing practices related to durability, but also start experimenting with approaches and collaborations that could potentially strengthen the role of durability in products and business models.

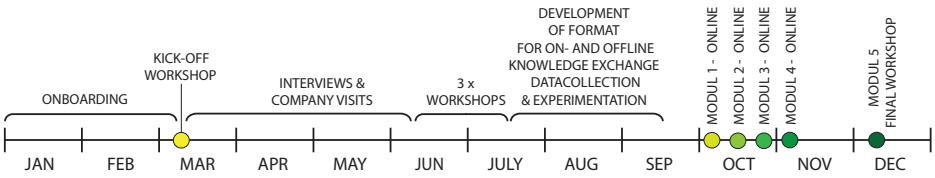


Figure 1: Timeline – project activities

The research partners conducted semi-structured interviews with all participating companies (Kvale, 2007). Most interviews were audio-recorded and transcribed, although

in a few cases, permission for recording was not granted. In these instances, interviews were documented through detailed note-taking. The three workshops were documented through detailed field notes, which were initially taken individually by the research partners and later compared and discussed. The research team will use the Gioia methodology for coding the empirical data (Gioia et al., 2012).

3. Circular Strategies as Conceptual Framework

CE is generally defined as systems in which materials are never wasted and nature is regenerated (Kirchherr et al., 2023). Focus is on slowing, closing, narrowing, and regenerating resource loops to tackle issues such as climate change, resource depletion, and biodiversity loss (Bocken et al., 2021). Circular business models are perceived to be central tools to transition to a CE (Geissdoerfer et al., 2023). However, despite the popularity of the CE concept, critics increasingly point to its lack of implementation at societal as well as organisational level, not least within the textile and fashion industry (Corvellec et al., 2021; de Jesus and Mendonça, 2018; Stål and Corvellec, 2018). Some call for increased attention to practices focusing on slowing cycles of consumption while others question if the CE can lead to sustainability at all (Kirchherr et al., 2023).

Making garments durable and long-lasting is seen as a key strategy for slowing resource loops (European Commission, 2022; Hasling & Ræbild, 2017). While much of the focus has traditionally been on the functional and technical aspects of durability (e.g., Hubbub, 2023), there is a growing recognition that durability also encompasses emotional and social dimensions (Selvefors & Nyström, 2023). As a result, the definition of durability is shifting from something that can be measured through pre-sales testing to something intrinsically linked to both business models and fashion cultures (Fletcher, 2017; Nielsen & Skjold, 2024; Wiedeman et al., 2020).

However, research calls for a deeper understanding of the interconnections between various aspects of durability—such as technical, functional, and emotional—and how these can be effectively supported in product development and by the business model (Jansen and Craik, 2028; Kirchherr et al., 2023; Richardson et al., 2024; Sarokin and Bocken, 2024).

4. Priliminary findings

Five main themes emerged from the initial data analysis. These themes are closely interconnected and span both product and business model levels. First, the analysis reveals that participating companies have established practices for addressing technical and, to a lesser extent, functional aspects of durability. In these areas, they have data available and focus primarily on measuring and setting supplier requirements related to dimensional change, pilling tests, seam strengths, colour fastness, etc. However, the companies are less

certain about emotional and social durability, particularly how these factors relate to product development and business models.

Second, although many respondents claim to create durable garments, few have a clear understanding of what happens to their products after they are sold. Our data indicates that designing for durability goes beyond just making long-lasting items. What lasts in one person's closet may not last as long in someone else, highlighting the importance of understanding the specific needs and behaviors of the people you are designing for.

Third, the analysis highlights the strong connection between products and business models when it comes to durability. A product team can only create durable products if the business model supports and enables that goal. For example, a durable product design might not last in practice if it's part of a fast fashion business model, which prioritizes rapid turnover over long-term use.

Fourth, and closely related to the business model, the initial analysis suggests a growing shortage of textile and garment skills in Denmark, as well as a lack of collaboration across various departments. A potential exists, for instance, for closer collaboration with the retail sector, which could provide valuable insights into user behavior and the product's use phase, if properly trained.

Fifth, the project demonstrates that any data collection and experimentation by participants had to be framed in a way that was manageable within their everyday work routines. Despite their interest in durability, participants struggled to find time and support to try the suggested methods and gather data. However, the project's focus on the use phase as a key factor in garment durability has proven to be a promising methodology. This can serve as an eye-opener, encouraging companies to start rethinking their products and business models with relatively minimal initial effort.

Keywords

Durability, business models, sustainability, experimentation, fashion

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The regenerative business model as an intermediary between market actors and local earth systems

A case study on aquaculture and mussel farming

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Extended abstract

In this paper we empirically investigate regenerative business models in the context of aquaculture, focusing on mussel farming. With escalating environmental degradation and transgression of multiple planetary boundaries (Richardson et al., 2023), to guarantee functioning earth systems in the future we need to move beyond a net zero impact towards practices that not only guarantee resilient ecosystems but also regenerative ones. Regenerative business models offer a possible path towards net-positive practices, where the businesses can enhance the social-ecological systems alongside the business practices (Hahn & Tampe, 2021). While the interest in regenerative business models has grown it remains a novel field of research. Notable articles such as Das and Bocken (2024) and Caldera et al. (2022) map patterns of regeneration through snapshots of business practice. To develop the concept of the regenerative business model there is still a need for more research on the operational aspects of how to do business in a regenerative way (Konietzko, Das, & Bocken, 2023) and how business can create a net-positive effect both directly and indirectly in regenerative ways (Das & Bocken, 2024).

In comparison to sustainability driven by an anthropocentric market logic, regenerative business practices require an emphasis on adaptation to the contextual characteristics of the local social-ecological system in which business activities takes place (Hahn & Tampe, 2021). The dependency on local social-ecological systems to access natural resources and enable the intended regenerative net-positive impacts requires a dynamic approach (Fischer et al., 2024). This includes a diverse and dynamic response to changes in the local social-ecological context (Walker et al., 2023) and the ability to see the long term wellbeing

of those systems (Das & Bocken, 2024). To sustain such a regenerative business relies on the ability to obtain feedback from the social-ecological system to create not only financial viability for the firm, but viability for the system (Hahn & Tampe, 2021; Muñoz & Branzei, 2021). The transformation to regenerative value creation in business models thus needs to be co-developed with the social-ecological system it is embedded in. Although regenerative business is an area of growing interest, the practices and strategies that directly facilitate regeneration remain under-emphasised (Das & Bocken, 2024; Muñoz & Branzei, 2021). In this paper we build on to the existing literature to explore how the regenerative business model acts as an intermediary between market actors and local earth systems.

Our aim is to categorise managerial practices required to design, continuously develop and sustain a regenerative business model. This includes the knowledge required to understand the contextual limitations and opportunities for regeneration, use of networks, and the implications of market structures on the viability of regenerative business models. Thus, this paper provides answers to questions such as:

- What managerial practices are linked directly or indirect to the regenerative net-positive contribution of the business model?
- What demands does the regenerative aspect of the regenerative business model put on the value creating practices?
- Is regeneration a question of ecosystem rebuilding only, i.e. can regeneration of nature be conducted apart from where the value-creating activities are located?

Previously, regeneration has been approached in several fields such as agriculture, design and ecology (Fischer et al., 2024), while the application in the use of marine natural resources such as aquaculture is under-emphasised. Seafood from aquaculture is a fast-growing industry and has become an important part of food production (FAO, 2020). While aquaculture holds a lot of promising growth, the impact on the marine environment and ecosystems has grown unsustainably (Halpern et al., 2019). The need to restore marine ecosystem and guarantee a future provision of ecosystem services coincides with the need to find future provision of food that can be sustainably produced (Barrett et al., 2022). To resist the degradation of marine ecosystems and to develop a more sustainable use of the oceans provide a context for the application of the developing research field of regenerative business models.

We use the context of aquaculture, more specifically mussel farming, to investigate the regenerative business model practices. Mussels, a bivalve, has certain characteristics that aligns with the regenerative business model. Mussels is a low trophic-level organism which means less energy input, and less wasted energy, per unit of output (Boyland et al., 2025). Mussels require no additional feed, can decrease eutrophication through nitrogen absorption, and have a lower impact compared to many other species in aquaculture (Gephart et al., 2021; Gren, 2019). Mussel farming has also been identified as having the potential to contribute positively to biodiversity (Theuerkauf et al., 2022). While there is

risk of negative impacts, in particular the impact on the ecosystems on the seafloor, the site selection for mussel farms can reduce the negative impact (Bergström et al., 2024). The placement of the farms in coastal areas has also become an important contributor to a sustainable livelihood in otherwise diminishing coastal communities (Barrett et al., 2022; Mizuta, Froehlich, & Wilson, 2023). These characteristics provides a resource that has a low impact on the environment, the potential to provide a financially viable product to the market and create a net-positive impact on the social-ecological system in which it is placed.

This paper is based on an empirical case study of mussel farming as a part of a transdisciplinary research project on ecosystem-based management, financed by the Swedish agency for Marine and Coastal Management (SWAM). The study is based on mussel farming on the west coast of Sweden due to its contextual proximity to, and impact on, coastal communities, the low level of stress on the environment, and opportunities for net-positive impacts. The case was selected based on key characteristics of regenerative business models and regenerative aquaculture, with an emphasis on the net-positive impact (Konietzko, Das, & Bocken, 2023; Mizuta, Froehlich, & Wilson, 2023). Data was collected through qualitative interviews and data collected online on the case company. This abstract presents the initial results and categorisation of the managerial considerations required for regenerative business models in aquaculture to develop, adapt, and sustain by integrating on one hand the contextual environmental limitations and opportunities, and on the other, the adaption to market structures.

This abstract presents the initial version of a study that contributes to the development of the concept regenerative business model, and the use of it in the critical context of marine ecosystems well-being. This highlights the social-ecological systems, the actors involved and related to it, as fundamental for regeneration to occur as a net positive outcome of regenerative business models. By utilizing the regenerative business model as an intermediary between market actors and local earth systems, we can identify barriers and opportunities to transform market structures that benefit a stronger sustainability agenda for businesses.

Keywords

Regenerative Business Models, Social-ecological Systems, Aquaculture, Sustainable Business Models, Strong Sustainability.

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Embedding sufficiency: A case study of sufficiency-oriented tools and strategies in the cleaning industry

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Abstract

This study explores the case of Clinitex, a professional cleaning services provider, which has been engaged in a seven-year transition to a sufficiency-oriented organisational model. Through a detailed case study, we explore the experimental tools, strategies, and the overall *dispositif* that enabled this shift.

Keywords

Sufficiency, sustainable business models, circular economy, management tools

Context and research questions

The growth of human activities is gradually overshooting the Earth system's capacity to support them over the long term (Rockström *et al.*, 2009; Richardson *et al.*, 2023). Moreover, this growth does not lead to an improvement in the quality of life beyond a certain threshold (Easterlin, 1974; Easterlin *et al.*, 2010). In this context, new business models are needed to rewire the economy towards strong sustainability. To achieve this, sustainable business model archetypes have been identified in the literature. The sufficiency archetype, defined as “products or services that use fewer resources, generate less waste and emissions, and create less pollution than products/services that deliver similar functionality” (Bocken *et al.*, 2014) seeks to achieve sustainability goals by reducing overall consumption of resources, while preserving financial profitability (Bocken & Short,

2016). It is however considered an effective but less common, or even 'niche' approach (Niessen and Bocken, 2021). This literature identifies the need for additional sectoral in-depth case studies (Bocken, Morales and Lehner, 2020), which we provide here. Moreover, we strive to explore the role of corporate governance in implementing sufficiency-oriented strategies and the tools and processes used to question the conventional growth-oriented mindset and operationalise sufficiency.

Clinitex is a family-owned professional cleaning services provider founded in 1980 in Lille by an independent tile washer. The company is now run by the founder's son and has over 3,500 employees spread across ten regional agencies in France. The company provides cleaning services to the private and public sectors, including office spaces, industrial sites, and hospitals. Clinitex was the first French cleaning company to become B Corp-certified and has won several awards for its sustainability and social initiatives. The company's current CEO seeks to embed sustainability into its governance and activities and was inspired to do so by a fortuitous meeting with Pierre Rabhi, a French philosopher and writer promoting sufficiency as a path to achieving a 'happy life' (Rabhi, 2010), lived within the boundaries of what the planet is able to provide. This meeting triggered a mindset shift from a conventional growth-oriented corporate strategy to a sufficiency-led strategy. The case we investigate illustrates how a philosophically rooted transformation towards sufficiency took place at the initiative of the CEO and gave way to experimentation with the company's business model, tools and strategies. By conducting this case study, we seek to answer the following questions: How can a company shift from a growth-oriented mindset to a sufficiency-oriented mindset? What levers were used at Clinitex to operate this shift, and with what challenges and limitations?

Theoretical framework

To uncover the complex interplay of discourses, practices, and institutional measures used to shift the organisation to a sufficiency-oriented mindset, we mobilise the theoretical framework of management *dispositifs*. Aggeri (2017) defines a management *dispositif* in the context of organisational studies as "the agencing of heterogeneous physical, cognitive and discursive elements designed to frame the behaviour of governed subjects and to guide it towards specific goals." This framework provides us with an analytical grid to classify the elements that make up the sufficiency-oriented organisational model at Clinitex, including the tools, processes, mission statements and interactions between the stakeholders. Moreover, the *dispositif* lens allows us to highlight the initial impulse for the shift, the arrangement of the elements, and the strategic purpose that they serve, as well as their unintended consequences.

Methods

We employ an abductive qualitative approach using two main sources of data: primary data via semi-structured interviews with employees and the leadership team, and secondary data extracted from the company's website, social media accounts and news features. Our choice of single case study stems from its ability to uncover the *how* and the *why* of the implementation of sufficiency-led tools and strategies at the organisational level. It allows us to dive into the socially-constructed nature of the phenomenon (Goffin *et al.*, 2019; Eisenhardt, 2021) in an exploratory manner (Yin, 2014). Namely, we use grounded theory to collect and analyse data, and to draw concepts from it (Glaser and Strauss, 1967; Corbin and Strauss, 2008).

We are in the process of collecting and triangulating data sources to improve the validity of the results. Approximately six hours of semi-structured interviews have been recorded so far, with additional interviews planned in the forthcoming weeks at the time of writing. We've also collected data and testimonies from the company's website, LinkedIn accounts, newspaper articles, TV news features, and podcast interviews of the founder and of the current CEO. As per grounded theory, we did not start our research with specific hypotheses in mind, to let key themes and questions emerge from the data. The company was identified as a relevant case study for the exploration of sufficiency experimentation via a Google alert for the keyword '*sobriété*' (sufficiency), which drew our attention to an interview with the founder[1] mentioning sufficiency as a guiding principle for defining strategic objectives. We pursued our investigation with an online scoping of the company's strategy and discourse on the topic, using its website, LinkedIn corporate page and employee profiles, as well as additional news features. Once we had collected sufficient data to identify initial salient but still elusive themes, we outlined the first draft of a semi-structured interview guide. We then approached the CEO and conducted a preliminary interview to confront our understanding of the secondary data with a direct testimony. This interview gave us access to additional contacts within the company, including with other members of the leadership team. Table 1 recaps the steps in the data collection and analysis process and Table 2 provides a list of interviews conducted so far.

[1] Les Echos Entrepreneurs (30/11/2022): https://entrepreneurs.lesechos.fr/developpement-entreprise/management/sobriete-comment-lentreprise-clinitex-a-supprime-les-objectifs-2019737 (in French)

	Step 1: Mapping the company's strategy using secondary data analysis	**Step 2: Conducting exploratory interviews with the leadership team**	**Step 3 (ongoing): Engaging in direct observation and in-depth interviews**
Source of data	Interview of the founder (newspaper article) Company website Company LinkedIn page publications CEO LinkedIn profile publications News feature (TV)	Exploratory semi-structured interviews with leadership team and employees	In-depth semi-structured interviews with employees 2nd round of interviews with leadership team Direct observation at the company's regional agencies and HQ
Method of analysis	Floating attention Back-and-forth with the literature to identify relevant theoretical frameworks	Thematic coding	Thematic coding
Outputs	List of key topics and grey areas First draft of interview guide	Initial grid of salient themes Refined interview guide	Comprehensive list of themes and conceptualisation of levers and challenges in the implementation of a sufficiency-oriented model

Table 1 – Data collection and analysis process

Role	**Date**	**Format**
CEO	26/07/2024	Phone call
COO	21/08/2024	Video call
Regional Director #1	23/08/2024	Video call
Commercial Officer	29/10/2024	Video call
Regional Director #2	22/11/2024	Phone call

Table 2 – List of interviews to date

The next steps in the data collection and analysis process include conducting additional interviews with employees, including HR, commercial and finance officers, and cleaning staff, as well as follow-up interviews with the leadership team and direct observation at the company's headquarters in Lille and regional agencies in Nantes and Paris. These observations will allow us to gather situational data to compare with secondary data and online and phone interviews.

Results

We structure our findings into two sections. First, we describe the impulse that initiated the shift at Clinitex. Second, we identify the discursive elements that make up the sufficiency *dispositif* and that are mobilised to transform reality: its speech acts, its acts of writing, and its acts of calculation (Aggeri, 2017). Third, we map out the interactions between the actors involved in the *dispositif*. This allows us to provide a comprehensive view of the processes and tools used within the company to operationalise sufficiency.

1. Initial impulse

We find that the initial impulse that led to the setting up of the sufficiency *dispositif* at Clinitex is a fortuitous meeting between the current CEO and the philosopher and writer Pierre Rahbi. The latter is a proponent of agroecology and advocates for a return to traditional rural societies, to put an end to "the indefinite growth that ruins the planet to the profit of a minority", whereby *sobriété* [sufficiency] constitutes a "conscious choice, inspired by reason" (Rabhi, 2010). This meeting led to a questioning on the application of the principle of *sobriété heureuse* [happy sufficiency] to the company:

> "We asked ourselves: how can we apply this concept within the company? A principle of frugality was thus developed at Clinitex. [...] It is based on the awareness of what is strictly necessary [...] while remaining dynamic for our employees, our investors, and the planet." (– CEO)

2. The sufficiency *dispositif*

From this initial impulse, the principle was broken down into discursive elements, arranged to serve the strategic purpose of rewiring the company towards a sufficiency-oriented organisational model. A core element of this *dispositif* is the 'sufficiency threshold'. This threshold constitutes a management tool; operationally, its function is to be "the metric that allows our agencies to know if the goals have been reached" (– CEO). The threshold is an aggregation of three metrics: profit before tax,

employee well-being, and customer satisfaction. For each of these metrics, a goal is defined at the beginning of the fiscal year by the leadership team. Table 3 presents how each metric is calculated.

	Profit before tax	**Employee well-being**	**Customer satisfaction**
Calculation	Cost of debt + employee subsidies + working capital requirement + reserve + "fair" dividends (approx. 3% pa)	Assessment by the cleaning staff of their working conditions and well-being at work	Grade attributed by the customers to the quality of the service and the experience with the company
Objective	"the level of net profit the company must reach to satisfy its vital needs" (– CEO)	"counterweighting the profit goal" (– Commercial Officer)	

Table 3 – Metrics making up the sufficiency threshold with their calculation and objectives

The purpose of the tool is to set boundaries for the work of employees: while a certain level of financial profit must be reached, it does not have to be exceeded ("we eat our fill, that's all"). The intended effect is that "past this threshold, everyone can relax and breathe" (– CEO). It appears clearly that this tool creates a tipping point in the life of the company: each year, when the financial objective is reached (if it is reached), commercial development slows down ("we release the pressure", "it becomes quieter on the development side" – Regional Director #1). Efforts become geared towards solidarity and environmental initiatives, well-being at work, or reinforcing customer relations. For this to work, the *dispositif* relies on various acts of speech and writing: the evolution of the threshold is visually represented and visible to all employees on the company's intranet; it is presented and discussed at team meetings, both at the regional agency and the corporate leadership levels.

3. Actors and interactions within the dispositif

The tool constitutes an actor within the company, influencing and being influenced by different actors: the leadership team in charge of designing it and defining its parameters of success, the financial, HR and customer service officers in charge of feeding it data, and the commercial officers and cleaning staff whose activities impact its indicators. Figure 1 depicts the interactions between these actors and the threshold.

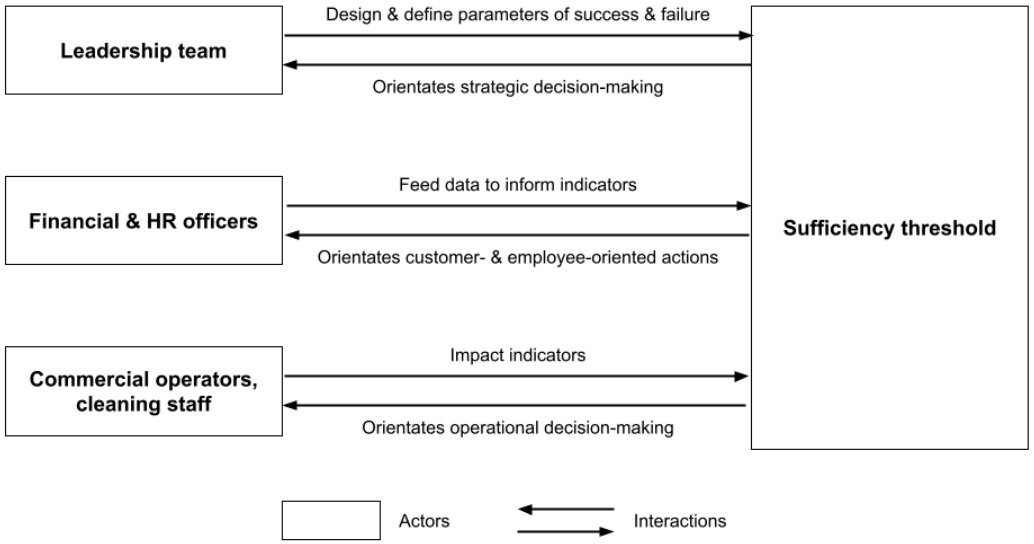


Figure 1. Interactions between the sufficiency threshold and internal actors

The threshold thus influences operational and strategic decision-making. It is a tool influencing behaviours, a manifestation of the company's values of openness, collaboration, and transparency, and it challenges conventional underlying assumptions of growth as an end in itself by counterweighting financial performance with customer and employee satisfaction. For instance, commercial officers may decide to refuse new contracts if they deem it would negatively impact employee well-being or customer satisfaction ("We refuse certain contracts because they don't insure the well-being of our cleaning staff. We then guide inquiries to other providers" – Commercial Officer).

However, employee testimonies show that the implementation of sufficiency is not without drawbacks. For instance, pressure to achieve financial and non-financial objectives is still felt. The threshold may not change the behaviour of all employees towards forsaking the growth-oriented mindset, and new employees coming from a more conventional growth-oriented organisation may find it hard to adapt ("I saw people come and go quickly because they weren't aligned with the values. [...] They just didn't manage to get acclimatised" – Commercial Officer). Moreover, the impact of the threshold on the company's environmental footprint and overall sustainability performance is not clear and needs further exploration. Another dimension of the *dispositif* that requires further understanding is the involvement of external actors, including customers, consultants and other partners, which we seek to address in the next steps of the research.

Discussion

We set out to shed light on the practicalities of embedding sufficiency at the organisational level. We identified that a 'philosophical awakening' of the CEO constituted the initial impulse at Clinitex that led to the shift from a conventional growth-oriented mindset to a sufficiency-led organisational model. This is in line with findings from Bocken and Short (2016) that a strong enabler of sufficiency at the corporate level is it being "driven from the top". While the case study highlights the role of governance and leadership in this shift, it also showcases the intricacies of the interactions between employees at different levels of the hierarchy, and the role of management tools as actors having agency within the *dispositif*. It shows that while leadership initiates the process with a specific purpose in mind, it can have unintended effects. For instance, we have given an example of new employees not being able to get accustomed to the sufficiency-oriented organisational model and having to leave the company as a result.

Furthermore, we bring a practical example of the corporate use of a management tool, success indicators and the arrangement of discursive elements around them to voluntarily moderate sales and promotion, which is an area that needs further investigation as identified by Niessen and Bocken (2021). On the topic of growth, our case illustrates an alternative to 'organic growth' in a sufficiency paradigm: the growth is employee-driven ("We talk of a 'human plan' rather than a 'business plan'" – COO). Degrowth was identified as an obstacle to employee well-being as it was felt to restrict personal aspirations. The company thus allows itself to seek avenues of growth depending on employee ambitions:

> "Opening new agencies depends on the wishes of the employees. [...] A colleague wanted to move there [in Lyon] and we looked for an agency to buy. Same in Orleans: a manager with a personal project started with a single contract and now they have about sixty clients there" – Regional Director #1

Our case study also allows us to provide an example of a larger-scale BtoB services company embedding sufficiency to the literature, which, as identified by Bocken, Niessen and Short (2022), lacks examples with these characteristics. Moreover, it allows us to discuss the sufficiency-oriented archetype within sustainable business models. Indeed, the company does not overtly seek to "reduce absolute demand by influencing and mitigating consumption behaviour" (Bocken and Short, 2016), but rather it seeks to question the conventional growth-oriented mindset by using sufficiency as a guiding principle, and arranging tools and processes to that effect. The approach to sufficiency is thus not customer-oriented, but organisation-oriented. The company seeks to reduce its environmental footprint not by curbing demand, but by refraining itself from the excessive production of its services. Upon further investigation of our case and its comparison with other cases, we strive to uncover the role of sufficiency-oriented management *dispositifs*

and the way they can complement sustainable business models in our understanding of the implementation of sufficiency in business.

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Paradoxical Tensions in Cascading Circular Business Models

Insights from the Textile and Clothing Industry

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Extended abstract

To foster systemic circularity, the principle of cascading (Sirkin & ten Houten, 1994) – within the broader circular economy (CE) framework – has been proposed to maximize resource efficiency by maintaining added value through successive uses of materials/products over time via circular business models (CBM) such as rental, reuse, and recycling (Campbell-Johnston et al., 2020; Lüdeke-Freund et al., 2018). Instigating cascading operations and aligning inter-organizational value propositions may, however, face conflicting organizational values, goals, and structures (Dagilienė & Varaniūtė, 2023; Salmi & Kaipia, 2022), potentially leading to complex and intertwined challenges known as paradoxical tensions (Smith & Lewis, 2011). These paradoxical tensions (PTs), though noted in individual CBM implementations (Daddi et al., 2019; Dagilienė & Varaniūtė, 2023), has remained largely unexplored in broader contexts like cascading operations. Thus, their understanding is essential to avoid jeopardizing systemic circularity and to make informed decisions that maximize the retention of material/product value (Campbell-Johnston et al., 2020).

The textile and clothing (T&C) industry is among the most polluting and resource-intensive sectors globally (Salmi & Kaipia, 2022; Sandin & Peters, 2018). The industry supports service-based CBMs like rental and repair, as well as reuse, remaking, and recycling (Ellen

MacArthur Foundation, 2021), making it a strong context for exploring how PTs might disrupt cascaded CBMs. Such PTs are recognized in the literature; Paras et al. (2019) found that although remaking worn-out garments can boost environmental value and enable reuse, the process is limited by insufficient technical skills, high costs, and low market demand. Consequently, these garments are frequently diverted to lower-value processes like recycling or downcycling, which, despite adding value to the materials, offer fewer environmental benefits. Considering these deficiencies, this paper seeks *to explore the challenges PTs pose to the implementation of cascading CBMs in the T&C industry.*

To address this, we draw upon cascade chain and paradox theory. Cascade chain theory compared circular flows in integrated manner like *"a river flowing over a sequence of plateaus"* (Sirkin & ten Houten, 1994, p. 215), that involves the sequential use of resources to preserve and extend material/product value. It highlights four principles to follow: *appropriate fit* indicates using the right quality resources as demanded by the task requirements, *augmentation* refers to extending resource utility and product lifetime, *consecutive relinking* signifies reprocessing and reusing resources after single use, and *balancing resource metabolism* aligns consumption with regeneration for sustainability. Paradox theory, developed by Smith and Lewis (2011, p. 382), defines paradoxes *"as contradictory yet interrelated elements that exist simultaneously and persist over time"*. Smith and Lewis (2011) sort paradoxes into four classes: *organizing* refers to internal dynamics and competing designs, processes, and structures, *performing* reflects conflicting stakeholder demands, *belonging* signifies identity tensions, and *learning* emphasizes the balance between exploration and exploitation.

Our methodology started with a content analysis of the T&C industry gathering academic insights on PTs in cascading CBMs, resulting in the identification of 12 relevant studies. This not only aided in creating pre-understanding of this complex topic but also contributed to designing our interview guide. Next, we employed purposeful sampling and conducted 26 semi-structured interviews with various European T&C industry actors, including two used textile collectors, seven fashion retail brands, six charities, seven sorting companies, and four textile recyclers. These companies utilize multiple CBMs, making cascading a key strategy for improving resource efficiency in their operations. Following the transcription of the interviews, cascading-related PTs were mapped, incorporating literature insights, along cascading principles and paradox classes. This approach enabled the identification of PT origins and the challenges they present to cascading operations.

Preliminary findings indicate that actors encounter various PTs within cascading operations, predominantly arising in terms of organizing and performing CBM activities:

When ensuring an appropriate fit, PTs related to safety/hygiene are particularly important, often leading to the overlooking of resale business models. One actor raised concerns about the safety/ethical implications of reusing old woolen textiles (which may contain

chemicals), counterfeit brands, or uncertified children's items, despite arguments for their potential second life. Another actor highlighted the challenge of ensuring the safety of protective clothing such as workwear, which, despite demand, impedes their second-hand use. Such PTs challenge cascading CBMs by diverting items from higher-value to lower-value stages in the waste hierarchy, even when these items are of adequate quality to be aligned with appropriate task demands. These tensions fall under the performing class paradox (Smith & Lewis, 2011), as they highlight conflicting socio-environmental and economic objectives.

For consecutive relinking, two types of PTs stand out more distinctly. First, several fashion retail brands emphasize that cotton-polyester blends are designed to extend garment life and enhance fabric functionality. However, this leads to recyclability issues later on, as insufficient recycling technology hampers the consecutive relinking of materials into closed-loop production systems. The opposing objectives of longevity and recyclability, each fulfilling a separate purpose, exemplify a performing paradox. Consecutive relinking of materials also confronts PTs related to global and local operations, stemming from sourcing shortages or inefficiencies in sorting and recycling. For instance, while aiming to use chemically recycled fibers from local facilities and promote nearshoring, recyclers often import waste due to insufficient post-consumer input, undermining local benefits like reduced transportation and a smaller carbon footprint. Transition to mechanical recycling further requires global operations due to underdeveloped infrastructure in Europe. Such competing designs in structuring the value chain reflect organizing class PTs (Smith & Lewis, 2011).

Although less frequently mentioned, PTs were observed in relation to augmentation and balancing resource metabolism. When augmenting clothing lifespan, regulatory mechanisms can create PTs within repair-based CBMs. Highlighted by Brändström et al. (2024), despite eco-design directive promoting long-lasting garments aimed at durability and repairability, non-adaptive tax policies – where taxes on repairing high-quality products are excessively high and those on virgin materials remain too low – discourage repair, thereby posing a challenge to its implementation. This is crucial because repair not only extends garments' lifecycle but also facilitates their consecutive relinking to higher-value loops in the value hierarchy, such as reuse. Striking a compromise between recycling and incineration represents another PT, mainly observed in balancing resource metabolism. While recycling supports CE objectives, it remains labor-intensive due to manual sorting for fiber blends, given the absence of fully reliable automated technologies. Transporting fractions to distant recycling facilities further increases environmental footprints. This often makes incineration and energy recovery more appealing, despite compromising the waste hierarchy. These structural and process-related challenges, including the implicit contradiction between environmental benefits (via cascading valuable materials) and economic realities, resemble an inter-class organizing-performing paradox. Failing to align consumption with regeneration disrupts resource metabolism and harms sustainability.

We conclude that PTs related to appropriate fit and augmentation principles pose challenges to cascading operations in inner-loop CBMs like repair and reuse. Conversely, outer-loop CBMs like recycling are impacted by PTs related to consecutive relinking and balancing resource metabolism. These tensions highlight the need for ongoing business model experimentation (like piloting new standards for second-hand safety certification, testing localized supply loops under material constraints, or redesigning policy frameworks to support repair incentives) to facilitate cascading operations. Further research is also needed on how organizations address these PTs by developing new resources and capabilities.

Keywords

Cascading, Paradoxical Tensions, Circular Business Model, Textile and Clothing

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Behavioral insights into circular practices

Enhancing urban sustainability through behavioral interventions

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Extended abstract

The transition to a circular economy is a global imperative to address environmental degradation and resource scarcity. Even if the consumer is indispensable to close the loop (Shevchenko *et al.*, 2023), there are a few studies on its impact on the circular economy loop (Niessen, Bocken and Dijk, 2023; Vidal-Ayuso, Akhmedova and Jaca, 2023). In urban settings, particularly in developing countries like Albania, individual and community behaviors play a critical role in enabling circular practices such as recycling, reuse, repair, and waste reduction. This research explores the behavioral dimensions influencing circular practices in Albanian cities, aiming to uncover barriers, motivators, and interventions for designing the proper strategies to fostering sustainable behaviors through conscious consumption (Bocken, Niessen and Short, 2022). It uses a mixed-methods approach, utilizing quantitative and qualitative data which produce findings to design experimental strategies to foster circular behaviors.

The research aligns with the experimentation-driven focus on Track 2.3, showcasing how behavioral insights can refine circular business strategies. It contributes to discussions on how emerging economies, where circular economy principles are not much explored (Luthra *et al.*, 2022), can adopt and adapt circular economy principles through behavioral change, reinforcing the importance of social and cultural contexts.

Keywords

Behavioral insights, circular economy, recycling, urban sustainability, Albania

Methodology

A mixed-methods approach was adopted to give the possibility to get both generalizable trends, but also nuanced individual experiences, ensuring the relevance and applicability of this research in real-world contexts. Quantitative data are gathered through structured surveys targeting urban residents across key cities, including Tirana, Shkoder, and Durres, which in total make up 51% of the overall population in Albania (INSTAT, 2023). Both online and paper-based versions are utilized to maximize accessibility and participation across demographic groups. The survey is organized in six sections, capturing demographic data, knowledge and thoughts on circular concepts, actual behaviour regarding circular practices, behavioral influences to explore the impact of external factors and preferences for interventions. Three open-ended questions (optional) allows respondents to provide qualitative input on barriers, suggestions for improvement, and general comments related to circular practices. The questionnaire is pre-tested with a pilot group of 30 participants to ensure clarity, relevance and reliability.

Qualitative data are collected also via in-depth interviews with stakeholders, including community leaders and local businesses. The data are analyzed using thematic coding for qualitative responses and statistical methods, including regression analysis to predict behaviors based on education level, access to facilities and incentives. Descriptive and inferential statistics provide a summary of the data and give an overview of the relationship between variables.

Results

The research provides quantitative and qualitative insights into urban recycling, repair and reuse behaviors, highlighting different barriers like cultural resistance or lack of infrastructure, but on the other hand economic constraints enforcing them to conscious consumption through reduced resource use. The findings can inform experimental strategies to foster circular behaviors (Niessen, Bocken and Dijk, 2023), proposing actionable interventions which can serve as prototypes for circular economy models in other contexts. The mixed methods approach enriches the methodological toolkit for studying and experimenting with circular economy models. By focusing on Albania, the study offers a localized perspective on behavioral experimentation that can inspire adaptions in other emerging economies. It can gives us insight on how to foster sufficiency-

oriented consumption through behavioral change or address barriers to regeneration by identifying behavioral motivators and obstacles within urban communities.

Preliminary conclusions

Behavioral interventions tailored to the Albanian urban context can significantly enhance circular practices. Key strategies may include:

- ✓ Establishing targeted awareness campaigns highlighting the environmental and economic benefits of circular practices
- ✓ Desingning incentive programs, such as discounts for recycled goods or rewards for proper waste segregation
- ✓ Improving infrastructure, such as accessible recycling bins and reuse facilities
- ✓ Leveraging social influence by engaging community leaders and influencers to normalize circular behavior

The paper emphasize the role of community leaders and businesses in co-creating circular behaviours, contributing to the understanding of multi-stakeholder engagement in designing circular business strategies. Implementing research-based strategies enhances the need of researchers to have a more engaged role in designing sustainable production and consumption patterns (Coffay *et al.*, 2024), giving practical solutions to real life problems. Most of the research on circularity is realized in developed countries, forgetting this way the concept of the hole ecosystem (Luthra *et al.*, 2022). This research will be a good contribution to give the proper framework in the behavioral context to be implemented in other similar economies.

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"Exploring the role of market orientation in aligning supply and demand for textile recycling"

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Abstract

This study explores the role of market orientation in addressing supply-demand mismatches in textile recycling. Through semi-structured interviews conducted with 20-well-known textile recyclers, this paper identifies how customer alignment, competitor awareness, and interfunctional coordination foster innovation and sustainability. Key findings highlight regulatory challenges and ethical considerations, emphasizing market orientation's potential to scale textile recycling.

Key words: Market Orientation, Textile Recycling, Circular Business Models, Supply chain Alignment.

1. Introduction

Textile recycling has gained prominence in recent years globally due to the inherent resource-draining, environmentally polluting nature of the textile industry (Sandberg and Pal, 2024). Textile recycling closes the linear flow by utilizing textile waste as raw material thus reducing the need for virgin resources (Sandberg and Pal, 2024). Globally it is accounted that not more than 1% of textile waste or non-wearable clothes are recycled, which poses a critical concern (McKinsey & Company, 2022). The effective recycling of textiles is significantly hindered by various factors related to product quality and process technology, including the high cost of advanced methods (such as chemical recycling),

limited recycling cycles, contamination with non-textile components, material composition and fiber blends, as well as color and dyeing challenges, as acknowledged in the extant literature (Celep et al., 2022). In addition, some recent scholarly works have illustrated that the major challenge also lies at the supply chain level, when detailing with different types of feedstock, and processing them to align to market demands (Ribul, 2021). For instance, Sandberg and Pal (2024) argue how supply-demand alignment along the textile recycling value chain is crucial at all stages to enable supply of feedstock for recycling and meet the customer requirements.

Previous research on textile recycling has predominantly concentrated on technological advancements (Mokhtari et al., 2020) and reverse logistics (John and Rahman, 2024), emphasizing the development of efficient recycling processes (Baloyi et al., 2024) and the optimization of supply chain operations (Chen et al., 2024) for waste collection and processing. While these studies have contributed significantly to improving the technical and logistical aspects of recycling, they have largely overlooked the economic and market dimensions of the industry. Specifically, there is a clear gap in understanding the dynamics of markets for recycled textiles, including customer demand, price sensitivity, and the challenges associated with integrating recycled materials into mainstream production. This gap is further compounded by limited research on the persistent mismatch between supply and demand, which poses a critical barrier to achieving a sustainable and scalable textile recycling ecosystem (McCauley and Jestratijevic, 2023). Addressing these overlooked areas is essential for fostering a holistic approach to textile recycling that balances technological feasibility with market viability.

A premise of this research is market orientation as a strategic approach enables companies to produce valuable and innovative goods by focusing on the needs and behaviors of customers, competitors, and employees (Taghvaee and Talebi, 2023). This approach proves particularly effective in addressing the misalignment between supply and demand by continuously monitoring shifts in market conditions and customer preferences, and enabling market-oriented firms to design products that align more closely with market demands, thereby minimizing waste and inefficiencies (Narver et al., 2004). MO has previously been recognized as a logical framework for examining supply-demand misalignment across diverse contexts and industries, such as food (Kharlamov et al., 2013), Italian luxury (Caniato et al., 2009), and textile and fashion(Braunscheidel and Suresh, 2018). However, its application within the textile recycling industry remains largely unexplored, revealing a notable gap in the existing literature.In the context of the Circular Supply Chain (CSC), Market Orientation (MO) has proven effective in enhancing resilience through proactive adaptation to disruptions, fostering customer-centric innovations, and promoting dynamic capabilities. It enables alignment between supply and demand by leveraging strategic collaborations, supplier innovativeness, and data-driven decisions, mitigating uncertainties while improving flexibility and responsiveness (Wong and Ngai, 2024). Studies have shown that market-oriented businesses tend to perform better in unpredictable and tumultuous conditions, as they are adept at responding to dynamic market demands and environmental uncertainties (Calantone et al., 2003). This adaptability is particularly relevant in the textile recycling industry, where businesses must navigate complex challenges such as fluctuating consumer demand, the variability of recyclable material supply, and the evolving regulatory landscape. Furthermore, market orientation

fosters strong relationships with suppliers and other stakeholders, enhancing collaboration and the overall effectiveness of the supply chain (Mostafiz et al., 2021). This strategic focus on market needs and continuous innovation ensures that textile recycling firms can adapt to changing market conditions and maintain a competitive edge (Frösén et al., 2016). In light of these challenges, this paper examines how market orientation can address supply-demand misalignment in the textile recycling industry.

2. Theoretical frame of reference

Market Orientation (MO) explains how companies align strategies with customer needs and market dynamics. According to Narver and Slater (1990), market orientation consists of three components: customer orientation, competitor orientation, and inter-functional coordination. These enable companies to deliver value, stay ahead of competitors, and coordinate organizational efforts to meet market demands. Kohli and Jaworski (1990) add that gathering, sharing, and acting on market information are essential activities for effective market orientation.

Customer orientation enables firms to understand and address the current and future needs of their target markets (Ketchen et al., 2007), fostering innovation and competitive positioning (Rosenzweig and Grinstein, 2016). It enhances adaptability to changing environments and facilitates effective networking and opportunity identification, supporting organizational success (Park et al., 2017).

Competitor orientation enables firms to anticipate and respond effectively to rival actions through proactive strategies (Narver and Slater, 1990) that drive innovation and restructure market dynamics, as well as responsive strategies that adapt to competitive threats. These approaches enhance organizational learning and innovation proficiency, securing a sustainable competitive edge (Day and Wensley, 1988).

Inter-functional coordination improves organizational performance by promoting collaboration, efficient knowledge sharing, and integrated decision-making across business units (Ellegaard and Koch, 2012). This alignment of internal processes enhances innovation, operational efficiency, and adaptability to dynamic market conditions, driving success in competitive environments.

3. Methodology

This research employs an exploratory and abductive approach to integrate conceptual and contextual perspectives, addressing the nascent state of textile recycling literature, particularly in market-oriented aspects. To achieve this, semi-structured interviews were conducted with 20 industry practitioners, including founders, CEOs, and top managers. The participants represent a diverse portfolio of companies, varying in size, geographical origins, and recycling practices. These companies originate from countries such as Finland, Sweden, Spain, India, Italy, and Turkey, among others, and their recycling methods span chemical, mechanical, and thermo-mechanical processes. Their customer bases range from B2B (brands and manufacturers) to B2G and B2C markets, producing recycled outputs like fibers, yarns, fabrics, premium denim, and bedding products. Leadership positions of the

interviewees reflect their strategic and operational oversight. Data collection was further complemented by secondary sources, including academic journals, industry reports, and corporate materials. The collected data were analyzed using thematic analysis, categorizing and codifying findings under market orientation, external influences, and sustainability goals. The iterative refinement of the knowledge instrument and the achievement of data saturation ensure reliability and contextual relevance.

4. Results and Analysis:

Our findings align with the theoretical subcategories of Customer Orientation, Competitor Orientation, and Interfunctional Coordination. In addition, two new themes emerged from the interview analysis—external factors and ethical and sustainable considerations—which the interviewees identified as significant influences on market orientation. The analysis delves into how textile recycling companies navigate these complexities, responding to market demands while adapting to operational and regulatory challenges to promote growth and sustainability.

Customer Orientation

For textile recycling, customer orientation can help firms design recycled products that align with market demand, improving adoption rates and reducing supply-demand mismatches. By meeting customer preferences, it also drives innovation, ensuring the development of high-quality, desirable recycled materials, closely fit to the expectations of the target market. Textile recyclers employ various customer-oriented practices to align their products and processes with market needs and expectations while gathering target market preferences. A majority of recyclers emphasized the importance of maintaining close communication with brands and customers and leveraging their insights during the design phase. This practice is considered a critical method for collecting data prior to production. Additionally, some recyclers reported collaborations with universities and industry practitioners, enabling them to forecast market trends and develop products that closely align with customer demands.

Certain recyclers operate branches or maintain partnerships with companies both within and beyond the European Union. These collaborations not only enhance their access to market intelligence but also facilitate supply chain and sales processes. Furthermore, some recyclers collect customer feedback through direct meetings, refine products iteratively using trial-and-error approaches, and engage sales teams to assess the feasibility of modifications or customizations. All mechanical recycling companies, which process input from diverse sources such as post-consumer and post-industrial waste, address significant health and safety challenges in B2B sectors by providing transparency and traceability through digital product passports (DPPs), ensuring product quality and provenance (Adisorn et al., 2021).

Implementing customer-oriented practices poses significant challenges for textile recyclers, as market actors often struggle to balance innovation with broader market demands. Recyclers focusing on high-quality innovations—such as fibers with purity comparable to virgin materials, zero-waste approaches, or unique processes for discarded textiles—

sometimes fail to align with customer expectations or industry needs. While these innovations offer a competitive advantage (Farida and Setiawan, 2022), limitations in market readiness and infrastructure create substantial barriers, particularly affecting financial sustainability. This misalignment is more pronounced among chemical recyclers producing high-purity fibers and smaller recyclers targeting niche markets, who often overlook the pressing need for standardization and cost-efficiency.

Competitor Orientation

In textile recycling, competitor orientation can help firms identify market gaps that have not been filled and innovate processes to outperform rivals, aligning recycled materials supply with market demand. This strategic focus ensures competitiveness while fostering the adoption of sustainable practices. The interviewees highlighted several competitor-oriented practices aimed at maintaining a competitive edge in the textile recycling industry. These include offering unique recycled fibers with diverse applications and high sustainability standards, specialization in recycling and pre-processing, and providing tailored services and products with high environmental standards. Additionally, recyclers leverage innovation and continuous R&D, collaborate with municipalities and local partners, focus on producing 100% recycled (non-blended) products, and develop unique, innovative solutions. Professional networking with peers, participation in industry events, and maintaining cutting-edge technological advancements were also emphasized. While some recyclers prioritized networking, others concentrated on innovation and technological uniqueness. However, the competitive landscape remains challenging, as recyclers face cost disadvantages compared to virgin fibers and lower-cost imports from outside the EU.

Interfunctional Coordination

In textile recycling, inter-functional coordination can streamline supply chain operations and ensure seamless integration of recycling processes with market demand. By fostering collaboration across departments, firms can better meet customer needs and enhance the adoption of recycled materials. All recyclers employ a combination of formal and informal strategies to address market and regulatory dynamics, emphasizing interfunctional coordination through regular meetings, collaborative goal-setting, and personnel training to enhance knowledge sharing and responsiveness. By leveraging customer feedback, they improve quality and traceability to align with market trends and sustainability goals. Collaborations with research institutions and industry alliances further strengthen their technical expertise and innovative capacity, fostering competitiveness in a dynamic market. Additionally, small team sizes and flexible organizational structures enable efficient communication and decision-making, allowing incremental adaptations based on experience. However, the small startups stated that, by maximizing the size of the company in the near future, the current method of implementing interfunctional coordination would not be effective. They would either take advantage of external companies to facilitate this process or restructure organizationally.

External Factors: EU Regulations and Policies

EU regulations serve as both enablers and challenges for textile recyclers. Supportive policies include funding opportunities and legislative incentives for circularity, which encourage the adoption of recycled materials. However, inconsistencies in waste management policies across regions, unclear guidelines, and limited access to high-quality recycled pulp hinder progress.

Recyclers in Northern Europe benefit from clearer regulations and infrastructure, while those in Southern and non-European regions face greater barriers, such as logistical and economic hurdles. These disparities force companies to adapt their strategies and align their operations with evolving regulatory landscapes.

Ethical and Environmental Challenges

Operational practices, such as exporting textile waste to emerging markets for sorting, raise significant ethical and environmental concerns. Low-cost labor in these regions often involves unsafe working conditions and exploitation, including child labor, contravening UN Sustainable Development Goals (SDGs). Furthermore, the environmental impact of transporting waste back and forth undermines the sustainability of these operations.

5. Conclusion

This study examines how market orientation influences textile recycling by tackling supply-demand mismatches, which pose a significant obstacle to scaling operations. The findings highlight the market-oriented practices adopted by textile recyclers and how these practices are adjusted based on factors such as recycling methods, infrastructure, and company size to meet supply and demand. Additionally, the study briefly addresses the barriers recyclers face, including high production costs, low demand, and regulatory complexities. By aligning product offerings with customer preferences, promoting internal collaboration, and responding to competitive pressures, recyclers can meet unmet market needs while advancing sustainability goals. However, challenges such as regulatory compliance and ethical considerations persist. The study emphasizes the critical role of close communication with customers, collaborations, and high responsiveness to customer feedback, as well as the challenges of balancing innovation with market needs, in achieving precision, aligning supply with demand, and ensuring global competitiveness.
Future research should explore absorptive capacity's role in enhancing industry adaptability to market and regulatory shifts. Comparative studies across EU and non-EU contexts could illuminate how differing regulatory landscapes influence circular business models. Additionally, longitudinal studies on the environmental and societal impacts of scaling textile recycling operations are essential to mitigate potential rebound effects and ensure ethical practices. By addressing these areas, future research can further advance the sustainability and resilience of the textile recycling ecosystem.

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Leveraging Circular Business Models for Social Inclusion: Empowering Low-Income Families in Developing Countries

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Extended abstract

Circular economy (CE) transition is progressively gaining attention as a solution to sustainability challenges, such as resource depletion, waste generation, and climate change. Circular business models (CBMs) are a means to achieve this, where instead of a linear "take-make-dispose" philosophy (Bocken et al., 2016), companies minimize, reuse and recycle materials. Although circular business models have been shown to be quite promising for advancing sustainability, there is an ongoing discussion around the inclusivity of these models, especially in the context of vulnerable populations. More vulnerable sections of the population, including low-income communities, women, rural populations, and marginalized groups, may not be able to take advantage of the opportunities and benefits that circular models may provide (Cohen et al., 2021). This study aims to identify the barriers that hinder vulnerable populations from accessing and deriving value from circular business models (CBMs), and to recommend scalable strategies and policies that could reinforce the effectiveness of the CBMs among the vulnerable populations.

Circular business models potentially offer environmental sustainability and economic resilience benefits, but vulnerable populations face several barriers toward accessing circular business model benefits. Usually, these populations experience inadequate access to resources, technological impediments, a lack of financial capability, and low support from the policy domain (Lacy et al., 2020). Consequently, these groups are more vulnerable to missing the boat on circular economy initiatives, cutting themselves off from new jobs, sustainable livelihoods and improved social mobility. In addition, scientific studies about both the intersection of circular economy principles and social inclusion as well as the opportunity of designing circular business models specifically for underserved groups is

scarce (Rizos et al., 2016). There are no bottom-up strategies and policies aimed specifically at transitioning to a circular economy which, if implemented as a blanket approach, could ultimately lead to increasing inequality and prevent the circular economy from reaching its full potential.

The purposes of this study are;

- Explore the barriers that prevent vulnerable populations from benefiting from circular business models.
- Review of existing public policies and frameworks to foster vulnerability incorporation in circular business models
- Generate policy recommendations and scalable strategies to stimulate the positive effects of circular business models on vulnerable populations, improve access to and ensure the inclusion of marginalized groups in circular economic opportunities.

In this Study, government officials responsible for decision-making, public governance and public programs promotion linked to topics such as economic development, sustainability and social equity. In order to obtain a balanced understanding of the topic, officials with different roles and expertise were selected. Deliberate purposive sampling was performed in order to include individuals who are likely to have a wide perspective on the intersection between circular economy practices and vulnerable populations. This strategy is essential, both for gathering data on targeting any harmful impact of government policies on historically marginalized communities, particularly low-income communities, women, and minorities. This case study focuses on a 15-government official sample. The use of this level of sampling is justified as qualitative research focuses on qualitative data, which can ultimately help you understand broader social phenomena without being too cumbersome in terms of the amount of data since, depending on the qualitative method used (Yin, 2018), the sample size naturally needs to remain manageable. "A sample size in a qualitative study can be anywhere from 5 to 30; the exact number will depend on the study and the data saturation goals of the project" (Patton, 2002). The sample size also provided different perspectives from various segments of government, including environmental policy, economic development, and social equity, which determined a nuanced understanding of the research subject.

Many aspects of circular business models can be challenging for vulnerable populations to engage with or benefit from. Findings of this study shows that socio-economically disadvantaged groups may not have the technology, infrastructure or know-how to participate in circular economy practices. As an example, rural small-scale businesses may lack access to recycling facilities or remanufacturing facilities (Bocken et al., 2016). The exclusion is amplified by the lack of information on how to adopt circular practices or a transition to a circular business model. Common circular business models also typically rely on large initial investments in infrastructure, innovation or technology that may not be feasible for marginalised communities. Furthermore, expensive repair and maintenance services and the absence of financial incentives or subsidies also reduce the participation of vulnerable populations in circular initiatives (Lacy et al., 2020). Technology-intensive processes, such as digital platforms to track goods or automated recycling technologies, are

often central to the move to circular models. Such technologies may be inaccessible to vulnerable groups, or the groups may lack the capacity to use them, preventing the groups from engaging with circular business (Cohen et al., 2021). Striking the right balance between the needs of vulnerable populations and environmental requirements can also lead to government policies and institutional frameworks that do not meet the diversity of organizations engaged in the circular economy, and their specificities. Moreover, social norms and cultural perceptions constitute limits to the acceptance of circular practices, such as sharing economies or product leasing (Rizos et al., 2016).

Keywords

Circular Economy, Business Model, Circular Business Model, Case Study, Developing Nations

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It´s the tensions, stupid!

Why hybrid circular business models should be more in the spotlight

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Abstract

Circular business models are challenging, especially if circularity is to exploit its full transformation potential and thus go beyond efficiency and consistency. Unfortunately, there is no blueprint for such a transition; it requires careful observation and experimentation. What exactly is the difficulty? It's not (only) about new products and how materials can be replaced; it's about the fact that circularity requires logics to be overlay that may contradict each other and the tensions that arise as a result are not practiced. However, there are organizations that live (well) with anchoring different logics in their business models: hybrid business models. From a circular transition perspective, these can be particularly exiting: because business models as change agents need points of contact in the mainstream logic of the regime and in alternative logics in the niches, which is what the circular economy has. But how exactly does that work? We still have to try it out, and the investigation of circular hybrid business models (e.g. those for which design is important in addition to market logic) is a hopeful combination. Three business case studies in the high-end office furniture sector will be used to examine how circular tensions are dealt with. The initial results seem to indicate that the “gateway” of simple circular strategies is also being used to discuss more advanced strategies. Whether these will actually be used and what this will look like is of course not yet clear, but it is worth taking a closer look.

Keywords

Circular Business Models, Hybrid Business Models, Sufficiency, Sustainability Transition, Upscaling of Niches.

Main text

Despite considerable economic, ecological and social win-win potential, the transition to a circular economy is not yet a self-runner (Welch et al. 2017; Morseletto 2020; Zwiers et al. 2020; Jaeger-Erben et al. 2021; Corvellec et al. 2022; Suski et al. 2023). There is no blueprint for transitioning towards circularity or a circular business model, especially if it is not based on consistency and efficiency strategies. These strategies are more in line with the current economic system and make it easier for organizations to integrate and develop business models and business cases from.

Sufficiency, on the other hand, tends to contradict the existing logic, making it more difficult for organizations to incorporate it into their business models, as it does fit well into existing strategies and structures - precisely because it is different. This can also be seen from a transformation perspective: the more radical a niche is, the more difficult it is to fit it into existing structures (Augenstein et al. 2020).

However, despite these challenges, organizations and their business models are seen as having enormous potential for transitions and the transition to a circular, sustainable society would be more difficult without these: “Business model have been ascribed the potential to disrupt entire industries, because they connect multiple actors, mediate between the production and the consumption side of business and support the introduction of novel technologies into the market”: (Bidmon & Knab, 2017: 903). So doing and thinking things differently, developing innovations and bringing them into the market and thus bringing about change is often the role of organizations. However, organizations are faced with the challenge of bringing together, developing or overcoming different requirements: being economically successful, incorporating sustainability and circularity into their business model but prevent greenwashing.

But what exactly is the difficult part? In the context of integrating sustainability into their business model, organizations are increasingly confronted with new stakeholder requirements and competing expectations (Battiliana et al., 2022; Kratz & Block, 2017). It is not just about developing innovations in business models and/or products or the value chain (even if that is hard enough). If it is meant seriously, then the transition is about changing fundamental logics and existing "industry recipes" (Bidmon & Knab, 2017) that have shaped the organizations up to now.

What do logics in transitions mean for business models?

Institutional logics determine how individuals and organizations 'produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality' (Thorton & Ocasio, 1999: 804). Logics thus provide precisely the rules 'about how to interpret organizational reality, what constitutes appropriate behavior, and how to succeed' (ibid.). While organizations are guided by the logic of the market and industry, they also face other logics. For example, if their core business is in the public sector (e.g. healthcare), or if aesthetics play a major role in the business model (as in fashion or design), or if they are a family business (Laasch, 2018; Silvia & Nunes, 2022).

However, these differing logics do not automatically lead to change. Transition research assumes that entire established, non-sustainable social practices, institutional rules and cultural norms change in the direction of sustainability for a transition.

A basic theoretical assumption of the multi-level perspective (MLP) (Geels, 2011) is that actors are characterized in their actions by structures that they (re-)produce themselves through their actions (Giddens, 1984). Under the further assumption that actors are fundamentally capable of critically reflecting on existing structures and their actions, they are also capable of changing structures. The analytical focus of the multi-level perspective is on the complex interplay between niches in which actors consciously develop and test sustainable alternatives, the existing regime, i.e. the mainstream of established and often unsustainable structures in the economy and society and the landscape, i.e. the trends and shocks from “outside” that initiate change through pressure.

Niche innovations, which often make their way into the regime with the help of landscape pressure, initiate changes to social structures and thus lead to a - in best case - sustainable system, are therefore of great importance in transition research (Kemp et al., 1998; Raven, 2005; Schot & Geels, 2008). Niches are characterized by alternative and proactive action based on other logics and the development of alternative ideas and innovations, e.g. in repair cafés, where the focus is not on buying new items or even just commercialized repair, but on the continued use and, if necessary, upgrading of existing items - in best case through one´s own (newly developed) skills in a community. So in transitions, niches provide the opportunity to do something different, precisely by not doing things according to existing logics (Fuenfschilling & Truffer, 2014).

Niches thus emerge precisely where actors try out alternatives that differ from the prevailing logic and the rules and routines of the regime, and where safe spaces for alternative actions are created (Geels & Schot 2007). Going beyond technology, it emphasizes new ways of acting (practices), thinking (including narratives and imagination) and organizing (structures) (Ehnert et al., 2018: 2). These novelties break with the prevailing, often unsustainable logic (which is why they are novel or different in the first

place) and must be ‘upscaled’ in order to achieve systemic change (Ehnert et al., 2018; Von Wirth et al., 2019; Loorbach et al., 2020). This ‘upscaling’ occurs in particular when niches find connecting points in the

regime, but cannot be completely captured by the regime, i.e. where different

logics meet and can somehow be brought into tension (Augenstein et al. 2020). Organizations that are tasked with the management of diverse logics, with the objective of achieving productive tension, are designated as hybrid business models (Battilana & Dorado, 2010). What do these tensions look like? It is in the nature of hybrid business models that they are defined by often mismatching logics and practices (Besharov & Smith, 2014; Greenwood et al., 2010). Hybrid business models are "in between" and must combine the different logics to remain in the regime and the common logic there while still taking other logics into their entrepreneurial actions. This requires good coping mechanisms that lead to an integration or productive combination of logics (Greenwood et al. 2010; Lounsbury & Crumley, 2007; Pache & Santos, 2013; Tracey et al. 2011).

Why is experimenting with hybrid circular business models so exciting against this background?

Successful business models that attempt to incorporate circularity are often such hybrid business models: even if they are established regime actors, they operate by incorporating the “new circular” in niches or between the two levels and can thus take on all three roles of business models in transitions (Bidmon & Knab, 2017). They are shifters between the worlds by combining the different logics and are thus constantly under tension to stay in the regime and the common logic there and still take other things into their entrepreneurial actions. They are thus constantly under the tension of having to harmonize the different logics, especially if these logics are not very compatible with each other and may even contradict each other in some cases (Besharov & Smith, 2014; Greenwood et al., 2010). And yet, at first sight, it is possible to find starting points for circular strategies for (almost) every business model that could function as a business case in the future (Geissendoerfer et al. 2020; Luedeke-Freund et al., 2018; Bocken et al., 2022). But how do hybrid business models deal with the tensions in a circular economy? We still have to try it out and hybrid business models that want to incorporate circular logics are very interesting:

With the help of three business case studies our research project “Circular.Office” (June. 2024 - June 2027) will examine the efforts of higher-end interior and office furniture organizations that can be considered hybrid organizations in moving from linear to circular business models/products. Why can these be considered hybrid business models? Because the “industry recipe” (Bidmon & Knab 2018) in the office furniture sector must also take

into account a logic of design or art in addition to a strong logic of the market and cost efficiency, at least for more upmarket offerings.

As all three organizations place their offers here in particular, they are also forced to constantly consider what the best approach is for the various products and offers, of course without knowing whether taking this type of design into account will be profitable. In other words, even without taking circularity into account, they are exposed to constant tensions that they have to endure time and again and, in the best case, utilize productively. The thesis is that these hybrid business models can deal with the tensions that can arise from the integration of circular strategies. Especially if the entry into the topic can be organized with circular strategies that are better suited to previous logics. Initial analyses show that circular economy approaches are being discussed in these organizations, suggesting transitions can be made at various times. For example, a strategy like refurbishment can be implemented while other strategies are being developed. Also, using circular processes and changing business models will be important in this shift.

Circular strategies with different logics to existing ones may seem insignificant, but radical change is also evolutionary and incremental. And this is precisely what makes the circular economy and hybrid circular business models so potentially transformative: Circularity seems very well suited to effecting a transition towards sustainability, precisely because it has points of convergence in both, niches and regimes. The design of “in-between” is of course still challenging, but the barrier of getting a point of convergence at all has already been overcome and there is a continuum of circularity on which the business model can develop. Of course, it is important to realize that the pressure for change does not stop at the introduction of regime-adapted answers only, but that the other, like sufficiency are also considered. Only in this way can circularity always remain “between the worlds” and not be completely absorbed into the regime - with too little ecological impact.

However, the breadth of the concept of circularity means that strategies can be found in a circular economy that align well with existing logics in the regime, in which, for example, resource and cost efficiency are considered together. Conversely, the circular economy also offers points of convergence with sufficiency strategies and current niches (e.g. community repair cafes). These function in a complete different way and incorporate alternative logics. They are therefore somehow in competition with the prevailing market logics and have the ability to bring about transitions for precisely this reason.

If we can endure or use the tensions productively, hybrid circular business models offer great potential for more radical strategies. These strategies are otherwise more likely to be located in niches due to their radical nature and would otherwise have hardly any points of contact with the regime. Despite the fact that sufficiency is not reflected in many circular economy approaches, it is possible to identify points of contact with sufficiency if circularity is understood comprehensively. This means not only by completely dispensing with

products (refuse), but also by not producing new ones, but by extending the product life cycle through various strategies (reuse, repair, refurbish, remanufacture, repurpose).

The tension between these divergent logics is a key factor in the complexity of circularity, and if this tension is not leveraged productively, it can impede the transition towards a circular future.

So we need a better understanding of how organisations can balance these tensions. This will open up organizational, reflexive adaptation processes and learning spaces (in protected niches). By illuminating these adaptive learning spaces, we can better understand the dynamic interactions between sustainability-oriented niche strategies and alternative logics, and their links to previous, unsustainable regime structures. This will help us harness the potential of circular transitions for organizations, both from an organizational perspective and from a transition perspective.

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Exploring the Industrial Symbiosis Behaviour: An analysis in SMEs, Italy

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1. Introduction

The 2023 IPCC Synthesis Report highlights the detrimental effects of climate change, particularly on industries like agriculture, fishing, and tourism, impacting overall economic growth. In response, enterprises are shifting toward strategies that create economic, social, and environmental value. One key approach is the Circular Economy (CE), which aims to address the limitations of the linear economy by promoting resource efficiency through reduction, reuse, and recycling (Yuan et al., 2006; Schroeder et al., 2019). A 2024 survey revealed that Italy leads Europe in circularity performance, with a recycling rate of 72% for all waste types. However, these figures fall short of European targets, particularly with an 8.5% increase in material consumption from 2018 to 2022, highlighting the need for collaborative circular strategies. Industrial Symbiosis (IS), a collaborative economic approach where companies exchange resources and byproducts, is crucial for implementing CE at the meso level (Chertow, 2007; Neves et al., 2020).

IS has been extensively explored in the literature (Chertow et al., 2021). Scholars have conducted theoretical reviews (Boons et al., 2011), offering overviews of academic work (Akhtar et al., 2019) and historical mappings of IS development (Zhang et al., 2015). Practical implementations have also been examined (Mirata, 2005; Boons et al., 2011), highlighting key barriers (Mortensen & Kørnøv, 2019; Neves et al., 2019) and enablers (Jiao & Boons, 2014; Park et al., 2018). Further research delved into the motivations behind IS adoption and factors affecting participation in IS networks (Chertow, 2007; Ferreira et al., 2019). However, to the extent of our understanding, there are no studies investigating the predictors of IS behavior. This study aims to fill this gap by investigating which predictors—awareness, trust, environmental commitment, satisfaction, social pressure, intention to cooperate, and organizational purpose orientation—impact IS behavior.

2.Literature Review and Hypothesis Development

This study distinguishes between and behavioral predictors of IS behavior, based on Theory of Reasoned Action (Fishbein&Ajzen,1975). According to this theory, human behaviour is determined by *behavioural intentions*, i.e., the reasons driving the individual to engage in the adoption of a certain behaviour, and by attitudes and subjective norms. *Attitudes* are the evaluations of the individual which, subject to personal beliefs and influences, lead to the development of a behaviour judgment. The *subjective norms*, on the other hand, concern perceptions from external sources, such as social pressures, and how significant others consider that behaviour to be (Conner & Armitage, 1998). Based on this theory, we

distinguish factors into subjective norms, behavioural intentions and attitudes. The subjective norms involve the perceptions from the internal and personal sphere to the individual and include: awareness, environmental commitment, satisfaction, trust and organizational purpose orientation. The behavioural intentions concern the reasons behind an attitude, including intention to collaborate. The subjective norms are the perceptions coming from the external sphere to the individual and include the social pressure.

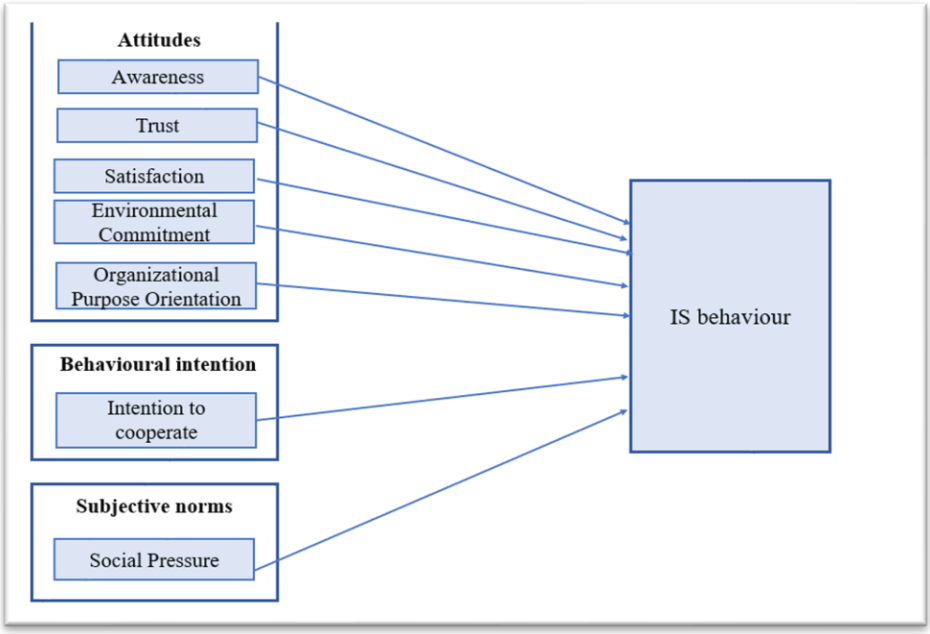


Fig. 1. *Theoretical model investigated in this study.*

(1) *IS Behavior:* IS fosters industrial collaboration, optimizing resources, reducing waste, and lowering environmental impact, all while creating a circular ecosystem that promotes both economic and sustainability benefits (Zhu & Ruth, 2014; Harala et al., 2023). (2) *Awareness* of environmental issues influences business decisions and the adoption of CE principles, with higher awareness expected to positively influence IS behavior (Bamberg & Möser, 2007; Masi et al., 2018). (3) *Trust* plays a crucial role in facilitating cooperation, reducing risks, and fostering collaboration, suggesting that trust is a predictor of positive IS behavior (Hardin, 2006; Ryciuk & Nazarko, 2020). (4) *Social pressure* from regulatory bodies, markets, and communities can drive businesses toward more sustainable practices, further influencing IS behavior in a positive manner (Roxas & Coetzer, 2012; Singh et al., 2016). Similarly, (5) *Environmental commitment* is a key driver for the adoption of sustainable practices, as organizations with strong environmental goals tend to engage more in IS (Roy & Thérin, 2008; Arsawan et al., 2024). (6) *The intention to collaborate* is another factor, with organizations more likely to engage in IS when their values and principles align with collaborative efforts (Ajzen, 1991; Khan et al., 2020). (7) *Satisfaction* derived from past collaborations enhances business performance and solidifies cooperation, making satisfaction an important predictor of IS behavior (Anderson & Narus, 1990; Sila et al., 2006). Finally, (8) *Organizational Purpose Orientation* reflects how purpose-driven

companies, which aim to balance economic, social, and environmental goals, are more likely to engage in IS (Rey et al., 2019; Mayer, 2021).

Methodology and Data Collection
The study employs a survey to collect data from Italian companies engaged in environmental or CE initiatives. Based on the literature review results, a survey among Italian SMEs companies was designed and conducted between July 2023 and September 2023. The questionnaire evaluates seven constructs—awareness, trust, environmental commitment, intention to collaborate, satisfaction, social pressure, and organizational purpose—using multiple-item scales. Data on company sector, respondent role, employee count, and certifications are also collected to analyze their influence on IS behavior. Future research will test the proposed hypotheses to validate the effects of the predictors.

Keywords

Industrial Symbiosis, Small and medium enterprises (SMEs), Sustainability, Questionnaire survey

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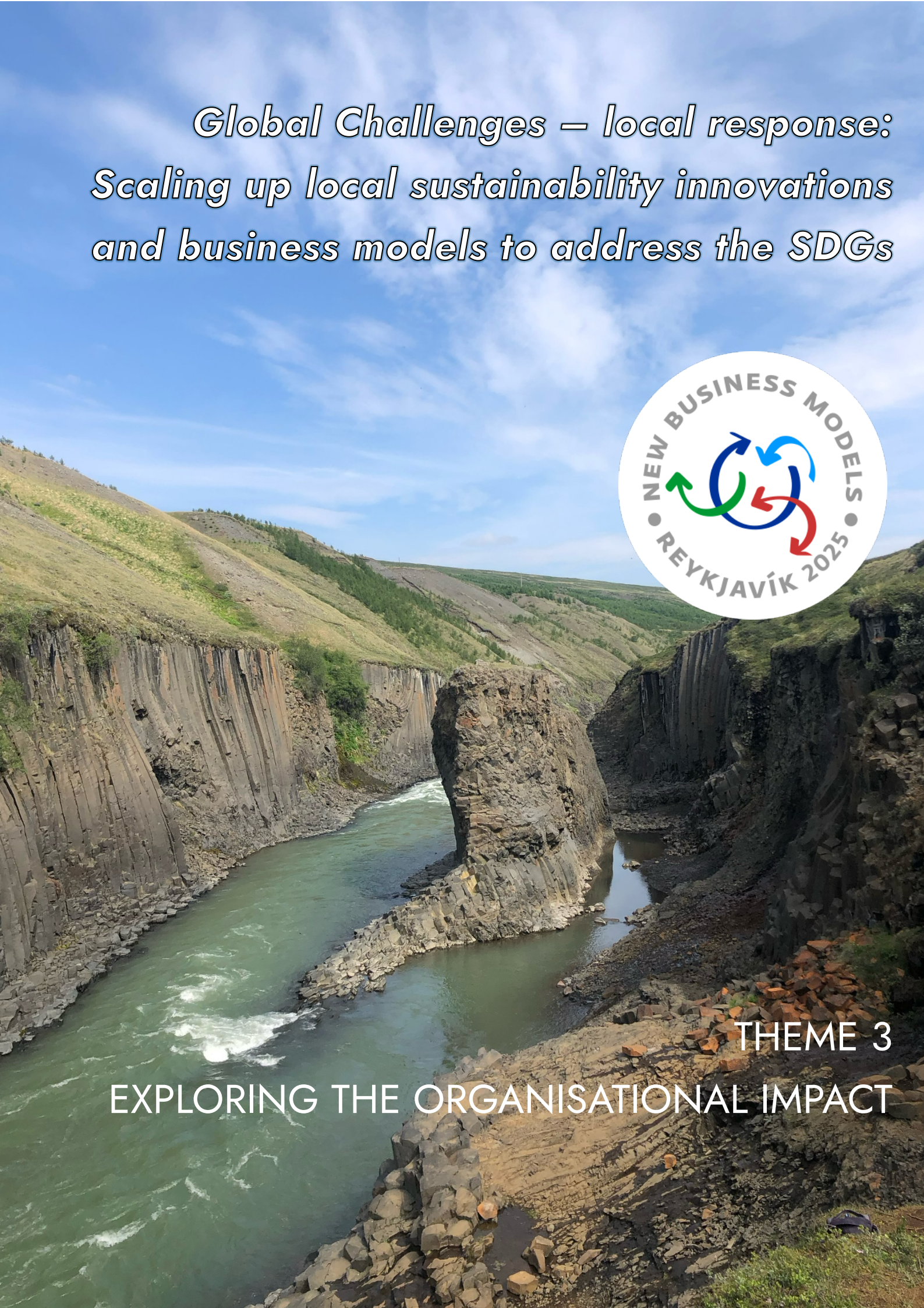
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Global Challenges – local response: Scaling up local sustainability innovations and business models to address the SDGs



THEME 3

EXPLORING THE ORGANISATIONAL IMPACT

EXPLORING THE ORGANISATIONAL IMPACT

How family imprinting shapes family business models?

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Abstract

We explore how family imprinting shapes family business models, using the value logics lens. We conducted 68 interviews across 15 Chinese family businesses and analyzed them using a thematic template analysis. Our findings show how family business models' value proposition, creation, exchange, and capture are shaped by three distinct family imprinting practices, namely practicing traditions, family storytelling, and family leading by example. These practices' shaping effects, both assume the form of maintaining family business models and changing them. We firstly contribute to business model research by exploring how family business models are influenced by family imprinting. We also contribute to the family business literature by embedding the family imprinting perspective as an important driving force during family firms 'development. Finally, we contribute to imprinting research by offering the value logic lens as a conceptual bridge between the family members' cognitive logic and the logics of action of a family business.

Keywords

Family imprinting, family business model, value logics

Introduction

This paper seeks to find out a particular organizational value logic for family business from a cognitive perspective (Laasch, 2018b; Ocasio & Radoynovska, 2016). The general concept of the business model discusses how companies do business, aiming to pursue economic goals (Zott & Amit, 2007). However, in family firms, with the features and uniqueness of family, the strategic goals are beyond pure commercial ones, but also emphasize on non-commercial goals, for instance, social and environmental concerns (Adendorff, Venter, & Boshoff, 2008). From a cognitive lens, along with the development and growth of the family business, shared beliefs, rituals, practices, and legacy help family firms persist over time, although these might constraint the changes of the organization (Lumpkin, Martin, & Vaughn, 2008). It implies the strong recognition of previous generation who imprinted the organizational tradition especially at the establishment stage (Stinchcombe, 1965) might survive and persist over time (Tilcsik & Marquis, 2013), within and among generations (Hammond, Pearson, & Holt, 2016).

Even though family business research has been widely discussed, there is still potential for us to combine family business research with business model as well as introducing a cognitive lens to better understand how cognition might influence the business model. From the previous research, firstly, there is a lack of family business research being discussed from a cognitive level. For instance, Erdogan (2020) applies a family imprinting perspective in discussing managing traditions and innovations paradox in family business. Marques et al

(2022) explores a family imprinting approach to nurturing willing successors: evidence from centennial family firms. Social emotional wealth in family business is also being discussed as part of the cognition topic (Dayan, Ng, & Ndubisi, 2019; Vardaman & Gondo, 2014). Secondly, there is little research combing both business model with cognition perspective. Outside the family business discussion there is a thriving research string that explores the link between business models and cognition, to analyze how cognition shapes or accelerates business models (Frankenberger & Sauer, 2019; Martins, Rindova, & Greenbaum, 2015; Snihur & Zott, 2020).

To close the research gap, we use family imprinting perspective as the entry point, we identify three key items of family imprinting and 4 value logics of family business, and we further investigate how these key items of family imprinting influence the value functions and how it works to accelerate the family business model shaping and transformation. Therefore, we generate a key research question: *How does family imprinting play a role in shaping family business models under value logics lens?* To address the research question, we used a qualitative research method, conducting interviews and doing multi-case studies. Semi-structured interviews allowed us to go deep into understanding why and how family imprinting exerts the functions and to what extent family imprinting shapes the value logics in family firms. We make three main contributions. First, we contribute to the family business literature by discovering family imprinting as an important shaping force of family business models. Secondly, we contribute to business model research by exploring how

family business models are influenced by family imprinting. Finally, we contribute to the imprinting research by offering the value logic lens as a conceptual bridge between the family members' cognitive logic and the logics of action of a family business.

Theoretical background

We will now combine the value logic of family business and family imprinting as a cognitive perspective to build our theoretical argument.

Value logic of family business

Business models have been conceptualized as a company's logic of value proposition, creation, capture and exchange (Laasch, 2018a). Business models are how company works to achieve goals by creating value in both economic and non-economic aspects (Massa, Tucci, & Afuah, 2017). Business model also discusses the value proposition and delivery to their stakeholders (Teece, 2007). These ideas emphasized the importance of business models as a strong support to achieve the firms' financial goals such as profits, market share and firms' blossom. Yet as the time goes on, business model concept has been transformed from description of how a firm work (Magretta, 2002) to optimize the daily operation by configuration of business activities (Zott, Amit, & Massa, 2010). Moreover, the business model reflects to what extent the company could achieve its value in a strategic way (Casadesus-Masanell & Zhu, 2013).

Family imprinting on business models

Business model is shaped by a firm's decision making through cognitive process and

mental model (Amit & Zott, 2015; Martins et al., 2015). We applied imprinting as a cognitive lens to explore how it shapes the business model in a certain way. Imprinting is a process through which a focal entity develops characteristics that reflect prominent features of the environment, and such characteristics persist despite significant environmental changes in upcoming periods (C. Marquis, Glynn, & Davis, 2007). Following Marquis and Tilcsik (2013), the main elements to describe an imprinting situation are the focal entity (entity bearing the imprint), the sources of imprints (imprinting entities), the sensitive periods, the imprinting mechanisms, and the resulting imprinting content, and especially the previous generation (Erdogan et al., 2020), with the incumbent leader found to be highly influential, especially if they also happen to be the founder. Other possible sources of imprints are the family business itself and its other members, as well as other organizations and their members.

Methodology

We conducted 68 semi-structured interviews in 15 family firms. The semi-structured interviews ranged from 40 to 45 minutes in length. The interviews were recorded, and transcribed. The participants all signed the consent form and agreed with the ethical forms. During the interviews, notes were taken when interviewees mentioned important information in order to enrich the data.

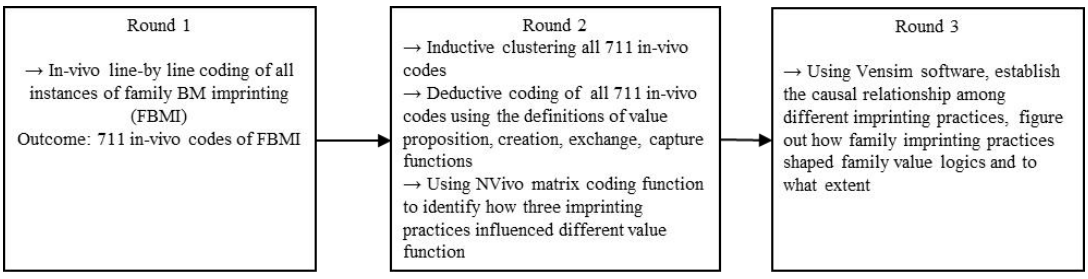
Sampling rationales

We applied purposive sampling, in order to improve the validity. Purposive sampling is conducted by deliberated selected the samples rather than random picking (Bryman, 2016).

Among our samples, 15 family firms are in 6 different cities and are from 4 industries. Referring to industries, we cover manufacturing industry which is the dominant, as well as logistics industry, casting industry and food processing industry. By doing this, we could avoid the samples from the same regions or the same industries. Apart from this, our 15 companies cover the sizes from small, medium and big, according to the evaluation criteria based on net asset, profit and income, the number of employees. We also have these companies at different development stages, 3 of them are owned and led by first generation, 11 of them are at second generation and 1 of them has already passed to the third generations.

Abbott described the coding process as decorating a house start from design, move back, change little things, move back again, make big changes and even re-organizing (Abbott, 2004). About categorizing, it is stated that the process is dealing with the data from origin to the shape and then summarize into a higher level (Richards & Morse, 2012). Corbin (2015) argued the responsibility of researchers is to show how themes relate to the theory evolution (Corbin, 2015).

Figure 1 Coding process



Round 1: In-vivo-coding

We analyze the interviews in four steps. In the first round, we did line-by-line code-in-vivo of all instances related to family business model imprinting, there are 717 in-vivo codes of family business model and imprinting. All the 717 in-vivo codes express how family firms propose, create, capture and exchange value as well as showing how family imprinting plays a role in business model shaping.

Round 2: Inductive coding, deducting coding and matrix coding

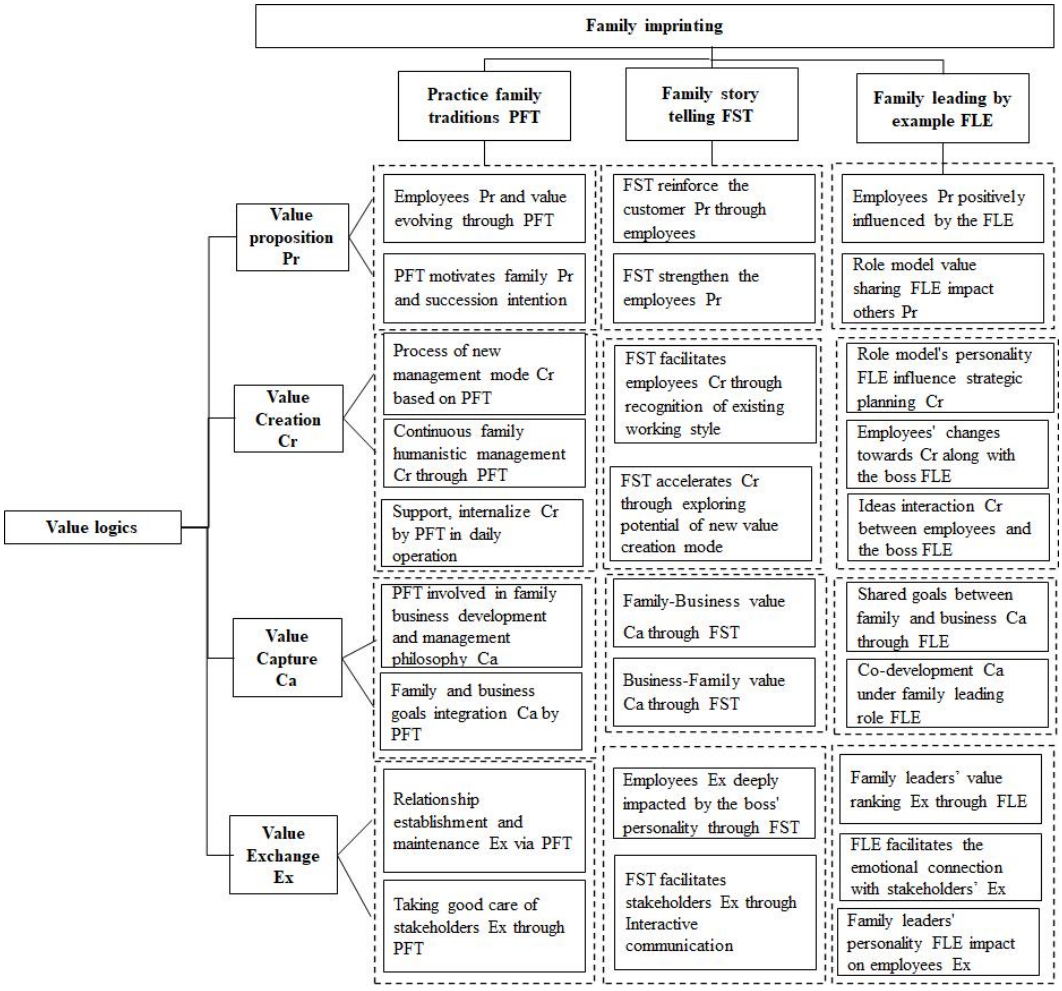
We extracted key words from the interview data that referred to family imprinting perspective based on their high word frequency and significance (Lewis et al., 2011). Using the in-vivo coding results, we developed first orders concepts from the initial quote (Eisenhardt & Graebner, 2007). Next, we aggregate the first order concepts into second order -themes which can represent the key perspective related to family imprinting items.

We then followed a deductive, top-down approach to identify how the imprinting practices identified in the second coding round, influenced the business model's value functions (Teece, 2010). In particular, we coded each one of the for value proposition, value creation, value capture and value exchange (Laasch, 2018b) We allocated each of the 711 in-vivo codes into one the 4 value logics.

According to the inductive and deductive coding results, we had coded the 717 in-vivo codes to both family imprinting practices and family business model functions. In Phase 4, we applied NVivo's matrix coding function to draw from step A and B, and to identify how family imprinting practices influenced the family business model's value functions. The

matrix coding function allows us to cluster to explore how practicing family traditions would influence the family business model shaping through value proposition, value creation, value capture and *value exchange*. Then we applied the same approach aiming to discover how 4 value logics are influenced by family storytelling and family leading by example.

Figure 2 Matrix coding result



Phase 3 Causal relationship

As is typical in developing grounded theory, organizing the data into categories could help better understand which is represented between the variables and causal relationships

(Glaser, Strauss, & Strutzel, 1968). By combining variables and causal relationships, scholars could begin identifying causal loops as a description of the feedback processes gradually emerging from this analysis (Yearworth & White, 2013). Morrison suggested that a succinct concept can be both grounded in qualitative data analysis and expressive of a dynamic hypothesis that was only revealed through the process of causal loop diagramming and system dynamics modelling and simulation (Yearworth & White, 2013).

Findings

From the empirical data analysis, we defined three family imprinting practices, practicing family traditions, family storytelling and family leading by example. Practicing family traditions enacts family customs and beliefs intergenerationally. It shows the employees' ideas and actions are passed from older generations, they take into practice based on the history or the development of the family firms, as well as setting a foundation for future development. Family storytelling is creating, sharing, and reshaping narratives of family events. Within family firms, the founders or the old generations will tell the stories to their kids and the employees in the company. Additionally, the employees heard the stories from someone else and kept in mind. Family storytelling states the process of repeating, reshaping, and adjusting the family stories. Family leading by example is a family member leading in a way that influences organizational members to emulate this family member. From figure 2, we figure out how family imprinting practices shape business model functions under value logics lens.

Table 1 Exemplary quotes

	Value proposition *Pr* *Value offered to whom and for what benefit.*	**Value creation Cr** *The processes aimed at increasing value generation.*	**Value capture *Ca*** *The process of securing profits from value creation and the distribution of those profits.*	**Value exchange Ex** *Multi-relational systemic interactions, emphasizing the "role of different stakeholder groups".*
Practice family traditions **PFT** *Enacting family customs and beliefs intergenerationally*	**Employees [Pr] and value evolving through PFT** "We care about our staffs; we encourage our employees to be more motivated and responsible. We value their ideas" [Dunni, general manager, Machinery company Co.]	**Process of new management mode [Cr] based on PFT** "We need to establish a new concept, a new management mode. I believe there is a great potential for the new ideas to develop. [Ji, Accounting manager, Flow instrument Co.]	**PFT involved in family business development and management philosophy Ca** "It pursues stable development rather than focusing on immediate interests." [Lai, Financial manager, Flow instrument Co.]	**Relationship establishment and maintenance [Ex] via PFT** "We emphasis more on the family tradition, there is an old saying in China called, you can be rich on more than three generations. There is ancestral discipline, because people are not disciplined enough, they need to be restrained. We aim to break it." [Zuimin, HR manager, Steel Co.]
	PFT motivates family [Pr] and succession intention "It [the firm] means something to the family, the boss must want to pass it on to the next generation, because the firm is handed down from the older	**Continuous family humanistic management [Cr] through PFT** "In the recent 20 years, our team is relatively stable. It might because we care about our employees, we design and continuously	**Family and business goals integration [Ca] by PFT** "For the boss, we aim at 100 years or more, it's a big goal, passing from generation to generation. Being a 100-year-firm is what we aim to achieve."	**Taking good care of stakeholders [Ex] through PFT** "Everyone is in a good relationship. Even though we have non-family members working in the company, we work well with each other, we feel we are being taken good care of. His father did this and now he [son, the boss] is

	generation." [Zhanzhan, branding director, Molding machine Co.]	improve the salary system." [Yanyue, CFO, Casting Co.]	[Bohu, Chairman, Pump Co.]	doing the same. " [Yumi, General manager, Sea shipping Co.]
		Support, internalize [Cr] by PFT in daily operation "I just wanted to say, if I can help, I can help." [Jihei, CFO, Electrical & Mechanical Co.]		
Family storytelling **FST** *Creating, sharing and reshaping narratives of family events.*	**FST reinforce the customer [Pr] through employees** "The founding family has been talking about revitalizing national industry and creating Chinese brand." [Yuanbian, Sales director, Molding machine Co.]	**FST facilitates employees [Cr] through recognition of existing working style** "The money that is too easy to make is not we are pursuing for." [Qianju, Administration director, Precise instrument Co.]	**Family-Business value [Ca] through FST** "We believe a good enterprise will drive the development of the whole family." [Jun, general manager, Mental Co.]	**Employees [Ex] deeply impacted by the boss' personality through FST** "I learn to communicate, to talk to others, I realize communication with others is extremely important." [Zhehui, CFO, Tools Co.]
	FST strengthen the employees [Pr] "I told them [employees], this factory is not just my	**FST accelerates [Cr] through exploring potential of new value creation mode**	**Business-Family value [Ca] through FST** "Our company will not be listed, we do not want to be bought by	**FST facilitates stakeholders [Ex] through Interactive communication** "Our boss told us we should make our own contribution to the country, the

	factory, it's your factory, it's our factory. When there are new employees joining us, our manage will also let them know [what I told them]." [Huwan, CEO, Mental Co.]	"We are always told not taking too many risks. Steady development is relatively safe. My uncle said this company is his second child, we should protect it and witness its growth." [Le, Sales director Tools Co.]	others, we always want to belong to ourselves. At every annual meeting, our boss emphasizes on this point, always being family owned and led." [Qiaxing, Logistic director, Flow instrument Co.]	society and the environment. I heard from colleagues that we built bridges, road and primary school in our town, which has been strongly recognized." [Zhuliang, CFO, Steel Co.]
Family leading by example **FLE** *A family member leading in a way that influences organizational members to emulate this family member.*	**Employees [Pr] positively influenced by the FLE** "Our company is very famous, which means everyone knows the name of the boss is Zhang. We respect and support him as he is our role model." [Yuan, Marketing manager, Molding machine Co.]	**Role model's personality FLE influence strategic planning Cr** "He just wants the family firm to get bigger and bigger. He was one of those who treated the business like his son." [Zanlan, Vice general manager, Mental.Co]	**Shared goals between family and business [Ca] through FLE** "As an entrepreneur, he constantly broadens his horizon and sees the changes in the world. Our enterprise develops step by step. Our boss is not only obsessed with making money, he also values other aspects of success." [Zhanzhan, branding director, Molding machine Co.]	**Family leaders' value ranking [Ex] through FLE** "He hires people with disabilities. He does charity work every year, contribute to the society is What he values the most important. [Zhan, Vice director of financial department, Flow instrument Co.]

	Role model value sharing FLE impact others [Pr] "The boss said that since you follow me, I will be responsible for you. I trust him, he is the role model, I believe he will do as what he said, …, I want to be the person like him." [Liufen, accountant officer, Machinery company Co.]	**Employees' changes towards [Cr] along with the boss FLE** "Our boss is good at humanistic management. We are strongly influenced by him, loving and supporting each other during our daily work." [Qianmai, Financial manager, Household electrical Co.	**Co-development [Ca] under family leading role FLE** "The firm's initial fund was from the founding family. Along with the company's development, the boss insisting on both commercial goals achievement and their contribution to the local community, which inspired me a lot." [Yunwen, Director, Bicycle Co.]	**FLE facilitates the emotional connection with stakeholders' Ex** "He has a very healthy lifestyle, without bad habits. We were also deeply influenced by him. I also want to do sports regularly, keep exploring new things and leaning from him how to establish a sustainable relationship with our suppliers and customers." [Juanli, HR director, Machinery company Co.]
		Ideas interaction [Cr] between employees and the boss FLE "Our boss does a very good job. He asks us for personal opinions, he gives a lot of respect to the executives, and allows more people to express their ideas. It's very democratic, not authoritarian." [Zhehui, CFO, Tools Co.]		**Family leaders' personality FLE impact on employees [Ex]** "We follow the boss 'working style, the boss goes step by step, we do diligently. The boss is very good, he treats the employees very well. We cannot be bad, his personality is very good, the staff are practical and realistic." [Yanyue, CFO, Casting Co.]

How Practicing Family Traditions Influence Value Logics?

Practicing traditions on developing the potential of family firm transformation shows the dynamics of the company's development.

Practicing Family Traditions influences value proposition. Family firms emphasize on employees oriented and value evolving rather than customer value proposition, they make efforts to embed family traditions with the employees and some of them feel they are part of the family, even though they are not family members. "It [the firm] means something to the family, the boss must want to pass it on to the next generation, because the firm is handed down from the older generation [Zhanzhan, branding director, Molding machine Co.]."

Practicing Family Traditions influences value creation. We can see the family traditions is not only being internalized in the company, but at the same time, there is a potential for the process of new management mode germinated. "We need to establish a new concept, a new management mode. I believe there is a great potential for the new ideas to develop [Ji, Accounting manager, Flow instrument Co.]".

Practicing Family Traditions influences value capture. When practicing tradition on *value capture*, it integrates traditional mission along with value chain. Family business development and management philosophy interiorizes in the firms."It pursues stable development rather than focusing on immediate interests." [Lai, Financial manager, Flow instrument Co.], which shows that protective growth and development has been part of

their *value capture* when setting the strategic goals.

Practicing Family Traditions influences value exchange. Practicing the benefits of family stable relationship explores how family firms develop and maintain good relationship with stakeholders. “Even though we have non-family members working in the company, we work well with each other, we feel we are being taken good care of. His father did this and now he [son, the boss] is doing the same [Yumi, General manager, Sea shipping Co.]”.

How *Family Storytelling Influence Value Logics?*

Family storytelling on value logics in family business is creating, sharing and reshaping narratives of family events.

Family storytelling influences value proposition. FST reinforce the customer [Pr] through employees: “This has positively influence on me, and on my customers, it is good to have competitors. [Lini, general manager assistant, Steel Co.]”. “The most important thing is to share with employees and managers. [Yuanbian, Sales director, Molding machine Co.]”. This is part of *value proposition* because through storytelling, the employees and the managers felt they are being treated as core members and they have great desire working in the company and actively involved in the company’s daily operation.

Family storytelling influences value creation. Family storytelling act as a mainstream mode when family firms make strategic decision. Through this, the ideas are being transmitted, which would benefit the management style and daily operation. Along with the development of the family firms, we can see family storytelling is embedded into daily

activities, the management mode is being optimized and the ideas are being exchanged and updated. Therefore, there appears to be the potential of new *value creation* mode as well as the upgrading of the existing management mode. FST accelerates [Cr] through exploring potential of new value creation mode: “The integration is that my ideas are influenced by you, then I will share my ideas to him, and finally the leader and us and discuss the idea and until we reach to a point. [Zhehui, CFO, Tools Co.]”.

Family storytelling influences value capture. Referring to *value capture*, throughout the whole process of the family firms’ development, storytelling act as an approach sharing the ideas about how family firms capture value since the firms’ establishment. Family-Business value [Ca] through FST: “I am also thinking about how to establish our own prestige. [Qiaxing, Logistic director, Flow instrument Co.]”, “For me, I grew up witnessing my father and my parents. [Jihei, CFO, Electrical & Mechanical Co.]”

Family storytelling influences value exchange. Storytelling is like a communication tool which deepens the relationship between the company and the employees. The employees are strongly impacted by the founding family especially the family leader. Thus, they establish a good relationship based on trust and support. “I think the chairman is saying that this is really a worthy of respect. He is more than 80 years old, last time when he gave us a 2-hour speech, He stood the whole time. [Tayuan, Financial manager, Molding machine Co.]”.

How Family Leading by Example Influence Value Logics?

Family leading by example on *value capture* is inspiring by shared family goals and

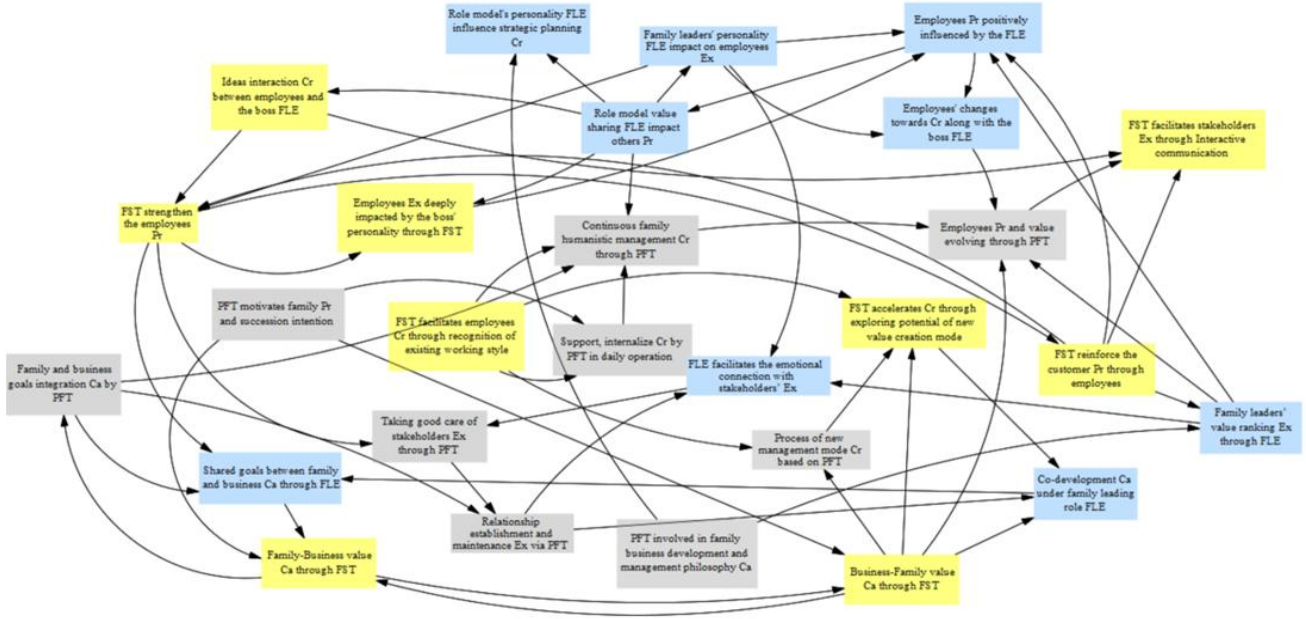
achievements.

Family leading by example influences value proposition. Family leading by example on *value proposition* states how family firms influence others by role model leading position. Employees [Pr] positively influenced by the FLE: “Everyone knows the name of the boss is Zhang [Zhanzhan, branding director, Molding machine Co.] They care not only about their customers based on the commercial goals, but more importantly they care about the *value proposition* to their employees, which is more family-orientated.

Family leading by example influences value creation. Ideas interaction [Cr] between employees and the boss FLE: “We believe that the company's decision makers, including the managers are great [Qianshu, CEO, Food processing Co.]”. This is part of *value creation*; the reason is the way how the family founders run the company would have a strong impact on management style and decision making.

Family leading by example influences value capture. Co-development [Ca] under family leading role FLE: “A good leader with a smart way of thinking can accelerate the enterprise’ rapid development, both the family and the company benefit. [Zhuancao, R&D manager, Electrical & Mechanical Co.]”*. Family leading by example influences value exchange.* Family leading by example on *value creation* Encouraging and recognizing the leading role of the family. Refer to value exchange, family leading by example plays a key role in establish and maintain a sustainable development with stakeholder.

Figure 3 A Dynamic System of Family Business Model Imprinting Practices



	Practice family traditions
	Family storytelling
	Family leading by example
→ Pr	Imprinting practice influence the value proposition
→ Cr	Imprinting practice influence the value creation
→ Ca	Imprinting practice influence the value capture
→ Ex	Imprinting practice influence the value exchange

Here is the conceptual framework showing how family imprinting plays a role on family business model shaping through practice family traditions, family storytelling and family leading by example. As we figure out, family traditions act as a bridge which family firms can not only inherent the family traditions as they used to play a role, more importantly family firms can also continue practicing traditions to emphasize the family feature and uniqueness.

According to the figure 4, "Process of new management mode [Cr] based on PFT" would have a direct influence on *value creation*, since the working style is a way showing how companies are being managed to achieve goals and objectives.

Table 2 Causal loops

Family imprinting practices	**Themes**	**Number of loops**
Practicing family traditions	PFT involved in family business development and management philosophy Ca	1274
	Employees [Pr] and value evolving through PFT	1230
	Taking good care of stakeholders [Ex] through PFT	881
	Continuous family humanistic management [Cr] through PFT	682
	Family and business goals integration [Ca] by PFT	673
	PFT motivates family [Pr] and succession intention	572
	Relationship establishment and maintenance [Ex] via PFT	360
	Process of new management mode [Cr] based on PFT	302
	Support, internalize [Cr] by PFT in daily operation	80
Family storytelling	FST facilitates stakeholders [Ex] through Interactive communication	1204
	Family-Business value [Ca] through FST	981
	FST reinforce the customer [Pr] through employees	899
	FST strengthen the employees Pr	851
	Business-Family value [Ca] through FST	621

	FST facilitates employees [Cr] through recognition of existing working style	378
	FST accelerates [Cr] through exploring potential of new value creation mode	203
	Employees [Ex] deeply impacted by the boss' personality through FST	186
Family leading by example	Employees [Pr] positively influenced by the FLE	1158
	Shared goals between family and business [Ca] through FLE	851
	Family leaders' value ranking [Ex] through FLE	811
	Co-development [Ca] under family leading role FLE	730
	FLE facilitates the emotional connection with stakeholders' Ex	657
	Role model value sharing FLE impact others Pr	467
	Role model's personality FLE influence strategic planning Cr	189
	Family leaders' personality FLE impact on employees Ex	186
	Ideas interaction [Cr] between employees and the boss FLE	161
	Employees' changes towards [Cr] along with the boss FLE	106

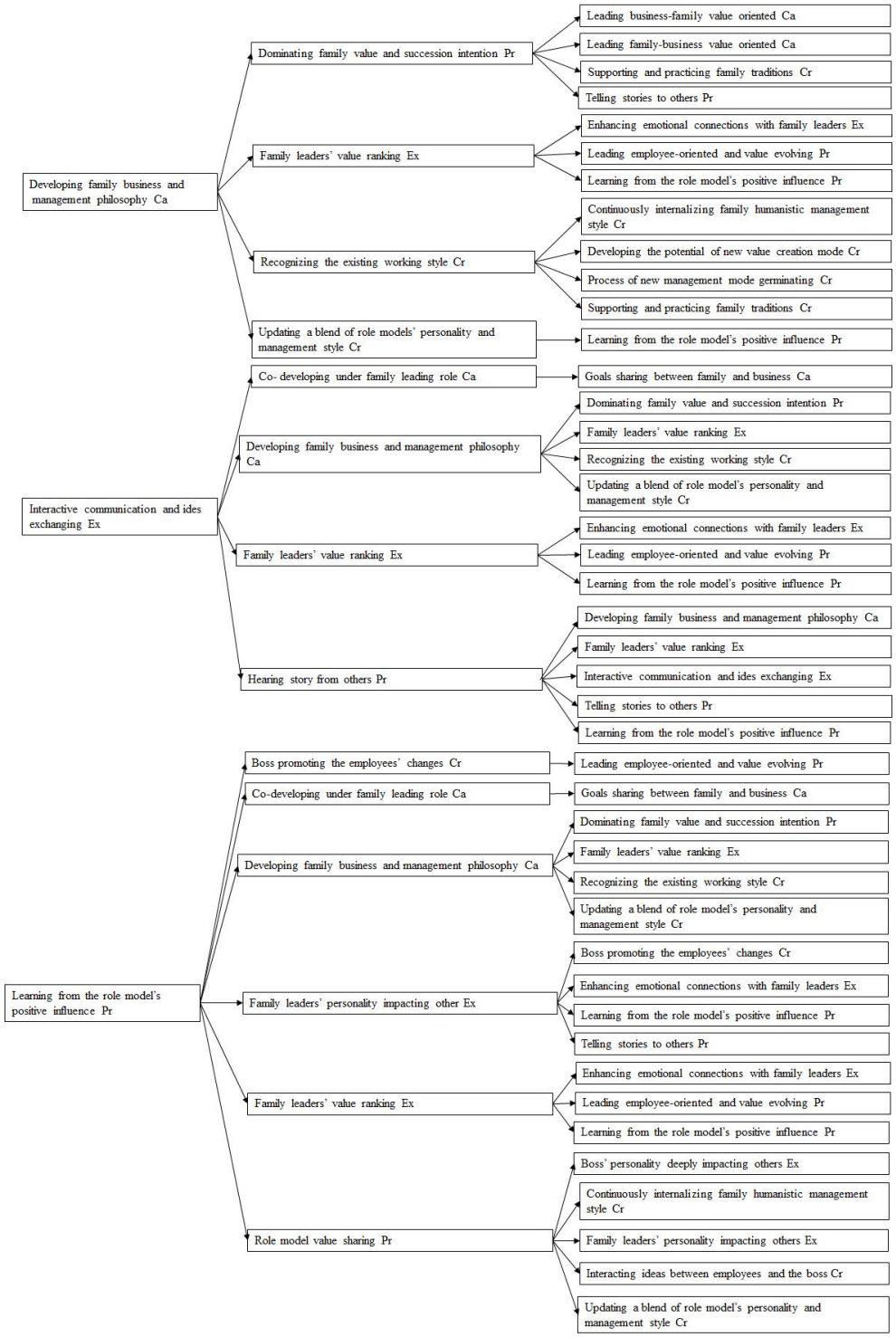
From table 4, the numbers of the causal loops, we indicate the most influential family imprinting practices on business model are "PFT involved in family business development and management philosophy [Ca] (1274)", "Employees [Pr] and value evolving through PFT (1230)", "FST facilitates stakeholders [Ex] through Interactive communication (1204)", "Employees [Pr] positively influenced by the FLE (1158)" and "Family-Business value [Ca] through FST (981)".

The least influential family imprinting practices on business model are "Support, internalize [Cr] by PFT in daily operation (80)", "Employees' changes towards [Cr] along with the boss FLE (106)", and "Role model's personality FLE influence strategic planning [Cr] (189)".

Figure 4 shows the causal relationship between family imprinting practices and business model. From the figure, we could identify how family imprinting practices

influence the value logics of family business.

Figure 4 Causal relationship



We illustrate how to read the causal influence on business model functions of each

of these family imprinting practices. Using the example of the practice of developing family business and management philosophy *Ca*, we show how it directly influences *value capture*, as well as immediately influence the v*alue proposition, creation, and exchange*, thus influences the entire business model.

Practicing family traditions

From figure 4, we can see there are 1274 causal loops in terms of PFT involved in family business development and management philosophy *Ca*, we take this item as an example because it takes up the most numbers of loops. It does influence all four value logics.

Family storytelling

From figure 4, we can see there are 1204 causal loops when referring to taking "FST facilitates stakeholders [Ex] through Interactive communication" (1204 loops) as an example because it occupies the greatest number of loops in "Family storytelling". Interactive communication and ideas exchanging serves as a significant influence when impacting on value logics of family business. In family firms, the role model plays a significant character. Family firms would encourage the interactive communication and ideas exchanging in their daily operation, it strengths the emotional connections between the leaders and the employees.

Family leading by example

From Figure 4, we take "Employees [Pr] positively influenced by the FLE" (1158 loops) as an example to illustrate how family leading by example actually shapes the family value logics. Learning from the role model's positive influence serves as an important effect when influencing the value logics of family business. Through learning from the role model's positive influence, the employees would be deepening their value system

according to the model's value sharing.

Discussion

We began our research with the question of how family imprinting plays a role in family business model shaping under value logics lens. We build on the recent literature in applying how family imprinting plays a role in value proposition, value creation, value capture and value exchange. We found three family imprinting practices: practice family traditions, family storytelling and family leading by example. We explored how these family imprinting practices actually shape the family business *value proposition, value creation, value capture and value exchange* respectively. Our conceptual framework also reveals the causal relationship from one imprinting practice to the other, as well as the influence of the practices on family value logics. We offer insights on how the concepts of imprinting is applied in the business model research, which is consistent with the imprinting concept (Stinchcombe, 1965)

Business model perspective

From the state of art, we can see different business model dynamics. The literature on business models has identified templates, or default solutions, to organize activities and exchanges, from which entrepreneurs can learn to design novel business models (Amit & Zott, 2015). Existing research on business model and imprinting discuss the critical role of founders for designing a specific, novel, and often continuous activity system at the early stage. Yet, it does not cover how imprinting shape the business model and to what extend (Simsek, Fox, & Heavey, 2015; Tilcsik & Marquis, 2013). It indicates imprinting occurs when the founders, and subsequently other members of the organization, display exceptional awareness of their industry structure and functioning, it is a complex system thinking style (Snihur & Zott, 2020). The newcomers who passed the hiring employee

selection process learned about centralization during initial formal meetings even the part of memorable early mentoring and from the founder through role modeling (Snihur & Zott, 2020).

From our findings, we suggest that the learning process happens between the family firms and the employees, which would frame and reframe the employees' thoughts, therefore shape the business model. During the whole process, the role model plays a significant position in business model design and transformation.We also found how family business members they are strongly involved in strategic management and daily operation, in this way, the employees promote the development of the firms. Additionally, the business model can be conceived as a boundary-spanning organizational design (Zott & Amit, 2007). Accordingly, structural imprinting as an imprinting process that affects characteristics that pertain either to a venture's internal organizational design or to its boundary-spanning design in the form of its business model.

Family imprinting perspective

Previous research discusses an imprinted subject or entity can be at different levels, including an individual, a collective, an organization, or even an organizational network (Christopher Marquis, 2003). Imprinting approaches have already been applied to family business research for a variety of purposes and at different levels of analysis, including within and between the family and the business (Simsek et al., 2015). They have been used, for example, to analyze family influence on the business. Within the FB system, the imprinting approach has also been used to explore how organizational imprints of the founder generation affect the structures and processes of FB in subsequent generations (Pieper, Smith, Kudlats, & Astrachan, 2015), and to explore the existence of sensitive periods and the nature and persistence of imprinted values in the family firm (Clinton et

al., 2017). In our paper, we applied a family imprinting perspective as a cognitive lens to further investigate how family business model is being shaped. The main reason of imprinting in family firms indicates the significance of family tradition on second-hand imprinting, meaning the indirect influence. We found within family firms; family imprinting plays a significant role in shaping family business model. Family imprinting is the primary element for family business (Hammond et al., 2016), which also perpetuate the family's beliefs and practices.

In our paper, firstly, we figure out family imprinting happens not only in the early stage, but it is a continuous process throughout the development of the company. Especially at different stages of the companies, imprinting exists and functions in a specific way. Our findings suggest family traditions is an important perspective to explore family business models (Lumpkin, Martin, & Vaughn, 2008b). Relying on traditionalizing mechanisms (Simsek et al., 2015), imprinted tradition plays a continuing role (Marquis et al., 2007). It requires the protections of the environment, behaviors, practices, places, and specific objects from threaten a role played by custodians "individuals or groups who are vested in the continuity of traditions and who carry, invent, guide, adapt and protect them" (Dacin et al., 2019, p. 351). For instance, by supporting, internalizing and practicing family traditions, deepens the understanding of family business development and management philosophy, as well as inspires the potential of developing new management model.

Secondly, in our research, we found family storytelling is an effective way accelerates the interactive communications and ideas exchange. Stories about heroic grandfathers or how the family tradition was sustained through turbulent times may contribute to second hand imprinting, based on this, the shared value and beliefs are passed by cross different generations, this is even longer than the imprinters (Kammerlander, Dessì, Bird, Floris, &

Murru, 2015). However, when family imprinting becomes weaker under specific situation, family business may take actions going back to the past stories and trace the tradition and experience (Katila, 2002). Family storytelling not only could reinforce the customers value proposition through employees, but also could strength the employees value proposition. Especially when family institutions and environment change at the specific stage, the role and impact of imprinting might accelerate the business model transformation. Additionally, family imprinting happens between family business members and family firms, as well as between the family firms and other stakeholders.

Thirdly, we found imprinting not only happens from entrepreneurs or founding institutions, it can also be other groups who imprint in the firms, even the community members imprint through the practice of business models. Other possible sources of branding are the family business itself and its other members, as well as other organizations and their members (Christopher Marquis, 2003). In our research, the role model's personality, hobbies and interests, value ranking actively influence on the employees as well. Family leading by example also facilitate the emotional connection between the company and the stakeholders value exchange. With the high influential of the role model, the team cohesion and cooperation is strengthened. The employees learn from the leaders as well as learn from each other, which promotes the development of the company.

Conclusion

This research was motivated to understand the key items of family imprinting and how it plays a role in shaping family business model under value logics lens. Our contribution acts as a theoretical extension of imprinting as a mechanism of business model change. We found practicing family traditions on value logics emphasize on

enacting value and beliefs intergenerationally, family storytelling acts as an information exchange channel between family firms and their stakeholders, family leading by examples states the influences of the founding family by motivating the family business members in achieving the shared goals.

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Green Digital Servitization: Can Opposites Attract?

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Extended Abstract

Manufacturers are under increasing pressure to highlight their contribution to economic, social, and environmental sustainability (Bocken et al., 2014) and must shift towards more sustainable business models while keeping and enhancing their profit margins. (Kohtamäki et al., 2023). Therefore, the concept of green digital servitization is increasingly important for manufacturing firms, combining the principles of servitization, digitalization, and sustainability into a cohesive framework. This paper explores the intersection of these dimensions, analyzing the transformation of product-centric companies towards service-oriented models with a strong emphasis on environmental responsibility (Lee et al., 2024; Opazo-Basáez et al., 2018; Schiavone et al., 2022). By adopting circular business models, companies can reduce their ecological footprint while also reaping financial benefits through optimized service offerings and improved operational efficiencies.

As a starting point for empirical research on green digital servitization, this paper builds on existing literature on servitization, digital transformation, and sustainability. The key question addressed in this paper is: What is green digital servitization? To answer this question, first we discuss the concepts of digital servitization and green servitization, along with their benefits and challenges. Next, we describe a conceptual model of green digital servitization.

Servitization emphasizes the move from a product-dominant to a service-oriented logic (Kowalkowski et al., 2017). Some empirical research findings indicate the presence of a servitization paradox (Kohtamäki et al., 2020), whereby there is a non-linear or even negative relationship between servitization and firm performance (Wang et al., 2018;

Bustinza et al., 2018). On digitalization, Gebauer et al. (2021) find a digitalization paradox with companies aiming to improve their yield with investments in digital means but failing to enhance their performance accordingly. The solution to both paradoxes, however, may come from jointly implementing servitization and digital strategies together (Favoretto et al., 2022). Digital servitization, in combination, is repeatedly found to lead to positive financial outcomes (Abou-Foul et al., 2021; Gebauer et al., 2021; Kharlamov & Parry, 2021; Kohtamäki, Parida et al., 2020; Visnjic et al., 2019; Yang et al., 2023). The reasons for this relationship are linked to the lower coordination and implementation costs of endowing highly customized offerings with digital servitization (Vaillant et al., 2023), whereby digitalization acts as an enabler of service provision and can evolve into a driver for advanced service delivery (Martin-Peña et al., 2019). By applying digital technologies, companies can collect and analyze vast amounts of real-time data on product use and performance. Furthermore, they are increasingly able to create personalized services that can meet the exact needs of each customer and use this information (Chauhan et al., 2022). This way they can increase their financial outcomes.

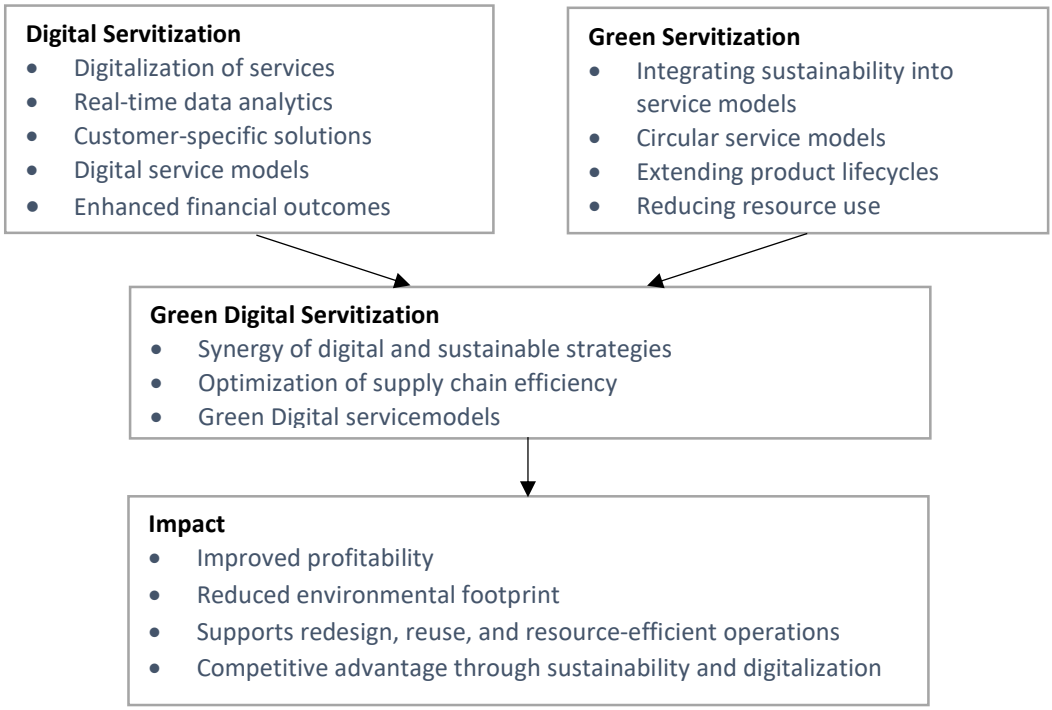
A circular economy applies, instead of the old linear take-make-use-dispose system, take-make-use-redesign-reuse business models, which encompass the recycling and reuse of goods. The support of companies in their transformation from a linear system into a circular one can be provided by product as a service (Mishra et al., 2023) and the positive effects of servitization to promote a circular economy are confirmed by recent studies (Abdelkafi et al. 2022). Also, the notion that servitization contributes to the maintenance, upgrading, and re-manufacturing of products is presented in several studies. Thus, integrating these practices into green servitization combines resource efficiency with customer-oriented services (Galimberti et al., 2024; Leocádio et al., 2024). This green servitization incorporates sustainability into service models, addressing environmental concerns while keeping highly competitive levels (Lafuente et al., 2023). According to Doni et al. (2019) several studies show findings that support the notion that servitization contributes to the maintenance, upgrading, and re-manufacturing of products, which extends their lifespan and reduces product turnover. This offers companies incentives by enhancing their value-creation capabilities through the elongation of the product life cycle and mitigating the ecological impact of product usage (Doni et al., 2019). According to Kumar et al. (2024), green servitization is an urgent requirement for the manufacturing sector to remain competitive in the modern market. However, Kohtamäki et al (2023) find only limited increases in profits when applying green servitization, and the interaction effect becomes negative, revealing the existence of the green servitization paradox. In this paradox the costs associated with implementing sustainability emphasis significantly outweigh the support servitization capabilities provide to generate and capture value from sustainability investments (Kohtamäki et al, 2023).

Green digital servitization combines the principles of digital servitization and green servitization. Unlike the previous paradoxes, Lafuente et al. (2023) suggest that merging these strategies generates competitive synergies, optimizing companies' overall performance. Green practices and digitalization complement each other by creating systems focused on delivering products and services while enhancing supply chain efficiency (Kumar et al., 2024).

However, Vaillant et al. (2024) note that the literature has yet to comprehensively address the impact of digital servitization on environmental performance, particularly on input resource efficiency and output waste management beyond circular economy scenarios (Sjödin et al., 2023; Zheng et al., 2018). Although sustainability strategies can be costly, and achieving profitability from these efforts stays challenging without supportive capabilities, Kohtamäki et al. (2023) highlight the importance of strategic alignment for success.

Our conceptual model illustrates how the intersection of digital and green servitization drives innovation in manufacturing, positioning companies for sustainable, future-oriented growth. Digital technologies support sustainable business practices by optimizing resource use, improving supply chain efficiency, and enabling digital green service models that foster long-term sustainability.

Conceptual Model: Digital Green Servitization



Green digital servitization represents a transformative opportunity for firms seeking to align profitability with environmental stewardship. By integrating digital technologies with circular business principles, companies can achieve sustainable growth while meeting evolving consumer demands. Future research should explore empirical applications across diverse industries to refine the theoretical framework and assess its impact on business performance.

Keywords

Green servitization, digital servitization, circular economy, digital transformation.

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The role of sustainability planning in addressing the tensions of ESG and corporate strategy integration

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Abstract

This study investigates how sustainability planning addresses tensions in integrating corporate sustainability with "usual" business strategy. Data collected from semi-structured interviews with 12 Italian firms across various sectors were analysed. The research highlights key tensions faced during the integration process, organisational changes, and the role of sustainability planning as a strategic tool. Insights are provided for managers and policymakers aiming to foster effective integration of sustainability principles into business strategies.

Keywords

Sustainability planning, integration process, strategic choice theory, ESG, Governance

1. Introduction

Increasing stakeholders' and institutional pressures and the recent emission of sustainability regulations, such as the Corporate Sustainability Reporting Directive (CSRD) and European taxonomy, have compelled organisations to reconfigure their business strategies to include sustainability goals (Engert et al., 2016). Corporate sustainability embodies a commitment to balancing governance, environmental, social, economic responsibilities (Cantele et al., 2024a), while ensuring the organisation's long-term competitiveness (Fontana et al., 2022; Cantele & Zardini, 2018). This integration process, however, is fraught with complexities and tensions as organisations attempt to reconcile multiple and often competing objectives (Nguyen & Kanbach, 2023).

Strategic management frameworks provide the necessary tools for organisations to align internal capacities with external demands (Mainardes et al., 2014). Integrating sustainability into business strategy requires a sophisticated interplay between leadership, organisational structures, and the socio-economic environment (Nguyen & Kanbach, 2024). While some part of the academic inquiry has focused on the theoretical aspects of sustainability integration (Calabrese et al., 2019), limited attention has been directed toward the procedural dynamics and the role of sustainability planning. This study seeks to bridge this gap by exploring if and how sustainability planning can answer tensions emerging in the integration process between sustainability and strategy. The following research questions were proposed:

1. *What tensions do companies face in integrating sustainability into business strategies?*
2. *How does sustainability planning can address these tensions?*

The paper continues with a literature review, the methodology description, the main findings and its discussion, and, finally, the final remarks.

2. Literature Review and Research Questions

2.1. The strategic choice theory in the corporate sustainability field

The concept of strategic choice theory (SCT) (Child, 1972) is employed in the literature to describe the process through which corporate decision-makers select strategically appropriate actions to achieve a range of objectives, including enhanced performance and competitive advantage (Child, 1997). SCT is based on the assumption that multiple internal and external factors influence a firm's decisions. According to Child (1972), external pressures, although important for corporate decision-makers, do not put the company in a position to passively undergo them: in fact, decision-makers can choose how best to respond to external demands, even deciding not to satisfy them. Firms continuously relate to other organisations, society and the environment and must be able to choose the most strategic actions to meet both their needs and the firm’s well-being (Starik and Kanashiro, 2013): it is very important the ability of decision-makers to respond quickly to internal and external stimuli, also by articulating flexible decision-making processes (Child, 1997).

Strategic choice focuses on the active role of corporate decision-makers, i.e. those who have the power to influence internal organisational structures through their choices and decisions (Sung & Choi, 2018).

Sustainability and corporate social responsibility (CSR) studies have used SCT as a theoretical framework (Bastini et al., 2022; Poisson-de Haro & Bitektine, 2015; Dai & Si, 2018) to examine how the business environment and entrepreneurial orientation guide the strategic choices of corporate decision-makers, also regarding sustainability. It was observed that the more they perceive the importance of sustainability and are guided by their business orientation, the more they will engage in choices strategically beneficial for the firm, both in economic, social and environmental terms (Dai & Si, 2018).

It was also analysed how adopting an effective sustainability control system (SCS) depends firstly on the ability of corporate decision-makers to make strategically advantageous choices based on the sustainability problems to be solved and secondly on the internal organisational structure (Bastini et al., 2022).

Finally, the strategic choice perspective was used to analyse how the underlying beliefs of corporate decision-makers influence current and future strategies. Decision-makers sometimes adapt to the pressures expressed by external stakeholders to adopt environmental or social practices; this is often done without thoroughly evaluating the actual business benefits. For instance, some managers might shy away from initiatives that lack immediate returns or adopte those with a simbolic value, favouring actions that align with their personal goals, enhance their reputation and deliver quick outcomes for the company (Krasodomska & Eisenschmidt, 2024). Instead, when their own personal beliefs and ideas guide them, they tend to prioritize strategies that offer greater long-term benefits to the firm (Tatoglu et al., 2020).

Building on previous studies that have applied this theory, this research adopts SCT as a theoretical framework to examine the tensions influencing the integration of strategy and sustainability. It also aims to determine whether sustainability planning can help firms navigate and overcome these tensions.

2.2. Integrating sustainability into business strategy: main enabling factors

Integrating sustainability into corporate strategy entails actions aimed at improving financial, environmental, and social performance (Wardhani & Rahadian, 2021). The recent

debate in the literature (Adolph & Beckmann, 2024; Maniora, 2018; Rao & Shukla, 2023) is primarily focused on changes in the process to define strategies required to incorporate sustainability in corporate decision-making (Nguyen & Kanbach, 2023; Tourais & Videira, 2023). Studies highlight the importance of human and organisational capabilities, such as employee engagement and teamwork, as key enablers of this transition (Cantele et al., 2024b; Lopez-Arceiz & Rio, 2022; Manninen & Huiskonen, 2022). Strong organisational competencies help adapt corporate strategies to evolving social and environmental conditions (Manninen & Huiskonen, 2022; Nguyen & Kanbach, 2023). Corporate governance and leadership are also pivotal, with effective governance structures and leadership driving the balance between short-term strategies and long-term sustainability goals (Cantele et al., 2024b; Calabrese et al., 2019; Wardhani & Rahadian, 2021). CEOs who emphasise sustainability across all business functions play a vital role, as does stakeholder engagement, which fosters alignment with stakeholder needs and accelerates sustainability achievements (Engert et al., 2016; Silvestre et al., 2022; Elmassri et al., 2023). Moreover, as shown by Cantele et al. (2024c) a good governance structure for sustainability allows to build a good sustainability plan, enabling the pursuit of sustainable success.

Contextual factors such as regulatory compliance (e.g., CSRD and European taxonomy) further support the integration of ESG issues into strategy, helping firms remain competitive and meet stakeholder demands for transparency (Fonseca et al., 2021; Hristov & Searcy, 2024; Riso et al., 2024). Strategic alignment within firms, ensuring harmony between business functions, strategies, and sustainability projects, is critical for achieving sustainable success (Baumgartner & Rauter, 2017).

Finally, internal and external communication plays a vital role, with internal transparency ensuring employees understand corporate values and actively contribute to implementing sustainability strategies (Engert et al., 2016; Silvestre & Fonseca, 2020).

3. Methodology

This study employed a qualitative research design to investigate the dynamics of sustainability integration and the mitigating role of planning. Semi-structured interviews were conducted with twelve Italian firms operating across diverse sectors, including food and beverage, fashion, and chemical industries. Participants were selected based on their

involvement in sustainability planning and their ability to provide nuanced insights into organisational processes.

3.1. Data Collection

The interviews, conducted between December 2023 and July 2024, lasted between 30 and 135 minutes. They followed a structured guide encompassing themes such as the motivations for sustainability integration, the role of planning, and the challenges encountered during the process. The interviews were audio-recorded and subsequently transcribed to ensure accuracy and depth of analysis (Fonseca et al., 2021).

3.2. Data Analysis

Content analysis was performed using NVivo software to code and categorise data systematically. The analysis focused on four primary themes: internal and external motivations, organisational adaptations, tensions in integration, and the elements of sustainability planning. This approach facilitated a comprehensive understanding of the interplay between strategic decision-making and sustainability objectives (Lopez-Arceiz et al., 2022).

4. Main Findings and Discussion

4.1. Tensions in Integrating Sustainability and Business Strategies

The integration of sustainability into business strategies brings organisational and operational tensions. Insights from the interviews highlighted some interrelated challenges that firms face in this process.

One of the most recurrent issues is cultural resistance within organisations, which often stems from employees perceiving sustainability initiatives as peripheral to the core business agenda. As one respondent noted: "*Sustainability is very often seen by our employees as one more thing, in addition to their daily tasks, and they struggle to integrate it with their other usual strategic actions*" (Firm 3). This perception could relegate sustainability efforts to the background, undermining their incorporation into everyday decision-making processes (Wardhani & Rahadian, 2021).

Adding further complexity, firms frequently encounter technical challenges, particularly around ESG topics and the ambiguity of regulatory requirements. The technical nature of

sustainability regulations, coupled with their lack of clarity, often results in inconsistent implementation across organisations. One respondent captured this struggle: "*There is not clarity on principles and taxonomies and this leads to uncertainty also on how to define sustainability projects and actions; this can disfavour integration with business strategies*" (Firm 10).

Compounding these challenges is the lack of standardised metrics for measuring sustainability outcomes. Unlike financial indicators, which are widely understood and established, sustainability metrics often vary significantly, making it difficult for firms to monitor progress effectively. This gap was a recurring concern among participants, as reflected in the literature (Engert et al., 2016).

Another prominent issue is governance, particularly the difficulty of aligning governance dimensions with sustainability strategies. This challenge often requires rethinking leadership roles, decision-making processes, and accountability frameworks. One respondent highlighted this complexity: "*Corporate sustainability includes not only environmental and social issues but also governance, and the latter is the most difficult aspect to integrate into ordinary business strategies*" (Firm 4).

Finally, multiple goals, often conflicting or not all achievable, generate tension that hinders the integration process between business and sustainability objectives. Many firms reported a lack of clarity in defining aligned sustainability and business goals, often leading to fragmented initiatives and inefficiencies. One respondent observed: "*The lack of a clear direction to go, a set of goals covering all dimensions of the business, including sustainability, has sometimes put us in difficulty. Proper integration requires clarity and doing things in order*" (Firm 7).

4.2. The Role of Sustainability Planning in Addressing Tensions

Sustainability planning emerged as a crucial mechanism to navigate and mitigate these tensions. The findings suggest that thoughtful planning fosters alignment between sustainability and "usual" business objectives through several key practices.

First, strategic coordination plays a pivotal role in helping to address the tensions in governance and organizational culture. Sustainability planning helps bridge organisational silos by fostering collaboration and communication across departments. On this point, a respondent affirmed: "*Each line of business has defined its own objectives and the CSR unit*

coordinates all the proposed objectives in a global vision. The responsibility for defining and pursuing the goals is distributed" (Firm 9).

Moreover, the formalisation of processes ensures that sustainability goals are not only identified but also prioritised and tracked systematically, helping to address the tension in presence of multiple objectives. By providing a structured framework, organisations can address the complexities of ESG integration more effectively: "*In the planning process, the first activity was to identify the goals. Then indicators were identified to measure ESG issues. Once these indicators were identified, it was a matter of defining which project to start with*" (Firm 8).

In many cases, sustainability planning also drives organisational restructuring, with firms establishing dedicated ESG teams and introducing flatter hierarchies to enhance agility in decision-making. As one interviewed shared: "*There has been a change in approach because there is now a direct involvement of various people within the group offices collaborating on ESG issues, making the corporate structure less hierarchical and more fluid*" (Firm 1).

The presence of teams or managers specialized in ESG can address the tensions of technical complexity and lack of metrics.

These findings show how sustainability planning could act as a strategic enabler, addressing the tensions and complexities that firms face in aligning sustainability with business strategies.

5. Final remarks

This study is the first to apply SCT (Child, 1977) to the literature on sustainability strategy integration and sustainability planning.

Indeed, it has provided insights into the tensions organisations face when integrating sustainability into business strategies and the strategic role of sustainability planning in alleviating these challenges. Five primary tensions were identified: cultural resistance, technical complexity, lack of metrics, governance challenges and presence of multiple objectives. Then, sustainability planning emerged as a critical tool for formalising processes, enhancing coordination and driving organisational restructuring with dedicated ESG teams or managers. These mechanisms address the tensions and help to navigate the integration of ESG in corporate strategy.

By applying SCT to the context of sustainability planning, this research contributes to a deeper understanding of how organisations navigate the complexities of ESG integration. Indeed, the SCT emphasises decision-makers' critical role in assessing internal and external conditions to define a company's strategy. In the current context, external pressures, such as regulatory requirements on sustainability reporting and strategies and stakeholders' needs, urge the integration of sustainability into corporate strategy. However, decision-makers may choose not to respond to these pressures or may do so ineffectively. This depends on their awareness of sustainability issues and their ability to identify and implement an effective decision-making process. Furthermore, when they decide to start an integration process, they encounter some tensions, as described above. In this regard, the sustainability plan, with its internal implications, helps the company establish the necessary conditions for an effective response.

This work offers several practical recommendations for managers. First, fostering a culture of sustainability across all organisational levels is essential. Second, the formalisation of planning processes can enhance flexibility and responsiveness. Finally, the governance structure needs to be organised to manage sustainability issues systematically.

This study has some limitations that can be seen as opportunities for future research. Firstly, the data were collected only in the Italian context, thus limiting the possibility of generalising the results. To overcome this problem, future research should expand the geographical scope of analysis to firms in other parts of the world.

Furthermore, the unit of analysis considered is limited to the focal enterprise. This limitation might not bring out the point of view and the influence of external stakeholders or partners. Therefore, future research should engage further stakeholder categories, as well as consider institutions and upstream and downstream partners to understand the existing collaboration mechanisms and shared goals definition in the planning process.

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Sustainable Shipping Business Models through Circular and Accountability Harmony: A Research Agenda

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Extended Abstract:

The shipping industry, a key component of global trade, plays a significant role in achieving the Sustainable Development Goals (SDGs) outlined in the United Nations 2030 Agenda (Mallouppas and Yfantis, 2021). Apart from its importance, shipping industry is also a significant source of pollution that affects both environment and aquatic habitats (Moldanov *et al.,* 2022). Continuation to this, the International Maritime Organization's (IMO) third greenhouse gas (GHG) study states that shipping contributed 2.6% of the world's carbon dioxide (CO2) emissions in 2012 compared to the 3.5% of global emissions released in 2007 (Bouman *et al.,* 2017). Moreover, the future emissions are predicted to rise by 150–250% between 2012 and 2050 (Buhaug *et al.,* 2009). Meanwhile, it also contributes approximately 940 million tons of carbon dioxide (CO_2) annually, for which it is undergoing a process of decarbonizing its supply chain to reduce Scope 3 emissions. In this connection, the scope 3 emissions related to other inputs are distinguished by the GHG protocol, a corporate standard, is widely accepted tool that defines value-chain emissions not related to the (direct) purchase of energy (scope 3).

However, Scope 3 emissions fall outside the direct control of shipping companies, as they are tied to the resources and raw materials consumed (e.g., paper, waste) and the emissions of suppliers.

This involves not only reducing emissions but also measuring and reporting them, striving to balance environmental concerns with profitability. Reporting and reducing these emissions are particularly important for shipping companies adhering to frameworks like the Carbon Disclosure Project (CDP), the Global Reporting Initiative (GRI), or the Task Force on Climate-related Financial Disclosures (TCFD). Shipping activities related to fuel production, energy consumption, and waste generation, categorized as upstream Scope 3 emissions under the GHG Protocol Corporate Standard, are influenced by the shipping industry's business model. This model, when driven by circular economy principles and business accountability, can help mitigate climate change and contribute to the achievement of SDG7 (Affordable and Clean Energy) and SDG13 (Climate Action). In this regard, carbon reporting allows firms to quantify their indirect carbon emissions in industry's supply chains (Hertwich and Wood, 2018).

In this connection, according to the IPCC (2007), by the second part of the century, global GHG emissions must drop to net zero and then even lower to negative levels. Therefore, the shipping industry is required to reach a specific level of decarbonization depends on the broad use of green technologies that can lower indirect emissions, like afforestation and bioenergy with CO_2 capture and storage (Di Vaio *et al.,* 2023). Furthermore, IMO stresses shipping industry to fight against increasing number of indirect carbon emissions in order to mitigate climate change and contribute to the achievement of SDG7 (Affordable and Clean Energy) and SDG13 (Climate Action) (IMO 2023 Strategy). Additionally, the measurement and reporting of emissions is becoming more and more popular. For this reason, carbon accounting helps the industry to put carbon reduction plans into actions (Di Vaio *et al.,* 2024). Moreover, the concept of circular harmony in terms of circular economy for environmental development is necessary (Kryvda *et al.,* 2022). The business models based on circular economy approach such as waste recycling, reuse and repair strategies are more amenable for sustainability transition (OECD, 2019). Specifically, the green technologies can support shipping industry for sustainable waste management processes to meet UN 2030 Agenda (Di Vaio *et al.,* 2022). The economic inefficiency, resource depletion, and widespread environmental degradation are the consequences of the conventional linear economic model (Kennedy *et al.,* 2024). Since the stakeholders are increasingly aware of resource scarcity and the impact that economic activity has on the environment, the concept of circular economy to harmonize the economic, social and environmental pillars of sustainability is gaining more attention (Bjørnbet *et al.,* 2021). The regulatory bodies stress shipping industry to focus circular economy addressing environmental issues like diminished resource availability, biodiversity degradation, and climate change through intentional process and product redesign, material recycling, and the integration of clean energy sources into business operations (Lakshmi *et al.,* 2024).

To develop sustainable shipping business models, the adoption of decarbonization practices and

the stringent laws and scrutiny to respond urgent environmental issues are required (Saz-Salazar *et al.,* 2015). Thus, the decarbonization, in accordance with the Paris Agreement's objective of reducing global warming is therefore at the top of global and national agendas as per stakeholder and institutional pressures, given that failure to reach the aim worsens the risks posed by climate change to both the environment and mankind (Psaraftis and Zis, 2022). Despite growing scholarly interest, these issues remain fragmented, particularly regarding the integration of circular economy models in the shipping industry's business practices and accountability mechanisms. After identifying the gap in literature related to the integration of circular economy models in shipping industry's business practices and accountability mechanisms, this study aims to address these gaps by analyzing existing literature and proposing a research agenda to advance knowledge in this area. Therefore, we propose the following research question (RQ):

> How are emissions from fuel and energy consumption, and waste generated from operations (Upstream Scope 3 emissions) measured, monitored, and reported according to a model based on circular harmony and accountability principles for SDG7 and SDG13?

This study conducts a bibliometric analysis of 60 articles published between 1990 and 2024. They were identified and collected from Scopus database, written in English. They were selected from the “Business, Management, and Accounting” and “Environmental Science” fields. The search strategy involved using boolean operators and keywords like: (“shipping” OR “ship” AND “emission*” AND “supply chain” AND “GHG” OR “greenhouse gas*” AND “Scope 3”) AND (“ship* " AND "Carbon Disclosure Project") AND (“busines* model*”) AND (“circular” AND "harmony" AND "accountab*" AND (“sustainab* develop* goal*” OR “SDG” OR “SDGs” OR “SDG7” AND “SDG13”). VOSviewer version 1.6.20 was used for descriptive, bibliometric, and network analysis. The results of this study provide significant insights into emerging challenges, policy recommendations, and propose a research agenda to support further analysis in this area.

Keywords

Circular and Accountability Harmony, Decarbonization, Affordable and Clean Energy (SDG7), Climate Action (SDG13), Sustainable Shipping Business Models.

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Toward a realistic pathway to circularity for SMEs

Developing a Circular Business Model Portfolio Management System for SMEs

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Abstract

188 Words

The urgent shift to circular business is also apparent among SMEs, offering solutions for sustainability and new opportunities. However, this shift also requires significant—and not always clear—changes to the typically linear business model of SMEs. Barriers, such as a lack of time, money and knowledge, the clear point of view, an approach to make the entire value chain work together, hinder this transformation. Companies that have successfully made a shift, have developed alternative business models alongside their current ones, a practice called business model portfolio management (BMPM). Research shows BMPM results in better business performance, competitive advantages, opportunities for synergy and complementarity, as well as spreading risk and increasing agility.

Despite its promise, BMPM is not specifically focused on circularity and nor designed for application in SMEs. This research aims to develop such an approach by conducting a design science study. In this paper, we seek to answer (i) What experiences do manufacturing SMEs have with circular business model innovation? and (ii) What are meta-requirements identified in the emergent literature on BMPM for an approach that can support SMEs in their transformation to circular business models?

Keywords

Circular Business Model, Business Model Portfolio Management, SMEs, Meta-requirements, Design Science.

Session

We propose this paper for session 3.1. Alternatively, session 4.3 could be considered, following the reasoning.

3.1 Management, governance and accountability for sustainable business models

In this paper we will present the development of a circular business model portfolio management system for SMEs. Such system aims to enhance managerial capabilities to shape and realize sustainable transition, specifically for SMEs. Participation of SMEs is critical in the circular transition.

4.3 Actor engagement in sustainable (circular) business model innovation through design thinking and other practices

The research proposed in this paper is part of a larger research focused on using design science to develop practical support for SMEs to develop a smoother transition from their current business models toward circular business models. Developing and applying the approach is expected to require facilitation and participation of diverse SME personnel.

Introduction

4241 words (excluding references)

The transition to a circular economy is increasingly relevant for SMEs (Dittrich, 2019). For SMEs, developing a circular business model—how an organization creates, delivers, and monetizes circular value—not only promotes sustainability but also offers long-term profit opportunities and resilience against volatile commodity prices (Schulte, 2013). However, circularity requires significant changes in business operations from SMEs and often also a different organisation and management of the value chain and other actors. The steps required for the shift to circularity are unclear and often ambiguous, making it difficult for SMEs to assess the risks involved. As a result, many SMEs continue with old practices and linear business models, optimized for the traditional economy. Additionally, converting to a circular model faces barriers such as limited time, money, knowledge, and a lack of clear strategy or collaboration across the value chain (Van Acker, 2020).

Barriers can be categorized into organizational and cognitive challenges. Organizational barriers include resource allocation difficulties (Chesbrough & Rosenbloom, 2002), lack of insight in customer needs (Baines et al., 2007), complexity of new business models (Markides & Charitou, 2004), and inertia following from uncertainty (Andries & Debackere, 2007). Cognitive barriers include lack of capability to think in terms of new business models (Bocken et al., 2016), dominant logic (Bettis & Prahalad, 1995) and inadequate leadership (Berglund & Sandström, 2013).

Literature shows that successful companies navigate the transition from linear to circular models by developing and managing multiple business models (Geissdoerfer et al., 2020; Guyader & Piscicelli, 2019). This process, known as business model portfolio management (BPMN) (Snihur et al., 2023; Aversa et al., 2017) helps companies build, manage, and maintain a collection of business models to optimize performance, create competitive advantages, and foster synergies (Bosbach et al., 2020; Casadesus-Masanell & Tarzijan, 2012; Globocnik et al., 2020; Snihur & Tarzijan, 2018). BPMN also aids in risk diversification and enhances agility (Aversa & Haefliger, 2017; Harren et al., 2022; Sohl et al., 2022; Sohl & Vroom, 2014; Westerveld et al., 2023)., (Aversa & Haefliger, 2017; Westerveld et al., 2023).

Despite the growing importance of BPMN, available methodologies are limited and vary in approach and outcome. Moreover, applying these tools to SMEs is challenging due to their unique characteristics (Miller et al., 2021). For example, SMEs are less likely than multinationals to split up a new business model into a new organization or business units (Harren et al., 2022; Snihur & Tarzijan, 2018). This is partly because SMEs often innovate in uncertain market conditions with fewer strategic resources (Balboni et al., 2019; Pati et al., 2018), leading them to manage multiple business models within the same organization (Clegg et al., 2017; Paiola et al., 2022; Randhawa et al., 2021).

To address this gap, this research aims to develop a circular business model portfolio management approach tailored for SMEs in manufacturing. By consciously developing and integrating new circular business models, alongside existing linear ones, SMEs can balance the benefits of both and phase out less desirable aspects. This supports their transition to a circular economy. Based on this discussion, our research question is: How can we support an SME in the manufacturing industry to develop and integrate a circular business model into its business operations in addition to the existing (linear) business model?

To answer this research question, we use a Design Science Research (DSR) approach (Cremers & Van Turnhout, 2023; Peffers et al., 2007), conducted in three design iterations. The first iteration establishes the approach and evaluates its application in practice. The second iteration focuses on adapting the approach for SMEs without a circular business model. The third iteration trains advisory teams to apply the approach.

Two key research questions remain at the start of the first iteration:(i) What experiences do manufacturing SMEs have with circular business model innovation?, and (ii) What are meta-requirements for an approach to support SMEs in their transformation to a circular business model? To explore these questions, we conducted observations, interviews, and focus groups with selected SMEs. This confirmed existing barriers and identified SMEs that already have multiple business models in place, which we refer to as "front-runners." We also derived six meta-requirements for a circular business model portfolio approach, based on emerging literature on business model portfolio management (Möller et al. 2020).

An important follow-up research question is how front runner SMEs manage their portfolio of business models. Insights from these SMEs, combined with the meta-requirements from corporate-focused literature, will inform the design of the portfolio approach.

This research offers valuable insights into the business model innovation practices of manufacturing SMEs, integrating emerging knowledge on business model portfolio management into usable design guidelines for developing circular business model portfolio approaches for SMEs.

The next section discusses background and related work. Section 3 outlines our research approach, while Section 4 presents the intermediate results of our study. Section 5 concludes this paper.

Background and related work

In this section we discuss literature on barriers to adopting circular business models (Section 2.1), and emergent literature on business model portfolio management (Section 2.2).

Barriers to adopting circular business models

Circular business models are a specific kind of business models. By linking circular principles to the business model, four strategies for developing a circular business model emerge (Bocken et al., 2014; Geissdoerfer et al., 2018).

- **Cycling** refers to the recycling of materials and energy within the system through reuse, remanufacturing, refurbishing, and recycling. For example, expensive industrial robots used by multinationals can be reused by SMEs, increasing their viability and productivity (Bi et al., 2015)
- **Extending** involves prolonging the product's use phase through durable design, marketing, maintenance, and repair activities. For instance, Patek Philippe creates high-quality, timeless watches that last for generations, supporting this with the slogan: "You never actually own the watch, you merely look after it for the next generation" ((Geissdoerfer et al., 2020)
- **Intensifying** refers to increasing the intensity of product use through solutions like the sharing economy or public transport. For example, car-sharing services reduce the number of cars in use compared to traditional ownership models (Prettenthaler & Steininger, 1999).
- **Dematerializing** involves offering services or product-service systems instead of physical products to fulfill the same customer function. This approach can reduce the number of products produced while enhancing the customer experience (Kohtamäki et al., 2019; Tan et al., 2010)

Literature distinguishes organizational and cognitive challenges to adopting circular business models.

Organizational barriers relate to the inability to manage and organize a new business model. These include:

- **Resource allocation**: Resistance to committing resources to a new business model (BM), reluctance to alter existing BM components that could disrupt established resources and competencies, lack of technical equipment, failure to adopt new technologies, and insufficient knowledge of the circular economy (Brax, 2005; Chesbrough, 2010)
- **Stakeholder issues:** lack of insight into customer needs, fear of absorbing customer risks, insufficient customer touch points or data exploitation, high switching costs, stakeholder resistance to adopting new a BM, insufficient collaboration opportunities, lack of customer acceptance and trust, competitor resistance, and difficulty in measuring value(Baines et al., 2007; Sivertsson & Tell, 2015).
- **Complexity**: Challenges in developing a new BM alongside the existing one, particularly when the new BM conflicts with the old((Markides & Charitou, 2004; Mezger, 2014; Santos et al., 2009).
- **Inertia and uncertainty**: Resistance due to uncertainty about the new BM's effectiveness, expected performance, or legal implications, and the lack of perceived need for BM renewal (Andries & Debackere, 2007; Lindgardt et al., 2009; Stieglitz & Foss, 2015).

Cognitive barriers relate to the inability to recognize new ways of doing business. These include:

- **Inability to think in business models**: Difficulty overcoming current business logic, thinking outside the box, or applying circular principles (Bocken et al., 2016; Clegg et al., 2017)
- **Dominant logic**: Management's vision that hinders the development of alternative business models and discourages the identification of new opportunities (Bettis & Prahalad, 1995; Chesbrough & Rosenbloom, 2002)
- **Lack of leadership**: Insufficient leadership to propose business model innovation (BMI) and to identify or shape the required structures, competencies, and processes, as well as a lack of awareness regarding the need for management to lead change (Berglund & Sandström, 2013; Chesbrough, 2010)

Evolution of Business Model Portfolio Management methods

According to Teece (2010) a business model describes how an organization creates, delivers, and captures value. Wirtz (2020) outlines five phases in the lifecycle of business model management: design, implementation, operation, adaptation, and control. Various tools, methods, and models exist for managing business models, such as the Business Model Canvas five phases: design, implementation, operation, adaptation and modification, and co (Osterwalder & Pigneur, 2010) and e3-value ontology (Gordijn & Akkermans, 2003). Some tools provide systematic guidance for specific tasks, like creating a change plan for a business model O (De Reuver et al., 2013). Business model portfolio management, defined as a strategic approach to helping companies oversee and optimize their collection of business models (Snihur et al., 2023; Aversa et al., 2017), is an emerging research area. but lacks standardized methodologies, with a variety of approaches and outcomes. By drawing upon the integrated management framework proposed by Globocnik et al., (2020), which encompasses four key components: strategy, business model portfolio, business model tactics, and business model operations. In this section we provide a comprehensive structure for understanding and describing the methods below.

In 2017, Aversa, Haefliger, and Reza (2017) introduced Complementarity Mapping, a systematic and visual method designed to analyze business model portfolios. This method focuses on understanding interdependencies and complementarities within business models to maximize synergies and improve portfolio performance. By visualizing relationships between business models, resources, and capabilities, organizations can identify weak links, strengthen critical connections, and make informed decisions about retaining or eliminating less effective models. This method aligns closely with the business model portfolio level of the integrated management framework (Globocnik et al., 2020).

In 2018 Koldewey et al. (2018) introduced the Smart Services Portfolio Planning method, aimed at technology-driven sectors. This method uses a four-phase approach that includes analyzing existing and planned services, generating archetypes, evaluating synergies and competition, and planning a coherent portfolio. Tools such as bubble diagrams and

consistency matrices are used to align companies' technological capabilities with market demands. This approach integrates tactical adjustments with portfolio planning, resulting in portfolios optimized for synergy and competitiveness(Globocnik et al., 2020).

In 2020, Osterwalder, Pigneur and Smith (2020) introduced the Portfolio Map, an iterative method for managing both existing and new business models. The approach focuses on balancing the exploitation of current models with the exploration of new ones to ensure profitability and drive innovation. Existing models are evaluated for their profitability and risk, while new models are designed, tested, and refined through customer co-creation. This method provides a balance between strategic vision and operational feasibility, fostering sustainable portfolio development(Globocnik et al., 2020).

Finally, in 2023, Snihur, Thomas, and Burgelman (2023) presented the Business Model Portfolio Trajectory Analysis. This future-oriented approach analyses intra-business model complexity, inter-business model complementarity, and external pressures to help companies adapt their portfolios to changing market conditions. By combining historical data with future projections, this method enables companies to align long-term strategies with the adaptability required to meet evolving challenges(Globocnik et al., 2020; Snihur et al., 2023)

Table 1 summarizes these methods, highlighting their approaches, levels of analysis, focus areas, and expected outcomes.

TABLE 1. OVERVIEW OF BUSINESS MODEL PORTFOLIO MANAGEMENT METHODS

Source	Approach	Strategy	Portfolio	Tactics	Operations	Focus	Expected outcomes
Aversa et al. (2017)	Visualization tool for complementarities within the portfolio		X	X		Analysis of relationships between resources, capabilities, and performance; identification of weak links	Dynamic overview of complementarities; identification of less effective models
Koldewey et al. (2018)	Method for smart service portfolios		X	X		Generation of archetypes based on consistent characteristics; focus on synergy and differentiation	Portfolio with archetypes and variants; optimization of synergy and competitiveness

Im et al. (2020)	Analytic Network Process (ANP) for feasibility and attractive ness	X	X			Evaluation of internal feasibility and external attractiveness of models; portfolio categorization based on priorities	Portfolio categorization (Fertile, Tempting, Fruitless, Dubious); strategies to shift models to the "Fertile" quadrant
Osterwalde r & Pigneur (2020)	Portfolio mapping for existing and innovative business models	X	X			Focus on sustainability, disruption risk (existing), and expected return (innovative)	Improvement of existing models; iterative testing of innovative models; holistic portfolio overview
Globocnic et al. (2020)	Formal control framewor k to manage business model portfolios and dynamics	X	X			Separation of concerns for strategy management to specific operations for business models	Consistent governance in different layers and responsibilities
Snihur et al. (2023)	Step-by-step analysis of the business model portfolio	X	X	X	X	Focus on complexity, complementa rity, and external pressures; trajectory analysis of the portfolio	Visualization of the portfolio's trajectory; insight into trends in complexity, synergies, and external pressures

The field has evolved from static portfolio evaluations to dynamic, forward-looking methods aimed at driving portfolio development. This shift prioritizes optimizing synergies, increasing adaptability to external pressures, and aligning more closely with market demands, emphasizing the balance between short-term performance and long-term innovation.

However, current methods overlook circularity and fail to address the unique context of small and medium-sized enterprises (SMEs). The transition to circularity requires a shift from firm-centric, linear thinking to ecosystem-oriented, circular thinking—something not

reflected in existing Business Model Portfolio Management methodologies. SMEs face unique challenges due to their smaller size, resource constraints, and informal structures (Frank & Roessl, 2015; Hadjimanolis, 1999). As a result, they innovate differently, often adopting continuous innovation strategies and agile methods to manage risk, as opposed to the radical innovation typically pursued by larger firms (Heider et al., 2020; Klewitz & Hansen, 2014;Sanchez & Ricart, 2010). Therefore, tools and methods developed for larger firms are often not easily applicable to SMEs (Miller et al., 2021).

Research design

We address the overall research question using a design science research methodology (DSR) (Cremers & Van Turnhout, 2023; Peffers et al., 2007). DSR is particularly useful if the research objective focuses on approaches to address identified practical business problems, combined with scientific rigour, such as products, services, interventions or methods (Berkers, 2023; Christis, 2020; Cremers & Van Turnhout, 2023; Hevner et al., 2004). DSR emphasizes innovation, solution-building, and stakeholder engagement (Goes, 2013), typically using mixed methods to answer empirical questions. Figure X illustrates our overall research design, where we define 'approach' as the artifact or design.

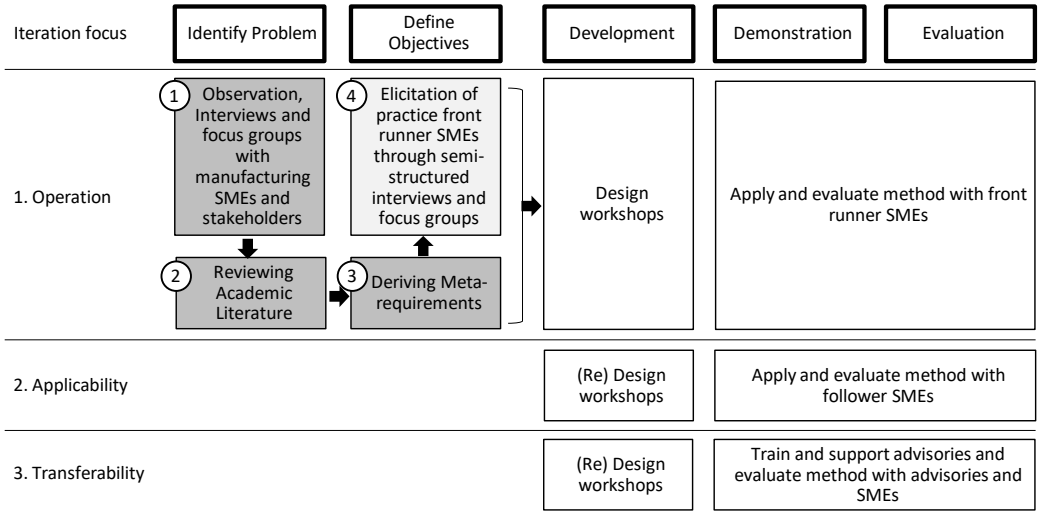


FIGURE 1: OVERALL RESEARCH DESIGN (SOURCE: OWN ELABORATION)

Our overall study design consists of problem analysis and requirements specification, followed by three design iterations: developing, demonstrating and evaluating the CBMPMS. The first design iteration is aimed at establishing the operation of the approach - i.e. determine how the approach should work and ensuring that it delivers its intended outcomes.

In Step 1, we investigated the problem in practice by observing and interviewing manufacturing SMEs and conducting focus groups. This was performed in a previous collaborative project. The results of this step are summarized in Section 5.1.

Step 2 involves reviewing the emergent literature on business model portfolio management. The results of this step are summarized in Section 3.

Step 3 focuses on deriving meta-requirements to guide the further design of our approach. These are requirements that address a 'class of approaches' (Walls et al., 1992), meaning multiple different implementations, or approaches could follow from these requirements. As such, they are typically expressed in an abstract and general way (Möller et al., 2020). To derive these requirements, we follow the guidelines of Möller et al. (2020).

In Step 4, we expect to present a synthesis of the front-runners' experience in business model portfolio management. Our aim is to make the experience of this group explicit through semi-structured interviews, focus groups and design workshops, based on the meta-requirements presented in Step 3.

The first iteration is further completed by conducting practical design workshops and applying and evaluating the approach with the front-runners. [Profile and selection of front-runners]

The second design iteration focuses on practical applicability of the approach. In this phase, we will redesign the approach, based on the evaluation from iteration 1. We will then apply and evaluate it with a group of manufacturing companies that are not yet familiar with circular business model portfolio management.

The third design concentrates on scaling the approach, i.e. its transferability. This involves ensuring that the approach can be taught to advisories, who will apply then it in their practices of working with SMEs. As part of this, we will train and support SME advisors in using the approach with SMEs in their focus areas.

Results

The following Section 4.1 reflects Step 1 of the research, whereas the succeeding Section 4.2 reflects the result of Step 3 of the research.

Problem in practice of SMEs (Step 1)

Manufacturing companies struggle to transition toward circular business models. The causes for this struggle liein organizational barriers (such as time, money and knowledge) and cognitive barriers (such as a product-oriented mindset and an inability to think in terms of business models). As a result, in their efforts to become more circular, manufacturing SMEs remain focused on low-hanging fruit. They typically stop at simple circularity options

at the lower end of the R-ladder (mainly reducing and preserving inputs) and do not take radical steps.

Entrepreneurs confirm that the transition from the existing linear business model to a circular one is often hindered by the difficulty of letting go of the old way of working.

Front-runners – those already creating circular value to varying extent – typically develop a new circular business model *alongside* their existing (linear) business model. By adding one or more additional business models, the entire portfolio becomes more circular. However, the question remains: how does one develop a new business model in a structured way, and how does one manage such a portfolio?

This investigation confirms that the practical challenge for manufacturing SMEs is unclear guidance on how to develop a circular business model in addition to an existing linear one and how to integrate it into their operations. The logic these companies seem to follow is as follows:

1. **Drivers**: Companies are confronted with the need to adopt more circular practices. These drivers are often external (e.g., environmental legislation, CSRD obligations, customer demands, competitors' actions) but sometimes also internal (e.g., stakeholder desires, internal motivation).
2. **Adapted Value Proposition**: These internal and external drivers are translated into an adapted value proposition (e.g., "Our product/way of working is circular/environmentally friendly").
3. **Value Creation/Delivery**: To realize this new value proposition, companies adapt their production processes (value creation/delivery), within the constraints of their existing revenue model (value capturing).
4. **Incremental Change**: The result is often an incremental (and sometimes marginal) change to the business model, which may not fully meet the originally promised value proposition (leading to potential greenwashing) and lacks a clear pathway beyond initial ideas.

Companies that successfully meet a more circular value proposition do so by developing an additional circular business model alongside their old (linear) business model. This usually involves not only changing the value creation/delivery but also adjusting the revenue model.

These ‘circular’ companies are then working with an implicit portfolio of business models and face the challenge of maintaining the desirability, feasibility and viability of this portfolio within the constraints of their available resources while ensuring sufficient circularity.

The result of this balancing act is that the portfolio rarely includes truly circular business models.

This investigation confirms that front-runner SMEs use multiple business models to build the shift from linear to circular. However, it is unclear exactly how they manage this process. Furthermore, other companies face similar barriers to those identified Section 2.1, during the shift from linear to circular.

Meta-requirements (Step 3)

Below, we present the meta-requirements for developing an approach to support SMEs in their transformation to circular business models. The meta-requirements relate to different aspects of portfolio management, depicted in Figure 2. The first aspect addresses how the concept and management of business models are linked to strategy and its execution. The second aspect concerns how business model options are created. The third aspect deals with how business models are managed and abandoned.

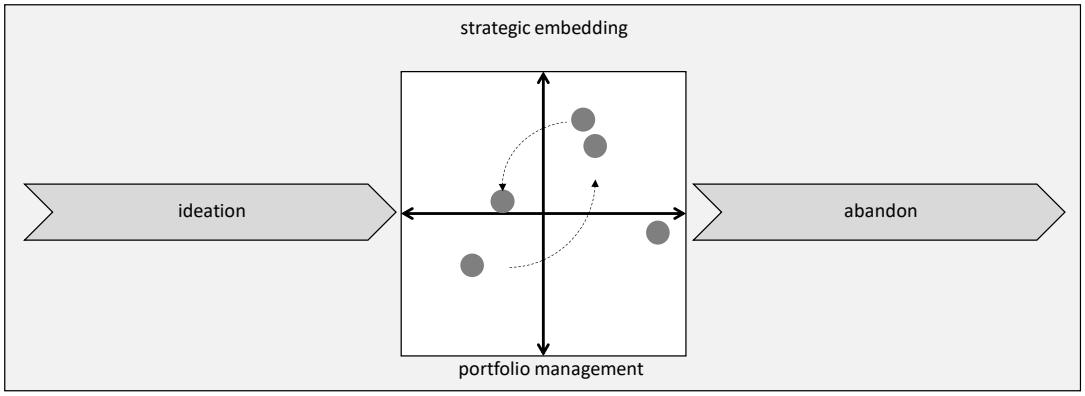


FIGURE 2: CONCEPTUAL DIAGRAM FOR PORTFOLIO ASPECTS (SOURCE: OWN ELABORATION)

MR1: The approach should support an organization in operationalizing a transformation from linear business models to circular business models

MR2: The approach should be useful for SMEs

This represents the overall objective for the approach we aim to develop and its intended focus of application. Throughout this transformation it is essential that the organization maintains an acceptable level of earning power, while progressing to the aspired circular future.

MR3: The approach should support an organization in operationalizing strategic objectives through business models

We follow the view that strategy can be implemented by one or more business models (Shafer et al., 2005). Berkers (2023) proposes a method that helps organizations derive business model design requirements from strategy. Several authors emphasize the importance of aligning external analysis with internal analysis to monitor the fit between an organization's position and strategy, , both in setting strategic objectives and adapting business models (Im et al., 2020; Osterwalder et al., 2020; Snihur et al., 2023).This

requirement also calls for the explicit use of business models, meaning that the approach should support identifying and clarifying (current) business models, as well as generating, selecting, evaluating, and further specifying business model options (e.g., Koldewey). Note that the explicit use of business models as a tool is not obvious for SMEs, highlighting a paradoxical tension between MR3 and MR2.

MR4: The approach should support an organization in managing each business model through its lifecycle stages

Wirtz (2020) presents business model lifecycle management as a continuous process through the stages: design, implementation, operation, adaptation and modification, and control. In greater detail, Wirtz and Daiser (2018) identify the phases of business model innovation (BMI): analysis, ideation, feasibility, prototyping, decision-making, implementation, sustainability. Osterwalder and Pigneur (2010) emphasize the distinction between exploration and exploitation, which includes phases, such as the dismissal (or phasing out) of business models.

MR5: The approach should support an organization in managing multiple business models in parallel

MR3 Links business models to strategic objectives, yet value creation also requires - and builds - resources and capabilities (Aversa et al., 2017). To effectively control the utilization and gradual building of resources, while maintaining earning power or value capture (i.e., returns (Osterwalder et al., 2020), or business model performance (Aversa et al., 2017), organizations need to manage multiple business models simultaneously. Several authors emphasize that the complementarity and complexity of business models are key dimensions to monitor when managing a portfolio (Aversa et al., 2017; Koldewey et al., 2018; Snihur et al., 2023). These dimensions should also influence the evaluation and decision-making process related to implementation of new business models and the addition of these models to the portfolio (MR3), as well as the phasing out of existing ones.

MR6: The approach should support an organization in specifying and planning business model evolutions

Wirtz (2020) includes ‘adaptation and modification’ as one of the phases in the lifecycle management of business models. To transition from one state to another, a plan for modifying one or more business models is needed. The planned change of business models is referred to as business model roadmapping (De Reuver et al., 2013). At each stage a functional business model is required, ensuring that value creation and capture align with objectives. Snihur et al., (2023) refer to this as trajectories. However, how to apply this concept on the level of a business model portfolio is unclear.

Conclusion

In response to the challenge SMEs face in transforming their often linear business operations into circular business models, we set out with the research objective of developing an approach to support this transition. The concept of business model portfolio management offers promise in balancing earning power while phasing in new circular business models. However, such approaches are not yet tailored to include circular business models, nor are they specific to SMEs.

For our overall approach we adopt a design science methodology. During the problem identification phase of our first iteration, we conducted interviews and focus groups with SMEs and industry associations. These consultations confirmed the need for support and helped us identify a few manufacturing SMEs that already implemented a form of portfolio management. To better understand their practices and derive objectives for a solution, we examined the body of literature on business model portfolio management and derived meta-requirements. So far, we derived six meta-requirements. These, along with the elicitation of current practices, will guide the design, application and evaluation of a business model portfolio management solution for SMEs.

Our research aims to support SMEs and their advisors in operationalizing the strategic shift from a linear economy to circular economy. The output presented in this paper is intended for designers of such support tools.

Our theoretical contribution lies in the design knowledge derived from the emerging literature on business model portfolios.

The limitations of this research include the fact that the outputs presented here reflect the initial phases of an intented multi-iteration design science approach, making them a preliminary stepping stone. The SMEs consulted, predominantly from the manufacturing industry, may not fully represent the broader industry. Furthermore, the literature from which we derived the meta-requirements primarily focuses on large and corporate enterprises, and does not address the strategic challenge of transitioning from a linear to a circular business model. The next steps in our research will explore how relevant these findings are for SMEs.

Further research should focus on completing the intended design cycles and applying the forthcoming approach to other domains.

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How Can We Support SMEs on Their Sustainability Journey?

Addressing the Gaps in Research and Practice

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Abstract

Small and medium-sized enterprises (SMEs) play a critical role in the transition toward sustainable business practices. However, they face significant barriers, including financial constraints, limited internal expertise, and fragmented regulatory support. Despite the increasing focus on corporate sustainability, a significant gap remains in the literature regarding structured support mechanisms for SMEs in their sustainability transitions. Existing research often fails to account for the highly context-dependent challenges SMEs face. This study addresses this gap by examining the key barriers and enablers of SME sustainability and proposing a concrete methodological approach to co-develop tailored support mechanisms in collaboration with stakeholders.
Through a systematic literature review, this study identifies financial and regulatory incentives, capacity-building initiatives, and multi-stakeholder collaboration as critical enablers of SME sustainability. Additionally, it highlights the shortcomings of current research, which largely relies on cross-sectional analyses and lacks iterative, practice-oriented methodologies. By integrating theoretical insights with real-world applications, this study contributes to both academic discourse and practical sustainability strategies for SMEs. By leveraging Action Research, this study advocates for an adaptive, participatory approach that enables SMEs to navigate sustainability transitions through continuous feedback loops and stakeholder engagement. The findings emphasize the need for long-term, context-specific interventions and call for further research into collaborative support mechanisms that align with SMEs' unique operational realities. Ultimately, this study

provides a structured pathway for advancing SME sustainability while addressing a critical methodological gap in existing literature.

Keywords

SMEs, sustainability, barriers, enablers, action research

Main text

1. Introduction

The sustainability transformation of small and medium-sized enterprises (SMEs) is focal point for advancing environmental and social goals, particularly within Europe and Switzerland, where SMEs form the backbone of the economy. In Switzerland, 99% of all businesses are classified as SMEs, defined as companies with fewer than 250 employees. These enterprises employ approximately two-thirds of the country's workforce (*Bundesamt für Statistik*, no date) and contribute to 60% of the national GDP (Bigler, 2023). Further, SMEs are responsible for 40-50% of the country's inland industrial emissions (McKinsey&Company, 2022) and are thus, a fundamental pillar of the Swiss economy and play a pivotal role in the country's sustainable transformation.

Swiss and European SMEs increasingly recognize the importance of sustainability and are motivated to address the associated challenges within their operations (Alsdorf, Kosmol and Rivera Fernandez, 2023; Fuchs, Mohan and Strobl, 2023). This motivation is driven by both intrinsic factors, such as organizational values, and external pressures, including regulatory demands and stakeholder expectations (Brammer, Hoejmose and Marchant, 2012; Furchheim *et al.*, 2023; Fuchs, Ladewig and Kersten, 2024). Despite their significant collective importance for sustainable development, SMEs have made relatively little progress in adapting sustainability practices compared to large corporations. While larger companies actively report on their sustainability efforts (e.g., under the Corporate Sustainability Reporting Directive, CSRD), set ambitious targets (e.g., through Science-Based Targets initiatives, SBTis), and often implement sophisticated corporate social responsibility (CSR) strategies, SMEs lag behind in adopting similar practices (Perrini, Russo and Tencati, 2007; Elford and Daub, 2019).

A primary obstacle in the implementation of sustainable management in SMEs lies in limited financial and human resources (Grothe, 2012; Takacs, Brunner and Frankenberger, 2022; Furchheim *et al.*, 2023; Fuchs, Ladewig and Kersten, 2024). SMEs often face restricted access to technological tools, struggle to allocate time for sustainability efforts alongside daily operations and frequently require employees to take on roles outside their expertise to address sustainability issues (Grothe, 2012; Fuchs, Ladewig and Kersten, 2024). These

constraints hinder SMEs from developing a comprehensive understanding of sustainability impacts across their operations (Grothe, 2012; Løkke and Madsen, 2022)).

Additional barriers include the perceived lack of economic viability of sustainability measures, challenges in measuring environmental impacts, and the absence of overarching sustainability strategies Internal factors, such as low awareness of sustainability within organizations, limited leadership support, and resistance to cross-departmental collaboration, further exacerbate these issues (Brammer, Hoejmose and Marchant, 2012; Furchheim *et al.*, 2023).

Even for SMEs that successfully implement sustainability initiatives, effective communication of their efforts poses a challenge. Businesses risk accusations of "greenwashing" if their communication lacks transparency and credibility. Conversely, they may engage in "green-hushing," withholding information about their sustainability achievements out of fear of scrutiny (Furchheim *et al.*, 2023).

Despite these challenges, SMEs remain crucial actors in societal transformation, making it essential to explore their unique barriers, drivers, and supporting mechanisms. SMEs often implement sustainability practices for various reasons, including regulatory compliance, market pressures, cost savings through resource efficiency, and improving their competitive advantage (Malesios *et al.*, 2021). Additionally, customer demand, supply chain requirements, and intrinsic motivations, such as ethical values or leadership commitment, can act as powerful drivers. On the other hand, barriers such as limited financial resources, lack of expertise, insufficient access to technology, and the absence of tailored support mechanisms often hinder SMEs from adopting sustainable practices (Brammer, Hoejmose and Marchant, 2012). Cultural and regional factors also play a role; for instance, Swiss SMEs may feel the pressure of high national environmental standards but may lack the resources to meet them effectively.

These complex dynamics highlight the need for tailored approaches that address both the motivations and obstacles unique to SMEs (Shani and Coghlan, 2021). However, academic literature on these topics, particularly in the context of Switzerland and Europe, remains limited. This gap underscores the necessity for a comprehensive review of the factors influencing sustainability in SMEs, providing actionable insights to foster sustainable practices in this critical sector. Using a participatory approach, such as action research (AR), in combination with an extensive literature review is a promising conceptual approach for addressing this gap because it enables a deeper understanding of the unique barriers and opportunities that SMEs face in the context of sustainability. While the literature review helps mapping existing knowledge and identify gaps, the participatory approach ensures that SMEs themselves are actively involved in co-developing solutions. This collaborative process not only empowers SMEs but also allows for the development of context-specific interventions that are directly relevant to their challenges and resources (Alfaro-Tanco *et al.*, 2021). Furthermore, AR's iterative nature facilitates the continuous assessment of the

impact of these interventions, enabling real-time adjustments and improvements, ultimately leading to more effective and sustainable practices for SMEs (Coghlan and Brannick, 2005).

2. Literature Review

Methodology

To address this research gap, a systematic approach was employed to develop and refine search queries for this literature review. The process began with defining the research scope, focusing on sustainable management practices in SMEs, particularly in Europe and Switzerland. Key themes included barriers to adoption, organizational resistance, drivers for sustainability, and the role of supportive mechanisms such as policies, stakeholder engagement, and collaborative efforts.

Keywords were systematically generated and refined through an iterative process of consultation and analysis. High-priority terms such as "sustainable management," "SMEs," and "barriers" were complemented by medium-priority terms like "policy interventions" and "collaborative efforts." Additionally, broader thematic extensions, including "circular economy" and "risk aversion," were incorporated to ensure a comprehensive yet targeted search strategy. These broader searches provided contextual background and deepened the authors' understanding of the topic. However, publications retrieved from these searches are included solely in the introduction and are explicitly excluded from the literature review to maintain alignment with the research question. In the literature review, the use of proximity operators (e.g., NEAR/3) within search queries enabled the identification of nuanced relationships between key concepts, thereby enhancing the precision and relevance of the results.

Two distinct search queries were developed. The narrow query focused on identifying SME-specific challenges and sustainability practices, yielding highly precise and contextually relevant results. The broad query, on the other hand, expanded the scope by including terms related to supporting mechanisms and external drivers, such as stakeholder pressure and policy interventions. Combining these queries allowed for a balanced literature review, ensuring a comprehensive exploration of sustainability challenges and support mechanisms for SMEs, particularly in Europe and Switzerland.

A comparison of the two queries with their limitations is presented in Table 1:

Combining the two queries enables a comprehensive literature review by balancing the precision of the narrow query with the broader scope of the expanded query. This methodology ensures both specificity and inclusivity, capturing diverse perspectives on sustainability practices in SMEs.

Table 1: Comparison of the used search queries for the literature review

Aspect	Narrow Scope Querry	Broader Scope Querry
Focus	Focused on sustainability challenges, barriers, and drivers for SMEs.	Expanded focus to include support mechanisms, policy interventions, and collaborative strategies.
Proximity Operators	Not used	Retained NEAR/3 but applied to broader terms for greater inclusivity.
Keywords	High-priority terms only (e.g., "SME," "sustainable management," "barriers," "drivers")	Includes high- and medium-priority terms, such as "supporting mechanisms," "policy interventions," and "collaborative efforts"
Filters Applied	Language (English), Document type (journal articles), Publication stage (final), Years (2015–2025).	Same filters applied, but additional terms like "German" language and broader SME-related keywords included
Precision	High precision; highly relevant results with minimal noise.	Moderate precision; captured diverse themes but with potential for less-relevant results.
Scope	Narrow scope; directly relevant to SME challenges and motivations.	Broad scope; covered challenges, enablers, and actionable mechanisms for sustainability.
Results	21 papers.	1775 papers.
Insights	Core insights into organizational barriers and motivations for SMEs.	Comprehensive overview, including actionable strategies and diverse stakeholder roles.

To refine the literature review and ensure that only the most relevant articles are included, the open-source software ASReview was employed as part of the research methodology (ASReview LAB developers., no date). ASReview utilizes an active learning model that combines machine learning algorithms and user interaction to efficiently prioritize and identify relevant literature from a large dataset. This approach was chosen due to its ability to handle extensive datasets effectively and to iteratively refine results with minimal manual effort. The model's default setup, consisting of TF-IDF (Term Frequency-Inverse Document Frequency) for feature extraction, Naive Bayes for classification, a Maximum query strategy, and Dynamic Resampling for balancing, provides a combination of speed

and accuracy. These methods work synergistically to identify patterns in textual data and prioritize articles based on user feedback during the screening process.

The broad query, which returned 1,775 results from Scopus, was imported into ASReview to allow the model to learn from diverse literature while ensuring the inclusion of critical studies. During the model's iterative learning process, international studies were included for training purposes but excluded from the analysis, as the focus of this research is on local and regional perspectives within Switzerland and Europe. International findings, while valuable, may not directly address the specific challenges and contexts faced by SMEs in these regions (Poufinas, Galanos, and Pyrros Papadimitriou, 2018).

Screening was guided by strict inclusion and exclusion criteria to maintain the relevance and focus of the review. Articles addressing SMEs and sustainability, particularly their opportunities, constraints, issues, and sustainability performance, were prioritized. Studies focusing on support programs, interventions, non-European regional contexts, financial sustainability, financial risks, sectoral or supply chain innovations, organizational behaviour, and consumer perspectives were excluded to align with the study's objective of exploring SMEs' sustainability efforts and challenges without an overemphasis on external or sector-specific factors. The model was calibrated to stop screening after encountering 20 consecutive irrelevant papers, enhancing efficiency while ensuring thoroughness. Through this process, a total of 69 papers were manually screened, resulting in the identification of 13 relevant studies, which were subsequently included in the analysis alongside articles from the narrowed search query.

This methodology ensures that the literature review remains focused on core themes—SME sustainability challenges, opportunities, and performance—while excluding extraneous topics. By leveraging machine learning, the review process was both efficient and comprehensive, providing a robust foundation for the analysis and synthesis of existing knowledge.

Results

The analysis of 35 papers combined from the narrow Scopus query and the refined ASReview broad sample revealed critical insights into the sustainability journey of SMEs. (Table 2) Below, findings are summarized by category, followed by a discussion of how refining the scope highlights a significant research gap and informs the stated research question.

Table 2. Summary of the literature review papers, including author, title, year, key insides and source, coded as follows: A(T) - ASR Training, A(R) - ASR Relevant, S - Scopus narrow, chronological and distributed in the different topics.

Authors, year, source	Title	Key insides
Challenges in SME Sustainability Adoption		
Rizos (2016) *S*	Implementation of circular economy business models by SMEs: Barriers and enablers	Identifies financial and technological barriers to circular economy adoption in SMEs.
Carrigan (2017) *S*	The Fine Jewellery Industry: Corporate Responsibility Challenges and Institutional Forces Facing SMEs	Discusses CSR challenges specific to SMEs in niche industries.
Tang (2022) *A(T)*	New Schemes for Investment in SMEs of China: Role of Access to Finance, Innovation, and Sustainability	Financial constraints limit innovation and sustainability efforts, highlighting the need for improved access to finance.
Jain (2021) *S*	Unlocking technology adoption for a robust food supply chain: Evidence from Indian food processing sector	Examines technological barriers to supply chain innovation in SMEs.
Metzker (2021) *S*	The Perception of the Market and Operational Area of Business by Service Sector and Tourism Companies in terms of CSR implementation	Discusses challenges in CSR implementation within service and tourism SMEs.
Lohwasser (2022) *S*	Strength in Stability: A Meta-Analysis of Family Firm Performance Moderated by Institutional Stability and Regime Type	Explores how institutional instability poses challenges for SME performance.
Polas (2022) *S*	Artificial Intelligence, Blockchain Technology, and Risk-Taking Behavior in the 4.0IR	Explores challenges in adopting advanced technologies like AI and blockchain.

	Metaverse Era: Evidence from Bangladesh-Based SMEs	
Tingbani (2023) *S*	Environmental Tax, SME Financing Constraint, and Innovation: Evidence From OECD Countries	Environmental taxes create financial constraints for SMEs, limiting their ability to innovate.
Di Chiacchio (2024) *S*	Eco-innovation in the textile industry: the strategic importance of data privacy and environmental knowledge management	Highlights challenges in integrating eco-innovation with data management.
Pöll (2024) *S*	Stakeholder relations as an asset in family firms – Performance effects of changes after PE investment	Examines how shifts in stakeholder relations affect SME sustainability performance.
Nazir (2025) *S*	A thematic analysis of factors influencing SME adoption of social media marketing: a TOE framework perspective	Explores barriers to technology adoption and how they affect SME performance.
Enablers of Sustainability in SMEs		
Bocquet (2019) *S*	Strategic CSR for innovation in SMEs: Does diversity matter?	Diversity in CSR initiatives fosters innovation and sustainability.
Wang (2020) *S*	A Study of the Relationship between Corporate Culture and Corporate Sustainable Performance: Evidence from Chinese SMEs	Highlights the role of corporate culture in enhancing sustainable performance.

Bazrkar and Moshiripour (2021) *S*	Corporate practices of green human resources management	Explores green HRM practices as an enabler for sustainability in SMEs.
Belas (2021) *A(T)*	Corporate social responsibility and sustainability issues of small- and medium-sized enterprises	Discusses how CSR initiatives contribute to sustainability in SMEs.
Sawe (2021) *S*	Assessing people-driven factors for circular economy practices in SMEs' supply chains: Business strategies and environmental perspectives	Explores how employee engagement and leadership enable circular economy practices.
Wei (2021) *S*	An examination to explain the mechanism of employees' environment-specific behavior through csr and work engagement from the perspective of stewardship theory	Highlights how CSR initiatives foster employee engagement and environmental behavior.
Doghan (2022) *S*	Organizational Environmental Culture, Environmental Sustainability and Performance: The Mediating Role of Green HRM and Green Innovation	Emphasizes the role of organizational culture and green HR in improving environmental performance.
Benjamin (2023) *S*	Sequential Impact of Green Supply Chain Initiatives on Sustainable Performance: Food and Beverage Processing SMEs in Australia	Examines how green supply chain initiatives drive sustainable performance.

Palacios-Manzano (2024) *A(T)*	Corporate Social Responsibility as a Vehicle for Ensuring the Survival of Construction SMEs	CSR improves survival and performance, with job satisfaction and innovation as mediating factors.
Zihan and Makhbul, (2024) *S*	Green Human Resource Management as a Catalyst for Sustainable Performance: Unveiling the Role of Green Innovations	Green HR practices drive sustainable performance and foster innovation in SMEs.
Support Mechanism for SMEs		
Oláh (2019) *A(R)*	The assessment of non-financial risk sources of SMES in the V4 countries and Serbia	Identifies support mechanisms to mitigate non-financial risks.
Yang (2020) *S*	The performance implication of corporate social responsibility in matched Chinese small and medium-sized buyers and suppliers	Explores the role of CSR in improving buyer-supplier relationships and overall performance.
Alfarajat (2023) *A(R)*	Strategic agility and supply chain agility: Potential antecedents of SMEs performance	Identifies supply chain agility as a driver of performance and sustainability.
Mishra (2023) *A(R)*	Exploring the relationship between environmental collaboration and business performance with mediating effect of responsible consumption and production	Discusses how environmental collaboration supports sustainable performance.

Prasannath (2024) *S*	The impact of government support policies on entrepreneurial orientation and SME performance	Highlights the positive role of government policies in promoting SME performance and sustainability.
Stoyanova and Stoyanov (2024) *A(T)*	Scaling Up Sustainability From Operational Capability to a Dynamic Capability: The Case of Royal Bank of Scotland	Highlights the transition from static to dynamic capabilities, focusing on adaptability and resource mobilization.
Rawashdeh (2024) *A(T)*	Strategic Agility and Environmental Sustainability: Role of Digital Transformation	Digital transformation enhances strategic agility and supports environmental sustainability.
Other		
Zientara (2017) *S*	Socioemotional Wealth and Corporate Social Responsibility: A Critical Analysis	Analyzes socioemotional wealth as a driver of CSR practices.
Esposito (2020) *A(R)*	CSR in the Italian Wine Sector through websites	Focuses on the role of CSR in branding and customer loyalty in niche markets.
Olekanma (2024) *S*	Small- and medium-sized enterprises' carbon footprint reduction initiatives as a catalyst for green jobs: A systematic review and comprehensive business strategy agenda	Examines how carbon footprint reduction initiatives foster green jobs and align with business strategies.

A significant number of studies emphasized challenges SMEs face when adopting sustainable practices. Financial constraints remain one of the most critical hurdles (Tang, 2022; Tingbani *et al.*, 2023). Other challenges include limited access to innovation and organizational inertia (Rizos *et al.*, 2016). For example, sector-specific issues, such as the

capital-intensive nature of construction (Palacios-Manzano, Leon-Gomez and Santos-Jaen, 2024) and the regulatory pressures in textiles (Di Chiacchio *et al.*, 2024) complicate the path toward sustainability. Enablers identified include the strategic role of CSR, with direct impacts on job satisfaction and innovation (Belas *et al.*, 2021; Palacios-Manzano, Leon-Gomez and Santos-Jaen, 2024), and the adoption of green innovations like green human resources management (Zihan and Makhbul, 2024). Additionally, strategic agility, leadership behaviors, and digital transformation were found to mediate sustainable practices in SMEs (Doghan *et al.*, 2022; Rawashdeh *et al.*, 2024). The importance of stakeholder collaboration, especially for circular economy practices, was also emphasized (Rizos *et al.*, 2016). The role of external support mechanisms is critical, yet underexplored. While some studies have highlighted the importance of government policies and financial support (Tang, 2022; Prasannath *et al.*, 2024), there is little comprehensive analysis on how structured support mechanisms—spanning government, industry associations, and multi-stakeholder collaborations—can effectively drive sustainable transitions in SMEs. The research predominantly addresses broader contexts, such as supply chain innovations or consumer-driven sustainability, rather than tailored support structures specifically targeting SMEs. Several studies explored adjacent topics, such as employer contribution (Wei *et al.*, 2021), , and the socioemotional wealth of family firms in relation to sustainability (Zientara, 2017). While these offer valuable insights, their relevance to support mechanisms for SMEs is peripheral.

This summary incorporates findings from a broad Scopus query, including studies with non-European regional contexts, financial risks, consumer-driven sustainability, and sectoral innovations. Narrowing the scope to focus solely on support mechanisms for SMEs in sustainability within a European context reveals a clear research gap. Specifically, while barriers and enablers have been extensively documented, there is limited research on the design, implementation, and effectiveness of structured support mechanisms tailored for SMEs:

In order to address this, we have identified the following research question: "What collaborative approaches can be used to explore, together with SMEs, the interventions that effectively enhance their motivation, improve their knowledge, and enable the implementation of sustainable practices, particularly in the absence of clear literature or self-identified solutions within the companies?"

4. Rationale action research

In addressing the identified research gap, it is essential to employ a methodology that not only generates scientific insights but also effectively supports real-world transformations (Guandalini, Zhou and Sun, 2024; Negri, Cagno and Colicchia, 2024).

By leveraging AR, this study contributes to advancing the understanding of sustainability practices in SMEs and highlights the value of iterative, participatory methods in addressing

complex organizational challenges (Kocher, Kaudela-Baum and Wolf, 2011). This collaborative approach is especially important in the context of sustainability transitions for SMEs (Annesi *et al.*, 2024), as it combines the expertise of researchers with the local knowledge, energy, and engagement of stakeholders in a specific organisational, community, political, or ecological context. Together, these actors form a collaborative learning community that defines the issues, identifies the required data, and develops hypotheses regarding the relevant causes (Greenwood, 2018).

AR has been successfully applied across various fields, demonstrating its potential to generate actionable insights and drive real-world transformations. In education, it has been used to enhance teaching methodologies and improve student outcomes (Kemmis and McTaggart, 1988). In marketing, it has supported the understanding of consumer behaviour and improved marketing strategies (Ballantyne, 2004), while in supply chain management, it has enabled the development of more efficient and sustainable processes (Näslund, Kale and Paulraj, 2010; Touboulic and Walker, 2016). These case studies illustrate the versatility of action research and its capacity to tackle complex, context-specific challenges across diverse sectors.

The primary goal of AR is not only to generate knowledge but also to trigger transformative processes in practice. Unlike traditional research methodologies, which often remain detached from the implementation phase, this method is deeply embedded in the context of the subject matter. It is particularly effective in multi-stakeholder processes involving diverse interest groups, as it fosters the active involvement of all relevant parties, facilitates the development of shared goals, and allows for dynamic adaptations during project implementation. This is crucial in the context of sustainability transitions for SMEs, as they often face specific, localized challenges that can only be understood through close engagement with the businesses and communities involved.

In the context of SMEs and sustainability, AR serves several critical functions:

- Analysing the needs and challenges of businesses (Kemmis and McTaggart, 1988),
- Developing joint solutions that address the real-world barriers to sustainability (Reason and Bradbury, 2013),
- Supporting the implementation of these solutions in practice, which allows for continuous adaptation to the businesses' needs, and
- Systematically evaluating the success of the measures through ongoing reflection and learning (Coghlan and Brannick, 2005).

The iterative feedback loops, workshops, and regular reflection phases central to **action research** ensure that the perspectives of various stakeholders are integrated into the process. This helps in developing solutions that are not only practical and scalable but also responsive to changing conditions. Moreover, it allows for the continuous refinement of

support mechanisms for SMEs, ensuring that these mechanisms remain relevant and effective over time. The iterative nature of AR is especially important in the context of sustainability, where long-term change often requires ongoing learning, adaptation, and re-evaluation.

By using AR, the proposed study aims to address the research gap effectively while providing actionable, context-specific solutions for SMEs in Europe. The combination of academic rigor and practical relevance inherent in this methodology makes it uniquely suited to bridge the gap between theory and practice in the sustainability transitions of SMEs. By integrating cycles of planning, action, observation, and reflection, Action Research fosters adaptability and responsiveness to the evolving needs of SMEs, making it particularly relevant for complex, context-dependent sustainability transitions.

This approach aligns with the study's aim of understanding and addressing the challenges and needs of SMEs in adopting sustainability practices. Through collaboration with stakeholders, AR emphasizes mutual learning, where both theoretical insights and actionable outcomes are generated. This dual focus bridges the gap between academic inquiry and practical implementation, ensuring the relevance and impact of the study. Furthermore, the method promotes the active involvement of diverse stakeholders, encouraging shared ownership of the process and fostering innovative, scalable, and effective solutions.

5. Conclusion and outlook

The lack of comprehensive data on SMEs and their access to effective support mechanisms for sustainable transitions reflects the highly context-dependent nature of these enterprises. SMEs operate in diverse environments, each characterized by unique challenges, priorities, and capacities. This heterogeneity makes it difficult to apply one-size-fits-all solutions, as the starting point for sustainability efforts varies significantly from one company to another.

This study highlights the importance of adopting a collaborative and iterative approach, such as Action Research, to address these challenges effectively. By actively engaging SMEs and their stakeholders in a participatory process, tailored solutions can be co-developed that account for the specific organizational, regional, and market contexts of each enterprise. This approach not only bridges the gap between theoretical frameworks and practical implementation but also fosters long-term, scalable, and sustainable transformations.

In conclusion, the use of action research offers a promising path forward for developing effective support mechanisms that can help SMEs overcome their unique sustainability challenges. Through active collaboration with diverse stakeholders, this approach ensures

that the solutions developed are context-specific, practical, and capable of delivering long-term impact.

Future research should focus on implementing a concrete action research setup tailored to supporting European SMEs in their sustainability transitions. Such a setup could involve pilot projects across various sectors, integrating different stakeholder perspectives to refine and scale support mechanisms. By using action research, future studies can generate valuable insights on the effectiveness of these mechanisms, ensuring that they are well-suited to the complex and dynamic environment in which SMEs operate. This research could ultimately provide a valuable blueprint for policymakers, industry leaders, and SMEs themselves to foster more sustainable and resilient business practices across Europe.

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Justice as a Leverage Point: Advancing Sustainable HRM for Transformative Change

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Abstract

This paper explores justice as a critical leverage point in advancing Sustainable Human Resource Management (HRM) for transformative change. While Sustainable HRM is pivotal in addressing global sustainability challenges, its fragmented implementation and misalignment between rhetoric and reality hinder its impact.

Drawing on socio-ecological systems theory and Meadows' leverage points framework, we argue that justice—encompassing distributive, procedural, recognitional, and contextual dimensions—can drive systemic change across environmental, social, and organizational sustainability. Justice-based HRM policies enhance fairness, equity, and inclusion, fostering sustainable work environments that extend benefits beyond organizations to communities and ecosystems. We demonstrate how justice-oriented HRM can mitigate socio-environmental inequalities, support sustainable workforce development, and encourage employee proactivity in addressing sustainability challenges. Furthermore, we propose that justice-centered HRM interventions have the potential to shift organizational values and paradigms, fostering long-term sustainability transformations. To facilitate this shift, interdisciplinary approaches, participatory research, and systems-thinking methodologies are essential.

By embedding justice as a core principle, HRM can move beyond compliance-driven sustainability initiatives to become a transformative force in achieving the United Nations Sustainable Development Goals. Our study provides a conceptual framework and research agenda for integrating justice into Sustainable HRM, bridging the gap between theory and practice.

Keywords

Sustainable HRM, Organizational justice, Socio-ecological systems, Equity, Social sustainability.

Introduction

Progressing towards United Nations Sustainable Development Goal (SDG) attainment is crucial if global challenges connected to environmental degradation, social inequality, and economic instability are to be effectively addressed. Organizations contribute to sustainability endeavors, with their innovative capabilities integral to this effort(Hall, 2000, Ristovska, 2010). The sustainable HRM literature suggests its operational function is most efficacious for driving this agenda(Stahl et al., 2020), with scholars advocating the development of a radically new approach to HRM is required – one which prioritizes social and environmental outcomes and one in which the fundamental purposes of HRM are reframed(Aust et al., 2020, Kramar, 2022, Kramar, 2014). At the same time, some suggest that currently the sustainable HRM rhetoric is different to organizational reality(Paulet, 2019), with issues of fragmentation evidenced in different approaches to sustainable HRM (e.g. socially responsible HRM, green HRM, triple bottom line HRM, common good HRM - Aust et al., 2020); a tendency to place emphases on different dimensions or aspects of sustainability(De Stefano et al., 2018, Sarvaiya et al., 2018); confusion about the scope of HRM for sustainability agenda responsibility (Guerci and Carollo, 2016, Gond et al., 2012) ; and a lack of skills required to deal with the complexity of sustainability issues (Paulet, 2019) cited. It is argued that these issues impede HRM's ability to gain momentum and consequently make meaningful contributions to SDG achievement(Brewster and Brookes, 2024). Practitioners and researchers alike find both the holistic nature of sustainable HRM along with the requirement to simultaneously contribute to multiple dimensions of sustainability (Paulet, 2019) problematic. In our paper, we suggest that some of these problems can be addressed by identifying a focal point for sustainable HRM intervention which, while building on exiting HRM strengths and capabilities, is able to drive transformation across different dimensions of sustainability. To identify this focus, we build on the socio-ecological system perspective(Ostrom, 2009, Reyers et al., 2018), the concept of leverage points(Meadows, 2008), as well as organizational justice theories(Colquitt et al., 2001).

Theoretical framework

Socio-ecological system perspective

The socio-ecological perspective brings together insights from social and environmental sciences to consider complex multilevel systems consisting of interdependent social and ecological subsystems(Ostrom, 2009). It looks at how social and ecological elements and subsystems interact with each other and identifies different types of variables and governance structures that can promote outcomes benefiting the common good(Partelow,

2018). It recognizes that humans, as part of ecosystems, can alter and change these systems at different points, while simultaneously being dependent on resources provided by these ecosystems. There are numerous examples demonstrating how human activities change the biosphere while being impacted by the changes produced. For example, global food systems, driven by monoculture practices, have increased crop yields but this has come at the cost of reduced biodiversity which leaves communities vulnerable to climate risks(Folke et al., 2021). Similarly, human activities drive greenhouse gas emissions, fueling climate change. This creates a feedback loop where climate change intensifies emissions from wildfires and reduces the capacity of oceans to act as a sink for these gases, thereby exacerbating the problem(Steffen et al., 2018). It is these cascading effects which have compelled humanity to reconsider fundamental aspects of life, including where to live and how to produce and consume goods and services.

Currently, it is widely recognized that society is rapidly approaching planetary boundaries within which it can safely operate, with recent evaluations indicating that six out of nine identified boundaries have already been transgressed(Richardson et al., 2023).The socio-ecological perspective recognizes the potential for human interventions, including the development of policies, institutions and governance structures, as well as collective action, to transform unsustainable socio-ecological systems into more sustainable ones(Fischer et al., 2015, Ostrom, 2009). This places an emphasis on understanding how socio-ecological systems operate, how different elements and sub-systems are inter-connected and which interventions will have the greatest potential to bring about change towards sustainability at a system level.

Systems thinking is not foreign to sustainable HRM. Indeed, the concept of sustainable HRM is grounded in this perspective (Ehnert, 2009) as requires consideration of a perspective that extends beyond organizational interests to one which supports social and environmental outcomes as well(Guerci and Carollo, 2016). Some sustainable HRM studies explicitly recognize the systems perspective by looking at how internal HRM practices create outcomes for the extended environments in which they operate (see for example Kira and Forslin, 2008, Mariappanadar, 2003, Mariappanadar, 2014, Mariappanadar, 2012, Roca-Puig, 2019) or by considering the complexities and paradoxical tensions involved in sustainable HRM execution(Bush, 2020, Ehnert, 2009, Poon and Law, 2022). These studies have two important implications. First, they demonstrate the potential for HRM practices and systems to impact outside of the organization, thus influencing the communities in which the organization operates. Second, they underscore the interdependencies that exist amongst sustainability dimensions and the relevance of this complexity to HRM and its potential to achieve its goals and objectives. Drawing on this research, we propose that HRM can meaningfully contribute to sustainability and address the inherent complexities by identifying relevant points for change. By doing so, the outcomes will have a flow-on effect not only for organizations, but also on the socio-ecological environment.

Leverage points

Leverage points are defined as “places in the system where a small change could lead to a large shift in behavior”(Meadows, 2008). Meadows (2008) identifies twelve levels of leverage points which can create change to a system. These points vary in their effectiveness, with the impacts ranging from minimal to significant. They are categorized into four groups: parameters (targeting elements, stocks, and flows), feedback (focusing on relationships and feedback loops), design (working on structures and rules of the system) and intent (points related to changes in goals, values, and worldviews)(Abson et al., 2017). The potential for transformation is contingent on the category to which an intervention belongs. Often sustainability interventions occur at lower levels (parameters or feedback loops), leaving design and intent relatively untouched (Abson et al., 2017). HRM interventions are no exception, so while sustainable HRM is often touted as a novel concept or a next stage in HRM’s development(Kramar, 2014), its rhetoric and operationalization in both academia and practice does not necessarily extend to challenging well-entrenched rules, principles, and logic. Consider for example Aust et al.’s (2020) analysis of current sustainable HRM models, three of which (socially responsible HRM, green HRM and TBL HRM) are based on the inside-out perspective (i.e. prioritizing organizational objectives) and primarily follow practices and approaches developed within strategic HRM(Aust et al., 2020, Ren et al., 2023, Stankevičiute and Savanevičiene, 2018). Acknowledge the effectiveness of current approaches, we align with Aust et al. (2020) in asserting that deeper changes are necessary for sustainable HRM to gain traction and drive large-scale transformation in organizations and communities. This requires identification of leverage points linked to design, values, and HRM intent. Here, based on the socio-ecological system perspective, we suggest justice and equality are salient leverage points which can have a long-lasting positive affect across both the social and environmental dimensions of sustainability.

Justice as a Leverage Point for socio-ecological systems’ change

Within the socio-ecological perspective, social justice emerges as a lynchpin by effectively connecting planetary and social well-being to notions of equality and equity to influence environmental sustainability and vice versa(Fischer et al., 2015, Folke et al., 2021, Leach et al., 2018). Indeed, justice is thought to be a key value for securing peace and a good life for all, with international sustainability agreements (e.g., the Kyoto protocol) underpinned by justice principles(Collins and Zheng, 2015). Inequality, on the other hand, is recognized as a significant contributor to environmental challenges as well as an impediment to unified efforts for their address. This is salient, because the addressing of sustainability challenges necessarily implies a collaborative approach from a wide range of stakeholders—governments, businesses, and communities (Van Tulder, 2018) as well as cooperation across nations and states(Barnosky et al., 2014). Modeling indicates that efforts to reduce

land degradation, enhance restoration, and promote conservation yield suboptimal sustainability outcomes when inequality issues remain unaddressed.

Perceptions of fairness and justice, as well as power imbalances, greatly influence the level of stakeholders' desire to cooperate, however(Tyler, 2023). Inequality directly impacts community trust and the willingness to cooperate in maintaining local commons, ultimately affecting collective actions toward sustainability(Hamann et al., 2018, Cushing et al., 2015). Fairness and equality perceptions are thought to facilitate knowledge sharing; this being an essential element for sustainability innovations(Zhou et al., 2020), with disparities in wealth identified as a key driver of unsustainable consumption, thereby contributing to environmental degradation. Here, it is suggested that wealthy communities set the desired standards for less wealthy communities to reach(Cushing et al., 2015), while simultaneously competing with these communities to retain their superior status(Leach, 2016). Power imbalances lead to unsustainable outcomes for both the environment and communities (Leach et al., 2018) (e.g., interest lobbying by groups such as large fossil fuel companies).

The converse of this relationship also holds, with the advent of climate change having further exacerbated existing inequalities via its disproportionate impact on already disadvantaged communities (Folke et al., 2021, Wolsko et al., 2016) through such things as the reducing of yields and restricting resource access. In this regard, women are found to be disproportionally impacted by climate change due to their lower participation in the workforce and in decision-making(Leach, 2016). As such, women are often the first to lose access to resources when these become scarce. Additionally, poorer communities often suffer more from environmental degradation associated with manufacturing because production facilities tend to be in neighborhoods and regions with lower socio-economic status(Rogers, 2014). These negative outcomes become exacerbated as poorer communities are often deprived of access to the knowledge and resources requisite for dealing with environmental degradation and climate change(Wolsko et al., 2016).

In sum, this discussion has shown social justice to be an important lever for transforming systems toward greater sustainability(Leach et al., 2018). This is salient, with objectives connected to inequality and poverty alleviation having multiple connections with the other (including environmental) targets explicated within the United Nations SDG framework(Le Blanc, 2015). This lever is particularly relevant to HRM where the social nature of work creates its close links to justice and fairness(Folger and Cropanzano, 1998, Otaye-Ebede et al., 2016). Justice is also salient to sustainable HRM, with notions of equity and ethics considered paramount(Järlström et al., 2018). Thus, sustainable HRM is well positioned to develop policies which promote organizational and social justice and, where these initiatives gain traction, change towards sustainability can be facilitated. By focusing on justice-enhancing policies and practices which afford a high value to equity and equality and are concerned with fairness perceptions over different facets of decision-making within

organizations(Colquitt et al., 2001), HRM can develop practices which contribute not only to organizational performance, but also to social and environmental wellbeing.

Organizational justice as leverage point for HRM

There are different types of justice relevant to sustainability: distributive, procedural, recognitional and contextual(Leach et al., 2018, McDermott et al., 2013). All are relevant to HRM and can be addressed through HRM policy and practice. Distributive justice is concerned with the fairness of outcomes correspondent to contributions (Colquitt et al., 2001, Colquitt et al., 2023) and is associated with initiatives such as pay, performance ratings/evaluations, and profit sharing(Cropanzano et al., 2007, Paauwe, 2024). It is closely linked to the concept of equality and focuses on fair allocation of resources, costs and benefits within society(Leach et al., 2018). Egalitarian HRM systems consider equality-, merit- and needs-based principles of distributive justice(McDermott et al., 2013). Procedural justice represents fairness of process connected to resource allocation. It focuses on whether the processes are accurate, consistent, fair, and unbiased and whether said processes allow correction and afford the employee voice(Colquitt et al., 2001, Colquitt et al., 2023). In terms of functional HRM it is concerned with fairness of activities connected to wage increases, selection processes, performance appraisal systems, and the like(Cropanzano et al., 2007, Paauwe, 2024). This type of justice is achieved through employee inclusion, representation, participation in governance and decision-making.

HRM policies focused on procedural and distributive justice support the change of socio-ecological systems towards sustainability. Fair payment practices across the entire supply chain (Aust et al., 2020) and equal employment opportunities for all members of community have implications for local communities and for mitigating negative environmental impacts. Research suggests that the HRM strategies of investment in workforce are connected to poverty and income inequality in communities(Roca-Puig, 2019). Poverty often leads to unsustainable environmental practices in communities (e.g., over-collection of firewood, over-exploitation of land for crops and relatedly, deforestation)(Liu et al., 2007); alternative sources of income (e.g., employment opportunities) can significantly reduce these practices(Cardenas et al., 2002). Further, by closing pay gaps, ensuring access to decent work for everyone, and encouraging employee participation in work processes and decision-making, HRM can reduce migration of the workforce to different regions. This has potential to decrease the use of environmentally harmful practices in said regions (Rogers, 2014) because people are more likely to adopt sustainable practices when they feel a long-term connection to locale and resources(Ostrom, 1999); a feature denied to migrants. Organizational justice can also serve as an identity-supporting resource required for the development of place identity by migrant workers(Zhang et al., 2019). Relatedly, participative HRM initiatives positively impact environmental sustainability in relation to both management and resource use, with these effects significantly enhanced where employees are incentivized through share-

ownership and/or profit-sharing schemes. Egalitarian organizational culture has also been shown to be positively associated with employee proactivity(Edgar et al., 2024); an employee behavior essential for identifying novel approaches for tackling environmental workplace issues(Boiral and Paillé, 2012). Egalitarianism also fosters trust within organizations, which underpins knowledge sharing - a feature required for addressing environmental challenges(Boiral, 2002, Lade et al., 2017).

Recognitional justice is defined as acknowledgement and respect for different values, identities, culture and traditions(Leach et al., 2018, Wells et al., 2021). In this regard sustainable HRM develops practices that create inclusive organizational environments that cater to diverse cultural, religious, health and individual needs(Macini et al., 2022). Examples of such practices include flexible work practices, cultural awareness and diversity training, recognition of cultural holidays and cultural requirements in HRM process such as recruitment or leave provision. For example, in Aotearoa/New Zealand organizations can adopt cultural practices such as whānau interviews which sees candidates bring support people to advocate for them during the interview process; this approach acknowledges and respects the cultural needs of Māori candidates. Additionally, organizations often tailor leave provisions to recognize the unique bereavement requirements of Māori and Pacific peoples. These inclusive practices foster a workplace environment where people from diverse backgrounds feel valued, supported, and more fulfilled. Consequently, individuals are encouraged to join the workforce and remain employed long-term and are more inclined to cooperate with others, contributing their knowledge and skills towards collective goals, including sustainability. Flexible work practices address existing inequalities connected to family care responsibilities and help promote the participation of females in the workforce(see Ministry for Women, 2023). Given a lack of female participation in the workforce is identified as a factor contributing to population growth(Rogers, 2014), with this increasing strain on socio-ecological systems(Meadows and Randers, 2012), flexible work initiatives make positive contributions to future environmental sustainability. Recognitional justice can promote diversity in organizations bringing the diversified knowledge requisite for tackling environmental sustainability. The literature widely recognizes that both scientific and traditional knowledges are required to successfully address social and environmental issues(Lade et al., 2017).

Finally, contextual justice focuses on social context features which might contribute or have contributed to inequality – both present and past(Wells et al., 2021). It scrutinizes the social background against which organizations operate, along with operationalized policies(McDermott et al., 2013). In doing so contextual justice ensures that individuals have means and capabilities, including power, access to knowledge and information tools, and time to fully function in their lives. This type of justice considers fairness for both individuals and groups(McDermott et al., 2013). In HRM, contextual justice refers to recognizing and addressing contextual factors that may hinder certain employees or groups from fully participating in work processes or achieving their employment-related

aspirations. HRM promotes justice through policies such as affirmative action or by prioritizing employment and development opportunities for groups that have been disadvantaged. HRM practices supporting contextual justice practices create access to resources and capabilities for disadvantaged communities – a critical aspect of social sustainability(Wolsko et al., 2016). This is achieved by supporting youth employment (Aust et al., 2020) and employability, along by providing employees with literacy, numeracy, and financial training. By ensuring access to information, knowledge and developmental opportunities for disadvantaged or historically excluded groups, HRM positively contributes to addressing environmental challenges, with knowledge access required for individuals to actively participate in addressing social and environmental problems(Wolsko et al., 2016).

While socio-ecological systems perspective demonstrates how justice connects social and environmental dimensions, organizational theory of justice (Colquitt et al., 2001) demonstrate the relationship between social and organizational dimensions. In this regard, research suggests that perceptions of procedural justice are related to job satisfaction, task performance and organizational citizenship behaviour(Kickul et al., 2002). Distributive justice was also found to positively contribute to organizational citizenship behavior(Özbek et al., 2016), with this finding supported by social-exchange theory (Blau, 1964) which obliges employees to reciprocate equitable treatment with heightened performance. Further, research finds it to be related to employee turnover intentions, such that where employees perceive inequitable outcomes, they are more inclined to leave their organization; however, when they perceive outcomes as equitable, they are more likely to reciprocate with loyalty(Poon, 2012). In the same vein, participation of employees in decision-making (procedural justice) is positively associated with productivity and performance(Sabharwal, 2014). Research also shows that employees' perceptions of organizational justice have a positive relationship with health (including mental health) and wellbeing outcomes(Le et al., 2018, Ndjaboué et al., 2012). This has positive implications for both organizations and the communities in which they operate. Contextual and recognitional justice (e.g., affirmative actions and diversity management) not only ensure legislative compliance, but also contribute to organizational performance and employees' job satisfaction(Pitts, 2009). Gjesdal (2024) argues that diversity of managerial teams makes organizations more legitimate in the eyes of their customers. By extension, it could be argued that, by ensuring the justice of resource allocation and fairness of processes involved in this allocation, HRM positively contributes to organizational sustainability.

Based on these examples, we argue that organizational justice represents a critical and viable leverage point for sustainable HRM, enabling it to gain traction and meaningfully contribute to sustainable development in a holistic manner. We have demonstrated how intervention at this level can drive broader transformations towards sustainability, encompassing organizational, social, and environmental improvements. This leverage point is particularly powerful because it facilitates changes at the level of social rules and purposes, ultimately contributing to shifts in the values and paradigms underpinning social

systems. These shifts may yield a significant—albeit delayed—impact on the environmental subsystem within the broader socio-ecological system(Folke et al., 2021). A justice-based approach to sustainable HRM is aligned with the concept of common good HRM, which challenges established HRM approaches and values by considering how HRM contributes to common good. Such an approach requires an outside-in focus for HRM, with social challenges also addressed. We further contend that a focus on justice, as a primary focus of sustainable HRM, aligns closely with HRM's core capabilities, ensuring its relevance and potential for meaningful impact. First, qualitative studies on sustainable HRM indicate that HR professionals are more inclined to engage with the social dimension of sustainability (Liang et al., 2024, Sarvaiya et al., 2018) as it naturally aligns with the role and function of HRM(Gond et al., 2012). Moreover, because justice is already a well-established concern within HRM practice(Folger and Cropanzano, 1998), it is easier for HR professionals to connect their existing expertise to sustainability initiatives through this lens. Last, we suggest that a justice focus enables HRM to proactively address some of the paradoxical tensions inherent in sustainability, thereby enabling HRM to go beyond trade-off or win-win approaches. We propose that a focus on justice supports a change in how communities and society operate. Intervening at this level allows for contributions to multiple dimensions of sustainability, minimizing the need for trade-offs between them.

Addressing justice in sustainable HRM – potential for research

The development of justice-oriented interventions may require diverse approaches to sustainable HRM research. Indeed, efforts to advance social justice, equality, and equity are inherently complex(Aguilar et al., 2016), however, and it would be an oversimplification to claim that our framework can address all potential challenges. On the contrary, a focus on justice may introduce its own difficulties. For instance, multiple perspectives on justice and fairness—such as utilitarian, egalitarian, and deontological views—can lead to differing interpretations and perceptions. HRM policies developed based on deontological and utilitarian principles of justice can significantly differ prioritizing outcomes for either organizations or communities(Brennan, 2023). Fairness decisions can be based on various approaches such as legacy, responsibility, economic or social contribution, needs, equality, development rights or capability(Bai et al., 2024). Thus, HRM practices developed based on the principles of needs or developmental rights may conflict with those underpinned by equality or economic contributions. Consider, for example, allocation of training budgets which can be undertaken based on equality principles (equal share of budget for every employee) or development rights (budget allocated mostly to those groups of employees who need resources to get out of poverty and improve life conditions – e.g. minority groups, migrant workers) or based on ability (budget allocated to those individuals who are evaluated as having the highest potential within organizations). In the same vein, initiatives aimed at promoting inclusivity and diversity through, for example, affirmative action, may be perceived by some as 'reverse discrimination'(Prats, 2021), while justice principles designed to address specific needs might conflict with economic-based approaches. Here,

it has been suggested that developing general principles that guide just decision-making in different situations may be helpful(Bai et al., 2024). Such principles could include stakeholder participation, considering implications of past injustices, considering safe and just implications of observed and unobserved cross-scale dynamics(Ahlström et al., 2024).

As system thinking implies affording special consideration to the design of interventions to enable desirable rather than unintentional outcomes, engaging with both research and practice is important. Qualitative studies, participatory research designs (including action research), and multi-disciplinary studies aligned with socio-ecological systems perspectives and sustainability ethics are likely to play a critical role in further developing sustainable HRM. Also, systems thinking methodologies, such as system dynamics and critical systems thinking, can be employed to design and evaluate HRM justice interventions at the systemic level.

Qualitative methodologies, including case studies, appreciative inquiry and ethnographic research, can deepen our understanding of current HRM systems that promote organizational and social justice. We advocate for increased research into egalitarian HRM systems—those more closely aligned with justice-focused goals and the SDGs. Cross-cultural research is also essential as it can reveal culturally appropriate systems for just decision-making within organizations. Further, examining the impact of modern technologies (e.g., HR analytics and artificial intelligence) on organizational and social justice, as well as exploring how these technologies might be leveraged to enhance justice, is a critical area of inquiry.

Participatory action research can help to identify different approaches to addressing complexity associated with justice. To produce desirable outcomes HRM systems need to be perceived as just by the key stakeholders including employees. In HRM, the complexity associated with justice often arises from employees' attributions toward HRM practices(Weiner, 1985), as perceptions of justice or injustice are heavily influenced their organizational experiences(Malik and Singh, 2014, Zhang et al., 2019). Engaging with stakeholders' action research methodologies allow their voice to be heard, making them legitimate contributors to the design of solutions(Altrichter et al., 2002). Participatory action research helps to identify local and contextually appropriate solutions to practical issues, assuming these niche solutions proliferate to drive and inform change at the level of social practices and institutions (Bradbury, 2022). Key methods for knowledge co-production can include appreciative inquiry, theory U, social innovation and transformation labs, scenario planning, world café, learning journeys(Drimie et al., 2022).

Finally, HRM will need to engage with other disciplines to understand and evaluate the implications of its justice-oriented interventions for other sub-systems including economics, communities and the natural environment. Sustainability strongly advocates for multi-disciplinary research (Becker, 2011, de Vos et al., 2022) and HRM studies can also benefit from it.

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A Short Paper Submitted to the NBM Conference 2025

Balancing Acts: How Ecopreneurs Reimagine Sustainable Business

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Abstract

In this paper, we delve into the world of ecopreneurs (Gunawan et al., 2021), those quixotic business leaders tilting at the windmills of environmental decay with profit-making lances. Peeling back the composted layers of green marketing, we reveal the human stories of these sustainability-minded capitalists—replete with their triumphs, tribulations, and the occasional compost-scented failure. Drawing on qualitative insights from a pilot study conducted in California, the research examines how these entrepreneurs reconcile the delicate balance between profit and sustainability. Using the lens of sustainability paradox theory (Hahn T., Figge, F., Pinkse, J., & Preuss, L., 2018), we scrutinize the cultural petri dishes in which these ventures germinate, uncovering how personal values, ethical dilemmas, and adaptive strategies shape their decisions. The presented research focuses on a portrait of ecopreneurs navigating the complexities of governance, accountability, and local impact, questioning whether their contributions to global sustainability are more than a hill of organically grown beans. It's a discussion as thought-provoking as a carbon offset scheme and as essential as the stories behind the green ventures redefining business. The

findings contribute to the discourse on governance and accountability in sustainable business models, aligning with Track 3.1, Management, Governance and Accountability for Sustainable Business Models, of the NBM2025 conference.

Keywords

Ecopreneurship, Sustainability Paradox, Business Model Innovation, Governance, Accountability

Main text

Ecopreneurs: Dreamers in the Land of Paradoxes

In the verdant fields of modern capitalism, a new breed of entrepreneur has taken root. These ecopreneurs, as quixotic as they are ambitious, charge forth with their profit-making lances aimed squarely at the windmills of environmental decay. They are not merely capitalists; they are idealists, envisioning a business world where environmental responsibility aligns seamlessly with economic gain. Yet, this idealism is tempered by the harsh realities of systemic constraints, consumer demands, and financial pressures.

The analysis takes place in the context of the growing importance of ecopreneurship in addressing environmental challenges while staying financially viable. Schaper (2010) posited that ecopreneurs play a crucial role in driving sustainable innovation and creating market solutions to ecological problems. For the purposes of this study, my examination of the nature of ecopreneurs has led me to adopt a more recent approach to defining them per Gunawan et al. (2021) as “an entrepreneur who is not solely driven by profits but is also concerned about the environmental impact of the business.” (p. 2). This updated definition better reflects the complex nature of ecopreneurs, who navigate between profitability and environmental concerns.

This paper examines the lived experiences of ecopreneurs through the narratives of three California-based business owners, exploring how they navigate the paradoxes inherent in sustainable entrepreneurship. Their stories illuminate the challenges of reconciling environmental ethics with profitability, highlighting the role of governance and ethical accountability in shaping their strategies. The study is an ongoing project, and by the time of the conference in June, the author aspires to collect 24 interviews in total.

Theoretical Framework

The analysis in this research drew upon the theoretical framework of sustainability paradoxes, as conceptualized by Hahn et al. (2018), who argue that tensions between economic, social, and environmental objectives are inherent in sustainable business practices. This framework provides a lens through which to examine the strategies employed by ecopreneurs in managing these competing demands. Additionally, the study builds on the work of Kirkwood and Walton (2010), who explored the motivations and challenges faced by ecopreneurs in their pursuit of sustainable business models. By focusing on the decision-making processes of ecopreneurs in the Santa Barbara-Ventura area, this pilot study offers a localized perspective on a global phenomenon, contributing to the broader understanding of ecopreneurship in diverse contexts.

Emerging Themes

Five themes emerged from the study. These themes illuminate the nuanced experiences of ecopreneurs as they navigate the complexities of sustainability and business. These themes—Defining Sustainability, Balancing Profit and Environmental Values, Challenges and Opportunities in Ecopreneurship, Personal Values and Business Practices, and Strategies for Managing Sustainability Paradoxes—emerged from the qualitative analysis of participant narratives. Together, they provide preliminary insights into the motivations, obstacles, and ethical considerations that shape the decision-making processes of these business leaders. This section explores each theme in detail, highlighting how ecopreneurs reconcile their environmental values with practical business realities and setting the stage for the main research study's investigation.

1. Defining Sustainability: Ecopreneurs articulated diverse definitions of sustainability, reflecting their personal values and priorities. For some, sustainability meant balancing the needs of producers, manufacturers, customers, and their businesses, emphasizing practicality and long-term impact. Others extended sustainability to include compassion for animals and the environment (Clayton, S., Kals, E., & Feygina, I., 2016; Talbot, C. F., Price, S. A., & Brosnan, S. F., 2016) broadening the ethical scope of their operations. The most experienced entrepreneur among the participants offered an insightful reflection that was more paradoxical and surprising compared to traditional sustainability approaches as she narrated her answer: “It's all about balance and finding solutions that are thoughtful for all shareholders, the producers, the manufacturers, the customers, and then for us. And so you have to be realistic about sustainability.” Such diversity of perspectives highlights how personal interpretations of sustainability influence decision-making processes.

2. Balancing Profit and Environmental Values Participants consistently faced the challenge of reconciling profitability with ecological commitments. For example, they addressed customer demands for affordable yet sustainable products by adopting a pragmatic approach, termed “imperfect environmentalism.” This strategy allowed them to prioritize progress over perfection, ensuring their businesses remained financially viable while making meaningful environmental contributions. I found the participants' stories to be

inspiring and thought-provoking. Their accounts revealed the dualities they navigate—balancing innovation with systemic limitations, and resilience with the pressures of financial viability. The challenges of higher costs, infrastructure gaps, and consumer misconceptions highlighted the persistent obstacles faced by small sustainable businesses. Yet, their creative adaptations, from closed-loop systems to customer-focused convenience, showcased their resourcefulness and determination.

3. Challenges and Opportunities in Ecopreneurship: Financial limitations and infrastructural gaps were significant hurdles for these small businesses. Despite these challenges, participants demonstrated creativity and resilience. As one research participant points out, "the sustainable choices often come at a much higher cost than conventional alternatives," a challenge pronounced for small businesses that lack the purchasing power of larger corporations. This financial burden is echoed by another, who shared: "the systems set up today make it very challenging for businesses like mine to exist…we're at a disadvantage because we don't have large economies of scale." Innovations like closed-loop systems and customer-friendly refill models exemplify their ability to adapt to systemic constraints while maintaining their sustainability goals.

4. Personal Values and Business Practices: The alignment of personal environmental values with business practices serves as a guiding principle for each ecopreneur. (Phillips, 2005; Kirwood & Walton, 2010). Their definitions of sustainability are deeply personal, and while similar, are not like one another, directly influencing how they approach decision-making and business strategy. The alignment of personal ethics with business operations emerged as a guiding principle. For instance, one ecopreneur's commitment to animal welfare influenced her sourcing and product selection, while another's values shaped her hiring practices and community engagement. This commitment affects every aspect of her sourcing and product selection as she prioritizes materials that "safeguard the well-being of the creatures we share [the planet] with." These narratives underscore the centrality of personal values in shaping sustainable entrepreneurship.

5. Strategies for Managing Sustainability Paradoxes: Each ecopreneur faces sustainability paradoxes that require ongoing strategies and adaptability. One of the research participants speaks to the inherent conflict between her mission and the need for sales, acknowledging that "on one hand, I need people to come in and spend for me to pay my rent…but at the same time, I don't want to push people to buy things they don't need." Another participant emphasized the importance of balance, explaining that "running a small business is tough, especially when you feel the need to handle everything yourself." For her, the process of growing sustainably requires collaboration and learning to trust her team more, which she describes as "essential to scale the business." Critical incidents (Butterfield, L. D., Borgen, W. A., Amundson, N. E., & Maglio, A. S. T., 2005) —like debates over product sourcing or customer demands—tested their commitments, compelling them to refine their approaches and reaffirm their values.

Together, these themes illustrate how ecopreneurs blend innovation, resilience, and ethical commitments to address the tensions inherent in sustainable business practices, offering a foundation for future research on sustainable entrepreneurship.

Discussion

The findings reveal that ecopreneurs' decision-making processes are deeply influenced by their personal values and ethical commitments. Their ability to adapt and innovate within systemic constraints underscores the importance of governance structures that support sustainable practices. This aligns with Track 3.1's focus on managerial capabilities and accountability in fostering sustainable business models.

From the perspective of the implications for governance and accountability, the study highlights the need for 1) Inclusive leadership to encourage diverse perspectives, 2) Knowledge sharing to facilitate eco-innovation, and 3) Stakeholder engagement in building co-creation opportunities. These practices can enhance accountability and drive the integration of ecological values into business operations.

Conclusion

This pilot study has provided valuable insights into the complex world of ecopreneurship, revealing the nuanced ways in which business owners navigate the delicate balance between environmental stewardship and financial viability. The narratives shared by participants highlight the ongoing challenges and innovative solutions that characterize the ecopreneurial journey. Key findings include the diverse and personal definitions of sustainability held by ecopreneurs, the continuous nature of balancing profit with environmental values, and the significant influence of personal ethics and stories on business practices. The study also uncovered common obstacles faced by ecopreneurs, such as financial limitations and lack of specialized infrastructure, as well as creative strategies employed to overcome these challenges.

The proposed methodological refinements, including expanding the geographical scope of participants and enhancing data collection techniques, will strengthen the main research study. These adjustments will allow for a more comprehensive exploration of ecopreneurial decision-making processes across diverse contexts. As we move forward, this research has the potential to contribute to the growing body of literature on sustainable entrepreneurship and new business models. By providing in-depth insights into the narratives of ecopreneurs, this study can inform both theory and practice, offering valuable lessons for aspiring ecopreneurs and sustainability, business governance, and business ethics researchers.

Ultimately, unraveling the complexities of ecopreneurial decision-making is crucial for cultivating a more sustainable business landscape and addressing urgent environmental

challenges. This research sheds light on current practices and paves the way for future innovations in sustainable and new business models.

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The Relevance of BM-LCA for Strategic Decision-Making

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Introduction

Due to the growing of environmental challenges, companies are pressured to adopt strategies like circular economy (CE) initiatives and sustainable business models (SBMs) to improve resource management and reduce impacts. Life Cycle Assessment (LCA) is widely used to quantify environmental effects, offering data across a product's lifecycle. Initially applied to packaging comparisons, LCA now supports R&D, strategic planning, product comparisons, marketing, hotspot analysis, and increasingly sustainability reporting (Stewart et al., 2018; Subal et al., 2024). However, LCA's use in strategic decision-making remains limited (Subal et al., 2024; Beemsterboer et al., 2025). Companies often employ LCA for product-level improvements rather than strategic formulation. Barriers include the complexity of LCA, lack of expertise, and its product-focused scope that misses business model-level insights (Pryshlakivsky and Searcy, 2021; Subal et al., 2024).

Traditional LCA struggles to assess business model sustainability. The Business Model Life Cycle Assessment (BM-LCA) method (Baumann, 2022; Böckin et al., 2022) addresses this by coupling financial and environmental data, calculating impacts per unit of profit (e.g., CO_2eq per SEK profit/year). BM-LCA thus frames environmental data in business-relevant terms. Early studies, such as Goffetti et al. (2022), illustrate BM-LCA's value for guiding sustainable strategy, notably identifying environmental hotspots in business models like garment rental. However, whether BM-LCA truly integrates into strategic decision-making remains underexplored. By investigating multiple cases of BM-LCA application in companies, we aim to uncover the extent to which BM-LCA fulfills its promise as a bridge between environmental metrics and strategic management. We also draw on decision-making theory to understand the facilitators and barriers for using BM-LCA results in strategic contexts.

Theoretical Background

Incorporating sustainability into strategic decision-making involves navigating complex tensions between environmental and economic goals. The literature highlights that how companies interpret and address these tensions depends heavily on their dominant organizational logic and managerial mindsets. Companies' driven by a market-led, instrumental logic often perceive sustainability and profitability as mutually exclusive, leading to an either/or approach that prioritizes financial objectives (Haffar and Searcy, 2019). In contrast, organizations that embrace a holistic logic tend to see environmental and economic objectives as interdependent, allowing them to treat sustainability as a core strategic concern. These firms are more likely to adopt integrative approaches and search for synergies, enabling innovation that serves both performance dimensions.

Managers' cognitive frames further shape how sustainability-related information is interpreted and acted upon. Hahn et al. (2014) distinguish between two ideal types of sensemaking frames: the business-case frame and the paradoxical frame. Managers with a business-case frame consider environmental initiatives worthwhile only when they support existing financial goals, often reducing sustainability decisions to cost-benefit calculations. This can lead to the rejection of projects that lack immediate economic returns. On the other hand, those with a paradoxical frame recognize the simultaneous existence of conflicting objectives and accept the inherent complexity of sustainability challenges. They are more inclined to consider a range of strategic responses and engage with long-term or transformative solutions.

Framing effects extend beyond internal cognition to influence actual decision behavior. For example, Glac (2009) showed that when investment decisions were framed in terms of personal values rather than purely financial terms, individuals were more likely to choose socially responsible investments. This insight translates well into corporate settings, suggesting that tools like BM-LCA need to be presented in a way that resonates with business values and long-term goals. When BM-LCA results are framed as contributing to competitiveness, resilience, or innovation, they are more likely to be embraced by decision-makers (Subal et al., 2024).

Organizational capabilities also play a critical role in whether sustainability insights lead to strategic change. The concept of dynamic capabilities, introduced by Teece et al. (1997), describes a firm's ability to integrate, build, and reconfigure internal and external resources to address changing environments. In sustainability contexts, dynamic capabilities include the ability to absorb environmental data, translate it into actionable insights, and transform business models accordingly. Companies with strong dynamic capabilities often exhibit cross-functional collaboration, experimentation, and a willingness to adapt. These traits are crucial for effectively using tools like BM-LCA, which require both technical understanding and strategic interpretation.

Past studies emphasize that without managerial commitment and institutionalized decision-making routines, sustainability assessments may not lead to action (Aragón-Correa & Sharma, 2003). Rigid silos between departments, short-termism, or treating BM-LCA as a one-off reporting task can limit its strategic relevance. In contrast, when firms engage multiple stakeholders, use integrated metrics, and embed assessments within strategic planning, tools like BM-LCA become enablers of long-term value creation.

This theoretical framing highlights that the integration of BM-LCA into strategic decisions is contingent on a combination of cognitive, cultural, and organizational factors. Understanding these internal dynamics provides a lens for analyzing how and why BM-LCA is used (or not used) to shape business model innovation and sustainability strategy.

Methodological Approach

We employed a multiple-case study method (Yin, 2018; Eisenhardt, 1989), analyzing companies that applied BM-LCA to various business models: (1) outdoor jacket rental, (2) reusable cups rental, (3) power tool sharing, (4) air purifier rental, and (5) paper recycling services. Primary data came from previous studies (e.g., Goffetti et al., 2022; Claesson and Skogum, 2023; Holzhausen and Troedsson, 2023) complemented by new evidence from public sources and ongoing interviews with sustainability and finance/business representatives. Our two-stage analysis involved within-case narratives comparing BM-LCA findings to subsequent company actions, followed by cross-case thematic analysis to identify patterns and enablers or barriers to strategic integration. Throughout this analysis, we relate findings back to our theoretical framework. We examine whether the companies that acted on BM-LCA had managers exhibiting more paradoxical thinking or holistic logic, or whether they had processes that allowed learning from the assessment. By integrating multiple data sources and analyzing through the lens of decision-making theory, we aim to draw well-founded conclusions about the strategic relevance of BM-LCA.

Results and Analysis

Our analysis across multiple cases revealed differing degrees of success in integrating BM-LCA results into strategic decision-making. In some companies, BM-LCA served as a catalyst for concrete operational and strategic changes, while in others, its influence was more limited. A compelling example came from a reusable cup rental service, where BM-LCA identified that the main environmental impact stemmed from transporting cups to and from a centralized washing facility. In response, the company invested in mobile on-site washing units to clean cups directly at event venues. This strategic adjustment not only cut transport-related emissions, as predicted by the BM-LCA, but also enhanced the service's sustainability appeal to clients. It represented a shift in the business model's value delivery

mechanism, moving from centralized to decentralized logistics, and was complemented by the introduction of new service offerings like composting units and on-site support.

Similarly, a company offering outdoor jacket rentals used BM-LCA to assess the environmental footprint of its rental versus sales models. The analysis revealed that customer travel to physical rental locations contributed significantly to emissions, despite the environmental gains from product reuse. Recognizing this, the company chose to relocate its rental stores closer to public transport hubs and introduced new drop-off options aligned with transit routes. This strategic realignment not only aimed to reduce emissions but also enhanced customer accessibility and reinforced the brand's sustainability credentials.

Beyond these specific cases, we observed that the process of conducting BM-LCA often led to strengthened cross-functional collaboration within companies. Sustainability, finance, and operations teams were compelled to work together, building mutual understanding and a shared language around environmental performance. In organizations where BM-LCA led to strategic changes, this collaboration appeared to be robust throughout the process. Business teams became more aware in concepts like environmental impacts, while sustainability staff learned to express environmental data in terms meaningful to business planning. This mutual learning has the potential to reduce the traditional siloing of sustainability and business metrics and enabled decision-makers to view environmental performance as a strategic concern.

In some ongoing cases, BM-LCA also appeared to foster collaboration beyond the focal company. For example, one firm needed to engage suppliers and recyclers to gather lifecycle data, which led to discussions about product take-back schemes and improved material recovery. By offering quantitative evidence of potential improvements, BM-LCA facilitated dialogue that could lead to joint initiatives aligned with circular economy. These instances suggest that BM-LCA can support not only internal strategic alignment but also ecosystem-wide sustainability strategies.

Across the cases, several recurring themes emerged. First, there were clear instances where BM-LCA insights informed strategic or operational changes (such as logistics redesign and location strategy) demonstrating its potential to influence business models. Second, the effectiveness of BM-LCA was strongly linked to how it was implemented. When conducted inclusively and collaboratively, it built organizational capacity for sustainability-oriented thinking. In contrast, when treated as a technical exercise confined to environmental teams, its strategic value diminished. BM-LCA sometimes acted as a catalyst for inter-organizational learning and collaboration, indicating its relevance for broader sustainability ecosystems, not just individual firms.

These findings underline that the value of BM-LCA goes beyond its analytical outputs. Its real power lies in how it is used: as a tool for internal learning, cross-functional dialogue,

and strategic reflection. Companies that embraced BM-LCA in this way were more likely to integrate its findings into their strategic priorities and business model innovation.

Discussion

Our findings confirm that BM-LCA can influence strategic decisions when organizations adopt a learning-oriented, paradoxical approach to sustainability (Hahn et al., 2014). Managers who viewed BM-LCA findings as strategic opportunities modified business models accordingly. On the other hand, companies with dominant business-case frames treated BM-LCA findings cautiously, acting only if immediate financial benefits were evident (Haffar and Searcy, 2019). This short-term mindset limits BM-LCA's strategic influence.

To maximize BM-LCA's impact, companies should integrate environmental metrics into regular strategic reviews, treating outputs like "carbon per profit" as key performance indicators. This aligns with integrated reporting practices (Eccles & Krzus, 2010). Moreover, treating BM-LCA as an interactive learning tool enhances sensemaking and fosters continuous strategic improvement. Cross-functional communication proved essential. Without translation between technical and strategic languages, sustainability insights risk remaining isolated within environmental teams. Workshops and structured dialogues post-assessment can reinforce sensemaking and promote actionable outcomes (Weick, 1995).

Our study highlights that successful BM-LCA integration requires managers with paradoxical thinking frames; organizational cultures that view sustainability as strategic; and dynamic capabilities for adaptive learning and cross-departmental collaboration.

Conclusion

BM-LCA has demonstrated potential for embedding sustainability into strategic decision-making. By linking environmental impacts to business model elements, BM-LCA equips companies to identify hotspots and innovate toward lower environmental footprints. However, the method's influence depends on organizational mindsets, structures, and capabilities. Companies must cultivate sustainability-oriented cognition and processes to translate BM-LCA insights into strategic action. Practitioners should approach BM-LCA as a strategic learning tool, integrating diverse departments and framing environmental findings in business relevant terms. Researchers should explore refining BM-LCA for better alignment with decision-making processes and expand applications across sectors and cultures. BM-LCA can help bridge the gap between sustainability assessment and strategic transformation, steering companies toward more sustainable futures.

Keywords

Sustianbility, Decision Making, Business Model Life Cycle Assessment, Business Strategy.

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Interdisciplinary collaboration in the shift towards sustainable business models

Theoretical insights on how collaboration and partnerships can support - or hinder - the sustainability transition

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Extended abstract

The transition from a linear to a sustainable, circular economy is essential for staying within planetary boundaries. Businesses play a crucial role in this transition by enabling sustainable production and supporting sustainable consumption within their markets. In recent years, attention has grown for the development and implementation of sustainable business models (SBM). SBMs "aim at solutions for sustainable development by creating additional monetary and non-monetary value by the pro-active management of multiple stakeholders and incorporate a long-term perspective" (Geissdoerfer et al., 2018). Different studies have looked at available methods and practices that support businesses in the shift from traditional to SBMs (Tsvetkova et al., 2020) and mapped supporting and hindering factors for the development and implementation of SBMs. In a literature review focusing on barriers hindering the establishment and growth of SBMs in small business and its supply chains, a lack of interdisciplinary collaboration and coordination comes forward as the largest hindering factor (Grimstad, Mæland & Skattum, 2023). Adner (2017) proposes using an ecosystem perspective as a way to provide structure and offer insights into stakeholder

alignment, interaction and collaboration to reach a shared SBM strategy (Adner, 2017). Research on ecosystems and SBMs is growing in recent years, however collaborations and partnerships that bring together multiple stakeholders in the development and implementation of SBMs remain underexplored (Pedersen et al., 2020). In addition, working with SBMs asks for interdisciplinary approaches, integrating different perspectives and knowledge from different fields, as well as a variety of skills that are needed to shed light on social, economic and ecological aspects of SBMs. However, interdisciplinarity does not simply happen through a mingling of disciplines or perspectives. It "requires well-functioning dynamics, methods, and processes, allowing teams and organisations to collaborate efficiently and, preferably, excellently" (Koria et al., 2011).

This work focuses on the role of interdisciplinary collaboration in the shift towards SBMs, with the aim to offer insights on how partnerships between businesses can support – or hinder – the sustainability transition. Through a scoping literature review, the study aims at gathering insights on the current state of research and identifying research gaps by focusing on the following questions:

- Which collaboration models occur during the shift towards SBMs?
- Which factors come forward as supporting or hindering the dynamics that foster interdisciplinary collaboration?
- How can interdisciplinary collaboration support or hinder the shift towards SBMs?

A systematic scoping review gives the opportunity to identify the nature and extent of research evidence through an exploratory process (Booth et al., 2012). Insights are gathered from literature in the field of SBM, thereby including a broader view on interdisciplinary collaboration through incorporating partnerships whilst keeping an ecosystem perspective in mind. The analysis of the literature focused on assessing the quality and quantity of previous research on the topic, guided by the study's questions.

The review indicates the presence of some collaboration models, focusing on amongst others collaborative processes in circular oriented innovation (Brown et al., 2021), partner selection (Jäger & Piscicelli, 2021), stakeholder alignment (Velter et al., 2020) and scaling (Ciulli, 2022). Preliminary results show that interdisciplinary collaboration gets emphasized as a key success factor as well as a potential, significant hurdle in the shift towards SBMs, but that empirical investigations in the collaborative processes are underexplored (Brown et al., 2021). Potential hurdles that come forward are the formulation of a shared value proposition, developing sustainability-oriented governance and decision-making (Ahmad et al., 2023). Velter et al. (2020) propose boundary spanners as a concept for overcoming these challenges through aligning different types of boundaries. Several sources provide insights on how interdisciplinary collaboration can support or hinder the shift to SBMs. Outcomes from partnerships, such as acquiring knowledge on complex challenges (Ademi et al., 2024), creation of a new culture for sustainability (Del Vecchio et al., 2022) and the co-creation of value (Ciulli et al., 2022) thereby support SBM development, whereas

tensions on different levels and differences in strategic intent (Ciulli et al., 2022) are considered to hinder SBM adoption. Up to now, the unit of analysis in research focuses largely on the single company, thereby lacking a systemic view (Ahmad et al., 2023) and emphasizing the need for an ecosystem perspective.

The results of this work point out directions for future research, with an overarching need for more research on how interdisciplinary collaboration is taking place in practice. This study indicates action-oriented research, experimental research, empirical in-depth cases as well as the need for theoretical underpinnings from adjacent theories as viable research methods. These can facilitate the identification, testing and following of collaborative processes and their impact. A first viable research direction is to study approaches, mechanisms, strategies and instruments that can support interdisciplinary collaboration, including research questions such as: how can collaboration diminish tensions, align value proposition, expectations and boundaries? How are these approaches connected to different collaboration phases? And what types of SBMs support collaborative approaches? The results of this study highlight an institutional focus, looking at organisational aspects, with much less attention to the interpersonal aspects that can make or brake a collaboration. In addition, little focus is given to the interdisciplinary aspects of the partnership, where the interdisciplinarity is considered a context, rather than a way of working together. Based on these insights, a second avenue for future research points to studies focusing on the human factors and the individual-level perspective, e.g. by studying capabilities and roles of actors, skills to deal with tensions and emotions that can impact trust and commitment, or employee empowerment. Simultaneously, the study also highlights the need for more research on the system level, whereby a connection between the individual-level and system-level can provide insights on the impact of interdisciplinary collaboration on SBM development and implementation within and between businesses.

This work is expected to contribute to the NBM2025 conference by providing theoretical insights on the role of interdisciplinary collaboration in the shift towards SBM. It contributes with knowledge that intertwines the organisational level with the context of the broader ecosystem. It can fit in the sessions *1.2 Ecosystems of actors in support of sustainability* and *3.1 Management, governance and accountability for sustainable business models*.

Keywords

Collaboration, interdisciplinary, sustainable business model, implementation, literature review

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Motivational archetypes for circular offers in business-to-business markets

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Extended abstract

Introduction

The transition to a circular economy (CE) requires circular business models (CBMs) like product-service systems or refurbishment offers to reduce waste and foster prosperity. Although multi-actor engagement is crucial, it remains challenging (Verleye et al., 2024). Verleye et al. (2024) investigate how to achieve circular economy engagement by different practices. However, the motivation driving individual firms to adopt CBMs, especially in business-to-business (B2B) contexts, remains underexplored.

This study addresses this gap by examining the motivations that drive B2B firms to integrate circular offerings into their portfolios. Using a multiple case study, we identify six motivational archetypes for adopting circular offerings in B2B markets.

Related Works

Literature on CBMs has increasingly focused on understanding the factors influencing its adoption. Recent work by Verleye et al. (2024) provides a holistic framework using the Motivation-Opportunity-Ability model to understand how to engage different actors in a circular transition. The authors emphasize the importance of systemic engagement among firms, customers, and regulators for advancing CE adoption, highlighting practices like signaling, matching, and supporting to foster collaboration. Despite these advances, internal, firm-specific motivations for CBM adoption remain underexplored (Table 1).

Refe-rence	Bansal & Roth (2000)	De Jesus & Mendonça (2018)	Zeng et al. (2017)	De Morais et al. (2021)	Ting et al. (2023)
Motiva-tors	• Competiveness • Legiti-mation • Ecological Respon-sibility	• Technical • Economic/ financial/ market • Institution-al/ regulatory • Social/ cultural	• Coercive pressures (Law/ regulation/ govern-ment) • Normative pressures (Customers) • Mimetic pressures (Management)	• Need for social status • Pure alturism • Compe-titive alturism	• Cost savings • Green credentials • Competitors action • Pressure on profit margin • Customer demand • Move toward circular economy • Scarcity of natural resources
Context	Corporate ecological responsive-ness of UK and Japan based firms	CE barriers and drivers	Institutional pressures impacting CE adoption in Chinese eco-industrial park firms	CE engagement among Portuguese and Brazilian citizens	Motivators and barriers of circular economy business model adoption in Malaysia
Method	Qualitative Study	Literature Review	Quantitative Study	Quantitative Study	Quantitative Study

TABLE 1: RELATED WORKS FOR MOTIVATORS IN THE CONTEXT OF CIRCULAR OFFERS

Researchers have acknowledged the influence of external drivers in CBM frameworks (Antikainen & Valkokari, 2016) as well as the role of consumer engagement in circular offerings (De Morais et al., 2021). Earlier research identified external drivers, including regulatory pressures, customer demand, resource efficiency and market opportunities, as critical motivators (e.g., Bansal & Roth, 2000; Govindan & Hasanagic, 2018; Ting et al., 2023). De Jesus & Mendonça (2018) categorized motivators into technical, financial, institutional, and cultural factors, highlighting the multidimensional nature of CE adoption. Similarly, Zeng et al. (2017) emphasized coercive, normative, and mimetic pressures as key determinants of CBM implementation. The research into motivation for the adoption of circular offerings is crucial as company motives for specific action can explain the reaction and effectiveness of external incentives such as regulations or market competitiveness (Bansal & Roth, 2000; Rovanto & Finne, 2023). Our study builds

on this gap by identifying and categorizing six motivational archetypes characterizing why B2B firms adopt circular offerings.

Method

This study follows a design science research process for taxonomy building and evaluation (Kundisch et al., 2021), using a three-step iterative approach (Kowalkowski & Ulaga, 2024). The first step consisted of a conceptual-to-empirical iteration grounded in a literature review. In the second step, we conducted interviews with 15 managers from B2B firms, including multinational chemical corporations, mid-sized family-owned manufacturers, and consultancies, all offering circular solutions. Additionally, we analyzed four secondary interviews (Spotify podcasts) discussing circular strategies at Trumpf, Hilti, Husqvarna, and Kaer. Primary data was analyzed via the grounded theory methodology by Gioia et al., with coding carried out in MAXQDA 2024. We began with In-Vivo coding to identify implementation goals, internal and external drivers, and motivation types. These were synthesized into first-order concepts, second-order themes, and six aggregated motivational archetypes. The secondary data served as contextual examples. They were not systematically coded but used to enrich and cross-validate interview insights through structured note-taking. Step three is currently in progress and includes another empirical-to-conceptual iteration to refine the taxonomy. A demonstration and evaluation phase will follow (Kundisch et al., 2021).

Results

In our preliminary results, we identified six archetypes of motivations for companies implementing circular offerings in B2B markets: the Rule Follower, the Market Listener, the Opportunist, the Guardian, the Strategist, and the Changemaker. The qualitative data analysis shows a distinction regarding the strategic ambition and motivation source of the six archetypes, as illustrated in Figure 1. Our framework distinguishes between two dimensions: motivation, ranging from protecting to creating value, and strategic ambition, ranging from legitimacy, to optimization, to transformation. Strategic ambition refers to the overarching goal a company pursues through circular offerings, while motivations underlying these ambitions can range from extrinsic compliance to intrinsic commitment. The Opportunist does not introduce new offerings but rebrands existing operations as circular, driven by the motive to create value by appearing more circular. Similarly, the Rule Follower implements circular offerings under regulatory pressure to maintain compliance and legitimacy. These companies invest minimal resources and aim to maintain business-as-usual operations and revenue streams. The Strategist, driven by value creation, identifies new business opportunities through circular offerings. Aiming to optimize his revenue streams, the Strategist implements circular offerings as an additional revenue source. The Market Listener responds to external customer demand or imitates successful competitors by introducing circular offerings. The Changemaker recognizes the unsustainability of the current economic system and

drives strategic transformation toward circularity to ensure a better future. The Guardian seeks resource security by reducing reliance on external suppliers through operational transformation.

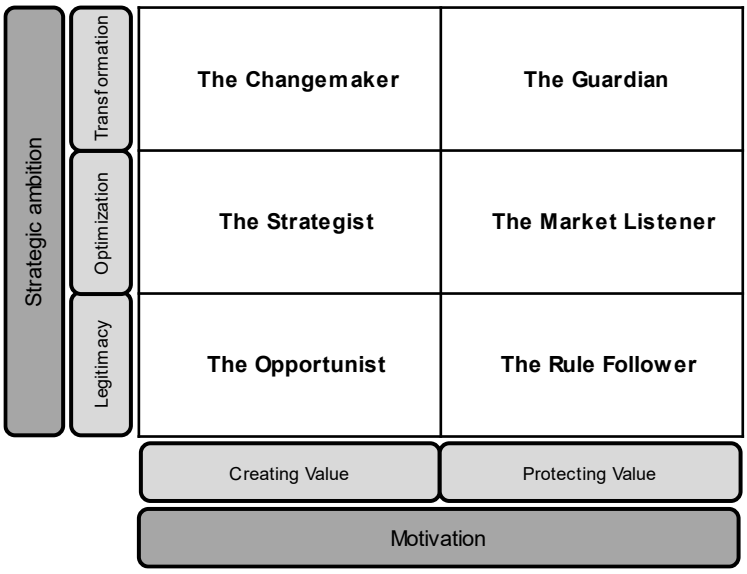


FIGURE 1: MOTIVATIONAL ARCHETYPES FOR CIRCULAR OFFERINGS IN B2B MARKETS

Our interview data suggest that companies' motivations may evolve, changing their goals and ambitions. We aim to further investigate the factors driving motivational shifts among actors and to explore how different types of motivations influence circular offerings developed through subsequent interviews.

Discussion Points

With our findings, we highlight the different motivations for B2B firms to adopt circular offerings. Our taxonomy links motivations and strategic ambitions, enriching the understanding of drivers behind CBM adoption. This contributes to theories on organizational change and sustainable business model innovation. We structured these findings into six distinct archetypes, resulting in a taxonomy framework. Our research adopts an inside-out perspective, examining what motivates firms to adopt circular business models (CBMs), thereby complementing prior studies like Verleyen et al. (2024) on circular economy engagement.

Our data indicate that motivations may shift from external drivers (e.g., compliance) to internal sustainability commitments or from protectionist to value-creating orientations. Such transformations are scantily covered in existing research. To deepen understanding, future research should not only undertake longitudinal studies to explore the named phenomenon of shifting motivations but also explore firms reluctant to adopt circular offerings. Hereby theories from psychology (e.g., self-determination theory by Deci & Ryan, 2002) might help to investigate barriers and amotivation. Contrasting case studies can reveal decision pathways, offering

valuable insights for fostering broader CE adoption. Additionally, longitudinal studies could examine how external pressures influence motivational transition.

Our future research aims to develop an evaluated taxonomy of motivational archetypes to guide practical applications and human-centered design processes. By using archetypes to develop personas, practitioners can design actor constellations and tailor strategies for CE engagement, driving more effective transitions to circularity.

In summary, exploring motivational dynamics and including resistant firms in research, while emphasizing evidence-based frameworks and tools, can enrich both theory and practice, supporting the widespread adoption of CBMs in B2B markets.

Keywords

Circular Economy, B2B Markets, Taxonomy, Engagement

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Business Model Innovation for Decoupling: application of Market Shaping Strategies and Analysis with Business Model Life Cycle Assessment

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Abstract

The concept of decoupling - dissociation of economic growth from environmental degradation - is generally considered a desirable development. Such a macro-economic development is dependent on changes in business models, which collectively make up the large-scale economy. Anticipating business models' potential effect on decoupling is non-trivial. This paper approaches such an analysis from the perspective of Business Model Life Cycle Assessment (BM-LCA) and market-shaping, drawing upon literature on these two concepts and literature on sustainable business models.

BM-LCA can measure the environmental performance of business models, while market-shaping strategies are tools to alter market conditions to support some given market development. As such, market-shaping strategies could be employed to favour business models with better environmental performance, and potentially facilitate decoupling. This paper serves as a starting point to explore the relations between BM-LCA, market-shaping and decoupling. A combined BM-LCA and market-shaping approach to analyse business models' decoupling potential is applied to three completed BM-LCA case studies, for sake of illustration. Lastly, an outlook for further research to improve the understanding of how business models relate to macro-level decoupling is presented.

Keywords

Business Model, Relative Decoupling, Absolute Decoupling, Measurement, BM-LCA, Market Shaping.

Introduction

Economic growth has historically been linked to increasing resource consumption and environmental impacts (UNEP, 2011), leading to unsustainable environmental pressures. The concept of decoupling offers a response to this development, referring to dissociation of economic activity and environmental impact. Decoupling is predominantly discussed on a macro-level, typically in relation to the gross domestic product (GDP) of a state and its emissions, as in CO_2/GDP unit (Wu et al., 2018). As such, decoupling is insufficiently linked to actionable strategies for business (Bithas & Kalimeris, 2018).

Conversely, sustainability-oriented companies face challenges in measuring their environmental impacts and embedding these metrics into strategic planning (Harris et al., 2021). Conventional tools, like product-level LCA do not account for the holistic impacts of business models, nor do they address systemic market constraints that hinder the adoption of sustainable practices.

Business Model Life Cycle Assessment (BM-LCA) provides a novel approach to address aforementioned issues. The method is the result of methodological innovation on LCA to make the method applicable to assess business models (Böckin et al., 2022). From the perspective of a company, a product is a means for business. Thus, in BM-LCA, the business model is the unit of analysis instead of the product as in conventional LCA.

The functional unit in BM-LCA expresses economic equivalence (e.g. a certain profit level) in contrast to conventional LCA where it expresses physical equivalence (Böckin et al., 2022). This allows for a quantitative analysis of the environmental performance of a business model when operating at a defined profit level. The BM-LCA results are (usually) on the form “environmental impact per unit of profit” (e.g. CO_2/€ profit), which is a measure of the relative (de)coupling of environmental impacts and economic performance at business model level.

BM-LCA considers both the monetary flows in a business model and the corresponding physical flows (of products, waste, energy and emissions) in the related product system (Böckin et al., 2022). By identifying where the monetary and physical flows intersect and connecting these, it is possible to link the profit level of a business model to a given level of environmental impact. Through varying parameters in the business model and the related product system, the method can also function as a tool to identify key areas of improvement to achieve decoupling at business model level. This decoupling-guidance

capability has been explored in case studies (Goffetti et al., 2022; Sivengård & Solér, 2024; Norin & Reenbom, 2024).

While BM-LCA can measure the environmental impact of a real or fictive business model, and guide towards decoupling at business model level, this does not directly lead to decoupling in actual *business operations*. The latter requires the improved business model to be implemented firstly, and secondly, to attract customers.

In relation to this, it is relevant to consider the concept of market-shaping. The notion that the behaviour and structure of markets are mutable and can be shaped by various types of activities undertaken by market actors has been around for a quarter of a century (Jaworski et al., 2000). Market-shaping strategies can be defined as a "set of purposeful activities a firm employs to shape a market in order to increase its competitiveness and create new opportunities" (Flaig et al., 2021). Such strategies can be implemented to promote sustainable innovations and practices aligned with circular and sustainable goals (Nenonen et al., 2019). Thus, market-shaping could be useful to support sustainable business models, which BM-LCA can point towards.

The macro-level economy is arguably composed of a large number of business models. In that regard, macro-level decoupling evidently ties into decoupling at business model level. Striving to understand how decoupling could be achieved at business level (and in turn, at macro-level), this paper explores the relations between decoupling, business models, BM-LCA and market-shaping.

Methodological Approach

The paper marks the starting point of a larger project, with the aim of facilitating the analysis of how business model changes could contribute to macro-level improvements with regards to environmental impact, i.e. through decoupling. The analytical approach of the project encompasses the BM-LCA methodology and market-shaping ideas and methods. To support said aim, theoretical studies bridging the fields of decoupling, BM-LCA and market-shaping will be conducted, along with a number of case studies in which the approach will be applied. This paper aims to present an initial analysis of how concepts in said fields relate, and present an outlook for further research on the topic.

The analysis is underpinned by focused reading and comparison of literature on sustainable business models and market-shaping, and approaching these matters from a BM-LCA and decoupling point of view. Three completed BM-LCA case studies are also reviewed and analysed with regards to the decoupling potential of the business models, to illustrate a preliminary application of the combined BM-LCA and market-shaping approach. These case studies include the original BM-LCA study, of garment rental versus retail by Goffetti et al. (2022), along with a study of tissue recycling (Sivengård & Solér, 2024) and a study of air

purifier rental (Norin & Reenbom, 2024). These three studies were selected out of the handful of completed BM-LCA studies to display a diverse collection of business models in different sectors to which BM-LCA can be applied.

Results and Analysis

Decoupling, a central concept in sustainability transitions, refers to the dissociation of environmental impact from economic activity. It is categorized as relative decoupling, where environmental impact per economic unit decreases, and absolute decoupling, where total environmental impact declines even as economic activity remains stable or grows (OECD, 2002; UNEP, 2011). Tapio (2005) further classified decoupling into strong, weak, expansive, and recessive types, emphasizing that decoupling can differ based on temporal, geographical, and economic dimensions (Silva et al., 2021; Zeng et al., 2022). These distinctions are critical for evaluating the scale and efficacy of sustainability strategies. While relative decoupling is an important step toward environmental efficiency, absolute decoupling is necessary to align economic growth with planetary boundaries, making it a key indicator for transformative change (UNEP, 2011).

Sustainable business models (SBMs) are designed to create environmental and social value alongside economic returns. However, their ability to deliver decoupling is contingent upon two interdependent factors: internal design and external viability. As noted by Lewandowski (2016) and Kirchherr et al., (2017), a key barrier to the transition towards circular and sustainable models is economic viability, particularly under current market conditions that often favor linear, volume-driven practices. Circular business models, for example, require changes not only within the firm but across the value chain and consumer behavior—areas identified as systemic barriers to transition (Han et al., 2022). Thus, understanding how SBMs contribute to decoupling requires not only examining their design and internal operations but also how they interact with and influence the markets in which they operate. This calls for both measurement, by using BM-LCA for example, and systemic engagement, via market-shaping strategies, to unlock sustainability potential.

BM-LCA provides a quantitative method for assessing environmental performance at the business model level, enabling comparison of different models based on a functional unit of profit (e.g., kg CO_2/€ profit) rather than a physical output (Böckin et al., 2022). This perspective acknowledges that products are means to generate revenue, and thus aligns the analysis with the actual unit of interest in business: the model generating profits through specific configurations of inputs, activities, and value propositions. By modelling the interaction between monetary flows and physical flows. BM-LCA allows for the assessment of relative decoupling potential. It also identifies hotspots or bottlenecks, such as logistics emissions, energy use or material flows, that can be optimized to improve performance. Crucially, however, BM-LCA alone cannot determine whether a business

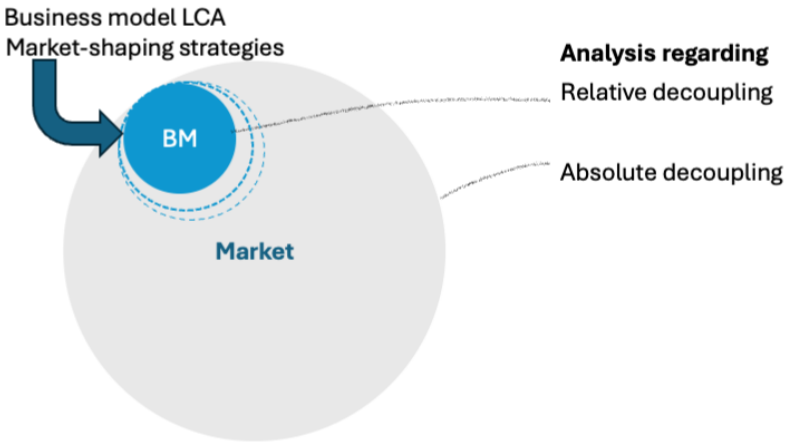
model will scale or replace more environmentally harmful ones. Only when environmental impact is reduced at a macro level (such as across an entire sector or economy) can we speak of absolute decoupling (UNEP, 2011). To assess this, market-level data such as market share, total profit, and size of competing business models is required.

Market-shaping strategies (MSS) provide a strategic complement to BM-LCA by aiming to alter the conditions under which markets operate (Flaig et al., 2021; Nenonen et al., 2019). Rather than passively adapting to market structures, MSS actively shape them to favor SBMs, targeting the very barriers (regulatory constraints, consumer resistance, and supply chain limitations) that hinder the adoption of sustainable alternatives (Kirchherr et al., 2017; Han et al., 2022). MSS can include regulatory advocacy, stakeholder collaboration, consumer education, and economic instruments like subsidies or penalties.

The integration of BM-LCA with MSS enables what can be termed business-led decoupling. In this approach, BM-LCA identifies a more environmentally efficient business model configuration and analyses scenarios for its economic viability and scale through market-shaping strategies used as parameters for sensitivity analysis. If the revised business model achieves the same or higher profits with reduced environmental impact, relative decoupling at the business operations level has occurred. If this model replaces or takes market share from less efficient competitors, and the overall market maintains or increases aggregate profit while reducing total environmental impact, then absolute decoupling at the market level can be achieved.

This conceptual logic is illustrated in Figure 1, where BM-LCA and market-shaping strategies jointly act on a focal business model to improve its environmental performance and enhance its position within the market. The central blue circle represents the business model, which is embedded in a large market system (light grey area). The arrow from the upper left shows the dual input of BM-LCA (analytical tool) and market-shaping strategies (strategic interventions). The dashed blue circles around the business model denote increasing sustainability potential through innovation and scaling of the business model within the market. The arrows extending toward the right indicate that the combined application of BM-LCA and market-shaping strategies enables analysis regarding both relative and absolute decoupling.

FIGURE 1: BM-LCA + MARKET SHAPING STRATEGIES FOR BUSINESS-LED DECOUPLING



While BM-LCA is effective in identifying environmental performance at the business model level, its diagnostic power can be enhanced through sensitivity analysis, particularly in relation to market-shaping parameters such as pricing strategies, consumer location, and logistics optimization. For example, price sensitivity analysis can reveal how consumer adoption rates affect profitability and emissions, thus informing the feasibility of scaling SBMs under different market conditions. However, it is important to note that not all MSS lend themselves to sensitivity analysis through BM-LCA. Strategies such as regulatory lobbying or consumer education produce systemic effects that may not directly modify the business model's internal flows but could nonetheless dramatically alter its market viability.

Moreover, to assess a business model's contribution to absolute decoupling, its market share becomes a critical variable. A model with strong environmental performance but minimal market penetration contributes little to aggregate impact reduction. Conversely, a widely adopted SBM can significantly shift the environmental baseline for the entire sector. Thus, BM-LCA provides the analytical foundation, while MSS offer the levers for implementation and systemic transformation.

The final insight emerging from this integrated approach is that market-shaping for sustainability is not limited to individual firms. As emphasized by Storbacka et al. (2022), shaping agents may include consumers, public actors, NGOs, and other non-firm organizations. Collective efforts in market-shaping can create new norms, policies, and economic incentives that favour environmentally superior business models. In such cases, the market itself begins to favour decoupled models by default, rendering sustainable business models not only viable but dominant.

In this broader vision, BM-LCA becomes a systemic diagnostic tool, not only for internal optimization but also for forecasting which business models are most likely to thrive in re-shaped markets. This synergy between analysis (BM-LCA) and action (MSS) offers a

comprehensive approach to progress from innovation to system-level sustainability transitions, with both relative and absolute decoupling as measurable outcomes.

BM-LCA case analysis

This section presents findings from three BM-LCA case studies, re-analyzed through the lens of decoupling and market-shaping strategies. Each case highlights the potential for relative decoupling at the business model level, while also pointing to the conditions required to enable business-led decoupling at the operations and market levels.

For the garment rental case study (Goffetti et al., 2022), the BM-LCA revealed that the rental business model had 43% lower climate change impact than the corresponding sales model per profit unit, indicating relative decoupling at business model level. Optimizing reverse logistics and incentivising low-impact transportation for returns - the customer transportation was a significant contributor to emissions in this case – are interventions that could be explored to enhance the environmental performance further. Dynamic pricing to encourage longer rentals is also an alternative that could be explored. While BM-LCA effectively identified environmental hotspots, the scaling and viability of the rental model hinge on market-level dynamics, particularly customer preferences and cultural attitudes toward ownership versus access. Thus, market-shaping strategies such as consumer awareness campaigns, behavioral nudges, and industry collaboration could support broader adoption and improve the model's viability. If such strategies are successful, and the rental model captures significant market share, this could contribute to absolute decoupling at the market level.

Analyzing the tissue recycling case (Sivengård & Solér, 2024), the rate of recycling showed a clear negative correlation to the extent of forestry required for the production of tissue. The BM-LCA highlighted that increasing the share of recycled input materials leads to a direct and measurable reduction in virgin resource use, emphasizing the resource decoupling potential of the model. From a business model perspective, this indicates that scaling recycling operations can significantly reduce environmental impacts per unit of profit. However, realizing this decoupling potential beyond the firm level depends on external factors. Policies mandating or incentivizing recycling, public-sector procurement preferences, and infrastructure investments in collection systems represent critical market-shaping levers. These MSS can help shift the market landscape to make recycling models more financially viable and socially normalized, thus contributing to market-level decoupling if they enable the replacement of less sustainable models at scale.

For the air purifier case (Norin & Reenbom, 2024), the rental business model reduced impacts by 10% compared to the corresponding sales business model. Logistics and filter lifetime were found to be the limiting factors, and hence the key areas of improvement for achieving further relative decoupling at business model level. Potential strategies to enhance decoupling include the introduction of modular filter designs for extended use,

offering discounts for regular maintenance, and building reverse logistics partnerships for end-of-life management. While these interventions could improve environmental performance, their implementation and effectiveness are contingent upon the economic viability of the business model under current market conditions. As such, market-shaping strategies (such as partnerships with healthcare providers, awareness campaigns targeting indoor air quality concerns, and government support for product-service systems) could help the model gain traction. Should these strategies enable the rental model to displace traditional sales models, the decoupling effect could extend beyond the firm to the market level.

In all three cases, BM-LCA provided quantitative insights into the environmental efficiency of SBMs and helped identify key parameters for potential improvement. Where applicable, sensitivity analysis of BM-LCA outputs (e.g., regarding logistics routes, customer behavior, and pricing structures) revealed how adjustments to specific business model configurations could enhance decoupling outcomes. However, not all MSS can be captured through sensitivity analysis alone. Finally, achieving absolute decoupling requires decoupled business models not only to perform well but also be scalable. This underscores the critical importance of market share data and systemic interventions, without which even highly efficient business models may yield negligible impact. By pairing BM-LCA's diagnostic power with MSS's transformative potential, these cases illustrate how innovation at the business model level could translate into system-level sustainability transitions.

Discussion

This paper demonstrates the value of combining BM-LCA with market-shaping strategies to evaluate and advance sustainability transitions through business model innovation. While BM-LCA provides a robust method for quantifying environmental performance and identifying potential for relative decoupling, MSS introduces a strategic layer aimed at enabling the broader economic and social viability of more sustainable business models. Together, they offer a way to link environmental improvements at the firm level to systemic change at the market level, under the right conditions.

The strength of this approach lies in its ability to connect environmental analysis with levers for real-world impact. However, the viability of SBMs remains dependent on external market dynamics, many of which cannot be captured through BM-LCA alone. For example, while sensitivity analysis can explore impacts of pricing or logistics, factors like consumer behavior, regulation, or cultural norms require qualitative insights and complementary data. Future research should focus on enhancing BM-LCA with market viability metrics, including consumer demand, cost structures, and policy contexts (Lewandowski, 2016; Kirchherr et al., 2017).

Further theoretical development is needed to better understand how different types of decoupling (Tapio, 2005) relate to varied market-shaping strategies (Storbacka et al., 2022),

including those led by non-firm actors such as public institutions and civil society. Clarifying these dynamics would support the design of systemic interventions that align economic and environmental goals. Practically, more sector-specific guidance is required to help companies implement MSS effectively. Evidence from existing sustainability policies, such as the European Union's Green Deal (European Commission, 2019), and incentive mechanisms (Schroeder et al., 2019) shows promising results, but needs to be contextualized.

There is considerable potential for further developing this approach. Enhancing BM-LCA's compatibility with real-time market analytics, or adapting it for multi-actor collaborations, would expand its relevance to broader transition processes. As this approach evolves, it should accommodate the complexity of socio-economic systems while remaining practical for business use. This paper offers a first step toward such integration, contributing to a more nuanced and actionable understanding of how to accelerate sustainable business model transitions.

Conclusion

This paper discusses the missing link between macro-level decoupling and business models, that jointly "make up" the economy. BM-LCA is a tool to analyse individual business models' level of *relative decoupling*. However, to analyse business models' potential to contribute to absolute decoupling in a market, additional reasoning is required. Matters such as the viability of the business model and market shares must be taken into account. This study scratches the surface of such an analysis, emphasising how the viability is dependent on market conditions. Further, market-shaping strategies are recognised as tools which firms and non-firm actors alike can employ in attempt to alter the market conditions in favour of more sustainable business models. The paper also presents an outlook for further research to support the analysis of business models' potential contribution to absolute decoupling.

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Frugal Design Workshop for SMEs: Innovation Insights from Ethiopia and the Netherlands

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Abstract

Small and Medium Enterprises (SMEs) face significant challenges in times of crisis due to resource constraints and market volatility. Frugal Innovation (FI) offers a promising approach to enable SMEs to develop cost-effective, resource-efficient, and sustainable solutions. This study explores FI as a guiding principle in business model innovation (BMI) through a Frugal Design Workshop framework designed for SMEs in the Netherlands and Ethiopia. Following a Design Science Research (DSR) methodology, the study developed and tested a training intervention that integrates FI with the Double Diamond Design Thinking framework. The resulting workshop routine, implemented across two economic contexts, facilitated SME innovation in times of crises through peer learning, problem-based facilitation, and resource-conscious business modelling. Findings reveal that the workshop routine works, with 83% of innovations generated had social or sustainable elements, demonstrating the relevance of FI beyond emerging markets. The study contributes to mid-range theory development by extending FI principles to SMEs in both developing and developed economies. Although, future research should examine long-term adoption and policy integration of FI to enhance SME resilience in times of crises. The study highlights the effectiveness of frugal design workshop routine in fostering innovation among SMEs,

offering practical and theoretical insights into business development for SMEs dealing with crises.

Keywords

Frugal Innovation, Design Science Research, Design Thinking, Business Model Innovation, SMEs

Introduction

Over the past decade, the world has faced profound challenges that have shaped the global economic, environmental, and social landscape. These global problems have caused widespread disruption, significantly impacting people and organisations in ways that continue to reverberate (Hampton et al., 2023). Organisations frequently encounter unexpected events and crises in today's highly competitive and volatile business environment, including natural disasters, economic downturns, pandemics, cyber-attacks, and political instability, which can significantly impact their operations and survival (Douglas and Haley, 2024). Simultaneously, another insidious and ongoing challenge has escalated: the sustainability crisis (IPCC, 2022). This crisis, driven by resource depletion, climate change, and environmental degradation, requires urgent attention and systemic solutions. Together, these crises emphasize the need for innovative approaches that not only enable recovery but also address broader sustainability objectives.

Small and Medium Enterprises (SMEs) are particularly vulnerable during such crises due to their resource constraints and the inherent "liability of smallness" (Eggers, 2020). Representing 90% of businesses worldwide and contributing over 50% of formal employment, SMEs play a critical role in global economic stability (World Bank, 2019). However, they also account for 60-70% of industrial pollution, highlighting the pressing need for these enterprises to adopt sustainable practices (OECD, 2018). Despite this, survival often takes precedence over long-term sustainability goals, especially in times of crisis (Pisoni, 2018). SMEs require innovative yet practical frameworks that align their immediate recovery needs with the broader goals of sustainable development (Akintola et al., 2025). Schumpeterian theories (Schumpeter, 1942; Knorringa et al., 2016) suggest that sustainable economic growth is driven by the successful introduction of innovative products, services, and processes, with the entrepreneurial innovator playing a pivotal role in this transformative effort (Spulber, 2014). Furthermore, rising sustainability demands emphasise the need for deeper insights into the effects of companies' business model innovations (BMIs), achieved through a thorough evaluation of innovation and its broader implications (Snihur & Bocken, 2022). This study explores the potential of frugality as a guiding principle to support SMEs in developing new products, services, processes, and ultimately innovative business models (BMs) that not only generate the financial value essential for recovery but also enable ongoing progress towards sustainability.

Frugal Innovation (FI) is now increasingly relevant in developed economies due to rising sustainability and efficiency demands. FI can bridge the gap between economic recovery and sustainability by enabling SMEs to innovate their products, services, and business models (BMs) in a cost-effective and resource -efficient manner (Le Bas, 2023). Frugality-

Based Advantage (FBA) outlines the advantage that can come from operating under severe resource constraints (Asakawa et al., 2019). Defined as the ability to turn resource limitations into a competitive advantage through FIs, FBA enables firms to overcome input, income, and infrastructural challenges (Asakawa et al., 2019).

The research stems from a collaboration between policymakers in South Holland, small business owners from the Netherlands and Ethiopia, and experts in FI. This collaboration arose from the recognition that many SMEs, particularly those not managed by conventional innovation programmes, could benefit from frugal approaches. These SMEs, referred to as the "peloton", are followers rather than frontrunners in the innovation ecosystem. Unlike the high-growth, high-tech "gazelles", the peloton comprises businesses with modest growth ambitions that are essential to economic ecosystems yet often overlooked in policy initiatives. These businesses perceive innovation programs as inaccessible or misaligned with their needs because of the high costs and uncertain returns on investment.

The decision to conduct this study in both the Netherlands and Ethiopia was strategically motivated by theoretical, practical, and comparative research considerations. By analysing two contrasting economic and business environments, this study aims to develop a universal and adaptable FI framework that can be applied across diverse SME contexts. Including Ethiopia, a region deeply connected to the origins of frugal innovation, allowed us to evaluate the methodology in its conceptual roots while comparing it to applications in a developed SME context.

This study follows a design science research (DSR) perspective. DSR is a methodological approach aimed at creating artifacts—concepts, models, methods, or systems—to solve practical problems while contributing to theoretical knowledge. It operates at the intersection of utility and intellectual contributions, emphasising the construction and evaluation of these artifacts in real-world contexts. Artifacts, as tangible outputs of DSR, are tools or frameworks designed to address specific challenges effectively; however, they also facilitate generalisation to broader problem classes (Venable, 2010). In the context of our study, DSR has been selected because of its practical relevance in crafting tailored solutions that cater to the unique crises faced by the "peloton" of SMEs.

We have set two demarcations/focal points for artifact creation. **Firstly**, the solution should explicitly enhance frugal innovations.

Secondly, since our institute (University of Applied Sciences) focuses on education and training, we have made a demarcation that our solution (artifact) will be a training intervention format. With training and educational resources readily available, this

demarcation enables a frugal and cost-effective solution that aligns with the needs and constraints of the "peloton" of SMEs while remaining within the capacity of the researchers.

Given our demarcations and case, as well as typical DSR questioning format (Hunziker & Blankenagel, 2021, p.103) , we use this central research question:

RQ: "What is a Frugal training solution for the peloton of SMEs struggling to deal with crises?"

Literature

This section first describes Frugal Innovation to highlight why it has been selected as a focal point for artifact creation. Second, we establish the criteria for evaluating training solutions (Step 2, Design Science) to the problems facing the peloton of SMEs (Step 1, Design Science research). Therefore, this literature review forms an integral part of the DSR methodology that this paper ascribes to (see Methods section for further elaboration).

Frugal Innovation

Frugal innovation (FI) has emerged as a concept rooted in the need to address resource scarcity while promoting inclusive and sustainable value creation. (Weyrauch & Herstatt, 2017). Its primary focus was inherently social however, over time, the concept has been adapted where it now centres on reducing resource use and promoting efficiency (Tiwari & Bergmann, 2018). It is commonly defined as the ability to "do more with less," a phrase that evokes similarities with the notion of efficiency. However, while efficiency is typically about optimizing existing processes and reducing waste within well-resourced systems, frugal innovation is characterized by its creative response to structural resource constraints. It emphasizes affordable, adaptable, and accessible solutions often developed in informal or under-resourced settings (Pisoni et al., 2018; Hossain, 2018; Radjou & Prabhu, 2015). Unlike efficiency, which assumes stable access to inputs and focuses on refinement, frugal innovation thrives in environments marked by limitation—financial, technological, or institutional (Ploeg et al., 2021). **It is less about improving what exists and more about reimagining what is possible with what is available.** This quality makes frugal innovation particularly relevant not only in developing economies but also in regions of the developed world where SMEs face rising pressures to reduce costs, operate sustainably, and remain resilient.

Originally conceptualized in the context of emerging economies, frugal innovation has increasingly gained relevance in developed countries (Le Bas, 2023). This shift acknowledges that resource constraints are not limited to low-income regions; they also manifest in developed settings through sustainability demands, regulatory burdens, and competitive pressures. Consequently, the application of frugal innovation in both the Global North and South allows for a more inclusive understanding of how innovation can be made accessible to all.

Moreover, the social dimension of frugal innovation—its ability to deliver value in underserved communities—persists across both developed and developing contexts. In high-income countries, frugal innovation contributes to social resilience, helping SMEs respond to affordability challenges, digital divides, and ecological pressures (Bocken et al., 2019a). In lower-income settings, it remains a pathway for basic access to essential products and services. Thus, frugality is not only an economic strategy but also a means to achieve social equity through entrepreneurial creativity (Hidayat & Pok, 2025). This approach is particularly useful in the design of training programs as it emphasises the creation of impactful solutions that are efficient, accessible, and resource-conscious. As such, this study applies the frugal mindset as a starting lens to design a training artifact that equips businesses to innovate effectively. By embedding frugality the training artifact aims to empower participants to develop new products, services, processes, and business models that deliver value while conserving resources such as time, energy, and financial capital (Hossain, 2018; Radjou & Prabhu, 2015). A frugal mindset perceives constrained resources as an opportunity to generate innovation outputs through creative, unconventional means." (Hidayat & Pok, 2025).

Furthermore, the study is informed by the Extended Resource-Based View (ERBV), which broadens traditional firm-centric theories by recognizing that SMEs derive value from combining internal capabilities with external relationships (Hidayat & Pok, 2025). This perspective supports our workshop's emphasis on peer collaboration, local knowledge-sharing, and networked learning. As such, the frugal innovation training artifact is designed not only to operate within resource constraints, but to harness them as a source of creativity and learning.

Criteria for Effective Frugal Training Solutions

To design an effective frugal training solution for SMEs in the "peloton", clear evaluation criteria are necessary. Grounded in DSR and insights from FI, sustainable business models, and training evaluation frameworks, this study defines a structured approach to assess and refine the training artifact.

Effective frugal training solutions must integrate the three essential frugality principles of Weyrauch and Herstatt (2017): one, substantial cost reduction, ensuring affordability for SMEs with limited financial resources; two, focus on core functionalities, prioritizing practical and essential tools while eliminating unnecessary complexity; and three, optimized performance, delivering high-quality, efficient, and scalable outcomes. These principles are further reinforced by Winkler et al. (2020), whose "second-degree frugal

innovation" model ensures that frugal principles apply across both developing and developed markets. Their framework emphasizes identifying core functionalities, reducing redundancies, and maximizing resource efficiency, which are key for SMEs operating under financial and time constraints.

In addition to FI principles, evaluation criteria from sustainable business model literature highlight the importance of sustainability in training solutions. Bocken et al. (2019b) suggest that training should contribute to business model innovation and long-term sustainability. The training should be rigorously developed using both academic and practical insights, iteratively tested with users, and incorporate interdisciplinary knowledge to enhance its applicability. The training should be transparent, time-efficient, and adaptable, making it accessible to various business contexts while ensuring that practitioners can effectively implement and refine it (Bocken et al., 2019b). Similarly, educational literature provides valuable frameworks for assessing training effectiveness. The Kirkpatrick Model (Kirkpatrick, 1996) evaluates training impact through four levels: reaction, learning, behavior, and results, making it a widely used tool for SME-oriented training. The CIPP Model (Ali, 2022) offers a comprehensive evaluation structure covering context, input, process, and product, ensuring that training design aligns with SME needs and generates measurable outcomes. Furthermore, Sakthi & Moshi (2021) emphasize the role of interactive methods such as role-playing, brainstorming, and peer-to-peer learning in enhancing knowledge retention, behaviour change, and the practical application of training content.

The evaluation criteria derived from literature on these three academic disciplines—frugal innovation, sustainable business models, and educational research—are summarized in Table 1 and serve as the framework for assessing the effectiveness of the training intervention.

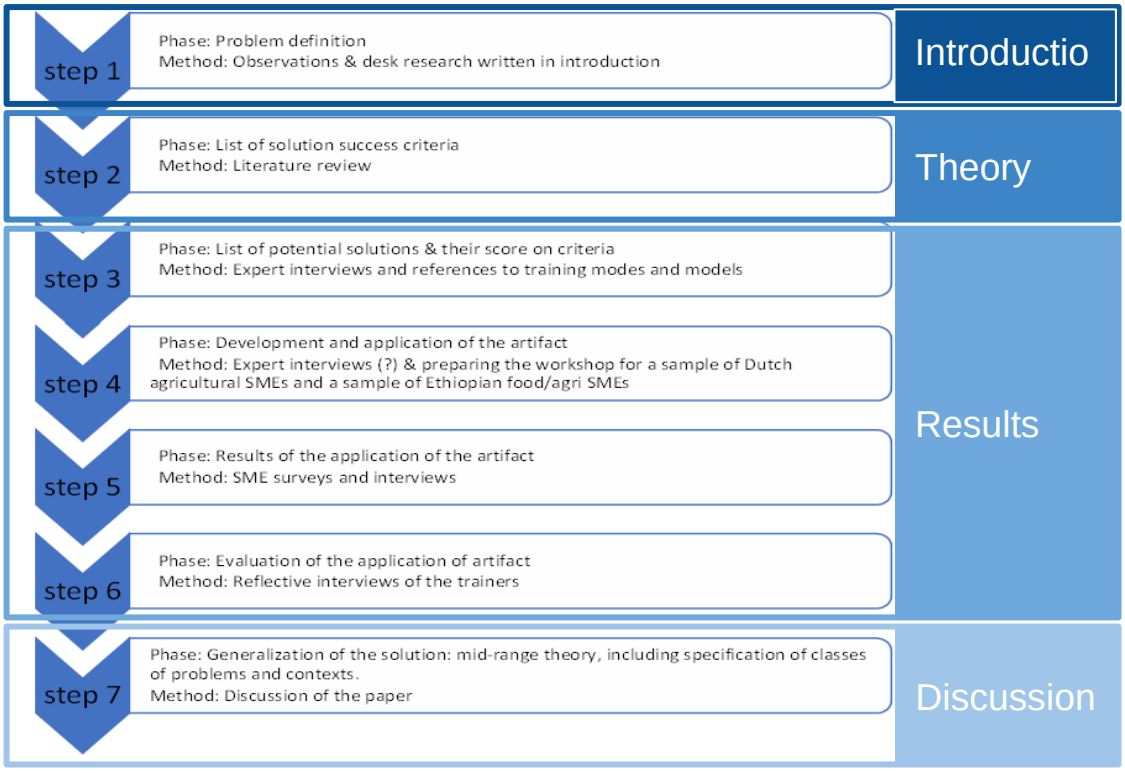
Table 1: Criteria for effective frugal training, as derived from the literature.

Domain	Criteria
Frugal Innovation Literature (Weyrauch and Herstatt, 2017; Winkler et al., 2020)	Substantial cost reduction compared to other trainings which help SMEs adapt to changing environments
	A focus on identification and prioritization of core functionalities (eliminating redundant elements and ensuring resource efficiency)
	Optimized performance compared to other trainings which help SMEs adapt to changing environments
	Cost-efficiency, core functionality, and performance optimization in assessing frugal innovations are interconnected
	The training routine aligns with the expectations and constraints of SMEs in the contexts.
Sustainable business model innovation literature (Bocken et al., 2019)	Societal impact through sustainability
	Circular economy and sustainability objectives are integrated and safeguarded
	The tool inspires or triggers business change
	Purpose-made for Circular Business Model Innovation
	Rigorously developed using literature and practice insights
	Iteratively developed, tested, and evaluated with users
	Integrates interdisciplinary knowledge
	Transparent guidance for use by others
	Practitioners have used the final version multiple times
	Simple and time-efficient design
	Adaptable to different business contexts
Educational literature (Sakthi & Moshi 2021, Ali et al., 2022)	Trainee satisfaction and learning (knowledge acquisition)
	Behavior change and organizational impact
	Measurable results
	Clear objectives and robust design
	Needs assessment (context) and delivery mechanisms (process)
	Interactive methods (e.g., role-playing, brainstorming) to improve retention and behaviour change
	Actionable insights for participants

Methods

Design Science Research (DSR) has been selected as it provides a structured means to address practical problems through the development and evaluation of training artifacts. DSR, originally coined by Peffers et al. (2007) as an approach for conducting research that involves the creation and evaluation of innovative IT artifacts to solve identified

organizational problems. It guides researchers through stages including problem identification, artifact design, demonstration, and evaluation, with a focus on producing solutions that are both practical and theoretically grounded. A later extension of this work emphasizes the importance of systematically evaluating artifact utility and effectiveness within real-world contexts (Peffers et al., 2007). Hunziker & Blankenagel (2021) further expanded and applied DSR's steps for artifact creation. Building on this, we adapt these steps to create 7 steps that outline the overarching methodology of this study. Each step formulates a different aspect of this paper. Each of the seven steps of our DSR methodology, deploys a different sub method to execute the step. The first three steps (see Figure 1) precede artifact testing: problem definition, establishment of evaluation criteria, and preselection of possible solutions. These foundational steps were critical for establishing the framework and methodology of this study. The following figure provides a reference point for each step of DSR and the method we used to execute the step, as well as where the step lies in this paper.



Step 1: Problem Definition

The first step in DSR–problem definition–identifies a relevant and practical challenge to address (Hunziker & Blankenagel, 2021, p. 104). In this study, the problem was defined as

the lack of a structured and effective training routine for promoting innovation within a peloton of SMEs. This problem was articulated in the introduction of this paper, where the challenges of fostering frugal, sustainable, and socially oriented innovations among SMEs in two distinct geographic and economic contexts (the Netherlands and Ethiopia) were described.

The study leverages the dual relevances for high-income countries and lower-income settings by comparing frugal innovation workshops implemented in the Netherlands and Ethiopia. Both contexts were deliberately selected due to their established presence within the agro-food sector, enabling focused exploration of frugal innovation in agro-food-based economies. While Ethiopia is often associated with the conceptual roots of frugality in informal entrepreneurship, the Netherlands represents a developed economy where SMEs encounter resource constraints of a different nature—such as regulatory complexity, labor shortages, or sustainability mandates. This comparative approach, anchored in agro-food contexts, facilitates the evaluation of the adaptability of frugal innovation training across diverse institutional environments and allows examination of how local agro-food-based conditions influence frugal innovation behaviors.

Step 2: Evaluation Criteria

The second step involves determining benchmarks for assessing the effectiveness of the training artifact (Hunziker & Blankenagel, 2021, p. 103). These criteria were identified and refined in the literature review, drawing on theoretical insights and best practices from the frugal innovation, design thinking, innovation management, and education/training literature. See Table 1.

Figure 1: Steps of Design Science Research adapted from Hunziker and Blankenagel (2021), including methodologies used.

Step 3: Preselection of possible solutions

The third step, **the preselection of possible solutions**, involves narrowing the range of training approaches and routines to those most likely to achieve the stated objectives (Hunziker & Blankenagel, 2021, p. 105). The primary methods employed in this phase were semi-structured expert interviews complemented by a detailed literature review.

Semi-structured interviews were conducted with three specialists:

1. An academic researcher in **Frugal Innovation**, who also brought expertise in **Design Thinking**, emphasised the conceptual foundations and stakeholder landscape of the framework.

2. A PhD in **innovation management**, who is an experienced trainer, offers perspectives on the practical implementation and training needs of SMEs.
3. An SME management consultant with extensive knowledge of **Design Thinking** provided insights into tailoring the framework to the specific managerial and operational realities of SMEs.

The interviews were designed to explore possible solutions suggested by experts for the stated problem. The interviews encouraged respondents to suggest training solutions which address the specific needs of SMEs. The discussions also delved into integrating training methodologies with **Frugal Innovation** principles, reflecting the iterative and prescriptive nature of design science research (Hunziker & Blankenagel, 2021, P .102). The assumptions and insights provided by the experts were further contextualised using references to the literature on Design Thinking.

Step 4: Developed artifact(s)

The fourth step in the DSR methodology focuses on the development of the training artifact. This aligns with the objectives of design science research, which emphasises creating practical solutions through iterative processes to address real-world problems (Hunziker & Blankenagel, 2021, p. 98).

The integration of expert inputs (possible solutions) and literature insights (criteria and possible solutions) enabled the creation of materials for two pilot workshop frameworks targeting SMEs. Consistent with the iterative nature of DSR, these workshops were planned in two distinct contexts.

- Netherlands, Westland
- Ethiopia, Arba Minch

These two contexts were specifically selected because both cities are prominent agri-food hubs within their respective regions, making them suitable locations for implementing and evaluating the Frugal design workshop frameworks. Additionally, these locations were chosen due to convenience sampling, as researchers had direct access to agri-food entrepreneurs in these regions. Workshop participants were selected based on their availability and proximity to the researchers, further underscoring the convenience sampling approach.

Both the Westland and Arba Minch workshops are independent initiatives led by the trainers/authors, rather than components of a larger existing project. By aligning workshop framework development with the iterative evaluation and refinement processes characteristic of design science research, this methodology ensures both practical applicability and theoretical contributions. The results not only addressed the specific needs of SMEs but also contributed to mid-range theoretical insights for step 7 relevant to Frugal Innovation and Design Thinking (Hunziker & Blankenagel, 2021, p. 104).

Step 5: Results of the application of artifact(s)

In DSR, evaluating an artifact in its intended context is a critical methodological step for assessing its utility and effectiveness. This aligns with the iterative evaluation process described by Hunziker and Blankenagel (2021), where the artifact must be tested under real-world conditions and its outcomes critically analysed (p. 101). After the implementation of the training artifact (the workshop framework) in Westland and Arba Minch, three types of data were collected to report the results of the application of the artifact.

Data collection (step 5)

The ***first*** data collection type was a mini survey designed to assess components of the workshop framework. Participants had to answer "yes" or "no" on statements like "I am now better able to come up with ideas/solutions that are more smart, sober and simple". This approach was a time-efficient way to measure the link between the workshop framework and its effectiveness, as perceived by the participants, which is consistent with the DSR emphasis on iterative refinement (Hunziker & Blankenagel, 2021, p. 102).

The ***second*** data collection type was an overview of participant' innovations two months after the workshop framework took place. It was compiled to evaluate their impact on fostering innovation. Innovations were categorised as Frugal, Sustainable, or Social, with additional data on whether sales were achieved post-workshop. This outcome-focused approach aligns with design science principles that emphasise real-world applicability and measurable results (Hunziker and Blankenagel, 2021, p. 104).

The ***third*** data collection type was in-depth interviews with six participants (three from each location) of the workshop. Participants were chosen based on their full engagement during the workshops and their willingness to share insights. During the interviews, participants reflected on their innovation development, its connection to the workshop framework, and the overall effectiveness of the workshop. The feedback sessions provided additional qualitative data, offering opportunities to discuss the workshop's design and gather actionable improvement suggestions. This approach reflects the design science's focus on triangulation and critical reflection (Hunziker & Blankenagel, 2021, p. 106).

Data analysis (step 5)

The artifact results were described using quantitative and qualitative data. Questionnaire results and innovation status were analysed using descriptive univariate statistics to summarise the strengths and weaknesses of the workshop framework. The conducted interviews were transcribed, coded, and analysed to capture deeper insights into the participants' experiences and contextual factors influencing the workshop's effectiveness.

Step 6: Evaluation of the application

The application of the artifact was evaluated based on the criteria listed in Table 1. These criteria were essential for measuring the artifact's success and aligning the outcomes with the workshop goals. The evaluation of the application of the artifact was performed by those who facilitated the workshop through observations and reflective interviews in the pre- and post-workshop sessions.

For these reflective interviews, we've used Donald Schön's reflective practitioner methodology (1987), which enhanced the FI workshops by fostering continuous learning and iterative improvement. Facilitators engaged in reflection-in-action (adapting activities in real time) and reflection-on-action (analysing outcomes post-workshop). This process involved reviewing participant feedback, identifying successes and challenges, and refining the workshop design. By embedding reflection into each iteration, facilitators ensured that workshops remain adaptive, practical, and effective for SMEs. This approach is expected to improve the workshop quality and contribute to a robust, practitioner-informed framework, enabling SMEs to develop and implement FI efficiently while addressing resource constraints.

Step 7: Generalisation of the solution: Mid-range theory, including specification of classes of problems and contexts

By analysing the results of the application of the artifact and the evaluation of the application, the effectiveness of the solution and research gaps were specified. This section forms the first part of the discussion section.

The generalisation phase aims to derive the mid-range theory from the iterative development and evaluation of the artifact. To achieve this, data collected during the pilot applications of the frugal workshop framework, such as participant feedback, were systematically reviewed. The patterns of how the artifact performed across different SMEs and industries were identified to determine its broader applicability. Additionally, the theoretical constructs underlying the artifact contextualise the observed outcomes in broader problem-solving contexts.

This process aligns with the goal of mid-range theory development by synthesising empirical evidence and theoretical insights to articulate the artifact's scope and applicability. By specifying the types of problems it addresses and the conditions under which they function best.

The outcome of this step is an iteratively improved FI workshop framework for peloton SMEs, based on the discussion of this study.

Results

This section presents the findings per remaining steps of DSR artifact development, starting at step 3 of DSR: development of the artifact. The artifact is designed to address the research question as a frugal solution for the peloton of SMEs to support them in dealing with crises.

Step 3: Possible Solutions

From the interviews with experts, the following possible solutions to the problem (given the criteria) were derived for the development of the artifact:

Possibilities regarding practical elements

Duration: To ensure lasting impact while respecting entrepreneurs' time constraints, a maximum of four training sessions, spaced two weeks apart for optimal knowledge retention.

Participant types: To enhance organizational change, participants should be SME owners or senior managers from peloton SMEs, ideally joining in pairs from the same sector but not direct competitors, to encourage peer learning over theoretical instruction.

Modality: A participant-centered workshop framework, facilitated by an expert and based on Problem-Based Learning (PBL), as the most effective approach, enabling entrepreneurs to exchange ideas and learn from each other rather than through traditional lectures. Workshop modality, with much interaction, would be most effective in catching the interest of entrepreneurs.

Possibilities regarding the frugality focus

The experts suggested applying the following three frugal elements:

1. **Frugal Lens**: recommend encouraging participants to view innovation as simple, cost-effective, and accessible, focusing on resource-conscious solutions that create value for underserved markets by embracing the principle of "doing more with less."
2. **Frugal Business Model Patterns**: suggest exposing participants to successful FIs and business model patterns from their industry to inspire adaptation, creative recombination, and effective strategies for commercialization.
3. **Frugal Intervention**: emphasize that the training itself should embody frugality by a) minimizing time commitments, b) reducing theoretical content in favor of action-based learning, and c) fostering peer-to-peer engagement among participants from similar industries.

The experts viewed these frugal adaptations as process innovations that enable experimentation and refinement, aligning with DS principles, while emphasizing the need for an innovation lens or conceptual framework to support adaptability and change.

Possibilities regarding the focus on innovation

Two experts recommend structuring the training artifact around the Design Thinking methodology, specifically the Double Diamond framework, known for fostering innovation (Brown, 2008). This human-centric approach emphasises collaboration, creativity, and iterative problem-solving (Klenner et al., 2021). Originally applied to product development, Design Thinking now extends to sustainable business model innovation (SBMI) (Geissdoerfer et al., 2016).

The Double Diamond model (Designcouncil, 2018) visually represents divergent and convergent thinking across four key phases:

1. Discover – Gathering insights, exploring opportunities, and identifying trends.
2. Define – Refining insights to establish a clear problem statement.
3. Develop – Creating, iterating, and testing potential solutions.
4. Deliver – Finalising, validating, and implementing the most effective solution.

While Design Thinking is versatile and effective, its traditional application is resource-intensive, requiring time, tools, and dedicated spaces (Bocken et al., 2019a). This makes it challenging for resource-constrained SMEs, which often innovate within existing limitations rather than with future resources (Ghorbel et al., 2021). Here, FI complements Design Thinking by ensuring cost-effective, practical, and resource-efficient solutions (Hossain, 2018). Simplifying processes and focusing on core functionalities align frugality with the iterative, user-centric nature of Design Thinking, making it an ideal framework for SMEs. Experts recommended designing the workshop as four-sessions, each integrating one step of the Double Diamond framework for Business Model Innovation.(Osterwalder & Pigneur, 2009; Geissdoerfer et al., 2016):

- Session 1: Exploring industry trends and analyzing the success of the current business model
- Session 2: Empathising with customers and refining business problems.
- Session 3: Brainstorming solutions and feasibility testing through peer discussions.
- Session 4: Presenting innovations and receiving feedback from participants and facilitators.

This structured approach optimizes SME engagement and innovation potential, ensuring solutions are feasible, actionable, and aligned with frugal business model principles

Given the solution criteria (see Table 1) and the possible solutions as suggested by experts, a workshop routine (our training artifact) was created. This artifact is described in the next section (Step 4).

Step 4: Developed artifact(s)

Figure 2: Design Thinking Process - Double Diamond (Designcouncil, 2018) with Business Model Innovation and added Frugal elements based on interviews with experts.

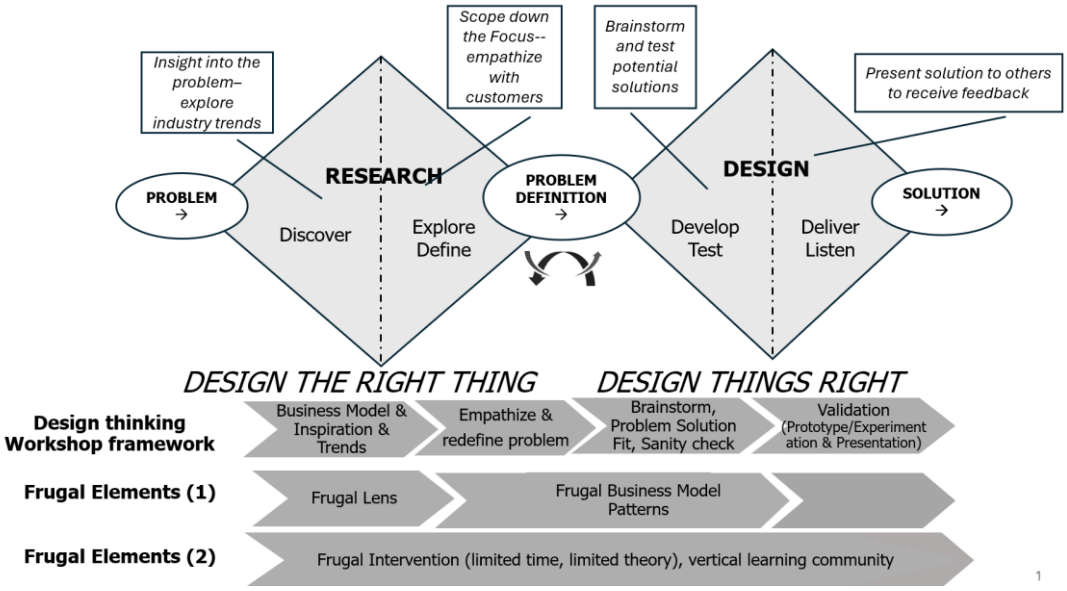


Figure 2 outlines the developed artifact: a four-session interspersed **workshop framework** based on expert insights and literature. Structured around the Double Diamond model, participants explore industry trends (Session 1), empathize with customers (Session 2), brainstorm and test potential solutions (Session 3), and present innovations for feedback (Session 4). The frugal elements are included in the two rows of arrows at the bottom of the figure. Note that the fourth session has no specific frugal elements. The workshop emphasizes FI by promoting cost-effective, practical solutions, peer learning, and problem-based facilitation, with experts guiding discussions rather than delivering lectures.

Step 5: Result of the application of the artifact

Participants were recruited through agribusiness associations, social media in the Netherlands, and personal networks in Ethiopia. However, challenges arose due to time constraints, scepticism toward innovation programs, and, in Ethiopia, expectations for expensive participant refreshments and a participant rewards (per diems). Despite this, SMEs were urged to send two senior representatives to ensure engagement and knowledge transfer.

The first pilot workshop was conducted at the Erasmus University campus of Rotterdam. Ten participants from seven SMEs in the agribusiness sector of the Westland region of the

Netherlands participated. A second workshop was held at the Arba Minch Polytechnic Satellite Institute in Ethiopia, with 20 participants representing a broader range of SMEs. These pilot sessions provided valuable insights into the applicability and impact of the workshop framework, particularly regarding the innovations developed, and their categorisation based on frugality, sustainability, and realised sales.

An overview of the participants, their innovations, and the outcomes achieved is presented in Table 2, which shows the practical value and impact of this frugal workshop framework.

Table 2: List of innovations and categorizations from the Pilot workshops

SME	Function	Country	Innovation	Product/ process?	Frugal?	Sustainable/Social?	Realised sales?
Solar energy solutions for growers	owner	NL	Frugalize solar heat battery for low tech greenhouses based on the hightech heat battery	Product	Frugal	Social and sustainable	no
	manager	NL					
Producer of organic substrates	owner	NL	Colorful socks produced from fishing nets taken from the bottom of the sea.	Product	no	Sustainable	no
Chrysanthemum grower	owner	NL	Christmas chrysanthemums and simplified processes in the greenhouse.	Product & Process	frugal features	Sustainable	yes
	owner	NL					
Exporter of fruit and vegetables	owner	NL	frugal order picking system: simplifies warehouse procedures	Process	Frugal features	Social and sustainable	n.a.
	manager	NL					
Wholesaler in lilies	owner	NL	unique ceramic vases as a co-sale to existing customers.	Product	no	Neither	yes
Fern grower	owner	NL	Baby ferns: blue fern cuttings in a box for end-consumers.	Product	Frugal features	Sustainable	yes
Technical services for agribusiness	manager	NL	Mechanical Trip sweeper. Instead of using chemicals, the Trip bugs will be swept up by a moving piece of cloth.	Product	Frugal features	Sustainable	no
Public TVET institute	Lecturer/innovator	Ethiopia	Banana Fiber Extraction and animal food chopping machine.	Product	Frugal features	Social and sustainable	no
Moringa and banana powder	Manager	Ethiopia	Blended moringa powder banana flour mix	Product	Frugal	Sustainable	?
Public TVET institute	lecturer/innovator	Ethiopia	Soy milk for babies	Product	Frugal features	Sustainable	no
Public TVET institute	lecturer/innovator	Ethiopia	Multi-purpose trasher machine	Product	Frugal features	Social and sustainable	yes
Cotton weaver	owner	Ethiopia	Educational handicraft tour	Process	no	Social	yes
Public TVET institute	lecturer/innovator	Ethiopia	Electrical weaving machine	Product	Frugal features	Social	yes
Farming group	owner	Ethiopia	Organic fertilizer	Product	frugal	Sustainable	no
Coffee and gift shop	owner	Ethiopia	Coffee for processing at home	Product	Frugal	Social	yes
Urban farm	owner	Ethiopia	Poultry production for meat	Product	no	Neither	no
Urban farm	owner	Ethiopia	Cheese from fresh milk	Product	no	Neither	no
Public TVET institute	lecturer/innovator	Ethiopia	Sweet potato pancakes	Product	no	Social	no
Enset flour producer	production manager	Ethiopia	Recipe book	Product	no	Social	no
Urban farm	owner	Ethiopia	Potted plant for in the house	Product	no	Social	yes
Fish farm	owner	Ethiopia	Fish feed	Product	Frugal features	Sustainable	no
Peanut butter producer	owner	Ethiopia	Special nutricious red peanut butter	Product	No	Neither	yes

All SMEs that participated in the workshops concluded the final phase by presenting their innovations, including five product innovations, one process innovation, and one that combined both product and process aspects. Among these, three product innovations have already been commercialised. Additionally, six of the eight innovations incorporated frugal features, such as simplifying organizational processes without relying on ICT solutions, while six also exhibited social or sustainable elements to some extent. These outcomes surpassed the expectations of stakeholders.

To analyse the result of the application of the workshop, routine participant feedback was gathered. Immediately after completing the workshop sessions, the participants were provided with evaluation forms to gather their feedback. The results are summarised in the table below.

Table 3: Participants Evaluation

Questions	NL yes	Eth yes	Total yes as %
Frugal innovation is important to me as an entrepreneur	8/8	17/17	100%
I now have a good idea of what frugal innovation means	8/8	15/17	92%
This workshop has helped me to grow my company	8/8	17/17	100%
Thanks to this course, I have become better at innovating	6/8	16/17	88%
I am now better able to come up with ideas/solutions that are more smart, sober and simple	7/8	15/17	88%
Frugal innovation is relevant for entrepreneurs in general	8/8	17/17	100%
I would also recommend this workshop to other entrepreneurs	7/8	17/17	96%
I felt comfortable sharing experiences with my fellow entrepreneurs during the program	8/8	17/17	100%

Given the limited number of SMEs involved in this artifact application, it would be premature to draw definitive conclusions regarding the effectiveness of the workshop framework based on evaluation responses. However, the feedback suggests several key insights: (a) the workshop framework supported participants in developing innovations and improved their ability to innovate; (b) the concept of FI resonated as relevant and applicable to their needs; (c) participants expressed a willingness to recommend this free-of-charge workshop program to others; and (d) these outcomes were consistent across two distinct cultural and economic contexts.

Further insights were obtained by closely examining the experiences of the six participants who were interviewed regarding their innovations in relation to the workshop framework. Their feedback provided valuable perspectives on routine effectiveness and potential areas for improvement.

Table 4: Interviews Netherlands (n=3) and Ethiopia (n=3)

	Participant 1 (NL)	Participant 2 (NL)	Participant 3 (NL)	Participant 4 (ETH)	Participant 5 (ETH	Participant 6 (ETH)
Innovations created during workshop	*Two innovations. First, "Christmas Chrysanthemums." In the winter, the chrysanthemum greenhouses are empty because wholesalers are convinced that chrysanthemums are not in demand in winter. Second, we simplified working routines in the greenhouse, and second,*	*I came up with a product called "Baby Ferns." This is a nice little box with blue fern cuttings with all the right ingredients and a step-by-step instruction. The cuttings are leftovers. My expertise on growing ferns is put into that box. Through this box, we can directly reach end-customers and become less dependent on wholesalers.*	*In the workshop, we discussed changing our current product (solar heat battery for greenhouses) into a bootstrapped version—a frugal solar heat battery designed for low-tech greenhouses. Our customer base might change from 400 high-tech growers in the Netherlands to possibly millions based around the equator.*	*Multipurpose trashing machine for crops. I already designed the machine, but I joined the workshop for market linkage.*	*Floating fish feed. Imported fish feed is too expensive. Currently we use peanuts, egg shells and grains, but most of this food is not eaten. It sinks to the bottom of the pond and pollutes the water. Floating fish feed would solve this problem.*	*The innovation that I worked out in the workshop is indoor plants. Very few people in Arba Minch know that plants can be kept indoor and provide health benefits. If they do, they don't know how to take care of plants indoor.*
Role of workshop in creating/implementing the innovation	*No, both innovations, process, and product are a direct result of the workshop.*	*No, the workshops were essential. In my company, it is difficult to discuss innovations with my subordinates.*	*No, I would not. The workshop opened our mind so that innovating is not necessarily about increasing complexity.*	*Yes, I already designed the machine before the workshop. The workshop put pressure on finding customers: now I am making the first machine because I found a first client.*	*No, before the workshop I did not consider it. Still I didn't manage to produce floating fish feed, though.*	*I had the idea before the workshop, but I didn't work it out seriously. After the workshop I refined the promotion text and found many followers in the pot flower Telegram channel. I got more customers.*
Opinion on workshop assumptions (frugality, inter-sectoral, interactive, etc.)	*I endorse all assumptions, but I would like to add that we would not have participated if a direct competitor had joined.*	*All the assumptions are correct, in my opinion.*	*I agree with all, however, I would like entrepreneurs from other sectors to be invited as well to enhance cross-sector innovation.*	*The assumptions are good, and they underline how we usually work (minimizing costs while maintaining quality)*	*The assumptions are relevant: the interactive nature of the workshop made it unique compared to other trainings.*	*The workshop was different from traditional workshops due to the frugal focus and that the participants were active. I like that, but it may be difficult for less-educated participants.*
Most relevant element of the workshop	*The strength of the workshop is a discussion between entrepreneurs within the sector and questions from the coaches. We have repeated the workshop in our organizations with employees. We are a family business; it helped the owners to agree on strategy and leadership style.*	*The biggest learning lesson was that by mapping my BM, BMs from other participants and BMs of successful innovators, so you can see where you can innovate. Frugal Innovation gave me the insight that you can innovate on something that is already in the organization, in our case, leftover cuttings.*	*Empathizing with customers and examples of Frugal BM Patterns inspired us to "simplify" our product. By offering the frugal version to Bottom of the Pyramid growers, we created a possible new market of millions and can contribute to food security (SDG2).*	*For me, market linkage is very important. I thought about the ideal customer, and what wishes and needs he has. However, I could not fully reach the target group so this part was well organized in theory but not very practical for my case.*	*I like the network. Being with so many other entrepreneurs, inspiring each other, and working on the canvases.*	*All the canvases were so informative and intuitive and relevant for our business! For us this was the first workshop which didn't bore us.*
Suggestions to add/delete	*Additional and reusable (plasticized) tooling that we can re-use within the company.*	*Every participant should be asked to come up with a Frugal Innovation for one of the other SMEs. This increases one's ability to innovate, might present you with an interesting innovation but also strengthens the vertical learning community.*	*Further validation of the proposed solution as homework for the last session. Both financial validation and customers' or colleagues' validation. Also, more tooling that we can re-use for future innovations.*	*The workshop was very informative and just enough.*	*I need to see more canvases and I want to learn more about design thinking. For me, a longer training (more sessions) would have been helpful.*	*For less educated participants it's needed to explain why the canvases are relevant, and to give clearer examples in Amharic. For me it was perfect, but I could see that other participants struggled to understand the content.*

The case studies and participant interviews from the workshops conducted in the Netherlands and Ethiopia provided valuable insights into the effectiveness of the FI workshop framework. Participants found the workshop framework highly beneficial for developing relevant innovations. The workshop enabled them to develop relevant and practical innovations tailored to their business needs. Many SMEs have successfully applied FI principles, some participants replicated the workshop framework at their own companies, expanding its reach beyond the training setting. The frugal elements integrated into the workshop (e.g. resource scanning, business model patterns, and rapid validation) were particularly impactful in helping SMEs conceptualize low-cost, high-value innovations. Peer learning and interactive exercises were identified as the most valuable aspects, reinforcing the importance of collaborative problem-solving in the innovation process.

While the workshop framework proved effective, participants highlighted areas for refinement. SMEs emphasized the need for structured financial feasibility assessments and practical tools to validate and scale their innovations. Industry-specific case studies and best practices enhanced applicability, while institutional differences emerged—Ethiopian SMEs valued government and community engagement, whereas Dutch SMEs prioritized market-driven feasibility, underscoring the role of local context in innovation adoption. Although many innovations incorporated frugal principles, participants suggested adding sustainability validation criteria to ensure long-term environmental and social impact. Some requested more time for feasibility assessments, while others dropped out or missed sessions due to time constraints.

Step 6: Evaluation of the application of the artifact

Table 5: Criteria for an effective frugal training with an evaluation of the application of the artifact

Domain	Criteria	Result (opinion of lecturers)
Frugal Innovation Literature:	Substantial cost reduction compared to other trainings which help SMEs adapt to changing environments	Yes
	A focus on identification and prioritization of core functionalities (eliminating redundant elements and ensuring resource efficiency)	Can be improved in further iterations
(Weyrauch and Herstatt, 2017; Winkler et al., 2020)	Optimized performance compared to other trainings which help SMEs adapt to changing environments	Yes, based on feedback participants
	Cost-efficiency, core functionality, and performance optimization in assessing frugal innovations are interconnected	Yes
	The training routine aligns with the expectations and constraints of SMEs in the contexts.	Can be improved in further iterations
Sustainable business model innovation literature:	Societal impact through sustainability	Yes
	Circular economy and sustainability objectives are integrated and safeguarded	Yes, but FI only acts as a mediator between innovation sources and circular economy implementation (Perera & Badir, 2024)
	The tool inspires or triggers business change	Yes
	Purpose-made for Circular Business Model Innovation	No, not circular but it can act as a mediator for circularity
	Rigorously developed using literature and practice insights	Yes
	Iteratively developed, tested, and evaluated with users	No, only tested in two contexts with limited number of participants
(Bocken et al., 2019)	Integrates interdisciplinary knowledge	Yes
	Transparent guidance for use by others	Work in progress
	Practitioners have used the final version multiple times	Work in progress
	Simple and time-efficient design	Yes
	Adaptable to different business contexts	Yes
Educational literature:	Trainee satisfaction and learning (knowledge acquisition)	Yes
	Behavior change and organizational impact	Yes
	Measurable results	Yes
(Sakthi & Moshi 2021, Ali et al., 2022)	Clear objectives and robust design	Work in progress
	Needs assessment (context) and delivery mechanisms (process)	Yes
	Interactive methods (e.g., role-playing, brainstorming) to improve retention and behaviour change	Yes
	Actionable insights for participants	Yes

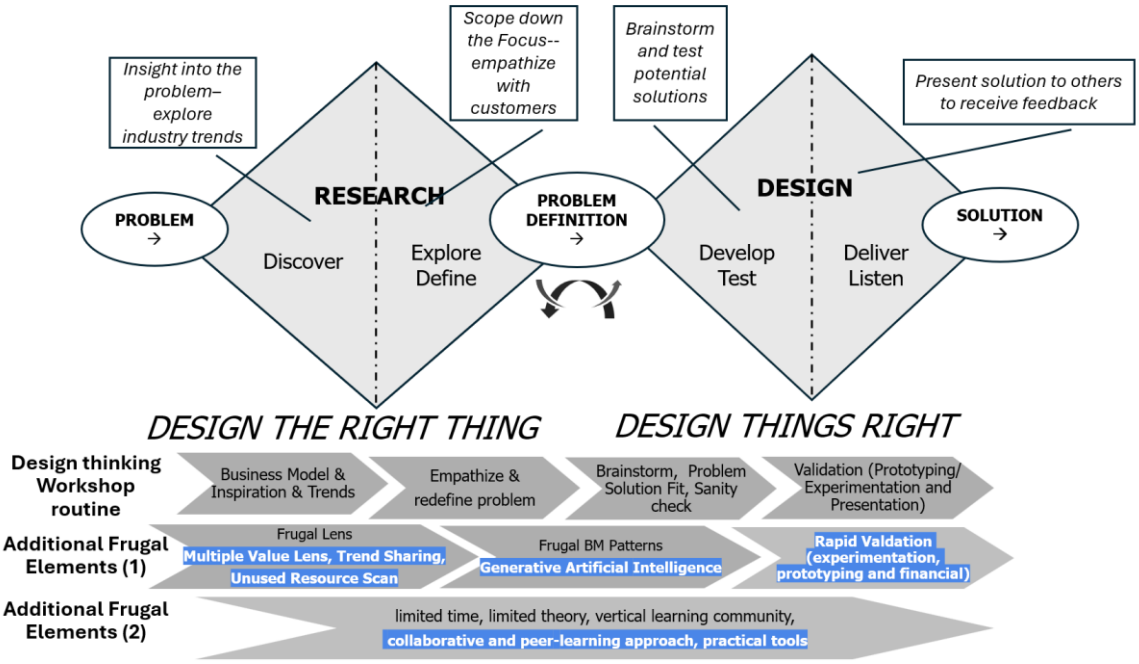
When comparing observations of both lecturers during and after finalizing the workshop routine, both lecturers confirmed that the pilot had been successful in terms of creating innovations in a relatively short period of time. Upon looking at the criteria derived from the literature, the lecturers scored each element.

Based on the reflective discussions of the practitioners, and the table of criteria there is room for incremental 'frugal' improvement. Some ideas for improvement that emerged from reflection as part of step 6:

- A "**multiple value-lens**" could be added to the first session, in order to increase the likelihood of innovations being either social or sustainable. An entrepreneur's main focus is to create financial value for the business; this can be extended. This can replace general clips on innovation outside the industry which did not resonate well with the participants.
- The workshop enhanced SMEs' agility to innovate amid changing conditions by leveraging their market expertise. A short **trend sharing** exercise with a focus on local and sector-specific trends gives new insights, as shown in the Ethiopian workshops. Dutch sessions showcase the importance of contextualising FI to specific sectors. Embedding tools for analyzing local trends into workshops ensures relevance and tailored solutions.
- Since many of the presented innovations actually come from an unused resource in business, it makes sense to do a small exercise called the **Unused Resource Scan**. In this exercise the participants can make a list of all resources in and around the business and evaluate whether they are fully utilised.
- During workshop sessions, participants relied mostly on what they already knew and what other participants said. They were not consulting the internet for problem identification and ideation. To quickly explore all facets of a problem and to get a list of potential solutions to a problem, participants could start by consulting **Generative Artificial Intelligence** (e.g. ChatGPT), and combine it with their own and other trainee experiences. AI can save enormous amounts of time, assuming it is used with caution.
- There are three validation exercises in the workshop: experimentation, prototyping and financial validation. The exercise we developed is "rapid killer assumption testing", to quickly validate or reject ideas inside or just outside the workshop room. This type of validation fits the constraints of SMEs, who often do not have time and budget to conduct a full market study before heavy resource investments. In addition, an Excel tool was developed for a quick sanity check on financial and sustainable business cases (Kraaij et al., 2023). Such **rapid and practical validations** result in resource-efficient iterations.
- As already predicted by the expert interview, participants are more likely to learn from peers than from theory; all participants greatly valued interactions with training participants, including the perspective of somebody not working in the same sector. Therefore, for this target group (the peloton of SMEs) the trainer should use **a collaborative and peer-learning approach**, primarily facilitating dialogue between participants.
- To achieve this collaborative peer-learning atmosphere, **practical tools** are crucial. The workshop slides about theory can be minimized and the focus can simply be on explaining the tools and maximising action learning, while also asking critical questions regarding the innovations.

The gathered data on the effectiveness and improvements resulted in an improved framework design of the workshop routine with incremental changes based on the input from the participants and lecturers (see Figure 3).

Figure 3: Workshop design after incremental changes based on input of trainers and participants. Note that the incremental changes are highlighted in blue.



Discussion

This section deals first with the final step of DSR by generalizing the above results into theory, it then delineates into recommendations for future research and limitations.

Step 7. Generalization of the solution: mid-range theory, including specification of classes of problems and contexts

The key findings from the frugal workshop routine provide a foundation for constructing a mid-range theory that specifies the classes of problems it addresses and the contexts in which it is applicable. This artifact, grounded in the principles of frugal innovation and Design Thinking, is tailored for peloton SMEs. SMEs typically lack access to traditional innovation resources, often perceived as too costly or mismatched to their operational realities. By incorporating frugality into the Double Diamond Design Thinking framework,

this workshop routine directly addresses the challenges of resource constraints, limited innovation capacity, and the need for sustainable business models.

This study expands FI beyond its traditional association with emerging markets, demonstrating its relevance in both resource-scarce (Ethiopia) and developed (Netherlands) economies. Frugal innovation originates from poorer countries and is later adapted in wealthier ones. This study gave us the opportunity to look at FI activities and ways-of-thinking of both target groups.

In this light it is good to challenge common stereotypes: when people in the West think about innovation, they often picture expensive, cutting-edge technology developed in advanced research labs, which is unattainable for the peloton of SMEs. However, this peloton can innovate incrementally and frugally, which is shown by the effect of our artifact.

A similar pattern exists in how people see innovation in poorer countries. The most well-known examples often feature individuals from penniless backgrounds creating low-cost, life-changing solutions, such as the Miticool refrigerator. These inspiring stories, however, do not represent the many smaller, everyday improvements made by most business owners in these regions.

In contrary to the stereotype of an innovator in a poor country (Zanello et al., 2016), the entrepreneurs in Arba Minch's workshop were relatively well-off and not seriously struggling to make a living. The workshop did not result in life-changing groundbreaking innovations, but incremental and frugal innovations were developed. The impact of a single innovation in this context is less groundbreaking than the impact of an innovation from an extremely impoverished or high-end laboratory context, yet the quantity of this firmographic (peloton SMEs) is high, which supports the relevance of our artifact, which is low in costs and easy scaleable.

The way how Ethiopian participants thought and applied what their learners was remarkably similar to that of participants in Westland, challenging the idea that innovation looks fundamentally different in richer and poorer parts of the world.

The findings of this study also align with the principles FBA, demonstrating how resource-constrained SMEs can gain a competitive edge through FI. These workshops not only facilitate cost-effective problem-solving but also enable participants to turn resource challenges into strategic opportunities, driving both economic resilience and societal impact (Asakawa et al., 2019).

By integrating the FBA framework with design thinking, it strengthens the theoretical foundation of FI within Design Science Research (DSR), making it more actionable for practitioners. While innovation policies often prioritize high-tech, high-growth firms, this research challenges the assumption that SMEs are resistant to innovation. Instead, it

highlights the need for practical, low-cost, and scalable methods, such as frugal design workshops, to activate innovation in SMEs.

The iterative nature of the workshop routine enhances its adaptability across industries and cultural contexts. Results show that innovation emerged even without an explicit sustainability focus, suggesting that frugality can drive both operational efficiency and broader societal impact. By embedding frugality into innovation frameworks, SMEs can create value despite resource constraints while ensuring survival and incremental growth. Future iterations should further refine the framework by testing it across industries and regions to validate its generalizability and assess conditions under which frugality-based advantages (FBA) and sustainability benefits emerge.

The common thread when developing this framework for a workshop routine was to do more with less. By adding frugal elements to the design-thinking process, a workshop routine was created. The workshop routine should result in the creation and commercialisation of several innovations/solutions for a specific group of SMEs. This specific group of SMEs, the 'peloton' are normally hesitant towards innovation programmes.

In the pilot, this peloton of SMEs was challenged to capture and create value with frugal innovations in their products, services, and/or processes, and improve their overall sustainable business modelling process. The Pilot was successful in the creation of products, processes, and business model innovations. 83% of innovations can be classified as sustainable or social. All participants perceived the workshop as successful in assisting them with innovation. The addition of frugal elements resonated well with this target group. Valuable feedback from the participants was gathered to further improve the effectiveness of the workshop routine.

Traditional design thinking methods, like the Double Diamond, are often resource-intensive and less accessible for SMEs. This study shows that incorporating frugal validation, business model patterns, and time-efficient interventions makes design thinking more usable and inclusive for SMEs. The comparison of Ethiopian and Dutch SMEs underscores shared challenges, from resource constraints in Ethiopia to policy and market barriers in the Netherlands, reinforcing the universal applicability of FI for SMEs navigating innovation challenges worldwide.

As such, the key research question of this study was answered by developing a workshop framework for a workshop routine based on the Double Diamond process, describing the divergent and convergent stages of the design process (Designcouncil, 2018) and the additional frugal elements the result of which can be seen in Figure 3.

Limitations

This study primarily evaluates the immediate impact of frugal design workshops in fostering innovation. However, there is a limited long-term assessment of whether participating SMEs successfully implement the innovations developed during the workshop. Future studies should track SME behaviour over time to measure business outcomes, sustainability impact, and the actual implementation of FI.

While the study assumes that FI principles are universally applicable, cultural and institutional differences may influence SME adoption of these principles. The role of business networks, regulatory environments, and societal attitudes towards innovation should be explored further to understand how different ecosystems affect the success of frugal innovation initiatives. The role of business networks, regulatory environments, and societal attitudes towards innovation should be explored further to understand how different ecosystems affect the success of frugal innovation initiatives. Cultural and institutional differences between the Netherlands and Ethiopia—such as differing expectations around government support or market-driven innovation—probably have influenced how SMEs engaged with the workshop. These contextual factors should be considered when applying the framework elsewhere.

Future Research Directions and policy implications

The primary recommendation of this study is for longitudinal studies to track SME innovation adoption, financial viability, and sustainability impact post-workshop. As SMEs increasingly embrace digital tools, future research should explore questions like *how elements of this workshop could be digitalized* and *what role digital frugality plays in enabling cost-effective and scalable SME innovations.* Additionally, *how do low-cost, high-impact digital solutions—such as AI, automation, and blockchain—align with frugal innovation principles?* Given that regional innovation policies often overlook the peloton of SMEs, it is further recommended that studies should examine the following two questions as well; *how policymakers can integrate frugal innovation frameworks into regional economic policies* and *how effective funding models for frugal innovation workshops are as part of SME support programs.* Moreover, the long-term sustainability and scalability of such initiatives should be assessed to reinforce their role in addressing global resource constraints.

Conclusion

This study successfully demonstrates that the frugal innovation workshop routine that was developed as an artefact can empower SMEs in both developed and developing economies to innovate under resource constraints. However, its impact should be evaluated over time, tested in different industries, and analysed for policy implications. Future research should

build on these findings to refine frugal business model frameworks, integrate digital and sustainability trends, and support long-term innovation adoption among SMEs.

While design thinking is widely used in innovation, this study uniquely integrates frugality into the process. By 'Frugalising' the design thinking process with focus on simplicity and limited resources, the specific target group of SMEs might be willing to invest some of their precious resource time to innovate. Policy makers might start to pay extra attention to this, in economic terms, an interesting group next to the industry's frontrunners. This particular focus might indirectly create innovations that are sustainable, despite this not being the primary focus of the SMEs.

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Searching for the tenth archetype: creating shared value as part of the sustainable business model archetypes

A proposal based on the application of the SBMAs to the oil and gas industry in previous research

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Abstract

This conference paper is based on previous research, in which we addressed how oil and gas (O&G) companies are facing a pressing process of adaptation to a new context determined by complex crossroads between major global crisis and sustainability trends. We applied the sustainable business model archetypes (SBMAs) taxonomy to shed light on this transformation. Based on this, we focused on one O&G firm with large socio-economic importance in the Basque Country region (northern Spain), gathering information via semi-structured interviews. Taking into account how multi-stakeholder collaboration and a regional focus on industrial clusters appeared to be key elements of the sustainability strategy of the case study, in this conference paper we explore further this dimension of the O&G business transformation. The research suggests that the ”creating shared value” (CSV) concept explains how the case study covers various SBMAs in its strategy. Based on this, we suggest integrating the CSV concept as a tenth SBMA and propose how to continue

the research by focusing on the case of the Net Zero Basque Industrial Super Cluster initiative.

Keywords

Oil and gas, energy transition, sustainable business model archetypes, clusters, creating shared value

Introduction

The interrelation between multiple crises at the global level hardly allows understanding the impact of each crisis in an isolated way (Shaheen et al., 2025). According to Garretsen et al. (2025), this multiple interrelation gains complexity when crisis episodes (*sudden shocks*) overlap with long-term structural shifts (*megatrends*), which at the same time are interdependent between them, creating an intricate network between climate change, technological advancement, demographic shifts, globalisation and rising inequalities. They add that policymakers, businesses and society must adopt an integrated approach to navigate the challenges from these global forces, which ultimately have local impacts, but also provide large opportunities for innovation, transformation and adaptation.

In a recently published article (Menéndez-Sánchez et al., 2025), we approach this context through the analysis of the transformation of oil and gas (O&G) companies into multi-energy companies, which have large innovation capacities to adapt progressively to sustainability requirements. This conference paper, on the one hand, summarizes part of the mentioned article[1], focusing on how we applied the sustainable business model archetypes (SBMAs)[2] framework to a regional case study of an O&G company in the Basque Country region (Spain). On the other hand, in order to offer a fresh perspective on the covered issue, this conference paper has two further objectives:

1. To include additional insights regarding the theoretical background, aiming to provide a novel view and to contribute to a comprehensive understanding of the SBMAs framework (e.g., see Table 1 and Figure 4). This brings to this paper new figures not included in the previous article (e.g., Figures 1 and 3).

[1] In this conference paper, the theoretical background, methodology and main results and discussion are namely summarized material of part of the previous research article. These are used to explain and build the section on industrial clusters and the conclusions and further reserach proposal, which are original contributions of this conference paper.

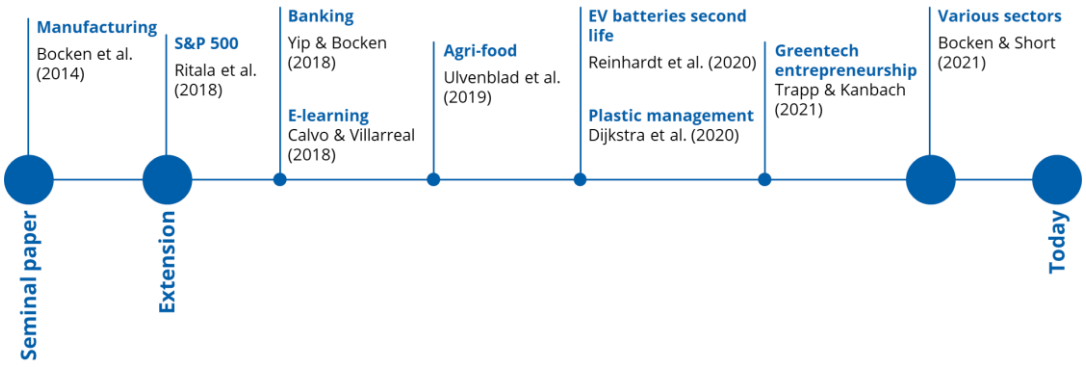
[2] The application of SBMAs in the mentioned article proposes carsharing as an example to understand how the SBMAs are interrelated. It incorporates as well a critical refection on the application of the SBMAs, related to issues like institutionalized unsustainability or greenwashing. The latter is addressed in previous NBM 2024 conference proceedings (Menéndez-Sánchez, 2024).

2. To focus on the potential role of clusters as channels to build shared sustainability initiatives within the industrial sector.

Theoretical background

The sustainable business model archetypes (SBMAs) framework constitutes a comprehensive taxonomy covering the major categories of sustainability-oriented business model innovation. Therefore, it involves technological, environmental, social, organizational and economic dimensions. Its purpose is to improve the understanding about how some business models support companies in integrating sustainability in practice (Calvo and Villarreal, 2018; Dijkstra et al., 2020). Scholars have demonstrated a flexible and cross-disciplinary application of SBMAs, which provide a unifying research agenda (Reinhardt et al., 2020) that covers a wide range of sustainable business model opportunities with applicability in different fields, sectors and activities. Figure 1 shows how academia has contributed to shape this approach. Beyond academic research, SBMAs find application in practice by companies, policy-makers, NGOs or demonstration projects. For example, Pezzi et al. (2021) explore sustainable business strategies in two levels (businesses and clusters) in relation to regional competitiveness policies. Other example is the European Union's Horizon 2020 RUSTICA project (De Keyser and Mathijs, 2023). Yip and Bocken (2018, p161) attribute this rich heterogeneity to how the research on SBMAs departs from a 'rigorous theoretical foundation' to build a 'repeatable methodology to distinguish and classify sustainable business models for different industries'.

Figure 1. Examples of relevant contributions in academic literature to the evolution and industrial application of the SBMAs taxonomy



Note: not time scale. This is not a comprehensive review. A previous version of this figure was presented at the NBM 2024.

The current SBMAs research agenda was initiated at the University of Cambridge's Institute for Manufacturing (IfM). Its roots can be found in the work by Short et al. (2012; 2013), who

pointed to a preliminary conceptual suggestion of sustainable business models archetypes (Bocken et al., 2013). Bocken et al. (2014) formally defined a first set of SBMAs in a seminal article, giving place to the corresponding theory further developed by scholars. This definition relies on a conceptual value-based business model framework formed by three main elements (value proposition, value creation and delivery, and value capture), which builds on classic literature on business models (Osterwalder et al., 2005; Richardson, 2008; Teece, 2010; Beltramello et al., 2013; Boons and Lüdeke-Freund, 2013).

Eight different archetypes make up the original proposal by Bocken et al. (2014), which are classified into three major innovation categories: technological, social and organizational. Bocken et al. (2016), Lüdeke-Freund et al. (2016) and Ritala et al. (2018) introduced some modifications and extended the original taxonomy, with three differences standing out:

1. The technological and organizational innovation categories are substituted by the environmental and economic ones, reflecting the triple axis of sustainability (Elkington, 1997).
2. The 'create value from waste' archetype is renamed as 'closing resource loops', to better reflect the complexity of the circular economy.
3. 'Inclusive value creation' is introduced as a ninth archetype. Yip and Bocken (2018) had previously used it separately in their analysis of the banking industry.

Table 1 shows how these two approaches are similar, despite the differences mentioned above. In fact, scholars have applied them indistinctively in business research. For instance, Bocken and Short (2021) combine both views, while Alonso-Martínez et al. (2021) consider that the 'develop scale-up solutions' and 'inclusive value creation' archetypes can be merged into one on account of their similarities. De Keyser and Mathijs (2023) suggest that hybrid business models can be created, for analytical and research purposes, by combining the identified archetypes. Indeed, flexibility is a main characteristic of SBMAs, as they can be used individually, in combination or conveniently adapted. Despite the fact that each archetype can pave the way for sustainable development individually, their largest potential is reached by combining them (Lüdeke-Freund et al., 2016, p57; Reinhardt et al., 2020, p9). Bocken and Short (2021) explore the last frontier of SBMAs to date: firstly, by identifying a set of 'unsustainable business model archetypes' (UBMAs) and, secondly, by proposing a hierarchy of SBMAs (in terms of their contribution to sustainability). As a whole, the academic discussion on the SBMAs taxonomy allows translating discussions on sustainability into a shared language, tearing down sectoral boundaries and addressing interconnected challenges within the economy and society.

In addition, this also means that different viewpoints and possible contradictions exist thoughout the literature on the SBMAs framework. Institutionalized unsustainability is a major concern with deep implications for the SBMAs (Bocken and Short, 2021; Menéndez-Sánchez, 2024) and, therefore, innovation in SBMs cannot be taken for granted without adversities and barriers (Ertelt and Carlborg, 2024). This means that a superficial or lenient application of archetypes would drive to limited sustainability advances, imperfect overlaps

or even rebound effects with negative implications (Bocken et al., 2014; Lüdeke-Freund et al., 2016; Geissdoerfer et al., 2018)[3].

Table 1. Summary of the SBMAs framework

<table>
<tr><td colspan="2">SBMAs (original set of eight archetypes)</td><td colspan="2">SBMAs (further developed set of nine archetypes)</td></tr>
<tr><td>Major innovation types</td><td colspan="2">Archetypes</td><td>Major innovation types</td></tr>
<tr><td rowspan="3">Technological</td><td colspan="2">Maximize material and energy efficiency (MMEE). Optimizing the resources used</td><td rowspan="3">Environmental</td></tr>
<tr><td>Create value from waste (CVW). Turning waste streams into useful input</td><td>Closing resource loops (CRL). Reusing products and materials</td></tr>
<tr><td colspan="2">Substitute with renewables and natural processes (SRNP). Innovations in renewables</td></tr>
<tr><td rowspan="3">Social</td><td colspan="2">Deliver functionality rather than ownership (DFO). Moving away from the necessity for ownership to the use and functionality of products</td><td rowspan="3">Social</td></tr>
<tr><td colspan="2">Adopt a stewardship role (ASR). Additional responsibility that a business might take on in order to address a specific social or environmental issue</td></tr>
<tr><td colspan="2">Encourage sufficiency (ES). Considering slow consumption as part of the business model</td></tr>
<tr><td rowspan="3">Organizational</td><td colspan="2">Re-purpose for society/environment (RPSE). Changing the corporate structure for sustainability</td><td rowspan="3">Economic</td></tr>
<tr><td colspan="2">Develop scale-up solutions (DSUS). Delivering sustainable alternatives at scale to maximize sustainability benefits</td></tr>
<tr><td>-</td><td>Inclusive value creation (IVC). Sharing resources, knowledge, ownership, and wealth creation</td></tr>
</table>

Note: each archetype is abbreviated in this paper, using an acronym (alternative abbreviations can be found in Alonso-Martínez et al. (2021)). These are only used with aesthetic purposes when various archetypes are mentioned in the same sentence. Short descriptions in italics come from Ritala et al. (2018); the one for CVW is from Bocken et al. (2014). "Inclusive value creation" is usually positioned as the eight archetype in the extended set of nine SBMAs; here it is positioned as the last one in order to simplify the comparison between both sets of archetypes.
Source: modified from Menéndez-Sánchez et al. (2025), which is based on Bocken et al. (2014) and Ritala et al. (2018)..

[3] This is related to a critical reflection on the application of the SBMAs developed in Menéndez-Sánchez et al. (2025). This is beyond the scope of the current paper due to word limit (see next in the Methodology section).

Methodology

This work is part of a broader research that follows the methods previously applied by authors who have studied SBMAs (Bocken et al., 2014; Calvo and Villarreal, 2018; Dijkstra et al., 2020; Bocken and Geradts, 2020; Trapp et al., 2021; Bocken and Short, 2021; Barth et al., 2021). Overall, our main inspiration was Yip and Bocken (2018), who formalized a methodology for applying the archetypes to various sectors and industries that is deemed to be appropriate for analyzing the O&G sector and other industries. This is complemented by following Calvo and Villarreal (2018), who provide a comprehensive view of the application of SBMAs to a certain industry and later pay attention to a single holistic case study through semi-structured interviews. This also takes inspiration from Kattirtzi et al. (2021), who study various energy majors through the review of publicly available documents and then complement the obtained evidence with semi-structured interviews. Barth et al. (2021) and Pezzi et al. (2021) also provide useful insights for our analysis, as they apply the SBMAs framework at the subnational regional level.

The original research in Menéndez-Sánchez et al. (2025) departs from the review of real-life qualified examples collected from practice, based on desk research addressing a sample of twelve representative O&G companies making up the Oil and Gas Climate Initiative (OGCI). Due to word limit in the conference proceedings format, and aiming to provide new insights based on further research purposes, this paper focuses on and summarizes the analysis stage that consists on case study research and semi-structured interviews as follows.

Case study selection

Aiming for a close approach to a regional and local reality, we focused on Petronor, a company that owns and operates a refinery in the Basque Country region (northern Spain), as well as a network of petrol service stations throughout Spain. The seminal work on SBMs by Stubbs and Cocklin (2008, p107) inspired the selection of the regional case study, following their argument of choosing a case study of theoretical interest because it "is not (the) typical" one. Previous research on this company (Menéndez et al., 2021; Álvaro-Hermana et al., 2023) indicates that Petronor is not a "typical" refinery, as it has its own corporate identity and a differentiated business vision from the global approach of its parent company (Repsol[4]), particularly characterized by a strong identification with the Basque Country region's economy and local business ecosystem. Following Shuen et al. (2014), Petronor can be considered a regionally focused independent case study with particularly interesting intangible resources for creating sustainable value. The analysis and interviews (see description below) draw from the most relevant contributions to case study

[4] Repsol sis one of the twelve companies taht make up the OGCI sample previoulsy indicated. Threfore, there is a relation between the previous research stage (review of real-life qualified examples).

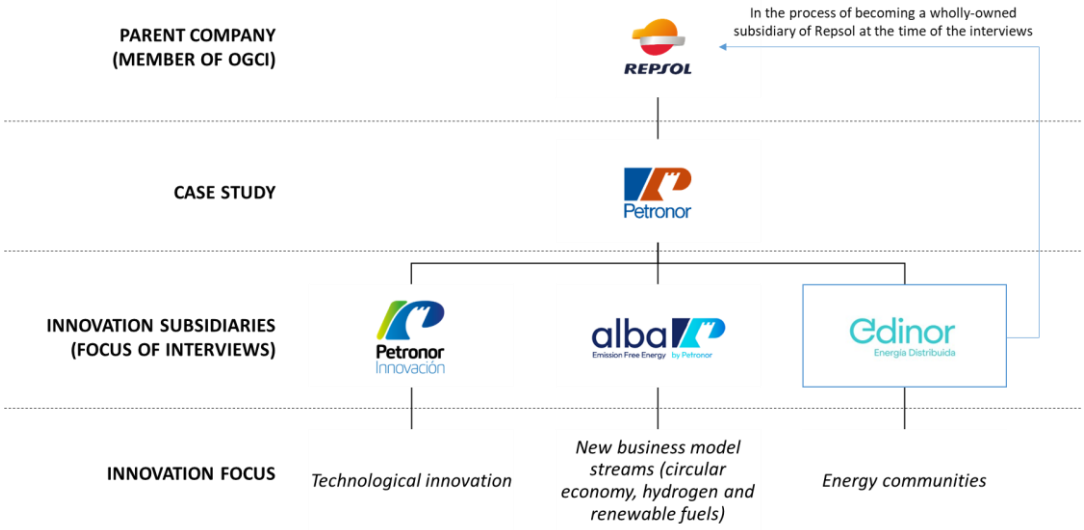
and business research methods (Eisenhardt, 1989; Villarreal, 2017; Bryman and Bell, 2015; Yin, 2018).

Interviews description

We carried out semi-structured interviews with senior executives within Petronor's corporate structure in order to gain an in-depth understanding of the company's innovation and new business strategies. In particular, we paid attention to Petronor's three highly specialized new-creation subsidiaries: Petronor Innovación, Alba Emission Free Energy and Edinor. These companies focus, respectively, on technological innovation, decarbonization solutions and the circular economy and energy communities (Figure 2). As these are three subsidiaries, carried out interviews were up to four (one per subsidiary, with two dedicated to Alba due the variety of new business models it is developing). Following Baker and Edwards (2012), choosing the number of qualitative interviews depends on the research purpose. Accordingly, we argue that the number of interviews (four) is sufficient because, on the one hand, there are not more subsidiaries[5] representing sustainability changes within the studied company; one the other hand, all the interviewees held top-level responsibilities within their organizations at the time of the interview (e.g., CEO, President, General Manager, Director-General other high-level positions). Additionally, all four of them had different positions within the Petronor or Repsol groups earlier in their careers, thus being able to provide a comprehensive understanding of both groups' strategies. In any case, the interviewees' exact job position is not indicated in order to guarantee data protection and, for similar reasons, the information collected during the interviews was treated in an aggregated way. This has been done under the authors' criteria and the aggregated data does not necessarily represent the official view of the analyzed company. Interviews' design was namely based on Yip and Bocken (2018)'s own interview structure.

[5] However, Petronor has recently announced the creation of a new joint venture called "Biscay Eco Aggregates" in collaboration with O.C.O Technology (being Petronor a 75% shareholder), aiming to produce carbon negative manufactured limestone aggregate based on accelerated carbonationt technology (ACT). This initiative was too young at the time of the original research and could not be addressed.
https://oco.co.uk/o-c-o-technology-signs-landmark-deal-with-petronor-to-develop-joint-venture-facility-in-bilbao-spain/

Figure 2. Focus on Petronor's specialized subsidiaries for interviews



Source: modified from Menéndez-Sánchez et al. (2025).

Analysis process and validation

In all the research stages we applied an analytical coding process (Corbin & Strauss, 1990), once again following the research methods already demonstrated in the literature on SBMAs (Bocken et al., 2014; Yip & Bocken, 2018; Dijkstra et al., 2020; Bocken & Geradts, 2020). Accordingly, we used the nine SBMAs as higher level theoretical themes in in order to classify the specific examples of company innovation initiatives or major themes obtained from the interviews. Thematic sub-nodes gave place to a coding structure (Kattirtzi et al., 2021), which was iteratively refined by conducting rounds of comparisons, looking for similarities and differences between data from the interviews, in order to find patterns or common traits that explain which mechanisms for delivering sustainability are taking place in the studied company and, potentially, in the O&G sector. This way, key themes and stakeholder typologies were progressively identified. Saturation was reached when no new themes could be categorized within the SBMAs, particularly due to overlapping points between archetypes (see next section).

The results from the interviews were complemented with examples of supporting innovations (following Yip and Bocken (2018)'s results structure), which were obtained in the previous desk research stage and provide the global O&G industry context. These were as well discussed on the basis of the existing literature. In particular, a critical reflection on the application of the SBMAs and on the limitations of technology innovation in the O&G industry was carried out, including discussions about major concerns like "greenwashing" or delay" discourses (de Freitas Netto et al., 2020; Lamb et al., 2020), how sustainability debates risk being simplified or "instrumentalized" (Bauwens et al., 2023). As previously

indicated, these are beyond the scope of this conference paper due to word limit and further research purposes.

Main results and discussion

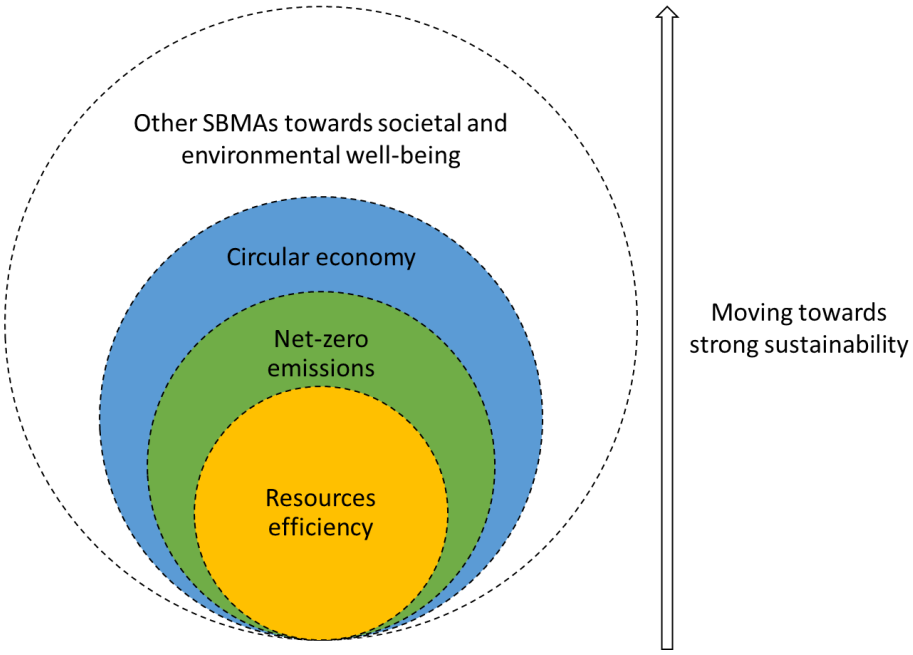
In this conference paper, we summarize key insights emerging from a bird's eye view of the interviews. Details are out of the scope of this conference paper, but they are thoroughly described in Menéndez-Sánchez et al. (2025), partly emulating the results structure in Yip and Bocken (2018). Each archetype was explained to and commented by the interviewees, keeping in mind that a global industry approach is implicit in the results due to the research design. When introducing the archetypes to the interviewees, we followed the classical order in the literature: first, the environmental archetypes, followed by the social ones and, finally, the economic ones. Given that the scholars' approaches differ in terms of which set of SBMAs they use, we decided to use the extended set of nine archetypes, in line with the approach adopted by Bocken and Short (2021).

After being asked about the environmental archetypes (MMEE[6], CRL[7] and SRNP[8]), interviewees saw the social and economic ones partly overlapping with the first three, given that many of their main implications were strongly related to the environmental ones that had been discussed. In particular, digitalization shows a particular central role in maximizing energy efficiency and, beyond environmental benefits, workforce safety is a critical focus of digital technologies (implying further social implications). Thus, the "Maximize material and energy efficiency" was found to be decisively promoted by digital technologies (with further systemic implications regarding the CRL[9] and SRNP[10] ones). This points to the archetype 'substitute with digital processes', originally developed by Yip and Bocken (2018) for the banking industry, which could also be relevant in the O&G business, emphasizing the linkage between digitally-enhanced processes and sustainability.

This approach matches how Bocken and Short (2021) describe the interrelation between archetypes and, also, how they place the three environmental archetypes at the lowest level of their hierarchy (Figure 3). Moreover, this also suggests that this interrelation can take place in an asymmetric way, depending on each major category. The results from the interviews indicate that the environmental archetypes clearly represent the foundations of the sustainable transformation of the O&G industry. As one interviewee said, "*they are the 'hardware' for a new corporate approach*".

[6] Maximize material and energy efficiency.
[7] Closing resource loops.
[8] Substitute with renewables and natural processes.
[9] Closing resource loops.
[10] Substitute with renewables and natural processes.

Figure 3. Environment-oriented archetypes at the foundations of the SBMAs hierarchy



Source: adapted from Bocken and Short (2021).

Overall, five SBMAs stood out in relation the O&G industry. As already mentioned, three are the "core" environmental archetypes. In addition, we found the "Develop scale-up solutions" (economic) archetype to be a common denominator across environmental archetypes, given that interviewees underlined achieving minimum scale as a critical issue for business competiveness and technological efficiency for the three environmental archetypes. The "Develop scale-up solutions" archetype points as well to the "Inclusive value creation" archetype, if sustainability solutions are scaled up by sharing resources. For example, through partnerships or via multi-sectorial platforms based on public-private cooperation, possibly including companies from different value chains (some of them that maybe do not have the resources for implementing sustainability solutions by themselves). Combining the "Develop scale-up solutions" and "Inclusive value creation" archetypes is in line with Alonso-Martínez et al. (2021)'s findings and the original 8 archetypes set of SBMAs, as explained in this paper's Theoretical background section. Indeed, the interviewees could barely separate the "Develop scale-up solutions" archetype from the "Inclusive value creation" archetype's in relation to collaboration and sharing resources with other actors, which has mainly an economic or organizational approach. Therefore, they separated the social implications of the "Inclusive value creation" archetype and even considered these as the least applicable part of the SBMAs taxonomy to the O&G industry. Although all interviewees believed that this will gain importance in the future. Furthermore,

clearly identifying the social dimension within the “Inclusive value creation” archetype is also similar to the modification of the SBMAs proposed by Yip and Bocken (2018).

Finally, interviewees coincided in pointing to the ”Adopt a stewardship role” archetype as arguably the most important one, given that collaborating with multiple stakeholders with sustainability purposes is the cornerstone of the company’s long-term strategy, aiming to generate economic and social impulse for change within the surrounding institutional, business and innovation ecosystems. One interviewee underlined the purpose of building a corporate “identity” that is clearly recognisable and associated to this sustainability stewardship role. This would imply a “business honesty” exercise that requires a strategic long-term perspective in order to patiently build a relationship with society based on trust, with increasing social legitimacy. This identity reframing process would start by fostering industrial and business development in the surrounding business ecosystem.

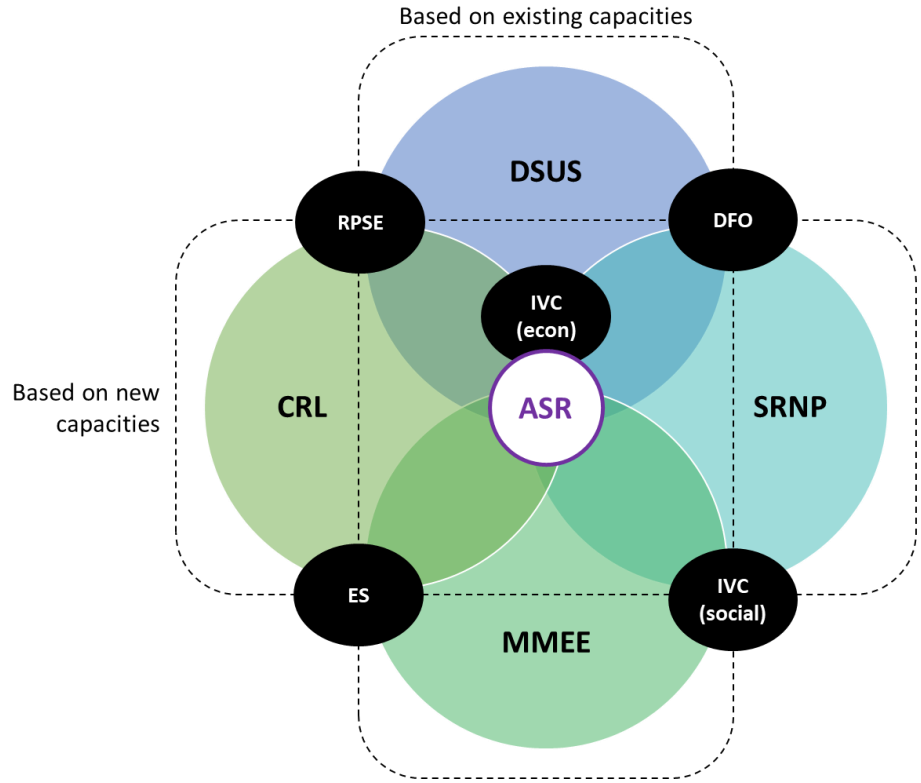
Ultimately, the ”Adopt a stewardship role” archetype would be a result of systemically linking the environmental archetypes with the economic ones. As Figure 4 illustrates, this implies combining existing capacities in the O&G sector (namely in the MMEE[11] and DSUS[12] archetypes, related to large-scale physico-chemical processes) with new ones (in the CRL[13] and SRNP[14] archetypes). This way, the ”Adopt a stewardship role” archetype would make the difference between players in the energy sector that successfully adapt to sustainability requirements and those that do not. However, adopting a stewardship role would necessarily imply a focus on the local and regional scale, displacing the classical multi-geographical, global strategy in the O&G sector and giving relevance to the regional circumstances of each company or facility.

These results corroborate Bocken and Short (2021)’s conceptualisation of the SBMAs framework as a “hierarchy” in which organisations should aim to succeed in various sustainability levels. In a similar fashion to our research, their hierarchy places the environmental archetypes as the basis of a preliminary sustainability approach that will evolve to include “higher,” more complex archetypes, like the ”Adopt a stewardship role” one. Accordingly, the successful transformation of the O&G industry, instead of prioritising between specifc archetypes, requires simultaneously implementing the strategic archetypes and eventually converging into the aimed stewardship role. This does not only allow to unleash synergies between archetypes but also to establish a more comprehensive conception of the company that catalyses further contributions to other archetypes in more advanced business development stages, particularly the social ones. Regarding this, small dark circles in Figure 4 indicate indirect contributions of archetypes not included in the five main ones. Although it is important to underline that their position in the figure in relation

[11] Maximize material and energy efficiency.
[12] Develop scale-up solutions.
[13] Closing resource loops.
[14] Substitute with renewables and natural processes.

to the main archetypes is merely illustrative (as could vary depending on the combination of capacities and sustainability objectives aimed at by a given company), they represent how synergies for supporting other archetypes could be found in more advanced business development stages.

Figure 4. Systematic interrelation between the sustainable business models archetypes for the O&G industry



Note: see Table 1 for the meaning of each archetype. Source: Menéndez-Sánchez et al. (2025).

The role of industrial clusters and creating shared value

The strategic importance of the "Adopt a stewardship role" archetype is strongly linked to multi-stakeholder initiatives and industrial networks in the Basque Country involving cluster associations from different industrial sectors. Interviewees paid special attention to the Net-Zero Basque Industrial Super Cluster initiative, which brings together a large number of industrial and other cluster associations and companies with the grand objective of decarbonizing up to two thirds of Basque industrial activities. According to one

interviewee, this “Super Cluster” implies stepping up the sectoral outreach of the company decarbonization activities and, therefore, the scope of the stewardship role by Petronor.

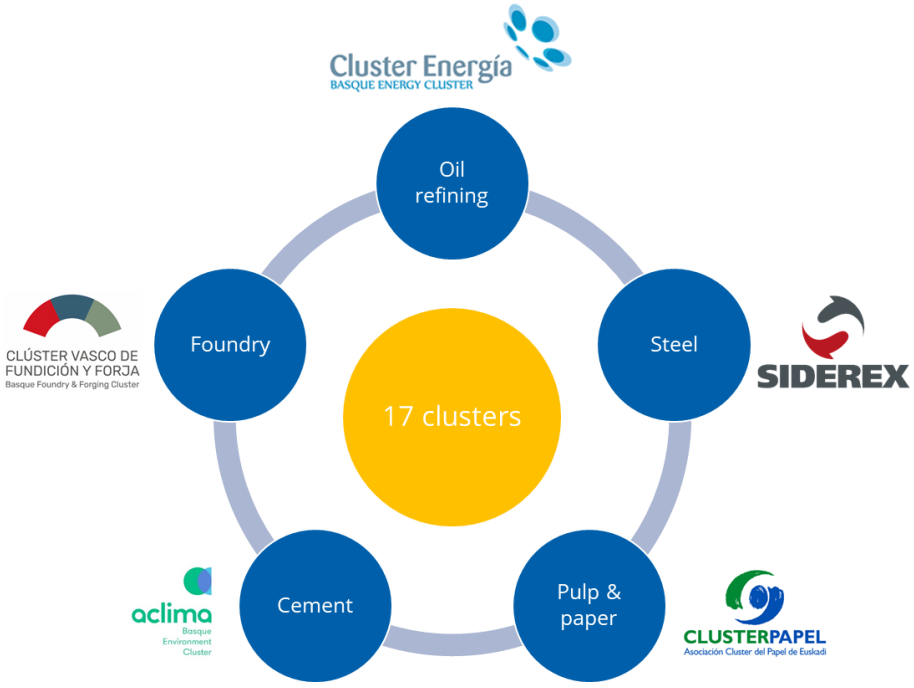
This multi-stakeholder industrial platform is a major public-private multi-stakeholder project led by the Basque Government (through its industrial, innovation and internationalization agency, SPRI[15]) and key private energy companies in the Basque Country (Petronor and Iberdrola). Its objective is to develop new technologies and solutions to reach net-zero industrial hubs in the Basque Country.

This “Super Cluster” has a novel approach: allowing cross-sectoral collaboration for industrial decarbonization through the engagement of several cluster associations. Because of this, the “Super Cluster” has been considered as a kind of *cluster of clusters* or *meta-cluster*. The initial industries covered by the initiative account for 67% of industrial GHG emissions in the Basque Country (with the ambition to extend the coverage to other industries). The cluster associations representing each of these initially targeted industries are the following five. Some of them also participate in the Basque Hydrogen Sectoral Forum (which, in turn, involves up to eight cluster associations), while the final objective of the “Super Cluster” is to involve up to seventeen cluster associations (Figure 5).

- Basque Energy Cluster Association (representing the oil refining industry)
- Aclima (representing the cement industry)
- Siderex (representing the steel industry)
- AFV (representing the foundry industry)
- Pulp and Paper Cluster Association (representing the pulp and paper industry)

[15] https://www.spri.eus/en/support/net-zero-basque-industrial-super-cluster/

Figure 5. Foundational scope of the Net-Zero Basque Industrial Super Cluster



Source: own elaboration based on data from SPRI (Basque Agency for Business Development).

Another interesting point related to the Supercluster is that this is not an isolated initiative, but one integrated in a large international project: *Transitioning Industrial Clusters towards Net Zero*[16], promoted by the World Economic Forum (WEF). This global initiative recommends a multi-stakeholder integrated approach towards a net-zero future for industrial clusters, identifying systemic efficiency and circularity as one of the four major groups of solutions that can help achieving industrial sustainability. In particular, the promoters of this international initiative state that "*implementing these solutions is more impactful when pursued through a cross-sectoral, multi-stakeholder approach, where different industries within a cluster can create synergies*"[17].

Indeed, Bocken et al. (2021) maintain that the need for a broader sustainability perspective by a firm does not only imply addressing as many archetypes as possible, but also incorporating a "system-wide" approach involving different stakeholders. Citing Sarasini & Linder (2018), they consider that "*to address the fundamental challenges, business models will increasingly need to be conceived with a cross-sector approach for successful societal*

[16] https://initiatives.weforum.org/transitioning-industrial-clusters/home
[17] https://www.accenture.com/_acnmedia/PDF-147/Accenture-WEF-Industrial-Clusters-Report.pdf

transformation, […] e.g., combining the energy, transport, construction and retail sectors under a new unified business model".

In this regard, the "Super Cluster" case suggests that there is a link between building a broad and comprehensive approach to sustainability and the popular policy construct of clusters. Clusters are "*geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions*" (Porter, 1998, p. 197), and the cooperative relationships within such clusters have provided the basis for an extremely resilient policy approach for fostering regional competitiveness (Wilson, 2019). Moreover, their cross-sectoral conception of related economic activities that are rooted in local geography and proximity relationships provides good scope for integrating a social/community perspective with the standard economic logic of competitiveness (Konstantynova & Wilson, 2017).

Adopting a system- or cluster-wide approach can be especially relevant when designing and implementing sustainability solutions. Cluster collaboration initiatives and exploiting cross-cluster synergies may help to align the sustainability and business goals of individual companies with systemic objectives such as increased productivity within value chains, or an improvement in environmental conditions locally. Leveraging such potential requires not only collaboration across companies, but also the support of public institutions within public-private cooperation models.

This strategic approach to local/regional clusters suggests a relation between the SBMAs and the concept of creating shared value (CSV), which indeed has been explored by some scholars as part of the SBMA literature pillars (Lüdeke-Freund et al., 2016; Pezzi et al., 2021). According to Porter and Kramer (2011), the development of local competitive clusters is one of the three channels that a company can follow to create shared value, which implies enhancing the competitiveness of a company while simultaneously addressing the economic and social conditions of the local community around it. For them, CSV is a way for leveraging "unique resources and expertise". This is equivalent to using the O&G existing capacities regarding the MMEE[18] and DSUS[19] archetypes in order to support advances in the CRL[20] and SRNP[21] archetypes, suggesting as well theoretical bridges between these archetypes and the other two channels for CSV described by Porter and Kramer. The shared umbrella of the "Adopt a stewardship role" archetype, as previously illustrated in Figure 4, highlights how the CSV theory offers an evolving scientific framework organizing previously disconnected discussions (Menghwar and Daood, 2021). Adopting a wide CSV approach would then help the company overcome a "corporate-centric focus" and engage in a "shared meta-mission" with local and regional actors (Alberti and Belfanti,

[18] Maximize material and energy efficiency.
[19] Develop scale-up solutions.
[20] Closing resource loops.
[21] Substitute with renewables and natural processes.

2019), whose objective cannot be other than reaching real sustainability, as Bocken and Short (2021) pointed.

A suggestion of a tenth archetype

Our original research, as illustrated by Figure 4, did not aim to modify the original SBMAs, even considering that Yip and Bocken (2018) did so for the banking industry. Nevertheless, in Menéndez-Sánchez et al. (2025) we suggested that some of the insights from our research could be integrated into the SBMAs framework in order to ease its application to the O&G industry or, as mentioned before, to other related industrial sectors within a needed cross-sectorial approach. Therefore, here we are proposing a first, preliminary possibility for this adaptation of the SBMAs, which namely could consist of:

a) Separating the social dimension from the economic implications of the "Inclusive value creation" archetype, following the results of the interviews.
b) The first could be replaced as an archetype within the social innovation category. This matches how Yip and Bocken (2018) firstly defined the "Inclusive value creation" archetype. This allows to focus the archetype's scope on social challenges to be addressed by the business.
c) The latter, the economic dimension of the "Inclusive value creation" archetype, could give place to a new "shared value creation" or "creating shared value" (CSV) archetype, in order to integrate the full potential of sharing resources and goals and fostering cooperation within a multi-stakeholder business and innovation ecosystem. Particularly, through local/regional clusters, as one of the channels for the "creating shared value" concept.
d) Other archetypes could as well be reinforced by integrating broader approaches. In this paper we mentioned how the "Substitute with digital processes" (Yip and Bocken, 2018) could be linked to the "Maximize material and energy efficiency" archetype. Similarly, this could be the case for others. The "Inclusive value creation" archetype, once fully placed as a social one, could incorporate the broader perspective of distributive business models. Similarly, the "Encourage sufficiency" archetype could incorporate the broader perspective of regenerative business models.
e) Finally, the "Adopt a stewardship role" archetype could find its largest impact potential by adopting a clear regional focus (*downstream stewardship*) and a wide value chain perspective (*upstream stewardship*), following the differentiation made by Bocken et al. (2014) within this archetype.

It is important to clarify the similarities of a possible economic CSV archetype with the existing SBMAs, as well as to underline the key differences that make it a useful extension of the taxonomy. The similarities or linkages can be explored through the two first channels that Porter and Kramer indicate for creating shared value: reconceiving products and markets and redefining productivity in the value chain. This way, a CSV archetype could be

potentially supported on the CRL[22] and SRNP[23] archetypes, given that these represent a form of "reconception" of products and markets (e.g., an O&G company moving away from fossil fuels by incorporating circular economy and renewable energies). This could also apply, for instance, to the "Deliver functionality rather than ownership" (e.g., carsharing business models). In a similar fashion, the MMEE[24], CRL[25] and ASR[26] archetype, could reinforce a CSV archetype by representing forms of "redefining productivity in the value chain". This particularly applies to the "Adopt a stewardship role" archetype, which can be "upstream" or "downstream" within the business value chain (Bocken et al., 2014). However, it is the third channel for CSV, enabling local clusters development, which cannot find a clear accommodation within the SBMAs framework. Therefore, a CSV archetype would allow a better focus on strategies based on industrial clusters (without, nevertheless, forgetting the mentioned linkages of CSV with other archetypes).

Following the former, the adapted list of SBMAs could be as follows:

1. Maximize material and energy efficiency (reinforced with Substitute with digital processes)
2. Closing resource loops
3. Substitute with renewables and natural processes
4. Deliver functionality rather than ownership
5. Adopt a stewardship role (reinforced by regional and value chain approaches)
6. Inclusive value creation (reinforced by distributive business models)
7. Encourage sufficiency (reinforced by regenerative business models)
8. Repurpose for society/environment
9. Shared value creation (reinforced by focusing on local regional clusters)
10. Develop scale up solutions

Conclusions and further research

We acknowledge that this study is based on a single case study, with limited possibilities of generalization and potential difficulties in applying our findings to other industries and regions. Following Stubbs and Cocklin (2008), the purpose of this work was not directly to generalize, but to "represent organizational forms that might exist rather than actual organizations and can be used as design guidelines for new or existing organizations". In any case, the applicability to different industrial sectors of the SBMAs framework, as argued by Yip and Bocken (2018), allows replicating and testing the concepts presented in our case study. Therefore, we believe that some of the learnings from the application of the SBMAs

[22] Closing resource loops.
[23] Substitute with renewables and natural processes.
[24] Maximize material and energy efficiency.
[25] Closing resource loops.
[26] Adopt a stewardship role.

to the case study of Petronor in the Basque Country region could drive further analysis covering not only other O&G companies, but also other industrial businesses facing shared challenges regarding decarbonization and sustainability targets.

This points to a number of policy implications and practical recommendations. For example, the "Super Cluster" case described in this work suggests the large potential of combining different industrial cluster associations in order to create a multi-level platform for a multi-stakeholder dialogue between government, research institutions, major leading businesses and a large diversity of industrial actors at different stages of various value chains, which may help to address the impact of ongoing megatrends and crises. This allows combining regional industrial capabilities in order to address sustainability challenges not only in a "vertical" way (as the hierarchy suggested by Bocken and Short (2021)), but also in an "horizontal" way with larger geographical and sectorial outreach, aiming to support the orchestration of industrial decarbonization on the basis of shared resources and capabilities. This can ground stronger sustainability-oriented policy design processes of industrial and business strategies, allowing a deeper self-understanding of regional industrial ecosystems through the involvement of small and medium size players in industrial value chains by using cluster associations as intermediate dialogue actors. By incorporating CSV in their business strategies, companies can find a broader playing field for sustainability initiatives. Following Porter and Kramer (2011), this would allow companies to "supersede corporate social responsibility" and to create social value by leveraging their "unique resources and expertise" in their communities. Moreover, the engagement through international initiatives, like the WEF's one *Transitioning Industrial Clusters towards Net Zero*, suggests as well that this multi-level dialogue could also take place connecting different geographies, even with potential implications for low-income countries or emerging economies (e.g., channeling the transfer of clean energy technologies and knowledge).

In this work we have further developed the possibility of including the concept of "creating shared value" (CSV) as a new archetype, with related minor modifications of the SBMAs framework. Regardless of this possible adaptation of the SBMAs taxonomy, further research could address the relationship between CSV and the archetypes. Following the introduced case of the "Super Cluster" as an aggregator of regional clusters and leading businesses, we suggest the possibility of studying as an expansion of the research in Menéndez-Sánchez et al. (2025), taking a multiple case study approach (e.g., cluster associations, leading companies, public institutions, international organizations, among others). This would be similar to the methods in Reinhardt et al. (2020), who applied the SBMAs by carrying out semi-structured interviews according to different groups of key stakeholders in a particular sector. In the case of the Super Cluster, this could include international partners (e.g., WEF), other public or private organizations leading the "Super Cluster together with Petronor (e.g., SPRI, Iberdrola) and, of course, the involved cluster associations, starting by the five key ones on which the "Super Cluster" is founded. Other

could include independent experts or stakeholders, not necessary involved in the “Super Cluster” initiative, in order to provide richer insights. Other related further research avenues could explore the possible policy implications and practical recommendations previously indicated, such as the international connection between industrial clusters.

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Empirical Analysis of Sufficiency-oriented Innovation Adoption Across Firms

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Extended abstract

1. Introduction

While sustainability efforts can no longer be ignored by businesses today, their sustainability strategies differ in their impact on the environment, society, and their competitive orientation (Young and Tilley, 2006). By following a strong sustainability perspective, the sustainability discourse increasingly focuses on the principles of sufficiency (Gossen and Niessen, 2024) in academia, industry, and policy (Jungell-Michelsson and Heikkurinen, 2022). Sufficiency addresses overconsumption and resource waste in consumption and production systems (Geels et al., 2015; Sandberg, 2021). The commitment to sustainability and, in particular, sufficiency requires businesses to innovate their products, services, and business processes, such as marketing activities ecologically and socially (Bocken and Short, 2016). Innovative approaches toward sufficiency integrate aspects of the circular economy and degrowth movement. Studies by Freudenreich and Schaltegger (2020) and Gossen and Heinrich (2021) find that sufficiency-conscious businesses provide, for example, repair services, more durable products, or educational materials, and thus counteract or moderate conventional economic growth ambitions. To survive in uncertain environmental conditions, businesses – young or old – must act resiliently and innovatively to alter their business models and enter into (social) relations beyond organizational boundaries. We argue, that for holistically assessing the level of sufficiency orientation of businesses, we need to analyze the adoption and diffusion of sufficiency and corresponding innovation activities at the firm level across industries and market players.

In this paper, we delve into the organizational and systemic structures established through sufficiency-oriented innovation, which enable mutual learning, reduction, and sharing of resources (Bocken et al., 2022; Lage, 2022).

2. Research questions

We aim to investigate the following research question: *How do businesses address sufficiency-oriented innovations?* By addressing the two sub-questions:

(i) *How are sufficiency-oriented innovations spread or linked across geographical areas, industries, and types of businesses?*

(ii) *How do sufficiency-oriented business models (and the related innovations) diffuse?*

3. Problem statement and hypotheses

A high level of interconnectivity between producers and consumers characterizes the concept of sufficiency (Beyeler and Jaeger-Erben, 2022). When examining the supply side of sufficiency, studies particularly conduct case studies on single consumer goods industries (e.g., Bocken et al., 2020) with a high environmental impact (Sandberg, 2021). Specifically, research on sufficiency-oriented businesses focuses primarily on consumer-intensive sectors such as mobility (Niessen et al., 2023), housing (Sandberg, 2018), food (Bocken et al., 2020), and clothing (Gossen and Kropfeld, 2022). However, linkages between these industries and quantitative studies have been largely neglected in the literature on sufficiency.

H1: The firm's likelihood of introducing sufficiency-oriented innovations is linked to the industry sector in which it operates.

Furthermore, start-ups and incumbent businesses are responsible for the sufficiency transition (Bocken and Short, 2016): While new businesses enter the market directly through innovation and build new customer bases (Gossen and Heinrich, 2021), established businesses benefit from market power and the autonomy to allocate resources to initiate change (Heikkurinen et al., 2019). In addition, implementing sufficiency products and services requires closer and fewer partnerships to check compatibility and to build up a loyal customer base that will make long-term use of the business's offerings (Bocken et al., 2014).

H2: The proportion of direct inter-organizational linkages of a firm is related to its likelihood of introducing sufficiency-oriented innovations.

4. Research design and methods

Analogous to the quantitative research design employed by Dahlke et al. (2024), who analyze Artificial Intelligence adoption, we aim to identify firms' sufficiency-oriented innovations and practices based on their corporate website information, such as product and service descriptions. Specifically, we use web-scraped data on German, Austrian, and Swiss firms to identify text-based content on sufficiency-oriented innovation through an appropriate keyword search. Based on major themes and principles in the sufficiency

business literature (see, for example, Niessen and Bocken, 2021), we develop the following search string: *'longer product use' or 'more intensive product use' or 'reduced resource use' or 'limited resource use' or 'shared production' or 'shared use' or 'less production' or 'less consumption' or 'slow consumption' or 'slow production' or 'sufficiency' or 'sufficient' or "product longevity'*. Since we only obtain information (websites) from German-speaking businesses via the platform, the keywords of the search string for this abstract were translated from German into English. Using this keyword search, we identify 604 (websites) firms.

Applying statistical and artificial intelligence-based techniques (e.g., topic modeling), we test the adoption of sufficiency-oriented innovations by businesses and linkages that allow the transfer of sufficiency-oriented knowledge and practices. We finally utilize an innovation index that refers to the firms identified as sufficiency-oriented to investigate the link between innovation and sufficiency.

5. Contribution

Our results support practitioners connecting to knowledge sources and selecting cooperation partners that enable the transfer of context-specific knowledge about (implementing) sufficiency-oriented innovations. We reveal potential strategies for both established and young businesses to implement resource-orientated innovation activities in the context of sufficiency. Regarding future research, our research lays a foundation for investigating the sufficiency and innovation nexus from a firm and sectoral perspective through quantitative results. Specifically, we encourage researchers to extend the literature on sufficiency from an innovation management perspective by integrating innovation as a means to promote sufficiency based on individual geographical and organizational capabilities.

Keywords

Sufficiency, innovation, web data, sustainable consumption and production

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An Extended Abstract Submitted to the NBM Conference 2025

Innovative Entrepreneurial Initiatives and Business Models for Sustainable Local Food Production and Institutional Change: A Pathway to Societal Transformation

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Extended abstract

Introduction

In an era of global crises—including climate change, economic instability, and supply chain disruptions—the need for sustainable, resilient, and locally adaptive business models has never been more urgent. The agrifood sector, a critical part of these challenges, faces mounting pressure to transition toward more sustainable and resilient food systems. However, innovation within the agrifood sector is not solely about technological breakthroughs; it also requires adapting existing business models, regulatory frameworks, and social norms. The current crisis further exposes the inefficiencies of traditional systems, highlighting the need for business models that integrate circularity, inclusivity, and resilience.

This paper investigates the role of entrepreneurial initiatives (EIs) in driving the transition to sustainable food systems, focusing on three agrifood start-ups based in Germany, Denmark, and Sweden: **Hermetia**, **Gårdsfisk**, and **Ausumgaard**. These EIs are innovating

alternative protein sources—such as insect-based feed, cultivated fish, and grass-based protein—to address the global challenges of climate change, food security, and social exclusion. The paper explores how these initiatives operate within existing institutional frameworks and how they influence these frameworks to foster broader systemic change.

Research Objectives

This study is driven by two key research questions:

1. **What institutional settings (IS) do entrepreneurial initiatives (EIs) interact with, and what challenges do these settings present?**
2. **How do entrepreneurs exercise agency to influence institutional frameworks and drive transformation in these settings?**

By exploring these questions, this paper aims to enhance our understanding of how EIs can reshape agrifood systems, particularly within the context of ongoing global crises. We seek to highlight how these business models engage with and navigate institutional structures to scale sustainable and resilient solutions.

Conceptual Framework

The paper is grounded in the concept of **institutional entrepreneurship**, which explores how entrepreneurs shape and transform institutional environments to create new opportunities (Fuenfschilling & Truffer, 2014). In particular, the paper examines how EIs in the agrifood sector work within formal regulatory structures, market dynamics, and consumer norms to scale their innovations.

The framework also incorporates the dynamic interplay of **fit-and-conform** versus **stretch-and-transform** strategies (Smith & Raven, 2012). **Fit-and-conform** strategies involve adapting innovations to align with existing institutional frameworks, while **stretch-and-transform** strategies involve challenging and reshaping these frameworks to create new institutional spaces that better accommodate the innovation. These strategies are particularly important in the context of alternative protein solutions, where misalignments with existing institutional structures can hinder the scaling of sustainable innovations.

Through this lens, the study explores how entrepreneurial ventures leverage both strategies to navigate regulatory, market, and cultural barriers, facilitating the scaling of sustainable innovations that can address the pressing challenges of the agrifood sector.

Methodology

A multiple case study approach is employed, focusing on three entrepreneurial initiatives: **Hermetia** (Germany), **Gårdsfisk** (Sweden), and **Ausumgaard** (Denmark). These companies have been selected for their innovative approaches to alternative protein production—ranging from insect-based feed, land-based aquaculture, to grass-based protein

production. These ventures represent a spectrum of innovation types, from radical to incremental, making them ideal case studies for understanding how entrepreneurial initiatives navigate and influence institutional settings.

Data collection involved semi-structured interviews with entrepreneurs, industry experts, and researchers, as well as secondary data from industry reports, company websites, and other relevant publications. A **grounded theory approach** (Charmaz, 2006) was used to analyze the data, emphasizing how EIs interact with institutional settings and exercise agency to influence institutional structures. Case studies were examined based on their business models, innovation strategies, and institutional challenges.

Key Findings

1. **Innovations in Protein Feed and Food:**
   The three case studies showcase a range of innovation types. **Hermetia**, with its insect-based feed, represents a radical innovation that faces significant institutional resistance, particularly in terms of consumer acceptance and regulatory barriers. **Gårdsfisk** focuses on cultivated fish, an incremental innovation that, while less disruptive, still encounters challenges in aligning with traditional aquaculture practices. **Ausumgaard** produces protein from grass through a biorefinery process, a more incremental innovation, but still requires adaptation to existing agricultural practices and regulatory structures.
2. **Institutional Challenges and Strategies:**
   All three EIs face common challenges related to production processes, certification requirements, market access, and consumer perceptions. Radical innovations, such as insect-based products, face greater resistance due to misalignments with established consumer norms and regulatory structures. In contrast, incremental innovations, such as grass-based proteins, encounter fewer barriers but still require adaptations to industry standards and certification processes.
3. **Fit-and-Conform vs. Stretch-and-Transform Strategies:**
   Initially, all three EIs adopt **fit-and-conform** strategies, adjusting their innovations to fit within existing institutional frameworks. However, as these companies scale, they shift towards **stretch-and-transform** strategies, actively engaging with stakeholders, policymakers, and industry players to reshape institutional frameworks in ways that support their innovations. This strategic shift is key to enabling the scaling of sustainable solutions and facilitating broader system-wide change.
4. **Entrepreneurial Agency:**
   The findings emphasize the critical role of entrepreneurial agency in overcoming institutional barriers. Entrepreneurs in more radical ventures, such as **Hermetia**, often engage in direct marketing and partnerships to bypass traditional market channels. In contrast, more incremental innovators, like **Ausumgaard**, work closely with established industry players to align their innovations with existing institutional structures. The ability of entrepreneurs to leverage their networks and build legitimacy is crucial for their success.

5. **Consumer and Social Norms:**
   Consumer perceptions play a crucial role in the success of these innovations. Shifting social and environmental norms provide a fertile ground for entrepreneurial ventures to introduce sustainable alternatives. **Hermetia**, for example, must overcome significant cultural resistance to insect-based food products, while **Ausumgaard** benefits from growing consumer interest in plant-based proteins and sustainable food systems.

Discussion

This research contributes to the growing body of knowledge on business model innovation by demonstrating how entrepreneurial initiatives can drive systemic change within the agrifood sector. EIs not only introduce novel solutions but also engage in institutional entrepreneurship by navigating and transforming the regulatory, market, and social environments that constrain or enable innovation. The findings highlight the importance of entrepreneurial agency in overcoming institutional barriers, particularly in response to the challenges posed by global crises such as climate change and food insecurity.

Conclusion

Entrepreneurial initiatives are essential drivers of change in the agrifood sector, enabling the transition towards sustainable, resilient food systems. By combining **fit-and-conform** and **stretch-and-transform** strategies, these ventures are able to scale innovations while also reshaping institutional frameworks to support broader societal transformation. This research underscores the importance of fostering entrepreneurial ecosystems that can support these ventures and the need for policy frameworks that facilitate the scaling of sustainable solutions. These insights are critical for policymakers, entrepreneurs, and practitioners seeking to accelerate the transition towards a more sustainable, inclusive, and resilient global food system.

Keywords

Institutional Entrepreneurship, Sustainable Food Systems, Business Model Innovation, Resilience, Circular Economy

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Scaling Resilient and Sustainable Local Solutions for Global Challenges Through Public Policy

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Abstract

This short paper explores how local governments can foster civic wealth and long-term societal well-being by implementing strategic planning while addressing global challenges at the local level. It examines sustainable urban development policies in Bursa, Türkiye, focusing on the tourism industry and using a participatory action research approach.

Keywords

Public policy, Türkiye, Societal wellbeing, Green Destinations, Resilience.

Main text

This short paper explores how local governments can foster civic wealth and drive long-term societal well-being by implementing strategic planning while addressing global challenges, such as climate change, at the local level.

As urbanization accelerates worldwide, cities of all sizes strive to achieve sustainability. However, they face significant challenges, often becoming hotspots for complex issues like migration and population density, environmental degradation, and rising social inequality. Recognizing these challenges, the United Nations (UN) has emphasized the importance of sustainable urban development through Sustainable Development Goal (SDG) 11, which aims to make cities inclusive, safe, resilient, and sustainable. To tackle the scale and complexity of the challenges and to create civic wealth and positive societal change. (Lumpkin & Bacq, 2019), collaboration across sectors and layers is essential (Brenton & Slawinski, 2023; Hatipoglu & Ertuna, 2024). Despite its significance and potential for value

creation, examples of engaged stakeholder participation and successful and long-term multi-stakeholder coalitions in sustainable development are difficult to find (Hatipoglu et al., 2016).

To address our research aim, we chose to examine the policies and strategies related to sustainable urban development in a metropolitan city. We focus on the tourism industry, as it strongly impacts urban development and societal wellbeing. Tourism has historically been regarded as a "valuable catalyst for development," especially in developing countries, due to its potential for significant growth and economic benefits (Sharpley & Harrison, 2019, p. 4). However, tourism can have positive and negative effects on destinations, such as environmental degradation from pollution, excessive resource use, and habitat destruction (Magnusson et al., 2024). It can strain local infrastructure, increase living costs, and lead to overcrowding, ultimately diminishing residents' quality of life (QoL). Therefore, studying the tourism industry aligns well with our research objective; by applying sustainability and circularity principles and a well-being approach to policy and planning of tourism, destinations may mitigate its adverse impacts, improve the QoL for residents and visitors, and promote sustainable development.

Theoretical background

We benefit from several literature streams relevant to global challenges and sustainable development. We suggest unrealized benefits could result from cross-fertilization between research on the development-first approach in sustainable tourism, the wellbeing approach in public policy development, and civic wealth creation (CWC). They share several important commonalities, focusing on human development and community wellbeing, emphasizing collaboration, recognizing local knowledge and culture, having a holistic perspective and long-term vision, and measuring impacts beyond economic outcomes (Table 1). These streams present complementary perspectives, which can help reach a more nuanced understanding of policy development, implementation, and evaluation processes for sustainable development and CWC.

The development-first approach to sustainable tourism prioritizes the needs and wellbeing of the host community, as it views tourism not as an end in itself but rather as a tool for achieving positive social and economic development outcomes (Font et al., 2016). This approach contrasts with the tourism-first approach, which centers on economic growth and industry expansion, often overlooking the potential negative impacts on local communities (Hughes & Scheyvens, 2016). The development-first principles include fostering human development, promoting equitable distribution of benefits, and ensuring that tourism development aligns with community goals and values. These require actively engaging residents in tourism planning, decision-making, and evaluation processes, valuing cultural capital and local knowledge, and building local capabilities to ensure long-term sustainability and community well-being. (Hatipoglu et al., 2019; B. Hatipoglu et al., 2022).

Table 1: A comparative table of approaches to societal wellbeing used in the study

Development-first approach to sustainable tourism	Social wellbeing approach in public policy development	Civic Wealth Creation (CWC)
Sustainable human development, building local capabilities, reducing the vulnerability of the poorest	QoL now and in the future. Wellbeing framework to be used to assess the vulnerabilities of residents and community groups in tourism.	Improve a community's capacity by developing skills, knowledge, and social networks, ultimately leading to greater self-reliance.
Holistic focus, social, cultural, and environmental well-being, as well as economic goals	Wellbeing at the heart of decision-making to provide a better balance between the economic, social, and ecological dimensions	Extends beyond the material resources and physical assets of a community to include intangibles such as health, happiness, and social justice
Culture is central in addition to other capitals; utilization of local knowledge.	Well-being/QoL is the central goal of good public policy. All capital types are important, but natural capital is non-substitutable	Community at the center, social, cultural, human, and political capital in driving positive societal change.
Community-focused goals	Efficient allocation of resources to enhance social wellbeing.	A diversity of needs and goals of the community, mutually beneficial goals to the stakeholders
Building relationships and collaboration locally, regionally, nationally, and internationally. Beneficiaries should be involved in evaluating the outcomes.	Participative approaches to developing wellbeing indicators and establishing societal priorities. Align national, regional, and international efforts to enhance social wellbeing.	Collaborations among diverse stakeholders with citizens (community, enterprise, and regimes of support).
Distribution of benefits, consideration of gender norms and inequalities	Equitable distribution of wealth and opportunity	Fair and equitable distribution, shared governance models
Monitoring and evaluation processes, acknowledgment of micro as well as macro impacts	Regular monitoring and reporting. Wellbeing outcomes, in addition to traditional macroeconomic measures, current and future well-being, objective and subjective indicators.	Wealth also includes intangible outcomes like happiness, social justice, and life satisfaction

The wellbeing approach in public policy development aims to create policies that enhance residents' QoL by looking beyond traditional economic indicators like GDP and considering a wide range of factors that contribute to individual and societal well-being (Durand & Exton, 2019), including health, education, social connections, and environmental quality. Governments like Iceland and New Zealand, which commit to well-being economics, measure and improve various aspects of social well-being, going beyond economic metrics to create a more equitable and fulfilling society for all citizens (Chatham House, 2019,

December 9). When applied to sustainable tourism, the wellbeing framework that integrates objective and subjective measures should guide decision-making at all stages of the policy cycle while prioritizing resident wellbeing as the ultimate goal (Dwyer, 2024). This approach will shift the focus from solely measuring visitor satisfaction to understanding the broader wellbeing impacts of tourism on visitors and host communities by considering factors like authentic cultural engagement, equitable economic benefits, and long-term environmental sustainability.

The CWC approach suggests generating social, economic, communal, and strategic wealth that benefits local communities and citizens by collaborating multiple stakeholders with diverse but joint interests (Lumpkin & Bacq, 2019). This is accomplished through the interaction of three major stakeholder categories: community, entrepreneurs, and supporters (i.e., governments, donors, universities, and large corporations), each driven by a distinct logic of action. Initiatives that target civic wealth will aim to cultivate an entrepreneurial mindset across diverse populations to enrich the community, emphasizing equity, accessibility, and social justice. (Fortunato & Alter, 2015). As such, the benefits of CWC can be shared broadly, and marginalized communities are not left behind.

Methods of analysis

To fulfill the research aim, the authors examine a metropolitan city's policies and programs for sustainable tourism development from 2022 to 2025.

Context

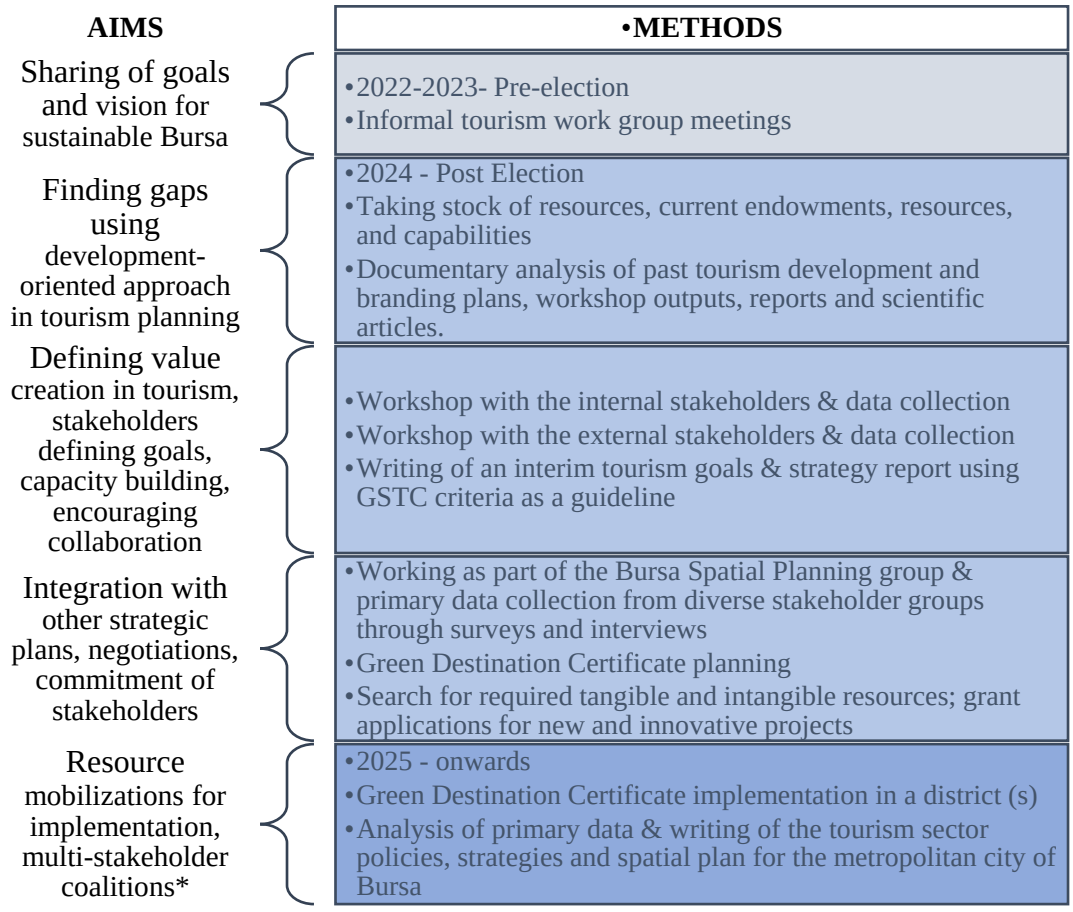
Bursa, Turkey's fourth most populous city with over 3.2 million residents, is a major industrial center known for its automotive, manufacturing, and textile industries (Bursa Valiliği, 2024). Located in northwestern Türkiye, Bursa is often referred to as the "Green City" because of its abundant parks and forests. However, Bursa faces numerous challenges due to its dense population, industry development, and uncontrolled urban growth. High pressure on infrastructure and housing, environmental concerns (air, water, and soil pollution), traffic congestion, preservation of cultural heritage assets, economic diversification (related unemployment), and hosting of forced migrants are a few of the key concerns. If left unaddressed, these issues will likely continue to affect the wellbeing of the residents.

As the first capital of the Ottoman Empire, Bursa has a rich cultural heritage, showcasing remarkable examples of Ottoman architecture alongside traces of its Roman and Byzantine past. However, Bursa's tourism sector faces a significant challenge in converting its abundant cultural and natural assets into a thriving industry. While the city attracts a substantial number of visitors, their stays are predominantly short-day trips, averaging only 1.8 days. This leads to underutilized hotel capacity and limits the economic benefits for the local economy (Bursa Valiliği, 2024). A strategic approach to tourism regeneration, grounded in sustainability principles, could be a key driver in diversifying tourism activities

across various types, locations, and seasons. Sustainability-focused tourism planning can complement other sustainable development-oriented policies and contribute to the overall well-being of Bursa's residents.

A new era of governance is underway in Bursa, marked by the election of a progressive mayor in March 2024. With a decade of experience leading a district municipality, the new mayor is committed to integrating economic development with social, environmental, and cultural priorities. This approach directly addresses the key challenges facing Bursa, which have emerged from its industrial growth and high population density. As authors, we had been asked to join the tourism work committee before the 2024 elections and continue to advise the mayor and Bursa Metropolitan Municipality (BMM).

Figure 1: Research design during 2022-2025



*The paper includes the results of the first four phases of the program.

Research Design

We employ a participatory action research (PAR) approach, in which the researchers develop the research tools in partnership with the practitioners. (Caniglia et al., 2021).

Using PAR, researchers can collaborate with practitioners to improve the situation. The data gathered through PAR provides valuable insights into the complex dynamics of engaging in development programs while also illuminating the behaviors and interactions of the stakeholders involved. (B. K. Hatipoglu et al., 2022).

The longitudinal study progresses in five stages between 2022 and 2025 (and onwards), using a mixed-methods research design (Figure 1). Our membership in the informal tourism work group and our advisory work with BMM allowed us to examine the program's applications. The collaboration between the authors and the BMM aims to inform and improve practice, develop a theory grounded on empirical results, and disseminate new knowledge through reports, academic publications, workshops, and presentations at practitioner-based events.

Throughout the study, we collaborate with the program partners and use varied data collection (e.g., field visits, surveys, workshops, and interviews) and analysis techniques (e.g., quantitative and documentary). The mixed-method research design enables us to gather insights from diverse stakeholders while allowing for confirmation, cross-validation, and refinement of findings and methodology. (Creswell et al., 2008).

Findings

Phase 1: In the years leading up to the election, the informal work group, composed of the mayor and his team, heritage and tourism management experts, and civil society representatives, met regularly to strategize how tourism development could be leveraged for societal well-being. The future mayor aspired to maintain balanced growth while addressing the broader challenges of Bursa and improving the lives of the citizens, which the group members also shared. Intentional action by the mayor and the team is a key driver in the program's progress (Lumpkin & Bacq, 2019).

We advised the team on how a development-first approach in tourism could achieve its intended effects on society. This included considering the input of the diverse stakeholders along the tourism supply chain and integrating tourism policies into a balanced agenda-setting process aligned with other development planning efforts to improve overall societal wellbeing.

However, promoting wellbeing and intangible outcomes presents a significant challenge for public policy in a developing country facing economic challenges. A key obstacle lies in shifting mindsets away from the dominant neoliberal ideology that prioritizes economic growth as the primary measure of progress. We found that to gain support for the wellbeing-focused plans, the instrumental value of tourism in enhancing lives had to be underlined to stakeholders, including public servants, at every stage of the policy and planning processes.

Phase 2: We conducted a comprehensive documentary analysis before engaging stakeholder groups to formulate policy goals and strategic plans for Bursa. Previous efforts have predominantly focused on economic goals, neglecting broader societal wellbeing outcomes. Notably, the analysis highlighted several critical issues hindering balanced tourism growth in Bursa, including a lack of integration and alignment with city development plans, insufficient coordination and collaboration among stakeholders, a failure to consider the entire tourism value chain, limited data-based monitoring and decision-making mechanisms, and inadequate resident participation in planning and tourism activities. These findings underscore the importance of adopting a development-first approach, emphasizing inclusive collaboration, good governance, and a focus on well-being outcomes to shape Bursa's future tourism development strategy.

Phase 3: To formulate strategy, in this phase, we aimed to set clear objectives, analyze the key political, economic, and social factors affecting success, and improve the capacity of stakeholders to get involved in the processes. We first organized a workshop with the municipality's internal stakeholders, inviting various departments that could provide input for tourism policy development and contribute to future collaborative projects with external stakeholders. Nearly every unit participated in activities supporting the tourism supply chain. However, they lacked awareness of other units' involvement and had a limited perspective on the broader system. Their siloed spaces challenged their collaboration. (Fohim et al., 2024). We suggested that by establishing safe spaces for collaboration and demonstrating the wholeness of the system, it would be possible to mobilize internal stakeholders for sustainable tourism development and align tourism policies with the municipality's strategic goals.

We then organized a workshop with the external stakeholders. We were challenged by breaking their thinking patterns, which assumed that higher growth in tourism and related economic outcomes would result in societal wellbeing. Vested interests and different logics of different stakeholders were elemental in this matter (Dwyer, 2024; Lumpkin & Bacq, 2019). In its current state, most of the stakeholders who attended the workshop were not ready to think creatively, propose long-term solutions to the issues at hand, or agree on a consensus plan.

Based on the workshop outcomes and our prior documentary analysis, we highlighted the underrepresented stakeholders in planning activities, i.e., residents, community representatives, women, youth, and migrant groups. We recommended determining the tourism vision with multi-stakeholder participation, establishing an empowered destination management unit to ensure joint action, and preparing a long-term tourism strategy and action plan. We emphasized the importance of strategies and action plans being fed with data, including a wide range of stakeholder views and mechanisms for managing conflicts of interest and determining a layered governance structure.

Phase 4:

Working as a part of a multidisciplinary and multisectoral group preparing the spatial plan for the metropolitan municipality of Bursa with a vision for 2050, we outlined analysis content and stakeholder mapping considering the tourism value chain and interactions with other sectoral and thematic groups such as manufacturing, services, agriculture and rural areas, transportation, cultural assets, nature and ecosystems, population and demography and climate change. We started working with three districts to plan and apply for a Green Destination Certification program. We consulted the municipality's Environment Management Unit for a Net Zero Destination Plan. We connected BMM with the International Green Destinations organization.

We collected primary data from diverse stakeholder groups through surveys and interviews, including different tourism businesses, public officials, local administrators, tourism associations, residents, and tourists. Then, we developed a scheme to synthesize our results with those of other planning groups. This phase revealed the elaborate web of interactions between stakeholders, facilitating the role of multi-stakeholder coalitions and the importance of power dynamics while planning for societal wellbeing and civic wealth creation through sustainable tourism development. The focus on political priorities and short termism of the municipal governance systems also emerged as a fundamental issue to address in CWC through sustainable tourism.

Theoretical Contributions

The complexity of sustainable development makes examining change towards sustainable development, circularity, and societal wellbeing difficult with a single coherent framework. Instead, in our discussion, we held the view of maintaining conceptual plurality. We have identified three streams in research relevant to sustainable development and societal wellbeing — the development-first approach in sustainable tourism, the wellbeing approach in public policy development and its applications to sustainable tourism, and civic wealth creation— arguing that these streams are complementary.

A significant commonality in these streams is prioritizing holistic, sustainable, and people-centered development that benefits the community. All three approaches emphasize the importance of community engagement, participation, and empowerment in development. They recognize that sustainable development must be driven by the needs and aspirations of the people it aims to benefit. On the other hand, with different theoretical foundations, they also differ in their focus areas and approaches. The core focus of the development-first approach is on the process of development, aiming to empower communities and create a more equitable distribution of benefits from tourism. The wellbeing approach is outcome-oriented, emphasizing the importance of understanding and enhancing people's lived experiences by incorporating a broader range of indicators. CWC can be seen as a potential outcome of both the development-first and well-being approaches, as it embodies the assets and resources that contribute to a thriving community.

Even if these streams cannot be combined in a coherent framework, they offer ways of adopting a variety of perspectives on the issue at hand. In this research, we have demonstrated one example of how such an analysis can be conducted. While offering stakeholder engagement, coherent and integrative public policies, and multi-stakeholder coalitions as strategies for CWC and achieving long-term change in urban sustainable development, we also pinpointed the obstacles to implementing these strategies. We treat sustainable development as a dynamic concept and explain why change toward societal wellbeing can be approached as an iterative and nonlinear process, almost like a spider web, demonstrating the contextual aspects of CWC and highlighting the trade-offs between short-term and long-term goals, especially resulting from the short-term focus of the municipal governance systems (Dodds and Butler, 2024).

Conclusions and Contributions to Track Number 3.2.

Our research responds to the call for understanding how actors from various sectors collaborate and govern collectively to build effective multi-stakeholder coalitions and resilient societies. We aim to contribute to the conference track by exploring how local governments can foster civic wealth and long-term societal well-being through sustainable development policies and strategic planning. We aim to offer insights into the relationship between civic wealth creation and the role of the State, which are important for developing new business models that address global challenges at the local level. Developing processes of policy making and tools of strategic planning to overcome obstacles from the short-termism of the municipal governance systems is offered as a key ingredient of the new business models for addressing global challenges at the local level.

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Scaling up local sustainable innovations in the energy transition

A business model perspective on Positive Energy Districts

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Extended abstract

Introduction In the transition towards a more sustainable modes of energy production and consumption in cities and urban environments, experimentation with Positive Energy Districts (PEDs) has increasingly become widespread across European cities, as part of the European Union's strategy for the energy transition, climate change mitigation, and carbon footprint reduction (EU, 2018; EU, 2020A; EU, 2020B; Bossi et al., 2020; Koutra et al., 2023; Clerici Maestosi et al., 2024). Given that urban areas account for approximately 75% of energy consumption and greenhouse gas emissions globally, cities and metropolitan regions have a pivotal role to play as physical environments in which the energy transition will takes shape over the next few decades. In order to move from experimentation projects on PEDs across heterogeneous urban context in European cities, scaling up PEDs beyond these pilot settings towards mainstream application in the wider energy system is crucial

for impact on the energy transition. The creation of viable business models for PEDs without significant subsidization is central for upscaling in this respect (Derkenbaeva et al., 2022; EU, n.d.; , given that all PED projects have been funded under the Horizon2020 program (EU, 2018). Taking the four pillars of PEDs into account (energy efficiency, renewable energy production, energy system flexibility, and electric mobility), this paper explores how firms strategically engage with urban stakeholders in experimentation projects for PEDs, and what type of commercially viable business models are emerging from participation in these projects to scale up PEDs in the wider European energy system. Hence, we take a firm-centric perspective on the upscaling of sustainable innovation from a business model perspective, and address how business models are emerging from local responses (local experimentation projects) to global issues (climate change, energy transition), taking PEDs and the European energy system as a research context.

Research focus In relation to upscaling of PEDs, the identification of business models is explicitly identified as a central tenet in moving from experimental settings to widespread dissemination, stating that "the large-scale deployment of PEDs requires the inclusion of sustainable business models that consider the whole process of building, operating and maintaining PEDs (EU n.d., 12). Firms in the energy industry and information and communication technology (ICT) market are a particularly important stakeholder group in this realm, given that the four pillars of PEDs (energy efficiency, renewable energy production, energy system flexibility, and electric mobility) require the application of a wide array of technologies developed and operated by the private sector (EU, 2024A). Hence, this paper addresses two interconnected research questions from a firm-centric perspective, focused on the identification of business models archetypes that can facilitate upscaling of sustainable innovations beyond local contexts in the urban energy transition. First, we address *what strategic role does engaging with urban stakeholders in local experimentation projects play in the approach of firms to address the urban energy transition*?; Second, we identify *which types of business models are emerging from these local experimentation projects that allow the upscaling from pilot setting to mainstream market application for firms?.* Hence, this paper addresses the global energy transition in urban contexts, focusing on scaling up local sustainable innovations through viable business models to address the urban energy transition in particular, thus addressing the nexus of Sustainable Development Goals (SDGs) affordable and clean energy (SDG 7), sustainable cities and communities (SDG 11), and climate action (SDG 12).

Structure This paper is structured as follows. The first section provides an overview of the literature on business models for sustainable innovation, and how business models can be a driver for value creation in moving from experimentation to upscaling. The second section focuses on the energy transition in urban contexts, which encompasses the setting in which we explore business models for sustainable innovation, and introduces PEDs as a novel phenomenon that has come to the fore in urban contexts in energy transition. Section three outlines the methodology and sources of data collection, followed by the results in

section four that centers around the strategic motivations for firms to engage in local PED experimentation projects, as well the identification of business model archetypes that are emerging for PEDs to drive the upscaling of PEDs beyond experimental settings towards the wider energy system. Section five discusses the results in the wider context of the urban energy transition, and the role of firms in creating viable business models for sustainable innovation in PEDs that facilitate upscaling beyond local contexts, and provides conclusions and avenues for future research.

Theory Over the past decade, a burgeoning body of literature has developed around business models and sustainability from an organizational-level perspective, most notably around the concepts of Business Models for Sustainability (BMfS) and Sustainable Business Models (SBM) (Lüdeke-Freund, 2010; Schaltegger et al., 2016A; Abdelkafi & Täuscher, 2016; Nosratabadi, 2019), which reflects that the business model lens is highly relevant to address value creation and capture from sustainable innovation by firms in relation to grand societal challenges and system transformation. Particularly in relation to scaling up sustainable innovation beyond local context, the identification of business models that are economically viable under mainstream market conditions is central for impact on system transformation (Schaltegger et al., 2016B; Bidmon & Knab, 2018; Rendtorff, 2019). The theory section identifies key antecedents of the business model to take into account in relation to value creation from sustainable innovation. In line with the research focus of this paper, we take business models for energy transition in cities and urban environments explicitly into account (Keirstead et al., 2012; Gauthier & Gilomen, 2016; Schiavone et al., 2019; Loock, 2020; Wagner et al., 2020; Bohnsack et al., 2021; Hargroves, 2023). Hence, taking the business model perspective as a lens, this paper addresses how firms engage strategically with other urban stakeholders in local experimentation projects, to identify how firms are able to use these experimentation environments for business model development, and unravel how firms can plays a central role in upscaling sustainable innovation beyond experimental settings.

Method This study adopts a qualitative research design with three data collection methods: internal project documentation, semi-structured interviews with experts, and thematic group sessions with representatives of EU-funded experimentation projects. All data collected through these methods are from organizations part of 20 Smart Cities and Communities (SSC) projects that are part of the EU's Scalable Cities network, a European network aimed at creating innovative and sustainable smart and climate-neutral cities in Europe, with 124 cities involved in *20 PED experimentation projects* funded by the Horizon2020 and HorizonEurope programs with consortia from public authorities, academia, industry, associations and consultants[i] (EU, 2024A, EU, 2024B). Data collection focused on four focal areas: (i) The transition from experiment to upscaling of LES in the urban energy transition upon completion of the projects funded through Horizon 2020; (ii) The role of business (divided amongst MNEs and SMEs) in the wider diffusion of LES beyond experimental settings to drive the urban energy transition; (iii) The characteristics of viable

business models for products, services, platforms, and systems that enable LES to be created in cities; (iv) The challenges across various domains interacting with opportunities for viable business models and ways to overcome these challenges. Overall, data was collected for this paper from 20 internal documents, 15 semi-structured interviews, and 5 thematic group sessions, which provided in-depth insights into the role of PEDs in the urban energy transition, the way in which firms strategically engage with urban stakeholders in PED experimentation projects, and the type of business models that are emerging for PEDs to move from local experimentation to mainstream application in urban environments.

Results For the strategic motivations for firms to engage in local PED experimentation projects (research question 1), our results show identify seven dominant motivations: portfolio development and/or diversification (product, services, platforms, systems), market entry and/or expansion, technology validation and optimization, risk reduction and mitigation, assessing solution feasibility and viability, collecting usage data, and thematic positioning and/or exposure. Related to these strategic motivations, a distinction can be made between multinational enterprises (MNEs) with a geographically diverse market presence and proprietary portfolio of technological solutions for the urban energy transition, and small- and medium-sized enterprises (SMEs) including both start-up and scale-up companies with a more locally oriented market presence and a more specific offering of technological solutions for PEDs. Related to the identification of emerging business models for PEDs as a novel phenomenon in the urban energy transition (research question 2), our results show five business models archetypes that are emerging from local experimentation projects in the urban energy transition that allow the upscaling from pilot setting to mainstream market application for firms, all with their own distinct characteristics: (i) the Energy Service Company (ESCO) business model, (ii) the Energy-as-a-Service (EaaS) business model, (iii) the Energy Management System (EMS) business model, (iv) the residential self-consumption business model, and (v) the commercial self-consumption business model. While each business model archetype has its distinct characteristics and rationale for value creation, as well as factors that can be a drivers and barrier in moving from experimentation to upscaling by firms, the commercial viability of the business model has been widely identified as a critical factor for the wider diffusion of PEDs beyond the EU-funded experimentation projects.

Discussion and conclusion The development of viable business models are central to scaling up PEDs beyond local experimentation projects towards wider application in the urban energy system. Our research has highlighted that both MNEs and SMEs strategically engage with other urban stakeholders in PED experimentation projects, and use these local contexts as a testbed to create, implement, validate, and optimize their portfolio of products, services, platforms, and systems for the urban energy transition. The business model archetypes for PEDs in the results section highlight that there is a clear potential for firms to scale up PEDs beyond experimental settings in different ways, whereby technologies are readily available for all four pillars of PEDs (energy efficiency, renewable

energy production, energy system flexibility, and electric mobility). However, the unique characteristics of each local urban environment in terms of the energy system, physical infrastructure, policies and regulations, stakeholder ecosystem, and climate-related challenges make upscaling a complex and multifaceted process, even when a viable business model for a firm is in place.

Keywords

Business models, sustainable innovation, urban energy transition, positive energy districts

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Developing behaviour change techniques on local online retailers to encourage sustainable cargo bike delivery

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Abstract

This study investigates the research-based development of novel behaviour change techniques (BCTs) to encourage sustainable consumer delivery choices on local online retailers. Using a webshop simulator, it will test BCTs designed for easy adoption by small businesses, aiming to promote eco-friendly last-mile delivery options and support local economic development.

Keywords

Sustainable logistics, consumer behaviour, last-mile delivery, triple transition, sustainable consumerism, e-commerce, behaviour change technique, nudging

Background

In recent times, there has been an upswing in business model innovation in both studies in practice, especially given that modifications to existing business models are generally acknowledged to realise novel innovations geared towards sustainability, i.e., sustainable business models (SBMs) (Evans et al., 2017). SBMs "describe the rationale of how an organisation creates, delivers, and captures value, in economic, social, cultural, or other contexts, in a sustainable way" (Nosratabadi et al., 2019, p. 1), where the value proposition provides quantifiable environmental or social value alongside economic value (Boons & Lüdeke-Freund, 2013). Generally, it is recognised that SBMs are a key element of cultivating a competitive advantage (Bocken et al., 2014). Nonetheless, many business model innovations still fail (Geissdoerfer et al., 2018), and thus the exact practicalities of how to successfully adopt SBMs warrant more attention (Evans et al., 2017).

Large multinational companies might be in a better position to scale sustainability efforts, and they are likely to have a major role once sustainable concepts are proven and competition pushes them to adapt. However, in the short term, it's more probable that new start-ups and smaller businesses will lead the way in pioneering bold innovations (Nerkar & Shane, 2003). In fact, a greater number of small and medium-sized enterprises (SMEs) are focusing on sustainable development and making the transition towards SBMs amidst changing market conditions, technological innovation, stakeholder influence and policy changes (Troise et al., 2024). According to Troise et al. (2024), SMEs in particular are characterised by their 'openness' to adapt to innovative approaches, which can help them adapt to everchanging market requirements as consumer needs are gradually adapted towards sustainability and firms strive to meet these expectations.

Looking particularly at the online retail environment, shopping on e-commerce sites has steadily increased (eMarketer, 2023). Without interventions, major cities could see a 36% increase in delivery vehicles by 2030 (World Economic Forum, 2020), leading to higher emissions and congestion. Furthermore, a greater number of delivery parcels has given rise to increased negative environmental externalities, namely air pollution, noise pollution, traffic congestion and greenhouse gas (GHG) emissions (Wernbacher et al., 2023). In particular, the last-mile delivery segment, which involves moving parcels from local warehouses to final destinations, accounts for a substantial portion of delivery CO_2 emissions in Europe (Higgs et al., 2022). So far, the emphasis has primarily been on supply-side solutions, such as adopting cleaner vehicles (Ignat & Chankov, 2020; Viu-Roig & Alvarez-Palau, 2020), such as e-cargo bikes. E-cargo bikes in particular offer a practical alternative to traditional and electric cars and vans, with the potential to enhance the sustainability of urban logistics, especially for last-mile deliveries (Malik et al., 2023). This is because cargo bikes are virtually noiseless, zero emissions, and are efficient to manoeuvre (Anderluh & Nolz, 2022). In recent times, the proportion of commercial delivery services via e-cargo bike has steadily increased, in line with the New EU Urban Mobility Framework,

which denotes e-cargo bikes' utility in terms of moving goods in urban areas (European Commission, 2021). Furthermore, platform-based delivery services have contributed to the growth of bicycle courier work, where the rise of on-demand delivery platforms has created new opportunities for bicycle couriers to expand their operations and meet the growing demand for sustainable last-mile deliveries (Suslowicz & Brömmelstroet, 2024). Such courier initiatives have taken form as small enterprises or community-driven cooperatives that work together with local businesses, municipalities and other courier services to effectively work towards social and environmental goals, such as FULMO Kurierunion in Leipzig, Germany (https://fulmo.cc/). In doing so, large-scale obstacles in urban logistics can be overcome by means of small-scale, local solutions.

The success of implementing new approaches that reduce environmental externalities largely rest on whether modifications to individual habits and practices can answer to the increasing number of new innovations offered (Lehner et al., 2016). Although there is progress towards the use of clean delivery vehicles, on the other side of the coin there is a growing recognition of the need for aligned demand-side approaches that motivate and encourage consumers to actively seize these environmentally friendly options (Lehner et al., 2016). Amidst a trend towards greater sustainable consumerism, a greater number of buyers are willing to offer flexibility and accept longer wait times or additional costs for greener delivery options (Seven Senders, 2022). However, retailers to date have lacked regarding equipping consumers with sustainable delivery choices (Buldeo Rai et al., 2021), which in turn "contradict the growing sustainability awareness of many end customers" (Wernbacher et al., 2023, p. 1). However, enterprises that emphasise such eco-attributes and have the potential to take advantage of this newfound consumer context and enhance their brand reputation (Becchetti et al., 2020).

Encouraging sustainable consumer delivery choices

Nudging customers towards newfound sustainable choices can possibly be a success factor for effectively leveraging more sustainable ways of doing business. In an attempt to steer and nudge consumer behaviour, interventions in the form of behaviour change techniques (BCTs) with roots in psychology and behavioural economics, defined as "observable, replicable, and irreducible components of an intervention designed to alter or redirect causal processes that regulate behaviour" (Michie et al., 2013, p. 2) have been a topic of interest. Such interventions do not restrict users from making a certain action but rather serve to subtlety guide one's behaviour (Hankammer et al., 2021). Although BCTs to date have been mainly applied within the context of health interventions, BCTs and their corresponding taxonomy are conceived to be cross-disciplinary and utilised in different application domains (Michie et al., 2013).

In fact, the use of BCTs has been increasingly employed to encourage sustainable consumerism (Carlsson et al., 2021; Evans et al., 2017; Schubert, 2016). Following the SBM archetypes by Bocken et al. (2014), the employment of consumer-facing BCTs with the purpose of transitioning consumer behaviour towards sustainable choices possesses a predominately social innovation component and can adhere to the SBM archetype *'Adopt a stewardship role'*, whose purpose is to enhance the positive societal and environmental effects of the company by promoting the long-term health and well-being of its stakeholders, including society and the environment, where companies work to support and advance the well-being of their ecosystems (Bocken et al., 2014).

Exploring the use of BCTs to motivate and persuade consumers to choose green delivery options on e-commerce sites is no exception and have already been experimented with in studies (e.g., Buldeo Rai et al., 2021; Caspersen & Navrud, 2021; Nijssen et al., 2023). However, most studies to date have only tested the same three types of BCTs. In our prior literature review, it was found that the most predominant types of BCTs tested were: (1) *Information about social and environmental consequences*, (2) *Social comparison*, and (3) *Material incentive* (Thelen et al., 2024). Furthermore, many prior studies conducted on this topic have only utilised a survey design (e.g., Ignat & Chankov, 2020; Nijssen et al., 2023; Thomas et al., 2022; Viet et al., 2023), with a dearth of the studies that employed a simulator (e.g., Nijssen et al., 2023). Utilising a stated-preference survey possibly overlooks the so-called *green gap*, known as "the discrepancy between what consumers say about their growing concern regarding the environment, on the one hand, and what they truly do to help sustain this environment" (ElHaffar et al., 2020, p. 1), as their behaviours are not quantified. Furthermore, in the context of online shopping and e-commerce, the discrepancy of consumer's green purchasing intention and behaviour has not been given enough attention (Wang et al., 2025). Testing varying BCTs in an online shopping simulator is perhaps better suited to bridge this gap than merely stated-preference surveys, as a simulated online shopping environment can more realistically mimic an actual e-commerce purchase process and perhaps better account for the situational cues and unconscious processes that are involved in the experience online shopping, such as the ones described in Papies (2017).

Current study

In order to find innovative BCTs that motivate and promote sustainable consumer delivery choices on online shops effectively, this research endeavours to go beyond existing studies by developing and incorporating novel BCT types which to our knowledge are not yet existent in the literature by: (1) offering a choice of the specific vehicle type (i.e., choosing between *"cargo bike delivery via a local courier service"* and *"standard delivery*"), (2) by utilising an experimental webshop prototype simulator which mimics a real-life shopping environment on a comparable local online retailer, and (3) by testing BCTs that can be

readily adopted by and have the highest ease of use for local small and medium-sized businesses. Considering the eventual uptake of these BCTs by online retailers, it is acknowledged that over 50% of European SMEs conduct online sales (Eurostat, 2024), and that local, small online businesses do not always possess the expertise nor capability to develop and display complex BCTs that take a lot of backend coding (e.g., displaying of precise CO_2 calculations). To maximise the uptake of such BCTs by local online retailers, future BCTs to motivate sustainable consumer delivery choices should be straightforward and able to be adopted by local online shops that possess minimal IT expertise. Employing such an inclusive approach to local online retailers can also further promote the use of sustainable local and regional supply chains. All in all, by considering the aforementioned elements, developing BCTs in such a manner has the potential to accelerate the global triple transition, a "systemic approach that places the interlinkages and interconnections of the environmental, digital, and social aspects of development at the core" (OECD Development Centre, 2023, p. 14). This is done by addressing the negative externalities brought on by e-commerce deliveries, while at the same time also nurturing sustainable local and economic development within localities.

Hence, we intend to expand our research by concentrating on the following research questions:

1. How can behaviour change techniques that motivate and incentivise online consumers to choose cargo bike delivery be most optimally developed to the benefit of local online retailers, local cargo bike couriers and users?
2. How can a field test that simulates a real-life webshop environment be best developed to capture the effectiveness of behaviour change techniques?

Methods

First, a literature review of previous relevant studies and a screening of online retailers were conducted to analyse currently implemented digital BCTs in studies and in practice and classifying them according to the Behaviour Change Technique Taxonomy of Michie et al. (2013). This was complemented by a co-creation workshop with a panel of local online consumers and several interviews with owners of local online retailers and local bicycle couriers to assess their needs and preferences concerning BCT design and implementation. After an internal design sprint, ideas for novel BCTs were developed according to the methodology of Rubinstein (2018) and ranked according to the APEASE criteria (West et al., 2019), which assesses BCTs based on their acceptability, predictability, effectiveness, affordability, side-effects and equity. Concurrently, an experimental webshop prototype simulator was developed by an e-commerce IT service provider, VIABIRDS Technologies GmbH, who took feedback into account in a stepwise manner during the stakeholder co-creation process in agile iterations. Thereafter, the final prototype simulator's usability was validated by means of two pre-tests: one internally (N = 25) and one externally (N = 110).

Thereafter, six novel behaviour change techniques for the context of the study will be implemented on the experimental webshop prototype simulator, which will be tested with prospective online shoppers based in Austria in the spring of 2025 (*N* = >1.000). The online field test in a simulated webshop environment will involve respondents undertaking a task with instructions (i.e., *"choose one or two products from the fictional store and complete the purchase as though you were making an actual purchase").* Specifically, the simulator tests prospective online consumers' choice of delivery option during the check-out phase of the customer journey, as they are confronted with two delivery options at checkout: *DHL standard delivery* or *local cargo bike courier delivery* (with the latter displaying an accompanying BCT alongside). Thereafter, a brief survey follows to gather insight on demographic and psychographic traits. Here, the total sample is assigned to one of six cases (six experimental groups with different displayed BCTs and one control group without a BCT) via random sampling. Thereafter, the sample's delivery choices will be quantitatively analysed to measure the effectiveness of the employed BCTs among different user groups.

Conclusion and preliminary results

Although still currently under way, our research employs a multifaceted approach by helping equip local online enterprises to stay competitive and market their sustainability attributes. At the same time, the use of local cargo bike courier services can be promoted, and sustainable consumerism can be nurtured by making online buyers cognisant of the eco-attributes of their delivery choices. In doing so, shorter, local supply chains are given greater attention by prioritising the needs of local online shops and the negative externalities brought on by the increased use of e-commerce can be better mitigated. By aiming to tackle such a wider, systemic issue through a lens of local, user and community-driven solutions, our research aims to scale more sustainable last-mile delivery and logistics operations that can be readily adopted by local actors. In doing so, newfound SBMs derived from SMEs that answer to contemporary social and market contexts can possibly be strengthened and better leveraged, all the while spurring local economic development.

Preliminary results point towards the general acceptance and usability of the developed BCTs and the webshop prototype simulator, which was well-received among a sample in the pre-test. Contributions towards the conference session would exhibit the prototype and delve into our systematic process of developing novel BCTs according to the aforementioned attributes that are accepted by all facets of the smart urban bicycle logistics ecosystem that take into account the needs of citizens, logistics providers and online retailers. Additionally, we will share insights into the process of systematically developing a research-based experimental webshop prototype simulator for effective field testing in an online retail environment.

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New Wines Into New Skins: Learnings From Fifteen Years' Systemic Entrepreneurship

The new business structures vital for any new business model

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Abstract

Much as modern civilisation has benefitted from the modern economy, it has root causes of the barriers now limiting otherwise excellent new business models for net zero, circularity, bioregionalism, etc. These lie deep in flawed assumptions in economics and business theory. These flawed assumptions have shaped how we incorporate, operate, and invest in firms. We will show that these structures and structured interactions are biased to deliver the outcomes we have today, regardless of the business model they contain. We discuss the complex, non-ergodic, path-dependent, multiplicative dynamics of all capitals, leading to typical outcomes differing from expectation values.

We propose that creating an ecosystem of companies which goes beyond the traditional firm is necessary to transit to at least net zero, better net positive and will describe over a decade of learnings incorporating companies as a FairShares Commons, which transcends and includes the functionality of limited companies, multi-stakeholder cooperatives, and foundations. Such FairShares Commons companies have the necessary functionality to be regenerative ergodic business ecosystem ready, most importantly the collective ecosystem-wide profit pooling necessary to shift the growth dynamics towards ergodicity in order to reduce the losses caused by the non-ergodic growth of individual companies. Pooling also happens across other capitals, made robust by governance including future generations, nature, and society, and with processes to create, grow, and close companies. We describe how to address a key human barrier to change: lack of adaptive capacity to recognise and change hidden beliefs such as those pervading economics and business theory.

Extended abstract

Problem

As the authors of the influential book, *Net Zero Business Models: Winning in the Global Net Zero Economy*, argue *"the shift from a fossil fuel-based economy to a net zero emission one is the biggest transformation project in human history"* (p. 3). They estimate that this transition will require "$275 trillion of cumulative investments in physical assets alone by 2050" (p. 3). This is roughly three times the current level of global GDP and raises questions about how this investment will be financed, how investment decisions will be determined, the role of the firm, and what changes to structures and structured interactions will be necessary. And it raises questions about how fit the disciplines of economics and business theory are to the task.

Problem 1: non-ergodicity

Much current thinking in economics and business implicitly assumes (Peters, 2019) the property of ergodicity, i.e., the time average (typical outcome) and the

expectation value are identical, hence the easily calculated expectation can be substituted for the time average to predict typical outcomes. However, many aspects of life, including our economy, have irreducible non-equilibrium complexity, leading to inherent nonlinearity and path-dependence, and hence non-ergodicity. Specifically in business the non-ergodicity is downwardly biased, i.e., the typical lies below the expectation, correcting for this manifests in negative externalities, needlessly high failure rates, resource consumption, and waste (Bookstaber, 2019).

Problem 2: flawed beliefs about the ontology of incorporation

Flawed beliefs (The Modern Corporation) about the ontology and epistemology of incorporation underpin rentier actions. Incorporating according to these flawed beliefs limits the capacity of companies to robustly implement new business models. Various forms of incorporation are known, yet none is fit for purpose for the new business models we need, yet each has necessary functionality. For example: shareholder primacy in the limited company fails to recognise the risks and investments made by other stakeholders (including nature and future generations) representing non-financial capitals; co-operatives fall short for financial capital investors; and all of them fall short vs. the ontology of legal personhood. By deploying legal personhood to the fullest extent in existing legislation we provide the new skins needed to contain the new wines of new business models.

Because the current theories in economics and business are founded on a faulty understanding of the real world we have specious decisions inconsistent with sustainability. To successfully achieve our “biggest transformation project” we need theories that describe the real world. Only a non-ergodic theory of business housed within a non-ergodic non-equilibrium theory of economics can comport with the principles of sustainability.

Problem 3: this is adaptive challenge

This is an adaptive challenge, i.e., one that requires changes to oneself in order to be able to recognise and deploy a technical solution. As Churchill said, *We Shape Our Buildings; Thereafter They Shape Us.* We have been shaped by the institutions of business and economics, making us stupid as Dietrich Bonhoeffer would say, and preventing us from seeing clearly.

Solutions

The purpose of this contribution is to discuss learnings addressing these three problems in diverse organisations, including in Evolutesix's business practice internally and with our clients.

We will begin by introducing critical shortcomings of traditional economics and business theory, in particular how its assumptions of equilibrium, ergodicity, rationality, and ownership have led to structures and structured interactions that steer towards the polycrisis we have today.

Then we will discuss the concept of non-ergodicity and how it can be applied (ecosystem-wide collective fractional profit pooling) to address certain root causes of the polycrisis and thus enable a transition to a net positive global economy.

The body will describe how we have been implementing, for over a decade, new business structures enabling new business models. We will use the six strata framework described in (Boyd and Reardon, 2020, p. 44).

The six strata are:

1. Inner-person ecosystem. Each person's constructed identity, mindset, worldview, psychology, cognitive, and meaning-making capacity.
2. Inter-person ecosystem. How we interact with each other to process tensions and conflict, to pool information, to reach decisions.

3. Organisation design. This is an abstract stratum, the ecosystem of structures and interactions between roles, tasks, and all other aspects of work.
4. Incorporation. An abstract stratum, the ecosystem of structures and interactions between capitals and stakeholders, and which forms a community of natural persons collectively granted legal personhood.
5. Business ecosystems. An abstract stratum, the ecosystem of structures and interactions between persons, natural and corporate. Relevant for city economies, bioregions, etc.
6. Global economy.

Each of these six strata is irreducibly complex with unknowable elements because of emergent properties along a single path through time. Hence it is non-ergodic. Each stratum is a holon, and together they form a holarchy. To effect a lasting change in any requires changes in all.

FairShares Commons incorporation

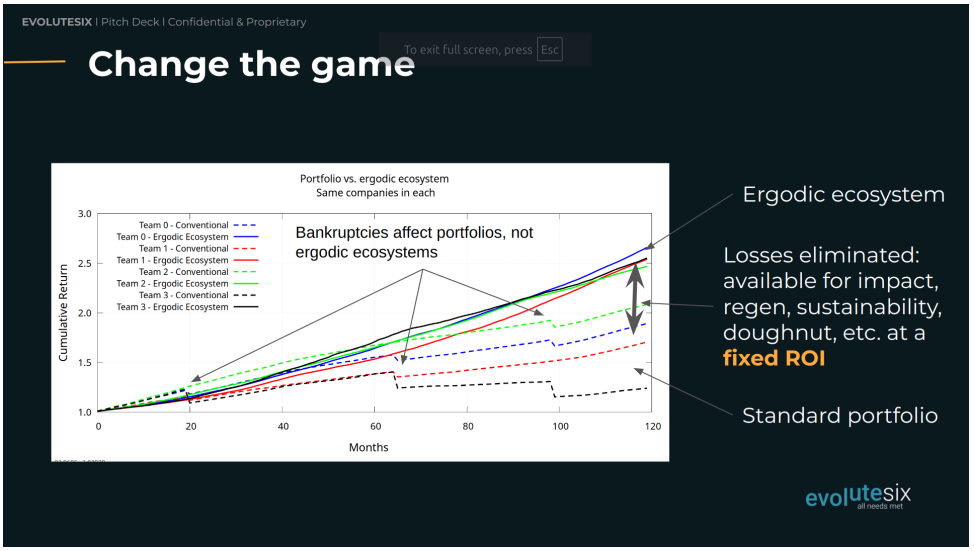
In Stratum Four we discuss what we have learnt over the past decade implementing, in multiple countries, the FairShares and FairShares Commons incorporation (including UK, Ireland, EU countries via a Framework project, Canada, USA, Nigeria, and Latin America).

The FairShares Commons, developed by Evolutesix and the University of Sheffield-Hallam business school, integrates the strengths of Mondragon's cooperative ecosystem, Somerset Rules multi-stakeholder cooperatives, limited companies, community interest companies, foundations, and more; and expresses Elinor Ostrom's eight principles for managing a commons. A FairShares Commons company includes in governance and wealth share all capitals the company touches and all significant stakeholders representing those capitals, including future generations, nature, communities, and the integrity of the company.

Solution: ecosystem-wide collective fractional profit pooling to restore ergodicity

Turning to Stratum Five, only a FairShares Commons company explicitly has the full agency (i.e., no vestige of the concept of ownership, and all relevant stakeholder-company relationships are enabled) required to be an anti-fragile member of a multi-capital profit pooling ecosystem of diverse companies. Such an ecosystem extends what cooperative ecosystems like Mondragon already do with profit pooling, what multi-brand conglomerates such as P&G do internally, and what has been and is being done in many of the world's religions and indigenous communities.

Reducing the negative externalities caused by non-ergodic dynamics through ecosystem wide profit pooling invites us to consider such an ecosystem as the minimum viable unit, rather than individual businesses, in order to move towards a net positive, global economy. This paradigm can be named systemic entrepreneurship and systemic investing.



Solution: developing adaptive capacity

For Stratum Three we briefly mention learnings about alternatives to the management accountability hierarchy (e.g. sociocracy and Holacracy). For Strata One and Two we mention learnings about deliberately development practices such as the Constructive-Developmental Framework (Laske), Stages of Adult Development (Kegan, Lahey), Spiral Dynamics (Graves, Beck, Cowan) and Acceptance-Commitment Therapy (Hayes) as well as dialogue practices such as Non-Violent Communication, Art of Hosting, and Pro-Social.

Conclusion

We need to rethink *how* we think since we are looking at

> "a shift in the paradigm [which] is far more complex than developmental or transitional change [i.e., more or less what we have been doing since the Industrial Revolution]… Transformational change bears a quality of stepping into the unknown…" Montgomery and Van Clieaf, 2023, p. 221).

It is high time for both a new economics and a new discipline of finance that recognizes and harnesses the non-ergodic, path-dependent, multiplicative dynamics of all capitals.

Keywords

systemic investing, systemic enterprise, FairShares Commons incorporation, ergodicity, net positive.

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Sir Winston Churchill in his speech to the meeting in the House of Lords, October 28, 1943.

Corporate Volunteerism in Iceland's Disaster Risk Management as a Model for Shared Value Creation

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Abstract

Local volunteerism enables Iceland's decentralised Disaster Risk Management design. This paper examines Icelandic companies supporting salaried employees as search and rescue volunteers, exploring corporate volunteerism through Porter and Kramer's Shared Value Creation framework. It highlights opportunities to formalise this model for enhanced public safety, value creation, and profit security.

Keywords

Disaster Risk Management, Corporate Volunteerism, ICE-SAR, Shared Value Creation

1. Introduction

Iceland's location at the meeting point of the Eurasian and North American tectonic plates, combined with dynamic climate, make it a region with diverse natural hazards (Arnalds, 2015; Van Well et al., 2018). Earthquakes, volcanic activity, mass movements, floods, and extreme weather have been a part of Icelandic communities since early settlement, shaping societal values (IMO, 2016).

The frequency of these events coupled with remoteness of many towns have led to a decentralised, largely autonomous Disaster Risk Management (DRM) structure under the umbrella of the Department of Civil Protection and Emergency Management (DCPEM) and its auxiliaries. This structure operates through principles of 'Responsibility, Similarity, Proximity, and Cooperation' (*SÁBF: stjórnun, áætlun, bjargir, og framkvæmd*, in Icelandic)

(Stjórnarráð Íslands, 2021, Amannavarnir Ríkislögreglustjóri, n.d.). The principles posit that, when possible, crises should be managed at the lowest possible societal level and decision-making should be as decentralised as possible (Ministry of Justice, 2017). Therefore, stakeholders, decision-makers, employees of local companies, and disaster relief volunteers are often made up of many of the same people, especially in small communities (Bernharðsdóttir and Hrafnsdóttir, 2022). While all Nordic countries utilise volunteers in emergency response, Iceland has a particularly robust and formalised volunteer role in risk reduction compared to the other Nordic countries (Eydal et al., 2016, Bernharðsdóttir and Hrafnsdóttir, 2022). The absence of a military in Iceland also means that there is no centralised abundance of response resources to be activated during crises.

At the local level of Iceland's civil protection structure are 93 volunteer search and rescue (ICE-SAR) teams. These teams are managed by the non-governmental organisation (NGO) Slysavarnafélagið Landsbjörg ('Landsbjörg' hereafter), or the Icelandic Association for Search, Rescue & Injury Prevention, an auxiliary of the DCPEM (Ministry of Justice, 2017). Landsbjörg is active in several aspects of risk management, including prevention and safety. They have some 18,000 members working across divisions, and approximately 6,000 active volunteers on ICE-SAR teams (Landsbjörg, 2023). Landsbjörg is generally financially supported by fundraising and donations from individuals and companies. The Icelandic Red Cross is another NGO that plays an important role in social services during crises.

Volunteers for ICE-SAR typically have diverse backgrounds, as many volunteers also have regular day jobs (Paumgarten, 2015, Landsbjörg, n.d.). As the necessity of this volunteer-driven system has emerged in society, it is well-known that many local Icelandic companies developed a norm with a unique approach to corporate volunteerism. Many companies allow their employees to volunteer when called out by ICE-SAR without sacrificing their salaries (Paumgarten, 2015). Some ICE-SAR volunteers have this agreement negotiated into their employment contracts. According to the conditions of the Act on Rescue Teams and Rescue Workers no. 43/2003, ICE-SAR must be activated when the DCPEM requests their assistance (Ríkislögreglustjóri, 2021). Volunteers, however, are not bound by the same contract and operate fully on a voluntary basis. This agreement may have developed from values shaped by internal drivers (internal stakeholder values, companies' roles and security in public safety) and external drivers (stakeholder expectations, natural disasters, the civil protection structure) (Amannavarnir Ríkislögreglustjóri, n.d., Landsbjörg, n.d.)

While this system is well-seasoned, climate change has the potential to make natural disasters more frequent and unpredictable in Iceland (Björnsson et al., 2023). Therefore, it may be necessary to inspect this embedded, corporate volunteerism norm to determine its long-term capacity. Governments in other parts of the Arctic may also need to reevaluate DRM organisational structures and future needs as these changes become more prominent (Clark & Ford, 2017). Through Porter and Kramer's Shared Value Creation framework (2011), this paper explores this cross-sectoral company-volunteer-NGO-governmental-

societal collaboration, specifically in the case of ICE-SAR volunteers. It aims to address the question: how do Icelandic companies' norm of corporate volunteerism exemplify Shared Value Creation?

2. Methods

This study takes a qualitative approach to examine corporate volunteerism within Iceland's DRM structure. A holistic, single-case study design was determined to be the best approach (Yin, 2009). In the case of Iceland, the unit of analysis is the societal model of corporate volunteerism supporting DRM. This case was analysed using the Shared Value Creation (SVC) framework developed by Porter and Kramer (2011) as the primary analytical lens. This case study does not develop new theory but rather applies an existing framework to a specific societal context. Through the SVC framework, secondary data sources were analysed. Sources were identified on Google Scholar through targeted keyword combinations: "Corporate volunteerism", "Iceland", "ICE-SAR" "disaster risk management", "sustainable business models", and "shared value creation." Titles and abstracts were scanned for papers that met one of these criteria: focused on DRM in Iceland; described ICE-SAR operations or volunteer management; discussed corporate volunteerism in the DRM context; or linked sustainable business models to public safety or resilience. Additionally, organisational reports from Landsbjörg and the DCPEM were scanned with the same inclusion criteria. Paumgarten's (2015) publication in *The New Yorker* was also included, as it explicitly describes day-to-day ICE-SAR operations. Analyses were driven by the SVC framework to map examples of corporate volunteerism onto the three organisational levels of SVC.

3. Results

The results of this analysis are presented in two parts. First, the selected literature is discussed and analysed in the context of Iceland's DRM structure. The findings are then analysed in the context of SVC.

3.1 Corporate Volunteerism in the Icelandic Disaster Risk Management Context

The orientation of modern corporations has shifted from a profit-only focus to sustainable business models that incorporate stakeholder values and needs (Lozano, 2015). Corporate volunteerism is one strategy for incorporating Corporate Social Responsibility (CSR) into business models (Sekar and Dyaram, 2017). Corporate volunteerism is legitimised when it

provides critical services to society and when the volunteers have specialised skill or personal investment into the cause (Rog et al., 2004; Grant, 2012). Employee volunteer programmes in the traditional sense refer to initiatives for volunteerism developed by the company for internal stakeholders to participate. However, these programmes have often shown to lack long-term, sustainable participation and meaningful employee engagement that is embedded in the core business (Sekar and Dyaram, 2017). Grant (2012) suggests that work design, or the characteristics of volunteer roles, is what drives employees to sustain their participation as volunteers. These characteristics include qualities like perceived significance of volunteer tasks, volunteer autonomy, skill variety, camaraderie, and problem solving.

Here, the relationship with some Icelandic companies and ICE-SAR is presented as a culturally embedded example of Grant's (2012) volunteer retention framework. In this unique example, volunteerism is embedded into employees' lives and society outside of the company, and companies have adapted to this values-driven societal norm where volunteering is a standard. Therefore, this may be a much stronger example of what corporate volunteerism could be, where volunteering is embedded into society rather than an extracurricular of a company (Sekar and Dyaram, 2017; Grant, 2012).

Additionally, in this example, companies that maintain employee salaries while they volunteer essentially make them paid volunteers. From this perspective, Iceland's stakeholder-level DRM infrastructure is financially supported by participating companies. In an overview of the role of CSR in disaster reduction, Twigg (2001) notes that while companies generally are more likely to offer one-off disaster relief support than long term initiatives, there are examples of more strategic and institutionalised support through philanthropy and technical assistance. It could be argued that the tactic in this case directly concerns companies' core business, as it ensures companies and stakeholders are beneficiaries of the public safety service provided by ICE-SAR teams.

The embedded corporate volunteerism model can be interpreted as a type of sustainable business model strategy. The concept of corporate sustainability has been defined with an adapted definition of the Brundtland Commission's general sustainability definition, describing it as, "meeting the needs of direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities, etc.), without compromising its ability to meet the needs of future stakeholders" (Dyllick and Hockerts, 2002, p. 131). However, Lozano (2015) states that this definition does not consider that future stakeholder needs may not be the same as the needs of today's stakeholders. Specifically, it may be considered that changes in climate, natural disasters, and resilience/vulnerability may be increasingly important for future stakeholders. Lozano also suggests that sustainable business models integrate environmental and social considerations into economic performance. Therefore, embedding greater resilience to

natural disasters into business models may inherently be strengthening future stakeholders' abilities to meet their own needs.

In the case of Iceland, many companies contribute to longer term societal resilience to disasters by supporting public safety while improving relationships with internal stakeholders. By maintaining employee salaries during ICE-SAR callouts, companies also build social capital and their social license to operate from an external stakeholder perspective (Plewa et al., 2015). These practices inherently value community wellbeing as an aspect of sustainability.

3.2 Shared Value Creation Framework

Shared Value Creation (SVC) argues that rather than economic needs, the needs of society are what shape markets and business opportunities, and societal harms also inherently harm companies (Kramer and Porter, 2011). SVC enables companies to incorporate societal wellbeing into their core business to maximise profits while creating broader societal value. It refers to company policies that increase competitive advantage while improving the social and economic status of the greater community. Porter and Kramer argue that SVC as a concept should supersede the concept of CSR because SVC integrates economic and societal benefits into its profitability, while CSR aligns with more reputational and philanthropic values.

Companies can create economic value when they create societal value (Kramer and Porter, 2011, Porter et al., 2012). The SVC framework has three levels for achieving this:

1. ***"Reconceiving products and markets"*** (Porter et al., 2012, p. 3). This level focuses on companies addressing society's unmet social needs through products or services, which also drives profits.
2. ***"Redefining productivity in the value chain"*** (Porter et al., 2012, p. 3). This level describes how improving internal operations management increases productivity and reduces risks. This involves operations that improve the environment, utilisation of resources, and employee investment and retention, for example.
3. ***"Enabling local cluster development."*** (Porter et al., 2012, p. 3). This level refers to a company's role in strengthening community investments, local institutions, and infrastructure as strategies for improving the external environment.

The results of the conceptual analysis are organised by the three levels within the SVC framework. Table 1 summarises how Icelandic corporate volunteerism in DRM aligns with these levels, with supporting examples from the literature review.

Table 1. Business and social results at each level of the SVC framework (Adapted from Porter et al., 2012).

Level of Shared Value	**Business Results**	**Social Results**	**Supporting Literature**
"Reconceiving products and markets." Icelandic companies fulfill unmet societal needs for trained responders by supporting their employees as ICE-SAR volunteers. This aligns the core business with community wellbeing.	• Strengthens DRM, which indirectly reduces disruptions in operations during natural disasters. • Secures profitability.	• Improves public safety. • Contributes to robust, bottom-up DRM. • Finances volunteer service through employer social and financial support.	Lozano (2015); Paumgarten (2015); Stjórnarráð Íslands (2021)
"Redefining productivity in the value chain." Employees volunteering during work hours without losing their salary may enhance stakeholders' trust in the company while contributing to employee skill development. This also contributes to risk reduction for the community and company.	• May contribute to employee morale, trust, and retention. • Improves social license to operate with internal and external stakeholders.	• Improves communities' ability to cope with natural disasters and emergencies. • Contributes to employee-volunteer-local stakeholder skill development.	Grant (2012); Plewa et al. (2015); Twigg (2001); Sekar and Dyaram (2017)
"Enabling local cluster development." This form of corporate volunteerism goes beyond a philanthropic contribution to DRM infrastructure by directly fostering symbiotic relationships among stakeholders, ICE-SAR, the DCPEM, and society.	• Maintains local collaboration and partnerships. • Drives profitability through greater visibility in society. • Enhances the company's own ability to cope with natural disasters and emergencies.	• Enhances local infrastructure. • Builds greater capacity for DRM for future environmental and social pressures.	Bernharðsdóttir and Hrafnsdóttir (2022), Eydal et al. (2016), Ministry of Justice (2017)

4. Discussion and Conclusion

Exploring the different levels of the SVC framework uncovers a deeper level of value creation from this corporate investment into public safety and DRM, conceptualised in Figure 1. By maintaining employees' pay when they are volunteering away from work, companies invest in employee skill development, support ICE-SAR operations, and strengthen the DCPEM's volunteer-driven DRM system. This creates value for these actors and community and company resilience to disasters.



Figure 1. Examples of shared value creation in financing employee volunteerism on rescue teams, based on the SVC framework (Adapted from Porter and Kramer, 2011).

The role of corporate volunteerism in Icelandic DRM represents a unique model of SVC, in which companies, employees, and society may all benefit. This collaborative relationship creates cross-sectoral value and reflects societal values. There is also room for improvement of this structure. Based on the literature, this corporate volunteerism model

is not well formalised, institutionalised, or discussed in an academic or social context, outside of being mentioned in journalistic descriptions of Landsbjörg's operations (Paumgarten, 2015). Companies that participate in corporate volunteerism with ICE-SAR have a unique opportunity to leverage this agreement and embed it further into their strategy. Porter (2012) recommends that SVC be measured in a process that is integrated with business strategy. A system of tracking SVC would establish targets by researching the business case to determine the relationship between social improvement and business performance; track progress with key performance indicators; and measure business progress against social progress (Porter et al., 2012). A more robust look into Icelandic companies' corporate volunteerism relationship with employees as ICE-SAR volunteers may contribute to a framework for measuring and tracking the impacts of this relationship.

This volunteerism model may be formalised to embed sustainability into core operations of businesses, especially as climate change poses emergent risks to future stakeholders. While climate modelling shows that there may be an increased future need for disaster response and recovery capacity, then building a strong, formalised foundation now may serve future stakeholders (Björnsson et al., 2023; Plewa et al., 2015). Future research could investigate how informal or formal volunteer agreements influence employee satisfaction and retention over time, which may affirm that sustained volunteer participation is linked to meaningful work (Grant, 2012).

Iceland's report, *Fourth Synthesis Report of the Scientific Panel on Climate Change* (2023) states that Arctic communities' DRM structures may be challenged in the future. (Björnsson et al., 2023). Unseasonable weather in some years have led to events that stressed Iceland's DRM structure. An example is the 2020 landslide event in Seyðisfjörður, East Iceland, which occurred after several days of warm temperatures, rain, and slope instability in the middle of December, the largest known landslide to hit a settlement in Iceland's history (IMO, 2021). According to the synthesis report, "Risks due to climate change extend from individuals, companies, institutions and local communities to social and economic systems, ecosystems and ecosystems, and can even be an existential threat for some groups." (Björnsson et al., 2023, p. 313). A threat of this system may be that companies face growing pressure if volunteers are needed more often and for longer periods. A more structured, trackable system could help companies plan for these disruptions, establish clearer guidelines, and measure the return on investment of their participation.

This uncertainty poses threats as well as opportunities for companies that are involved in corporate volunteerism DRM relationship to preemptively think about systemic risks and their role in capacity building. Integrating Icelandic values of volunteerism more concretely into their core business may address these threats with opportunities for meaningful cross-sectoral engagement and SVC, inherently contributing to sustainable business models.

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An Extended Abstract Submitted to the NBM Conference 2025

Operational framework for integrated sustainability assessment of circular and inclusive initiatives: focus on circular craft centers

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Extended abstract

The circular economy is predicated on the elimination of waste, the circulation of materials and the regeneration of nature through strategies such as repurposing, reuse, repair, etc. (Homrich *et al.*, 2018). Urban circular economy initiatives are diverse; however, grassroots urban initiatives face challenges in terms of resources and visibility despite their important contributions to the circular economy (Blomsma and Brennan, 2017; Henry, Hoogenstrijd and Kirchherr, 2023). A promising bottom-up model of urban circular economy initiatives is the network of Circular Craft Centers (CCCs) in the Netherlands, launched in 2019, aiming to transform cities into more sustainable, circular, and inclusive places (Ministerie van Infrastructuur en Waterstaat, 2025). This network consists of 96 centers distributed throughout the country and is designed to promote sustainability and circularity in municipalities, while engaging all stakeholders (Ministerie van Infrastructuur en Waterstaat, 2025). CCCs serve as nexuses that integrate thrift stores, recycling centers, repair services, educational activities, and social employment opportunities. The integration of these building blocks fosters resource conservation, waste reduction, community engagement, and inclusive employment. The range of waste streams that are typically managed in these centers is extensive, including textiles, furniture, electrical and electronic equipment, household goods, plastics, wood, bikes, construction materials, among others. However, the extent to which these centers contribute to and act within the circular economy is not sufficiently visible and little data can be found in the literature.

Consequently, the objective of this research is to develop a comprehensive operational framework for the monitoring and evaluation of CCCs as key enablers of the circular economy in urban areas with a view to improving the decision-making process in this under-represented sector. The proposed framework is based on integrated sustainability assessment, incorporating environmental, social and economic dimensions, and circularity and inclusion metrics. The objective is to refine general approaches towards an operational framework that can be applied to CCCs (urban circular economy initiatives, etc.), defining specific impacts to be considered, methods and indicators in an integrated way.

Specific objectives are as follows:

1. To conduct a comprehensive analysis of current assessments related to the proposed operational framework.
2. To identify and define a set of impacts, methodologies and indicators adapted to the CCCs.
3. To develop a robust operational framework for CCCs.
4. To validate the operational framework through testing in two distinct CCCs.

In addressing these objectives, the study identifies synergies and proposes efficient monitoring tools to measure the centers' contributions to the circular economy, sustainability, community development and social inclusion.

The proposed methodology involves a multi-step process (Figure 1): Context setting, identification of methodologies and indicators, definition of the operational framework, testing process and operational tool.

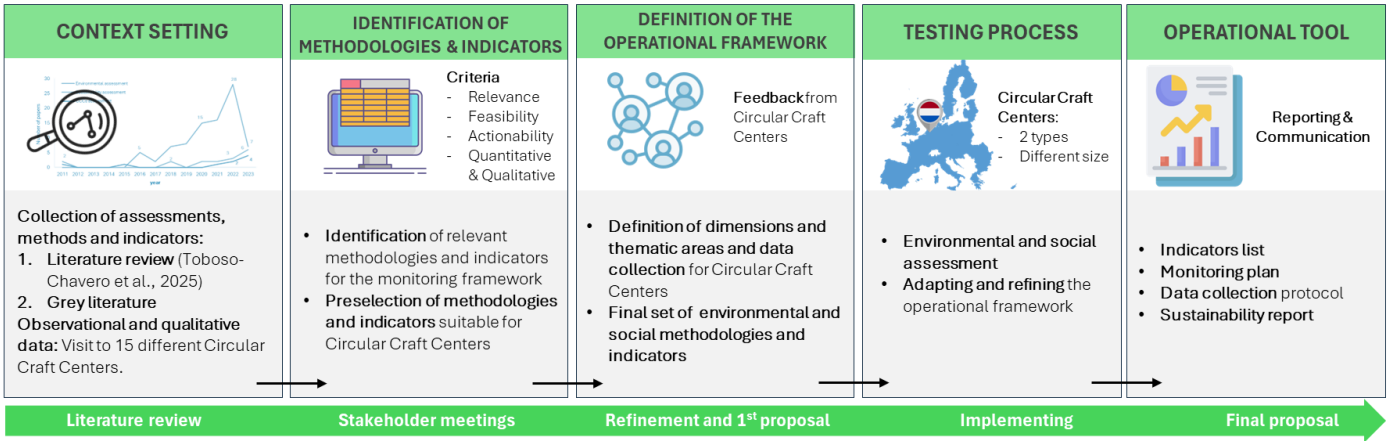


Figure 1: Proposed step-by-step methodology for the operational framework

The ***context setting*** phase was based on a thorough literature review of scientific papers focusing on assessments, methodologies, indicators, and other relevant topics, pertaining to urban waste management systems (Toboso-Chavero *et al.*, 2025). In addition, a comprehensive analysis of grey literature was conducted, encompassing reports specifically related to CCCs. This phase also involved site visits to 15 different CCCs in the Netherlands, providing hands-on experience and insights into these centers. Utilizing these diverse sources of input, we identified specific tools for monitoring these centers (***identification of methodologies and indicators*** phase) and pre-selected a set of methodologies and indicators suitable for measuring their environmental and socio-economic performance. The subsequent phase entailed the ***definition of the operational framework*** phase, following the delineation of the CCC system's boundaries, and incorporating feedback on the pre-selected methodologies and indicators from the CCCs. This culminated in the finalization of a set of environmental and socio-economic indicators for the operational framework. The ***testing*** phase was based on the testing process of different CCCs in order to implement data availability, data collection and environmental and socio-economic assessment, including E-LCA (Life Cycle Assessment) and Social LCA (SLCA), as well as circularity and inclusion metrics. The final phase, the ***operational tool***, was based on the provision of a set of documents for appropriate reporting and communication: list of indicators, monitoring plan, data collection protocol and sustainability report. It is vital to acknowledge that these phases are integral to the establishment of a robust assessment process. This process is designed to capture a range of environmental and socio-economic impacts, inclusion, and circularity dimensions. A key strength of this operational framework is the active involvement of stakeholders throughout the design process.

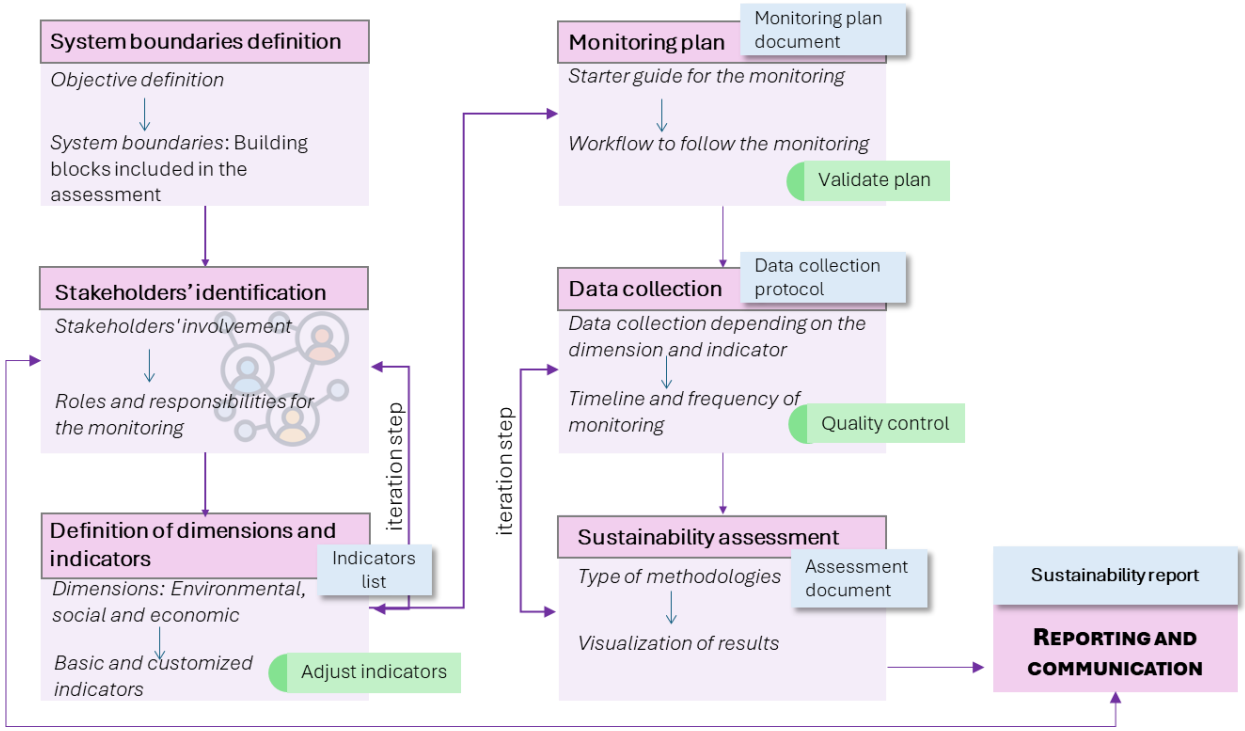


Figure 2: Operational framework diagram

Preliminary results indicate a pragmatic proposal for the evaluation of the performance of CCCs. The operational framework (Figure 2) involves the capture of all dimensions of sustainability, including, environmental indicators (e.g., carbon footprint, water footprint, etc.) socio-economic indicators (e.g., number of jobs, number of volunteers, citizen engagement, etc.), metrics related to circularity (e.g. circular rate, reuse rate), and inclusion (e.g. number of employees in the full-time equivalent (FTE) metric of vulnerable groups, women, migrants, etc.). The bespoke framework has been delineated into two distinct tiers, a necessity imposed by the critical nature of data availability in these centers, which are responsible for the management of a substantial volume of discarded products and materials. The social dimension has been subdivided into two parts, one quantitative and one qualitative, to capture in depth their contribution to the country's circular economy.

The testing phase was conducted across two distinct CCCs, one of which was a prominent center (CCC1) with a long-standing history of data collection and substantial infrastructure. This entity collects approximately 2.3-2.4 million kilograms of discarded products and materials per year (approximately 9 kilograms per inhabitant). Preliminary results from CCC1 indicate that textiles constitute the predominant waste category, accounting for 58% to 64% of the total. Reuse emerged as the predominant circular strategy, however, with 83-89% of textiles being sold to other companies that subsequently export to international markets.

The second center (CCC2) is smaller and more focused on the collection of discarded materials and products from companies, associations and, on occasion, bulky products generated in the municipality (around 31,000 kg/year). This organization had no data available, and the implementation of data collection was the first step in monitoring it. Preliminary results indicate that CCC2 has specialized in the collection of wood for repurposing in new products (58% of the total by weight) and bikes for reuse, repair or recycling (30% of the total by weight).

Adopting the proposed operational framework will facilitate a systematic and participatory approach to evaluating the environmental and socio-economic dimensions of CCCs. This approach will address existing data gaps and ensure the relevance and practicality of the resulting framework. However, in these types of centers, data play a pivotal role, necessitating the establishment of two distinct tiers. The initial tier is conceived to be more elementary and to comprise fewer indicators, with the objective of enhancing data availability. The second tier, by contrast, is intended for more sophisticated centers with a high level of expertise in data collection. The objective of its implementation is to propose a progressive monitoring process in these centers, which represent the majority, collecting minimal data. Nevertheless, this framework will provide significant support to ongoing monitoring and improvement initiatives in the context of the circular economy in the Netherlands, as well as serving as a model for other urban circular economy initiatives.

Keywords

Urban resources centers, inclusive circular cities, social inclusion, urban sustainability, environmental and socio-economic impacts

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Leveraging a Circularity Indicator to Ensure Sustainability in Circular Business Models

Enhancing Decision Support at the Fuzzy Frontend of Innovation

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Extended abstract

One of the fundamental principles of circular business models is the ability to think in lifecycles and understand the consequences of choices along the value chain. However, there is an inherent difficulty in adopting this perspective from an early stage, since supply chain information is not readily available. This leads to an underutilization of lifecycle thinking in the early phases of product development, particularly in the fuzzy front end of innovation. This is problematic, as decisions made during these early stages significantly influence the environmental impacts of products, services, and related business models (Ramani et al., 2010).

The salience of the circular economy over the last decade has resulted in the development of several indicators and metrics that aim to measure circularity at the micro-level of products and business models (Kristensen and Mosgaard, 2020). Although this implies a response to the need for decision support tools that can be deployed during the early stages of the innovation process, in reality the field is still at a fluid stage characterized by multiple inidicators based on different quantification techniques, comprising varying levels of quality, with a majority having not progessed beyind the conceptualization stage (Shevchenko et al., 2024). A lack of standards-in-practice for quantifying micro-level circularity poses problems for practitioners that require an empirical base upon which to make critical decisions related to strategy and product design.

To address this gap, we have explored the potential of the C-metric, an indicator intended to align well with the concept of circular business models (Linder et al 2015). Circular business models focus on value creation through the utilization of remaining value in previously used materials, components, and products (Linder and Williander, 2015). The C-metric is defined as the ratio of value retained from previous use cycles to the total employed value in a product. It is relatively quick to calculate for various scenarios and has shown strong correlations with lifecycle assessments for impact categories such as global warming potential and abiotic resource depletion (Linder et al., 2017). It resolves some of the suggestions in the circularity standard ISO 59020:2024 (en) section 7.4 which states that "It is valuable to explore calculations of circularity indicators that contribute to retaining, recovering and adding resource value."

Since its beginning in 2022, the EU Horizon project CircEl-paper has explored solutions to facilitate the diffusion of printed paper-based electronic circuit boards (PCBs), aiming to minimize the environmental impacts and maximize the potential for circular strategies, in particular *recycle* and *regenerate*. As one part of this, the project has explored the contextual validation of the C-metric for the case of printed electronics. The aim has been to guide new product development (NPD) teams through key decisions regarding material and process choices during PCB design, bypassing the need of time-consuming LCA studies in parallel to technical development. We have assumed that the usefulness of the C-metric in driving sustainable decisions in the front end of innovation is highly dependent on a well-established scope of validity, as this achieves both accuracy in decision guidance and acceptance among the stakeholders.

The aim is to systematically explore and validate the use of a value retention-based indicator for assessing circularity in the printed electronics sector. This is done comparing parametric C-metric calculations and life cycle assessments over different scenarios for the same system (a PCB on paper substrate), based on real-world experimental manufacturing processes, developed during the project. The investigated parameters include the recycled content of raw materials, the nature (and thus the value) of raw materials, and process parameters such as time and temperature.

Our findings demonstrate that the value retention-based C-metric can effectively guide sustainable decision-making in the early phases of product development, with a surprisingly wide range of validity. The parametric studies revealed that the C-metric's guidance is robust across a range of scenarios, aligning closely with LCA assessments. The indicator is able to capture the large range of quantities and values typical of electronic systems and of functional materials in general. Moreover, it can be quickly calculated for many technical options, as it is based on data which are easily available in the organizations (costs and technical prameters). For instance, the c-metric captures changes in the manufacturing process (energy, auxiliary materials, waste), which heavily impact the sustainability but are not taken into account in many (mass-based) indicators (e.g. EMF & Granta design 2015).

Such an indicator is a valuable tool where technology options have to be assessed and compared in terms of their sustainability, especially in new technologies, where the detailed supply chains and production routes are not known yet. In fact, if market price is a reliable proxy for environmental impacts, there is no need to model materials and processes outside the considered system (the so-called background data), speeding up the feedback loops to the technical team.

Circular business models with negative environmental impacts perform poorly in the c-metric, and this privileges the circular strategies with the largest benefits in terms of sustainability. Indeed, improving the sustainability is mentioned as the main driver for circular business models by many Nordic companies (Bajuk & Linder 2024), but it's not certain or straightforward (Lonca, 2018, Niero, 2019, Brändström, 2022).

This suggests that the C-metric can serve as a practical tool for organizations lacking extensive LCA capabilities, enabling them to make informed decisions that align with sustainability goals. As a single indicator based on financial data, it is easy to understand and communicate across the teams, overcoming one of the largest drawbacks for LCA as decision making tool (Bengtsson 2000).

By providing a quick and reliable indicator of sustainability performance, it can help organizations navigate the complexities of sustainable innovation. However, its effectiveness is contingent upon clear communication of its scope of validity and the contexts in which it can be applied.

Future research areas identified:

- What are the right parameters to determine the scope of validity of a circularity indicator for a specific industry?
- Through which mechanisms do a well determined scope of validity increase the contribution to the circular transition?
- Which industries and use cases would benefit the most from the C-metric?

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Keywords

Value retention, Circular business model, Frontend of innovation, Circularity indicator, C-metric, Sustainability indicator, Measuring and managing the sustainability effects of business models.

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Assessing the Sustainability Performance and Impacts of New Business Models in the Craft Beer Sector: Lessons from Massachusetts

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Extended abstract

Advancing business sustainability requires developing new frameworks and tools to better measure the *impacts* of business models (environmental, social and economic) and recognize different types of value created or co-created: public, partner, and customer (Biloslavo et. al. 2018; Lüdeke-Freund et. al. 2020). Such performance assessment is crucial for helping companies refine their business models for sustainability. While some theoretical frameworks have been proposed in the literature (Lüdeke-Freund et. al. 2017; Biloslavo et. al. 2018; Lüdeke-Freund et. al. 2020; Dembek et. al. 2023), there is limited empirical research on how to assess the sustainability performance of business models and their impacts. In addition, most tools to date only provide qualitative information (Pieroni et al., 2019). There is a need to develop quantitative assessments for measuring business models' performance and *impacts* on society and the environment (Whalen et. al. 2022; Bocken et. al. 2022). Such impact measurement should involve third-party, independent groups to ensure credibility and prevent greenwashing.

The proposed presentation aims to address this research-impacts gap by focusing on the Massachusetts craft beer sector and sharing key findings from a new BetterBev recognition program and related sustainability assessment tool (BetterBev, 2024). The latter evaluates breweries' performance in eight categories of impact and provides quantitative scores and

recommendations to participants how to improve performance and reduce negative impacts. For this presentation sustainable business model is defined as "business model that creates, delivers and captures economic, social and environmental value" (Dembek et. al. 2023)[1]. The research combined stakeholder perspective theory on value creation (Freudenreich et. al. 2020) with systems theory of impact assessment to answer the following questions: How can sustainability performance and impacts of new business models be measured within a specific industry? What are the strengths and limitations of quantitative measures of sustainability performance and impact? How do companies use such performance measurement to refine their business models and achieve greater sustainability impacts?

After experiencing rapid growth at the beginning of the century, the craft beer industry in the U.S. is facing declining sales as result of changing consumer preferences and increasing competition. The 2023 beer volumes were still lower than in 2019, before the Covid-19 pandemic (BA, 2024). Many breweries have closed or have been acquired. Supply-chain disruptions caused by the pandemic, the wars in Ukraine and Gaza, and inflation, have led to significant increases in the cost for raw materials, energy, and water. Climate change is advancing at unprecedented rate, increasing the urgency for companies, governments and individuals to act. As result, many craft breweries see environmental sustainability as a crucial strategy to reduce costs, minimize environmental impacts and risks, and differentiate from competition (Veleva et. al. 2024). The industry is very sustainability-committed, with many small entrepreneurial players adopting innovative business models along the value chain to incorporate local sourcing, reduce energy, water and chemical use, prevent waste, and promote social justice and community wellbeing (Ness, 2018; Rosburg & Grebitus, 2020; Veleva et. al. 2024). These companies are typically privately held, employee-owned or certified as B-Corp (benefit corporations) and their mission often includes supporting their local community, the environment and regenerative agriculture.

Many stakeholders have been working with the craft beer industry in the U.S. to support adoption of pollution prevention (P2) and sustainability, including state and federal policy makers, the national Brewers Association, state brewers' guilds, universities, and other partners along the value chain. Since 2022 with funding from the U.S. EPA, several New England states have provided free technical assistance and recognition to craft breweries, and over 60 facilities have been recognized by the recently launched BetterBev program (BetterBev, 2024). Yet, while research and academic studies about the industry have been growing, there is still a gap in measuring the specific *outcomes* and *impacts* (environmental and business) of P2 and sustainability practices (Bahl et. al. 2021; Sozen et. al. 2021; Dembek et. al. 2023; Rahman et. al. 2023). Measuring these however, is critically important

[1] The work focused primarily on evaluating environmental performance as it was funded by the U.S. Environmental Protection Agency.

for communicating success, scaling up sustainable business models, and devising effective policies for industry transformation.

This presentation is based on a research project funded by the U.S. Environmental Protection Agency which involved 29 Massachusetts craft beer manufacturers. The study included site visits and assessments, interviews with founders and master brewers, online research and quantitative assessment of environmental performance, and impacts. Data were collected between October 2022 and October 2024 and included: a) a survey of craft breweries, b) site visits and assessments, c) publicly available data from breweries' websites and social media, and d) quantitative estimates of the environmental and financial impacts of adopted pollution prevention and sustainability practices. Each participating brewery was provided with detailed sustainability assessment and recommendations. Approximately a year after the initial assessment the research team followed up with each participant to find out which recommendations were adopted, and to measure the resulting impacts, as well as identify barriers for adoption. The research revealed that 16 of the 29 participating breweries implemented a total of 30 pollution prevention recommendations which required $100,828 in upfront costs and led to annual savings of $41,005 (in aggregate). Some of the estimated environmental outcomes and impacts as of October 2024 included: 273 pounds of hazardous material input prevented (toxic cleaning chemicals), 14,993 pounds of water pollution prevented, air emissions were reduced by 32,590 lbs., and participants reduced their water use by 60,760 gallons annually. Overall, the 16 breweries were estimated to have prevented 67 MTCO2e emissions annually by adopting innovative sustainable business models.[2] For example, by launching a can carrier take-back program, Untold Brewing leveraged customer willingness to support environmental initiatives and saved $4,200 annually by avoiding purchasing 25,000 new can carriers, which also prevented the use of 800 pounds of plastic and the generation of 0.57 $MTCO_2$ emissions (UMass Boston, 2024).

The study found that despite the lack of federal mandates in the U.S. to prevent waste and emissions, a growing number of small, mission-driven companies are taking advantage of shifting business conditions (including customer demand, state-level technical assistance and recognition, stakeholder pressures, and cost benefits of sustainability) and implementing innovative sustainability strategies. Measuring their performance in key areas of impact, coupled with technical assistance and education, is necessary but not sufficient condition for better managing the sustainability impacts. Based on the empirical research the author will discuss the need to increase industry knowledge and capacity, the role that technical assistance and recognition programs can play, and the challenges in measuring and managing the sustainability impacts of business models.

[2] The research only measured the impacts of implemented pollution prevention strategies, although participating breweries implemented other sustainability strategies.

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Keywords

Sustainability performance, sustainability impacts, pollution prevention, craft beer industry, assessment tool

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Qualitative analysis of the application of BM-LCA in the evaluation of business models for renewable energy communities

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Abstract

This study explores the application of Business Model Life Cycle Assessment (BM-LCA) to evaluate the environmental performance of Renewable Energy Communities (RECs), using the Hitzar REC located in Gipuzkoa (Basque Country, Spain), as a real case study. A novel integration of a Sustainable Business Model Canvas is proposed to enhance the methodology by incorporating a preliminary qualitative assessment of governance and sustainability aspects along with the traditional business model considerations. The analysis focuses on defining a clear value proposition, evaluating environmental and economic flows, and identifying strengths and challenges in the application of BM-LCA to the evaluation of RECs, which has also proven to be a useful tool for systematically identifying the key elements that must be understood when analyzing business models. The study demonstrates how BM-LCA links material and financial flows to sustainability outcomes, enabling informed decision-making processes and contributing to the development of sustainable energy solutions. Additionally, the study highlights the importance of tailoring BM-LCA to address the unique characteristics of RECs, such as their community-oriented governance and dependence on external technical and financial support. These aspects underscore the need for methodological adaptations to better capture the social and economic dimensions of these initiatives. Future work will expand on this framework through the quantitative application of BM-LCA to compare BM configurations and energy management scenarios of different REC models, contributing to the sustainable energy transition.

Keywords

Business model life cycle assessment, Circular business model, Life cycle thinking, Renewable energy communities, Sustainable business model innovation

1.Introduction

Renewable energy generation by community-owned projects has the potential to increase energy efficiency, reduce CO_2 emissions, lower consumers' energy bills, foster the creation of new jobs and promote citizen empowerment, social cohesion, and social equity (Mendoza et al., 2022; Kiamba et al., 2022). Furthermore, energy communities are seen as a key lever for the energy transition (Bellini *et al.*, 2024). The European Commission estimates that by 2030, more than 50 GW of wind energy and over 50 GW of solar energy could be owned by energy communities, representing respectively 17% and 21% of the current installed capacity, respectively (Vernay and Sebi, 2020), while by 2050, almost half of European households are expected to participate in renewable energy generation schemes, 37% of them in collective projects (Kampman *et al.*, 2016; REScoop, 2018).

Renewable Energy Communities (RECs) are increasingly being linked to Sustainable Business Models (SBMs) as they transform traditional energy systems into more decentralized and participatory models (Neri and Corsetti, 2024) On the other hand, REC can provide several sustainability benefits across six Sustainability Development Goals (SDGs) (Ibarra *et al.*, 2023), such as reducing emissions, boosting local economies, enhancing social equity, alleviating energy poverty, and promoting gender equality, (SDG 4, 7, 8, 9, 11, 13). This is why the literature on SBMs for REC has grown in the past few years, particularly from 2019, aligning with the "Clean Energy for All Europeans" package (Cavallaro *et al.*, 2023).

Business models play a crucial role in shaping production-consumption systems and enabling sustainability-driven innovation (Boons & Lüdeke-Freund, 2013a; Lüdeke-Freund & Wever, 2010; Urbinati et al., 2017). SBMs are understood as holistic view on how business is done in relation to its stakeholders, including the society and the natural environment (Bocken, 2023). In this sense, research indicates that the deployment of SBMs can lead to relevant progress in terms of decoupling economic activity from resource consumption and environmental impacts (Das *et al.*, 2022; De Giacomo and Bleischwitz, 2020; van Loon *et al.*, 2021).

Reaching environmental sustainability requires understanding the relations between human actions and material (tangible) flows, which sets the foundation for the sociomaterial perspective on flows (Baumann and Lindkvist, 2022). The sociomaterial approach highlights how institutional arrangements are shaped by the impact certain actors have over others within product chain (Afrane, 2013; Baumann & Lindkvist, 2022). This is of great interest for REC's business models in which the business ecosystem plays an important role (Ibarra et al., 2023). The study from Rabanete et al., (2024) underlines the importance of adaptable, responsive, and community-driven ecosystems in supporting RECs. The socio-material approach was developed by complementing the environmental analysis of flows in product Life Cycle Assessment (LCA), incorporating additional

information about actors and networks, and reframing this hybrid study through a socio-material perspective (Lindkvist and Baumann, 2017).

The literature on SBMs has been mainly focused on the environmental assessment of products with different business configurations, with comparatively less focus on the detailed analysis of the business models themselves (Mendoza et al., 2022). Most studies use LCA (ISO, 2006) to compare products associated with different business model scenarios and configurations, such as the rental and sale of clothing (Bech *et al.*, 2019; Johnson and Plepys, 2021) or baby strollers (Kerdlap *et al.*, 2021). Nevertheless, these approaches do not provide a clear evaluation of the environmental performance derived from (or being dependent on) the economic structure of the business models, even when combined LCA and life cycle costing (LCC) studies are performed (Bi *et al.*, 2017; Kaddoura *et al.*, 2019).

Furthermore, academic studies have primarily focused on qualitative aspects, with relatively quantitative approaches providing metrics and indicators to assess the sustainable impact of different business models beyond a non-profit approach, such as REC (Ibarra et al., 2023). As the sustainability of REC's business model is often dependent on external support (e.g., legal, technical, and economic advice), adopting an ecosystem perspective is essential to identify key stakeholders across the value network and understand their roles in supporting the REC's operations (Giehl et al., 2020; Vernay & Sebi, 2020a). Thus, the environmental assessment of SBMs requires the use of robust methodologies integrating economic and environmental business model considerations (Bocken *et al.*, 2016; Harris *et al.*, 2021; Ibarra *et al.*, 2024; Kravchenko *et al.*, 2019), which is the case of the recently developed BM-LCA approach.

BM-LCA (Böckin et al., 2022) is a novel methodology for evaluating the environmental performance of business models (Böckin *et al.*, 2022; Lüdeke-Freund, 2010). Key aspects of BM-LCA include a fundamental shift in the unit of analysis from the product system to the business model itself, using economic performance as the basis for comparison (Böckin *et al.*, 2022; Lüdeke-Freund, 2010). BM-LCA links the financial flows of a business model to the physical flows of a life cycle assessment in a coherent, analytical way and enables analysis for decoupling within business practices which supports business model innovation and helps validate sustainable business models (Böckin *et al.*, 2022). This method can be applied to any business models involving material or resource use, including circular and sustainable business models (Baumann, 2022; Goffetti et al., 2022).

RECs are increasingly linked to innovative business models, transforming traditional energy systems into more decentralized and participatory ones (Neri and Corsetti, 2024). Unlike traditional for-profit business models, RECs focus on community ownership and creating social, environmental, and economic value for their members, rather than prioritizing financial profit. This difference means that BM-LCA needs to be adapted to properly evaluate the sustainability of RECs. Analyzing these differences will strengthen the rationale

for this study, highlighting the need to adjust the methodology to fit the specific characteristics of RECs.

Although RECs serve as the specific empirical context of this study, the methodological approach particularly the integration of the SBMC-REC in the BM-LCA framework is intended to be transferable to other sustainability-oriented business models. The unique characteristics of RECs, such as democratic governance and community-driven value creation, make them a valuable case to explore broader insights relevant to mission-driven organizations and socio-technical systems.

The aim of this conference paper is to qualitatively analyze how BM-LCA can be applied in practice to evaluate and improve the sustainability performance of RECs´ business models and, in this process, to define methodological challenges and opportunities for further improvement for the assessment of complex systems. Accordingly, this study attempts to provide a baseline for the development of a clear conceptual framework for the application of BM-LCA to develop SBMs for RECs, serving as a foundation for future research involving a quantitative sustainability assessment, incorporating the business ecosystem perspective. While the study applies BM-LCA to a specific case, its findings are highly relevant for advancing a truly sustainable energy transition, as they provide valuable insights to support the transformation of business models across various economic sectors.

Specifically, the study addresses the following objectives:

1. To qualitatively apply the BM-LCA methodology to a real-world REC case (Hitzar) in order to assess its sustainability performance.

2. To identify methodological and practical challenges in applying BM-LCA to non-profit, community-based business models, and to derive recommendations for further development of the method.

Although not initially defined as a research objective, the integration of the SBMC-REC emerged during the analysis as a helpful tool to structure the “Goal and Scope” phase of BM-LCA, particularly in capturing governance and sustainability dimensions specific to RECs. This contribution is discussed in the results.

2.Method

The methodology (Figure 1) follows a three-step structured approach for the exploration of the application of BM-LCA to the analysis and comparison of different SBM-REC system configurations.

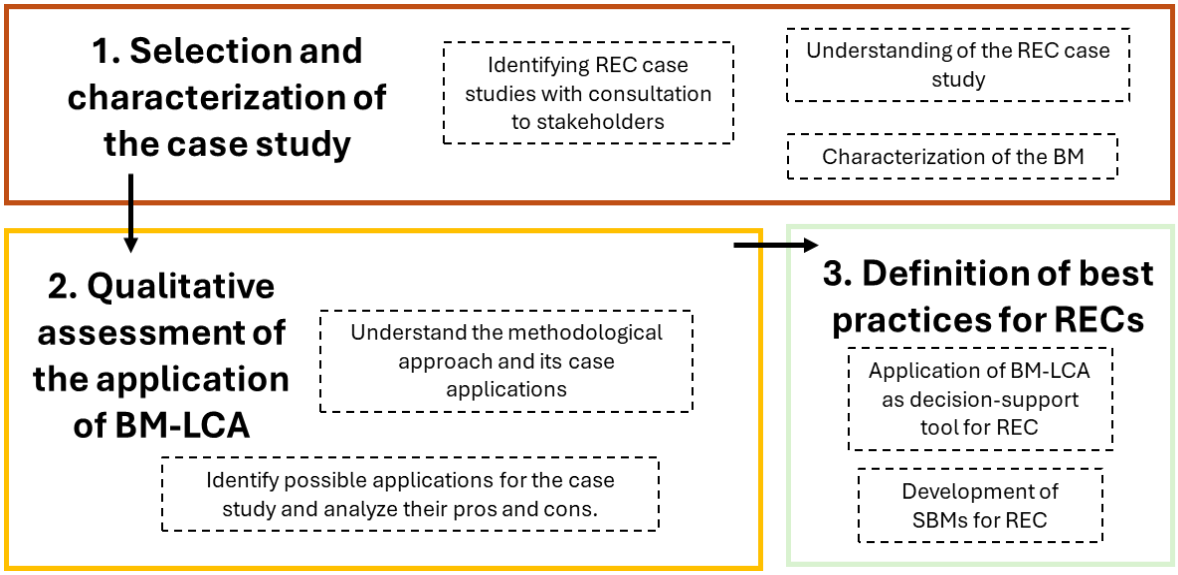


FIG. 1 DESCRIPTIVE OVERVIEW OF THE APPLIED METHODOLOGY ACRONYMS: REC: RENEWABLE ENERGY COMMUNITY; BM: BUSINESS MODEL; BM-LCA: BUSINESS MODEL LIFE CYCLE ASSESSMENT; SBM: SUSTAINABLE BUSINESS MODEL

2.1. Selection and characterization of the case study

The first step of the methodology involves the selection and characterization of a case study. In this study, the REC of Hitzar (HITZAR.Koop. S., 2024) located in Gipuzkoa (Basque Country, Spain) serves as the reference case to explore the qualitative application of BM-LCA (Böckin *et al.*, 2022).

2.1.1 Identifying REC case studies with consultation to stakeholders

The process of identifying RECs in Gipuzkoa involved an in-depth analysis of the approximately 55 REC currently operating in the region. This was conducted using a Participatory Action Research (PAR) approach (Bocken *et al.*, 2018), a collaborative methodology that integrates knowledge and action to drive social transformation (Torre *et al.*, 2015). The PAR approach actively engaged community members, researchers, and stakeholders, leveraging their strengths to identify representative RECs for further study (Collins *et al.*, 2018).

This identification process was enriched by insights gathered during the First Forum of REC in Gipuzkoa (November 2024), where representatives shared the progress, challenges, and achievements of these initiatives (DFG, 2024). The Forum organized by the Transformation Energy Office of Gipuzkoa**,** gathered key stakeholders, including representatives from 25 RECs, officials from the Gipuzkoa Provincial Council (such as the Deputy for Sustainability, the Director of Ecological Transition, and technical staff), and members of the Transformation Energy Office of Gipuzkoa. The forum served as a platform to share

experiences, address challenges, and propose collaborative actions to strengthen the development of REC in the region.

As a result of this process, the Hitzar REC (HITZAR.Koop. S., 2024) in Itsasondo was selected as the case study for this research. Hitzar was identified as one of the most developed RECs in the region and recognised as a highly relevant case by key stakeholders involved in the energy community sector. This business case offers a unique opportunity to explore how BM-LCA can be effectively applied to explore the environmental and economic sustainability performance of an ongoing REC in the region of Gipuzkoa (Basque Country, Spain). This is one of the Spanish leading regions in the deployment of REC across the territory, providing valuable insights into its potential for supporting sustainable business model transformation for a sustainable energy transition.

2.1.2 Understanding of the REC case study Hitzar

Hitzar REC is located in Itsasondo, a small village in Gipuzkoa (Basque Country, Spain) with 400 inhabitants. The journey to establish this community began in 2022 with the intention of developing an association. After extensive discussions and collaboration with Goiener, a leading promoter of RECs and a key cooperative in the Basque Country focused on renewable energy development (Goiener, 2025), the initiative evolved into a more robust structure as a Cooperative.

By 2023, the Hitzar REC, a cooperative focused on sustainable energy generation, had grown to 35 members. Goiener stepped back from the project in 2023, leaving Hitzar to lead the development of its first installation; a project, named Iraola, for the implementation of 35 kW solar system. However, Iberdrola, the regional electricity distributor (Ibedrola, 2025), limited the installation's capacity to 10 kW due to transformer restrictions, allowing it to supply energy to only 9 members.

Faced with these constraints, Hitzar redefined its strategy to ensure economic, technical, and voluntary sustainability. After an unsuccessful attempt to collaborate with Goieki, a local economic development agency (Goieki, 2025), they partnered with Biziola, a regional entity dedicated to supporting and promoting sustainable energy projects and community initiatives (Biziola, 2025). Through Biziola’s guidance, Hitzar realized the potential to expand their project regionally in the Goierri area, a region in Gipuzkoa, Basque Country.

By late 2023, Hitzar began work on its second installation, named Lukasain, a 65 kW solar system in Ordizi, which helped grow the cooperative to 70 members by 2024. Hitzar now operates two solar installations:

1. The Iraola system (10 kW) in Itsasondo.with 10 members
2. The Lukasain system (65 kW) in Ordizi with 58 members

Plans for 2025 include the development of two additional solar installations: a 100 kW system in Zaldibi and a 60 kW system in Segura. Beyond installations, Hitzar also supports its members with guidance on Tax on Real Estate (OHZ) (Gipuzkoa provincial council, 2025), assisting them in understanding and managing tax obligations related to renewable energy systems.

2.1.3 Characterization of the Hitzar REC´s BM

To characterize the SBMs of RECs, the traditional Business Model Canvas (BMC) (Osterwalder and Pigneur, 2009) was adapted, resulting in an extended version that we have called the Sustainable Business Model Canvas for RECs (SBMC-REC) (Bocken et al., 2014; Osterwalder, Pigneur & Tucci, 2005) and integrates sustainability dimensions such as the governance model and the triple bottom line impacts, aligning with SDGs (United Nations, 2025). It has been shaped by complementary perspectives from Hall & Roelich, (2016); Hannon et al. (2013) and Richter, (2013), providing a robust tool to analyze and compare innovative approaches in the energy sector.

TABLE 1 SUSTAINABLE BUSINESS MODEL CANVAS FOR RECS (SBMC-REC) ACRONYMS: SDG: SUSTAINABLE DEVELOPMENT GOALS

Block	Information	Source
Value proposition	Need/problem addressed	(Boons and Lüdeke-Freund, 2013; Engelken *et al.*, 2016)
	Offer (good and/or service)	
	Organisations' meaning of existence	
Value delivery	Customer segment	(Boons and Lüdeke-Freund, 2013)
	Key channels (promotion and distribution)	
	Key relationships	
Value creation / Supply chain	Key resources (technological, human capital, knowledge)	(Pereira and Caetano, 2015)
	Key activities	
	Key partnerships	
Value capture	Financial model (how the model is financed)	(Osterwalder *et al.*, 2005; Pereira and Caetano, 2015)
	Cost structure (capital and operational costs)	
	Revenue streams (how earnings are obtained)	
Governance	Promoter (who initiated the project)	(Hellström *et al.*, 2015; Smith, 2007; Zott and Amit, 2010)
	Focal firm (who runs the business)	
	Governance model (how is the business managed, how is ownership defined, how are responsibilities shared, how are agreements and decisions made)	
	Legal form (SL, S. Coop, etc.)	
Triple bottom line impacts (sustainability)	Social (+/-): Positive or negative impact on local, regional society, lifestyles	(Ibarra *et al.*, 2023)
	Economic (+/-): Local, regional economic development	
	Environmental (+/-): Positive or negative impact on natural environment	
	SDG (+/-): Positive or negative impact on what sustainable development goal)	

While the block labeled “Value Creation” refers to the configuration of key resources, activities, and partnerships that enable value delivery, the broader effects of the business model on stakeholders are captured in the Triple Bottom Line section. This block represents the sustainable value generated across social, environmental, and economic dimensions, in alignment with the SDGs. Following recent literature (Lüdeke-Freund *et al.*, 2024), value creation for sustainability is considered to encompass the processes of maintaining, unlocking, and sharing value with diverse stakeholder groups

An example of how sustainability principles shape business models can be seen in the solar business model (BM) described by Bankel & Mignon (2022). In this model key roles such as property owner, PV system owner, and electricity consumer can be assigned to different actors depending on the project configuration. Core activities include project development, technology purchasing, installation, monitoring, and maintenance, with applications ranging from residential to utility-scale setups. These principles are reflected in Hitzar’s approach, where roles and activities are tailored to meet the needs of its energy community.

Hitzar’s model, has been structured around the SBMC-REC (Table 2). The SBMC-REC for Hitzar was completed through interviews with members of the energy community, providing first-hand insights into the roles, key activities, and relationships that define the model.

TABLE 2 SBMC-REC OF HITZAR REC ACRONYMS: GHG: GREENHOUSE GAS; SDG: SUSTAINABLE DEVELOPMENT GOALS

Value proposition	**Need/problem addressed**	• Contribute to the energy transition in the Goierri region. • Provide members with advice on property tax (IBI).
	Offer	• 2 solar installations in private roof 1.The Iraola system (10 kW) in Itsasondo.10 members • 2.The Lukasain system (65 kW). In Ordizi. 58 members
	Organisations' meaning of existence	• “We are a cooperative, a non-profit association.” • Ensuring transparency and compliance with the law in our activities is essential.
Value creation	Key partnerships	• Ernamuina: Seed funding or incubation -Biziola.coop: Biziola Cooperative • Goieki (Goierriko garapen agentzia): Goierri Development Agency • Nafarkoop: Nafarkoop Cooperative -Farapi: Farapi • Goiener (initially) • Ekisolar (solar energy company) • Ingeteam (engineering and energy company)
	Key activities	• Generate renewable energy • Supply members with renewable energy • Explore local opportunities • Understand local regulations • Project development 1) Select a suitable roof 2) Conduct a preliminary assessment 3: Develop a feasibility project and explore financing options 4: Obtain permission from Iberdrola for the desired KW installation 5: Proceed with the installation process

	Key resources	• Human Resources: Skilled personnel for installation, maintenance, and community outreach; legal and technical consultants. • Technological Resources: Advanced solar panels, inverters, and energy monitoring systems. • Financial Resources: Membership contributions, grants, and subsidies. • Social Resources: Strong member network and partnerships with local organizations for community engagement.
Value delivery	**Key relationships**	• Member Engagement:. • Local Partnerships:. • Community Trust:
	Key channels	• Website: Comprehensive information on the community, projects, and how to join. • Email Support: A dedicated email for inquiries and assistance. • Consultation Services: Personalized advice on membership, renewable energy systems, and property tax (IBI). • Energy Delivery: Direct supply of renewable energy to members via the local grid. Allocation of energy packages (1 kW or 0.5 kW) tailored to member needs. Surplus energy management and compensation through grid connections. • Community Outreach: Local events and forums to foster engagement and attract new members.
	Customer segment	Members in the Goierri region (Itsasondo, Ordizi, Legorreta, Zaldibi) and future members
Value capture	**Cost structure**	• Capital costs for installation (solar panels, infrastructure). • Operational costs for maintenance and monitoring. • Administrative costs for cooperative management and legal compliance. • Community engagement and educational initiatives. • Profits are reinvested in the community to increase capacity.
	Financial model	• Membership fees (€20/year). • Additional fees for energy consumption from installations (€30/year). • Grants and subsidies for renewable energy projects.
	Revenue streams:	• Membership contributions. • Revenue from surplus energy sold back to the grid. • Local or regional funding initiatives supporting renewable energy.
Governance	**Promoter**	Initiated by local residents of Itsasondo with early support from Goiener.
	Focal firm	Managed and operated by Hitzar Koop., the cooperative itself.
	Governance model	Democratic decision-making within the cooperative, with members actively participating in key decisions and project developments.
	Legal form	Cooperative (S. Coop.)
Sustainability	**Social**	Strengthens community cohesion, reduces energy poverty, and empowers members through participatory decision-making.
	Economic	Provides cost savings for members, reinvests in the community, and supports local economic growth
	Environmental	Reduces carbon emissions, utilizes renewable energy, and minimizes land use impact.
	SDG	Contributes to SDG 7 (Clean Energy), SDG 11 (Sustainable Communities), SDG 12 (Responsible Consumption), and SDG 13 (Climate Action).

The next analysis focuses on a specific value proposition rather than the entirety of Hitzar's business model to provide a more detailed and actionable understanding of one key aspect of its operation. Among the value propositions identified through the SBMC-REC, we chose to examine the delivery of affordable, renewable energy to members. This decision allows

for a focused exploration of how this value proposition is realized through one of the cooperative's installations, the 65 kW project in Ordizi. By narrowing the scope to this specific case, we can better understand the practical implementation, challenges, and impacts of this value proposition.

2.2. Qualitative assessment for BM-LCA application

The second step of the methodology consists of three sub-steps that guide the qualitative evaluation of the methodology's applicability: i) understanding the 5 steps of the BM-LCA framework and reviewing reference studies to grasp its practical application, ii) identifying possible applications for the Hitzar REC case study with a focus on its specific value proposition, and iii) analyzing the pros and cons of the application by evaluating factors that facilitate or challenge its implementation.

2.2.1 Understand the methodological approach and its case applications

BM-LCA offers several advantages, including the provision of insights into a broad range of business model elements, as product system, pricing, distribution channels and supply chain (Baumann, 2024), making it useful for business strategy development. By measuring business model environmental performance, it helps companies determine which models to compete with (in terms of sustainability advantage) and supports critical analysis against greenwashing claims. BM-LCA also enables identification of business model elements most in need of environmental innovation and offers a practical way for business and LCA experts to merge their respective knowledge (Goffetti *et al.*, 2022).

TABLE 3 SUMMARY OF EACH PHASE OF THE BM-LCA METHODOLOGY, ALONG WITH A DESCRIPTION OF EACH STEP. ACRONYMS: LCI: LIFE CYCLE INVENTORY; LCIA: LIFE CYCLE IMPACT ASSESSMENT; GHG: GREENHOUSE GAS; BM-LCA: BUSINESS MODEL LIFE CYCLE ASSESSMENT

Phase	**Description** (Böckin *et al.*, 2022)	**Example of jackets** (Goffetti *et al.*, 2022)
Goal and Scope: Descriptive phase	Step 1: Detail the business models and describe them in relation to the product systems using actor analysis. Identify and connect cost and revenue streams for these actors (in and outside the company). This simplifies the identification of relevant economic parameters later. Also state a time period from where to get data.	• Describes rental and sales business models, focusing on roles of suppliers, users, and internal processes. • Maps revenue from jacket sales (5,000 SEK) and rental fees (600 SEK) while tracking costs (production, labor, and repair costs). • Collects production cost data (k=2,500 SEK/jacket) and revenue data from customer sales and rentals.
	Step 2: Define system boundaries and the impact categories that will be studied.	• Identifies GHG emissions, resource consumption, and waste as critical impact categories.

Phase	**Description** (Böckin *et al.*, 2022)	**Example of jackets** (Goffetti *et al.*, 2022)
Goal and Scope: Coupling phase	Step 3: Define the connection between transactions, (t), and production, q, for each business model. Then determine the Functional Unit as the profit level, π, that will act as target for both business models	• Identifies production costs (2,500 SEK), rental fees (600 SEK), and jacket sales (5,000 SEK) as key inputs • Product lifetime (200 days) as key parameters.
	Step 4: From the actor analysis, identify costs and revenue streams for each business model. Find coupling equations, relationships between q and t so costs and revenues can be expressed with transactions, t. Set up an equation for the Functional Unit (profit), π, as revenues – costs:	• -Profit equation for rentals: $\pi = t_s(30days) - q_s(200\ jackets)$. This links production (q_s) and transactions (t_s) with profit. • -This translates to a physical flow of 200 jackets per month, since, in the linear model, the number of sold jackets equals the required production. • -Functional unit is set as 319,391 SEK profit to allow comparison between rental and sales models.
	Step 5: Solve the equation and find the transactions, tr needed to reach the Functional Unit. From tr, derive the required production, qr. Do this for all business models.	• Calculates required in rental model production (q = 28 jackets) and rental transactions (t = 1,108) to achieve profit target (319,391 SEK). • In sales model (q=200 jackets) (t=200) for same profit
LCI	Construct flow model, the collection of data and the creation of an inventory of environmentally relevant flows scaled to the functional unit	• All flows are normalized to the defined functional unit, which is the monthly profit from jacket sales or rentals (e.g., 319,391 SEK for sales).
LCIA	Translates the LCI data to environmental impact categories using emission factors.	• Quantifies GHG emissions from production and transport as key impact drivers.
Interpretation	Analyze the results from the LCIA and test the calculations sensitivity by conducting a sensitivity analysis. Perform Environmental Hotspot identification.	• Identifies textile production and customer transport as key hotspots for GHG emissions.

The methodology is based on two key principles: shifting the focus from the product to the business and the socio-material perspective in the product chain (Böckin et al., 2022). Case studies applying BM-LCA have covered various business models and product and services typologies (e.g. outdoor clothing designer/retailer; jacket, outdoor lifestyle company; reusable cups, automotive company; battery electric, air purifier (Carolina, 2024; Norin, 2024) demonstrating its applicability across different sectors (Baumann, 2022). However, challenges remain, such as data collection difficulties, especially for new end-of-life technologies and use stage information (Bjørnbet and Vildåsen, 2021). Additionally, BM-LCA has not yet been applied to non-profit business models such as RECs, which may

require adaptations to the methodology, further justifying the need for this qualitative analysis of its applicability in this context.

The BM-LCA methodological steps defined by (Böckin *et al.*, 2022) were used as reference (Table 3). To provide a practical perspective and improve understanding, Table 3 also presents a case study on jackets (Goffetti et al., 2022) illustrating how each methodological step can be applied in practice to evaluate the performance of a business model.

2.2.2 Identify possible applications for the case study and analyze their pros and cons.

The BM-LCA study focuses on qualitatively defining how each stage of the process should be carried out, establishing the specific steps required to assess the environmental performance of the most significant value proposition of the Hitzar REC, its second installation in Ordizi of 65kW. This involves understanding the relationship between monetary and material flows and their contribution to environmental, social, and economic sustainability

This application explores practical ways to connect theoretical aspects of the BM-LCA methodology with the real-world dynamics of RECs, a key component of the Hitzar REC as a benchmark for further development. The focus is specifically on the first two phases of the BM-LCA methodology: Goal and Scope: Descriptive Phase and Goal and Scope: Coupling Phase.

In the descriptive phase, the analysis centers on describing the energy system supporting the second installation, which is the primary focus of this study, and establishing the impact categories that will be measured using the BM-LCA methodology. As part of this phase, actor mapping for LCA is also considered, helping to identify where the BM sits within the overall life cycle. This mapping process provides a clearer understanding of the roles and interactions of different stakeholders, facilitating the identification of cost and revenue streams and their linkages to material and energy flows. In the coupling phase, the emphasis is on defining costs and revenues, establishing the functional unit, and formulating the coupling equations. The findings and their implications are further detailed in the Results and Discussion section, where the application of these phases is critically evaluated.

At the same time as possible applications are analyzed, the positive and negative aspects are also evaluated—specifically, the factors that may facilitate this analysis and those that may pose challenges, based on the functioning of the system under review. The results are summarized in Table 4 (Results and Discussion), which highlights the phases of BM-LCA, possible applications to Hitzar's value preposition, and the pros and cons of each step

2.3. Definition of best practices and recommendations

This step uses insights from the analysis to develop best practices and recommendations for RECs. It focuses on strengthening SBMs for RECs, using the BM-LCA as a decision-support tool. While the third stage contributes valuable insights, the main objective of this study is to establish a qualitative foundation for applying the BM-LCA framework to RECs

2.3.1 Application of BM-LCA as decision-support tool for REC

The BM-LCA methodology will be applied as a decision-support tool to guide the strategic and operational development of RECs. This application involves a systematic evaluation of the pros and cons identified in the previous phase to refine and adapt the methodology to the specific context of RECs. To strengthen the qualitative measurement of the BM-LCA approach, we will identify any missing data or overlooked concepts in the deployment of RECs. At the same time, we will explore potential future developments of the methodology, reflecting on how it can evolve to better suit the unique needs of RECs. Additionally, by analyzing the methodology, we can identify its favorable aspects that support the development of REC. These reflections and insights are further explored in the results section (3.3). To enhance the quality and robustness of the impact assessment, we will compare our findings with reference studies and relevant literature that have applied similar analyses.

2.3.2 Development of SBMs for REC

In SBM the value proposition focuses on creating social, environmental, and economic value, aligning the interests of a wider group of stakeholders. It goes beyond just monetary value for customers and shareholders, considering both people and the planet (Geissdoerfer *et al.*, 2018). The SBMC-REC framework encompasses various approaches, including Circular Business Models (CBM), which provide a specific pathway to sustainability by addressing resource efficiency (Mendoza, Gallego-Schmid, *et al.*, 2022).

SBMC-REC and BM-LCA are mutually reinforcing frameworks. BM-LCA quantifies the practical outcomes of SBMC-RECs' theoretical principles, bridging the gap between sustainable intentions and measurable results. For RECs, applying BM-LCA within an SBM-REC framework allows for actionable strategies that align value creation with sustainability goals. Additionally, using the outputs of the methodology, a critical analysis has been conducted, leading to proposals for areas of improvement to make RECs more sustainable business models results section (3.3).

3.Results and Discussion:

This section describes how the BM-LCA methodology is applied to the second installation of the Itsasondo HITZAR energy community (HITZAR.Koop. S., 2024). The first two phases, which are the most relevant for this qualitative analysis of the application of the methodology, are described below. The section concludes with recommendations for REC

3.1. Goal and scope: Descriptive phase

This phase involved three main tasks: (1) clarifying the value proposition of Hitzar REC, (2) describing the energy system of the 65-kW installation, and (3) the impact categories to be measured using the BM-LCA methodology.

In the analyzed business model, the product system (Figure 2) refers to the energy transferred from the PV installation to the users. For this phase, insights from a previous step ”Understanding of the REC case study Hitzar” were critical. This analysis provided a detailed understanding of the key actors, their roles, and the flow of resources and information within the system.

The second installation of Hitzar involves a 65 kW solar energy system, distributed in 1 kW or 0.5 kW packages among users (CUPS). The allocation depends on each user’s electricity consumption and energy bill. This tailored distribution ensures that the installation aligns with individual energy needs and maximizes efficiency. Once each CUPS has its assigned package (usually 1 kW), Iberdrola (the electricity grid) analyzes how much of that kilowatt is consumed. In the case of surplus energy, it is sold back to the grid obtaining revenue (R2 in fig2). It is important to note that this kilowatt can only be consumed during production hours (when sunlight is available), as there is no battery for energy storage.

Another key aspect of this energy production system is that 10% of the energy produced is allocated to the owner of the roof where the installation is located. In this case, 6.5 kW are designated, which typically are not fully consumed. Therefore, the roof owner earns additional revenue by selling this surplus energy back to the grid (R1 in fig2).

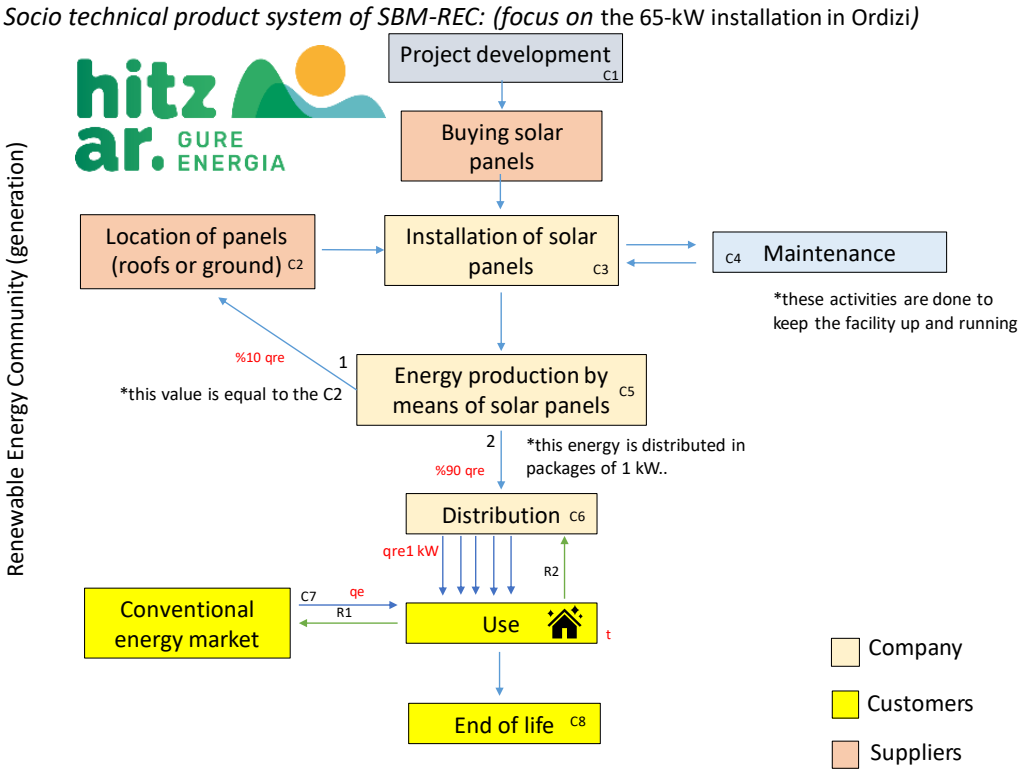


FIG. 2 SOCIO TECHNICAL PRODUCT SYSTEM FOR REC CASE STUDY HITZAR

Regarding the consumption packages, there is a proposal to increase the current limit of 1 kW, aiming to introduce businesses as members of these communities. However, for households, consuming more than 1 kW is generally unnecessary, particularly considering that consumption is limited to daylight hours. Restaurants and shops could also become interesting users, as they may experience peak energy demands during daylight hours. The processes involved in the system are defined in the (Table 4).

TABLE 4 DESCRIPTION OF THE PROCESSES INCLUDED IN THE TECHNICAL SYSTEM OF REC CASE HITZAR

Process	Description
Project development	Define the installation capacity (kW). Verify that the transformer capacity supports the installation. Recruit members for the project, ensuring each member is allocated 1 kW of consumption.
Buying solar panels	Panels are purchased after reviewing and selecting the best available offer.
Location of panels	In the Hitzar REC model, the roof used for the solar installation always belongs to a member of the cooperative. As compensation, the member receives 10% of the energy generated by the system.
Installation	Install the solar panels following technical specifications.

Process	Description
Energy production	Generate energy through the installed solar panels.
Maintenance	Ensure the proper functioning and upkeep of the system.
Distribution	Distributed in 1 kW or 0.5 kW packages among users (CUPS). The allocation depends on each user's electricity consumption and energy bill.

In defining the impact categories for assessment, the most effective approach is to reference EU standards for life cycle analysis (LCA), such as the Product Environmental Footprint (PEF) (Manfredi *et al.*, 2012). However, it is equally important to consider categories relevant to the local context. For example, in regions prone to drought, categories related to water use may be more significant (Lehmann, Bach & Finkbeiner, 2016) (Lehmann, Bach & Finkbeiner, 2016). A recommended strategy involves assessing 25 categories defined by the EF 3.1 (Commission, 2024) method and then applying a weighting system to prioritize those most relevant to the region or REC according to ISO14040-44 (ISO, 2006).

This customization allows the analysis to reflect local environmental priorities effectively. The prioritization process will be guided by input from experts in the field of environmental sustainability and renewable energy, as well as feedback from members of the energy community itself. By consulting these stakeholders, the weighting system can reflect both technical expertise and the community's specific concerns and values.

To simplify decision-making, it is advisable to focus on a few core categories. for REC, these might include climate change (energy-related emissions and savings), mineral depletion (related to the production of energy technologies), and land-use change (centralised vs descentralised energy production systems). While these categories primarily address environmental aspects, economic and social dimensions must also be included. The economic perspective is naturally integrated into the BM-LCA framework (Böckin *et al.*, 2022), but selecting appropriate social indicators remains a significant challenge. This is a critical gap in the methodology, as social indicators must align with the values of RECs. Additionally, it is important that the selected indicators capture potential reflect potential interactions and conflicts between sustainability aspects, such as CO_2 emissions versus biodiversity/land use or CO_2 versus toxicity, depending on the specific context.

3.2 Goal and scope: Coupling phase

The coupling phase is more technical and requires precise data, which can be challenging to obtain. For an initial approximation, this phase focuses on three key elements: (1) Defining costs and revenues; (2) Establishing the functional unit , such as profit margin or

energy produced over a specific time period; and (3) Formulating the coupling equations, which link costs, revenues, and energy flows to enable accurate analysis and modeling.

The costs and revenues (Table 5) for the second installation were determined through consultations with project members and technical studies. Fixed revenues (R2) include an annual membership fee of €20 and an additional €30 for consuming 1kw energy from the installation, totaling €50 per member annually. A study conducted by Hitzar estimates total annual cost (C) at approximately €30,000, which can be covered by contributions from around 500 members. This relationship between costs and revenues underscores the scalability of the project, making the community's expansion across the region both feasible and beneficial.

At the same time, the analysis highlights specific costs, based on data from Hitzar's economic plan. Project costs (C1) amount to €5,070, while installation costs (C3) represent €42,980, making them significant components of the total expenditure. Maintenance costs (C4) are €598 annually, and insurance (C5) adds €495 per year. The surface cost (C2) is paid in energy produced by the installation itself, reflecting an alternative payment structure. Other costs, such as distribution (C6) and energy purchased from the grid (C7), are more variable and influenced by external factors, adding complexity to the financial model.

Another interesting debate arises around the sources of data collection, as the choice of sources can significantly influence the results obtained. Depending on the reliability, scope, and precision of the data, the analysis outcomes may vary, highlighting the importance of selecting appropriate and representative data for accurate evaluations. For example, the price paid by the energy supplier for surplus energy (R1) can vary between the highest rate of 0,078€/kw (*Goiener*) and the lowest 0,04 €/kw (*Factor energia*). This variability underscores the importance of conducting a sensitivity analysis, as it allows for assessing the impact of fluctuating data inputs on the final results.

TABLE 5 COST AND REVENUES OF THE SOCIO TECHNICAL PRODUCT SYSTEM

C	Cost	R	Revenue
C1	Cost of the project	R1	Revenue of selling the energy
C2	Cost of surface	R2	Revenue of member contributions
C3	Cost of installation	**Product (energy) flow**	
C4	Cost of maintenance		
C5	Cost of insurance	q re	renewable energy produced
C6	Cost of distribution	q e	grid energy consume
C7	Cost of energy	t	Use period
C8	EoL cost	k	Cost per unit (external data)

Additionally, based on economic plans from the community, it becomes evident that other expenses could also be integrated into the analysis, such as internal management, communication, administrative services, and project pre-evaluation. However, it is

important to focus the results on costs and revenues directly related to the value proposition to maintain clarity and relevance in the analysis.

To define the functional unit, various indicators can be used, including profit margin and rate of return (Schmidlin, 2014), which is particularly interesting for our non-profit business model. This opens the possibility of tailoring the functional unit to better align with the objectives of non-profit organizations, where the focus is not solely on profit but also on social and environmental impact. The profit can be the amount of money that is needed to survive, or the money that will be needed to develop improvements in the infrastructure. The functional unit can be the revenues of the energy consumption system minus all associated costs over a one-year period.

Finally, the coupling equations will link the quantity of energy produced or consumed with the corresponding unit price of energy. This approach allows us to assign specific values to the cost categories. For the cost calculation, we will use the unit price of energy purchased from the grid, reflecting the external energy supply costs. Similarly, to define the revenue categories, we will use the unit price offered by energy suppliers for the surplus clean energy generated by our installation but not consumed locally.

A key point of debate here is that these external prices, both for grid energy and for the surplus energy we sell, are beyond our control and are often highly variable. This volatility introduces significant uncertainty into the financial calculations, complicating the accurate assessment of both costs and revenues. In this context, sensitivity analysis can be particularly useful in identifying the range within which the business model remains viable and determining which parameters may need adjustment to ensure financial stability.

Table 6 provides a concise overview of the key results from applying the BM-LCA methodology in REC. It highlights the main phases, possible applications, and key pros and cons for each step. To better understand the costs and flows referenced in the table, it is essential to see the sociotechnical system diagram (Figure 2), which provides a visual representation of the processes and interactions within the system, and the cost and revenues categories (Table 5). The logic used by Goffetti (Table 3) for the business model of jackets differs significantly from what can be assumed within the context of an energy community installation.

TABLE 6 BM-LCA IN REC. ACRONYMS: LCI: LIFE CYCLE INVENTORY; LCIA: LIFE CYCLE IMPACT ASSESSMENT; GHG: GREENHOUSE GAS; BM-LCA: BUSINESS MODEL LIFE CYCLE ASSESSMENT

BM-LCA Phase	The theory	BM-LCA in Hitzar REC, the 65-kW installation in Ordizi Possible application	Pros and cons
Goal and Scope: Descriptive phase	Step 1: (a) Description of the Value preposition (b)Product system (actor mapping + cost/revenue mapping) (c) Data collection	The defined model is based on a project of Hitzar REC value preposition and reflects the necessary steps for 65-kW installation in Ordizi	Some stages, such as maintenance, end-of-life processes, and the installation of solar panels, lack clarity in terms of detailed information.
	Step 2: (a) Impact categories for the environmental assessment	For indicator selection, EF impact categories used in ISO14044, and the EF impact category indicator used in the 14044:2006, focusing on variables relevant to energy communities.	Selecting indicators that reflect social aspects remains challenging since existing standards prioritize environmental metrics. Tailored indicators can bridge this gap to some extent.
Goal and Scope: Coupling phase	Step 3: (a) Cost and revenue categories (b) Values of cost prices and parameters	Costs and revenues were defined based on observed interactions within the system for Hitzar's second installation.	Energy costs (C7) are highly volatile, and the price offered by suppliers for renewable energy (R1) remains low, complicating financial predictability. Using the profit margin as an indicator could help address this uncertainty by providing a clearer picture of financial stability.
	Step 4: (a) Coupling equations (b) Functional units	Relate energy quantities (qre, qe) to costs or revenues at a given price "k" based on real-time energy prices.	Energy generation (qre) occurs only during daylight hours, leading to variations in the equations by time of day. Grid energy prices (C7) also fluctuate.
	Step 5: (a) Calculate the cost and revenues	To calculate the most critical costs and revenues (C6 and R1), data on energy consumption and renewable generation (qre) per user are required.	Completing these calculations is difficult without a full annual dataset (t) for meaningful consumption and generation patterns.
LCI	Identify material flows (e.g., raw materials, emissions) and scale to the functional unit	Renewable energy flows, grid energy flows, payments for energy, and revenues from surplus energy sales are included in the inventory.	These inventories will vary daily. Averages or seasonal groupings may offer more actionable insights. The distances involved in production and consumption

BM-LCA Phase	The theory	BM-LCA in Hitzar REC, the 65-kW installation in Ordizi Possible application	Pros and cons
			can also be important when defining the inventory.
LCIA	Use emission factors to convert LCI flows into environmental impacts	This phase can be debated as it requires measuring appropriate values. What metrics truly characterize REC? Social-oriented indicators, as mentioned by Bocken and others, and references to the SDGs in the 2030 Agenda could be used.	Considering the social, environmental, and economic sustainability potential of these business models, reflecting impacts across all three categories is vital. However, it is highly challenging to adapt the methodology to include such a comprehensive set of indicators.
Sensitive analysis	Analyze environmental hotspots and test sensitivity of results (e.g., see which factors most affect impact).	Given Hitzar's plans to develop more installations by 2025, this analysis could inform improvements for future projects.	Imagining future scenarios (e.g., battery storage or increased production capacity) is challenging due to external influencing factors, such as market volatility and policy changes.

A key divergence is the temporal variability of energy production in RECs, which depends on daylight hours, requiring adaptations to reflect its impact on financial and material flows. Additionally, while the original framework emphasizes environmental and economic factors, RECs necessitate tailored social impact indicators, such as community engagement and equity. Cost and revenue categories in RECs are also more dynamic, influenced by fluctuating energy prices and the absence of traditional end-of-life processes. Adapting the BM-LCA methodology to include metrics for intermittent energy production and social sustainability could make it more effective for evaluating RECs.

3.3 Definition of best practices and recommendations for the case REC

Applying the BM-LCA methodology to RECs requires balancing their social mission with technical, economic and environmental considerations. While these communities often emphasize social values, it is crucial to integrate technical and financial aspects into their operations in order to become a SBM. At the same time, environmental aspects must not be overlooked, ensuring that social and economic progress does not come at the expense of the enviroment. Furthermore, the participation of diverse stakeholders is vital, as their roles and contributions directly influence the sustainability and scalability of these initiatives. A comprehensive approach addressing these dimensions is essential to maximize the impact and long-term viability of REC.

To effectively use BM-LCA as a tool in the development of RECs, it is essential to address both the strengths and challenges identified during its application. One key challenge is that the data requirements of BM-LCA reveal gaps in the comprehensive understanding of current business models. While business models are often analyzed in fragmented ways, the process of collecting all necessary data highlights the full complexity of cost and revenue structures. First, efforts should be made to improve data collection practices to reduce variability and enhance the accuracy of results. Rather than strict standardization, gaining more experience with BM-LCA and developing guided protocols could provide a more practical approach at this stage.

Additionally, integrating tailored indicators that reflect local priorities, such as water usage in drought-prone regions or social indicators that evaluate community impact, is crucial. The volatility of energy prices and associated costs can complicate financial calculations, so conducting sensitivity analyses and developing future scenarios, including policy changes and technological advancements like battery storage, is recommended. Finally, to maximize the impact of BM-LCA, priority should be given to creating scalable and replicable models that adapt to different contexts, strengthening the role of RECs in the sustainable energy transition.

Even though BM-LCA was not fully applied, its partial use already provided valuable insights into cost structures, revenue streams, and sustainability trade-offs, highlighting its potential as a decision-support tool. Using the outputs of the methodology, a critical analysis has identified areas for improvement to make RECs more sustainable. Key recommendations include simplifying system operations, minimizing the impact of energy price volatility, and refining governance to enhance transparency and participation. These steps aim to improve scalability, adaptability, and resilience in the face of market and operational challenges. Scalability remains a key challenge for RECs, as noted by Mendoza & Ibarra, (2023)who emphasize the role of adaptive strategies to ensure economic and operational viability across diverse contexts.

4.Conclusions

This paper qualitatively analyzed how BM-LCA can be applied in practice to evaluate and improve the sustainability performance of REC's business models, using Hitzar REC as a case study, while identifying methodological challenges and opportunities for further improvement in assessing complex systems. The study demonstrates that BM-LCA is a powerful tool for aligning sustainability objectives with economic feasibility in RECs. The analysis of Hitzar's 65-kW installation highlighted the importance of focusing on a well-defined value proposition, which serves as the foundation for targeted and actionable insights. By integrating material and monetary flows, BM-LCA provides a comprehensive

assessment of the environmental, social, and economic impacts of RECs, helping them achieve sustainable business model transformations.

The traditional BMC (Osterwalder and Pigneur, 2009) was adapted, resulting in an extended version that we have called the SBMC-REC, the integration of this SBMC-REC into the "Goal and Scope" phase of BM-LCA represents methodological advancement. This SBMC is specifically tailored to include sustainability dimensions such as governance and triple bottom line impacts. While this framework has not yet been formally applied or integrated into the BM-LCA methodology, we propose its integration into the first phase, "Goal and Scope: Descriptive Phase," specifically in Step 1, where the business model is defined. By incorporating this framework at this stage, we can enhance the characterization of the business model, ensuring a more comprehensive analysis of its cost and revenue structures, sustainability aspects, and overall impact. This qualitative addition enhances the clarity and structure of the analysis. This explicit connection between the conceptual SBMC-REC and the practical BM-LCA framework represents a key strength of the approach and a valuable contribution for aligning business model design with sustainability assessment. The feedback loop between the SBMC-REC and BM-LCA is particularly valuable, as the outcomes from the BM-LCA process inform adjustments to the SBMC-REC, resulting in improved design and functionality of the business model. This dynamic interplay ensures that both frameworks evolve to better address the specific needs and challenges of RECs.

In the future, the present research will continue expanding the application of BM-LCA to explore and compare different scenarios within RECs. This includes integrating battery storage systems, hybrid energy generation methods (e.g., combining solar and wind), to evaluate their impacts on sustainability and economic performance. Quantitative refinements, supported by the development of sector-specific databases, will enable consistent comparisons across different REC models, Mendoza and Pigosso (2023) highlights that advancing CE strategies requires robust data collection, stakeholder collaboration, and systemic approaches. Additionally, a cradle-to-grave approach will be adopted to assess the lifecycle impacts of infrastructure components, such as solar panels and batteries. Comparative studies with other RECs within the analysed region in Spain, will provide valuable benchmarks and insights into best practices.

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A Conceptual Triple Bottom-Line Framework for Assessing Wind Turbine Blade End-of-Life Business Models and Value Chains

Comparative Analysis of Closed-Loop and Open-Loop Recycling

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Abstract

Approximately 43 million tonnes of wind turbine blade (WTB) waste will accumulate worldwide by 2050, with Europe accounting for about 11 million tonnes. Given this substantial volume, it is crucial to develop and analyse WTB End-of-Life (EoL) value chains to optimize recycling processes and identify bottlenecks that hinder material recovery, economic feasibility, and large-scale implementation. This study presents a conceptual framework for comparing WTB EoL value chains from a triple bottom-line (TBL) perspective. The framework adopts a top-down approach, ensuring that macro-level system-wide insights guide meso-level stakeholder interactions and micro-level process efficiencies. This structured approach enables a comprehensive assessment of how different recycling strategies align with long-term sustainability goals, policy constraints, and economic

feasibility. The framework is applied to conduct a comparative analysis of a Closed-Loop Recycling System (CLRS) and an Open-Loop Recycling System (OLRS) for EoL WTBs. CLRS achieves higher material recovery rates and landfill diversion by reintegrating high-quality fibers into WTB production but requires higher capital investment and energy consumption. OLRS is more accessible, with lower initial costs and energy use, but produces lower-quality materials for secondary markets, limiting long-term circularity. Using stochastic methods, the framework accounts for uncertainty in material composition, market demand, and policy shifts, offering robust comparisons of EoL strategies. The results provide actionable insights for optimizing recycling technologies, improving resource efficiency, and advancing circular economy principles in WTB waste management.

Keywords

WTBs Value Chain, System Dynamics, Agent-based Modelling, Discrete Event Simulation, Multicriteria-decision making, CBM-LCA.

Introduction

As of 2024, wind energy contributes approximately 20% of Europe's electricity generation (EVWind, 2024; WindEurope, 2025). To achieve net-zero greenhouse gas emissions by 2050, projections indicate that wind power's share in Europe's electricity mix must increase to around 50% (WindEurope, 2025). To reach this goal, the EU aims to expand its wind energy capacity from 220 GW in 2024 to 1,300 GW by 2050 (WindEurope, 2024). This rapid expansion has significant implications for sustainability. For example, Liu and Barlow (2017) projects that by 2050, approximately 43 million tonnes of WTB waste will accumulate worldwide, with Europe accounting for 25% of this total, equating to about 11 million tonnes. Beyond this timeframe, specific data is scarce. However, considering the anticipated growth in wind energy installations to meet increasing energy demands and climate goals, it is reasonable to infer that WTB waste will continue to accumulate in the latter half of the 21st century. This substantial volume underscores the urgency for effective recycling strategies within the European context. Without effective recycling strategies, this volume of waste threatens to undermine the environmental benefits of wind energy. This is important because even WTBs could be reused and repurposed, these practices present technical and economic limitations (meaning that these circular strategies are not applicable to all WTBs) and, in any case even if WTBs are reused or repurposed, they will eventually become waste at some point in the future, requiring proper handling. WTBs are primarily made of glass fiber-reinforced polymers (GFRP) and/or carbon fiber-reinforced

polymers (CFRP) designed for durability, strength, and resistance to withstand 20–30 years of operation in harsh environmental conditions (Sandia National Laboratories, 2017).

Recovering materials like GFRP and CFRP from WTBs is vital for multiple reasons, including environmental sustainability. Recycling GFRP and CFRP reduce landfill waste, decreases greenhouse gas emissions associated with virgin material production, and conserves critical resources (Hadigheh, 2022). Beyond the environmental benefits, it addresses critical material supply issues, reduces dependence on limited and energy-intensive resources, and strengthens supply chain resilience (Khalid et al., 2023). Economically, GFRP and CFRP are high-value materials due to their superior properties, such as high strength-to-weight ratios and durability, fostering industrial competitiveness and lowering material costs in sectors like aerospace, automotive, and renewable energy (Revilla-Cuesta et al., 2023). Additionally, material recovery promotes innovation by driving advancements in recycling technologies and supports job creation in the green economy (Maykova, 2022). These combined benefits underscore the strategic importance of developing and investing in blade recycling technologies to meet future global sustainability and industrial needs (Liu & Barlow, 2017).

Current recycling methods for WTBs present trade-offs between cost, energy consumption, and material quality. For instance, while solvolysis - a chemical recycling process that uses solvents to break down composite materials - and pyrolysis - a thermal decomposition process in the absence of oxygen that breaks down composite can recover high-quality fibers, they are energy-intensive and costly (Diez-Cañamero and Mendoza, 2023; Khalid et al., 2023; Mendoza et al., 2022). Conversely, mechanical recycling offers a simpler and more economical option but yields materials with reduced mechanical properties, suitable only for low-performance applications (Mendoza et al., 2022; Khalid et al., 2023). The scalability and regional disparities in recycling infrastructure further exacerbate these challenges, as some countries lack facilities for large-scale blade recycling, increasing transportation costs and logistical complexity (Mdallal et al., 2023; Revilla-Cuesta et al., 2023).

Despite ongoing research on specific recycling technologies, there remains a lack of consensus on the most effective approach. This paper aims to develop a conceptual framework that integrates the perspectives of circularity and sustainability to facilitate a holistic evaluation of WTB recycling methods. The framework seeks to provide a clearer understanding of the trade-offs and long-term viability of different recycling strategies. From a circular economy perspective, it prioritizes material retention, waste reduction, and resource efficiency, promoting higher-value reuse while minimizing landfill dependency. At the same time, sustainability considerations evaluate key factors such as energy consumption, carbon footprint, economic feasibility, and logistical challenges, ensuring the

real-world applicability of each recycling method. By analysing the entire EoL value chain at the macro, meso, and micro levels, this framework will help stakeholders identify bottlenecks, synergies, and opportunities for optimization.

Contribution

Most existing research focuses on isolated aspects, such as the technical feasibility of recycling methods, cost analyses, or environmental life cycle assessments, often neglecting the trade-offs and interdependencies between these dimensions, (see, e.g., Zhang and Kirumira, 2024; Sproul et al., 2023; Chickka et al., 2022).

Among existing studies, Hanes et al. (2021) offer the most relevant framework for our work, integrating Life Cycle Assessment (LCA), Economic Input-Output (EIO) modelling, and System Dynamics (SD) modelling to assess circularity transitions. Their CELAVI framework closely aligns with our objectives by identifying trade-offs in environmental and economic impacts, making it the closest approach in terms of methodology and analytical scope. However, unlike CELAVI, which primarily models circularity transitions, our framework takes a more holistic, decision-support approach to evaluating WTB recycling strategies. It integrates technical feasibility, economic trade-offs, and policy implications while explicitly addressing interdependencies across macro, meso, and micro levels for a more practical and actionable assessment. This approach provides stakeholders with strategic insights that extend beyond impact quantification, facilitating informed decision-making. Furthermore, by bridging the gap between theoretical modelling and real-world implementation, our framework enhances scalability and adaptability across diverse industrial contexts, making it a versatile tool for circular economy planning.

Related Literature

The strand of literature relevant to this analysis focuses on modelling and simulation methods used to evaluate the sustainability and circularity of EoL recycling scenarios for WTBs. It also encompasses related fields, including renewable energy systems, waste management, circular economy modelling, and sustainable supply chain.

Among the methods, Agent-Based Modelling (ABM), Discrete Event Simulation (DES) and System Dynamics Approach (SDA) are the most applied (Moon, 2016). For instance, Walzberg et al., (2023) applied ABM to study the techno-economic and social conditions promoting circularity and sustainability of WTBs for two strategies; lifetime extension and recycling, indicating that high costs and logistic issues prevent WTBs from being recycled in greater quantities. Along these lines, Lange et al., (2021) present a systematic iterative method to explore and improve CBMs prior to actual implementation by means of agent-

based modelling and simulation. In the field of renewable energy systems, several authors have utilized SD modelling to assess the sustainability of supply chains, evaluating the environmental and economic trade-offs involved, (see. e.g., Saavedra et al., 2018, Vimmerstedt et al., 2014). DES is increasingly used in waste management to model scenarios like landfilling, recycling, and incineration while optimizing collection and disposal strategies (Oliveira et al., 2020). It also supports green supply chains by integrating reverse logistics and material recycling, enhancing circular economy processes, and improving efficiency through better resource allocation, processing capacities, and logistical management (Mutingi et al., 2013).

Other approaches, such as Circular Business Model Life Cycle Assessment (CBM-LCA), integrate business model innovation with environmental impact assessment by using LCA to quantify sustainability performance at the business model level (see, e.g., Goffetti et al., 2022; Böckin et al., 2022; Mukoro et al., 2022).

This article is organized as follows: the Methodology section introduces the conceptual framework, methods, and simulations used, as well as the interdependencies at the macro, meso, and micro levels. The Discussion section compares two case studies: CLRS and OLRS, using the principles outlined in the methodology section, including an analysis of sustainability trade-offs. And finally, a conclusion is provided.

Framework Design and Development

Conceptual framework

This study proposes a conceptual framework to assess WTBs EoL value chains from a triple bottom-line perspective using a macro, meso, and micro approach. The methodology integrates SD for macro-level trend analysis, ABM for meso-level stakeholder interactions, and DES for micro-level operational efficiencies. Additionally, a CBM-LCA is incorporated to define the core elements of each business model, specifically the value proposition, value creation, and value capture, providing a structured foundation for assessment. Multi-Criteria Decision-Making (MCDM) is applied to rank different recycling strategies. As depicted in Figure 1, the interaction in the framework follows a top-down approach: while the CBM sets out the business model's objectives, the simulation methods shape and test how value is delivered, captured, and sustained within complex, real-world systems, ensuring that decisions at the micro and meso levels are aligned with long-term system-wide sustainability objectives. The forthcoming sections introduce the interactions between each level, the methodologies that contribute to each perspective, and the decision-making process to rank the value chains.

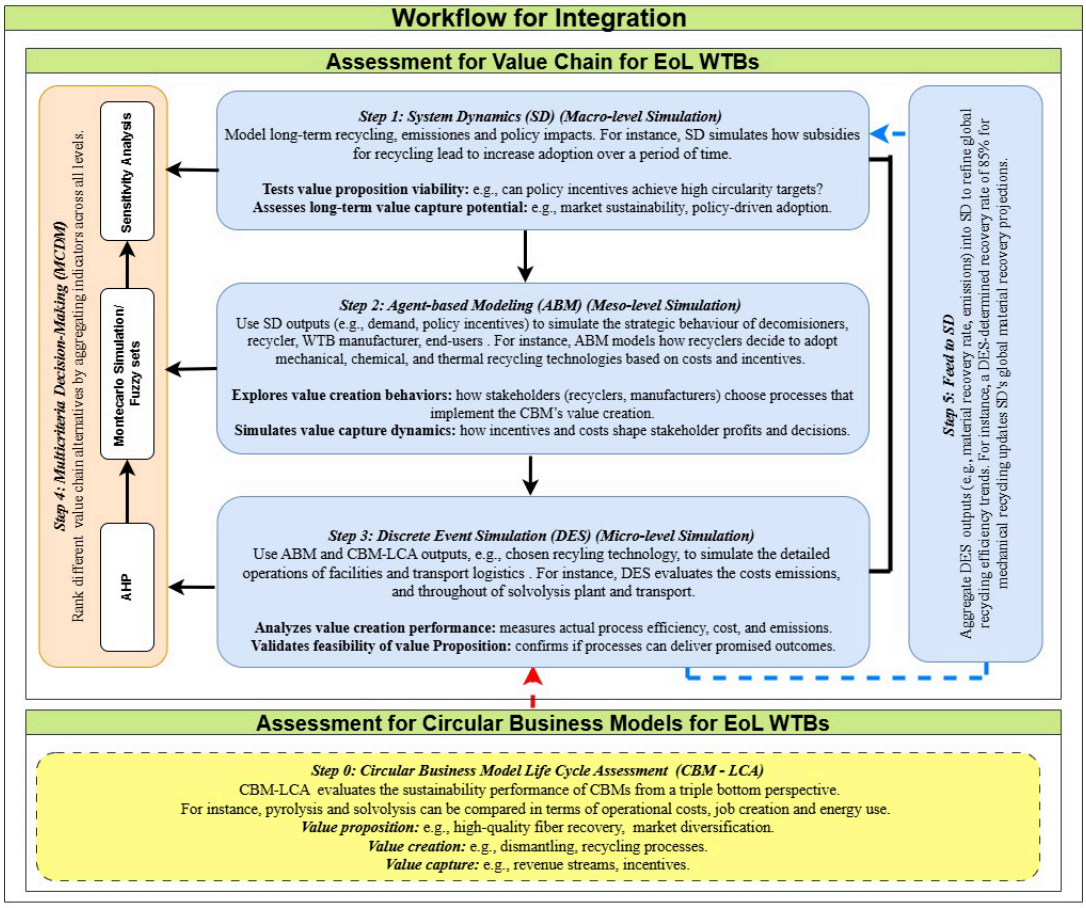


Figure 1 Workflow showing how value proposition, value creation, and value capture are integrated and tested through three simulation methods and the decision-making tool at macro, meso, and micro levels.

Interactions between macro, meso and micro levels

Macro level ⟶ Meso level

The macro-level defines the boundary conditions and constraints for the meso level. For example, projected system-wide material recovery rates at the macro level influence the decisions of recyclers and manufacturers (meso level) regarding investment in recycling technologies.

Meso level ⟶ Micro level

The meso-level captures how stakeholders (e.g., recyclers, manufacturers) interact with policies and market conditions. These insights inform micro-level process simulations. For instance, decisions by recyclers to adopt specific technologies at the meso level dictate dismantling efficiency and recycling throughput at the micro level.

Macro level ⟶ Micro level

Macro-level trends, such as increasing WTBs waste or shifts in demand for recycled materials, directly influence process-level dynamics. For example, projected growth in WTBs waste at the macro level leads to variations in transportation costs and material processing rates at the micro level, affecting operational efficiencies.

Micro level ⟶ Meso and Macro level (Feedback Mechanisms)

The micro-level provides granular insights into process-level efficiencies, emissions, and costs. These micro-level findings aggregate into meso- and macro-level analyses, refining system-wide sustainability assessments. For example, detailed emissions data at the micro level update macro-level emissions projections, ensuring more accurate long-term policy evaluations.

Integration into the decision-making process

All three methodological levels feed into decision-making process, which ranks and compares EoL value chains from a triple bottom perspective.

Simulation Methods

System Dynamics (SD) (Step 1, Figure 1) provides a simulation framework for modelling recycling networks and policy evaluation (Berenjkar et al., 2021; Georgiadis, 2013). It consists of

- Material Network: Stocks and flows of products, waste, and recycled materials.
- Information Network: Data flow among stakeholders (e.g., WTB manufacturers, recyclers, decommissioners).

These networks interact via decision rules controlling material flows (Georgiadis, 2013). At the macro level, SD assesses long-term trends and system-wide effects, such as overall material recovery rates and emissions.

Agent-based Modelling (ABM) (**Step 2, Figure 1)** explores interactions between environment, agents (e.g., manufacturers, recyclers, regulators), and technologies (Lange et al., 2021). It models:

- Individual actor behaviors (e.g., recyclers optimizing costs, policymakers enforcing regulations).
- Stakeholder interactions influencing recycling decisions, market dynamics, and policy compliance (Bonabeau, 2001).

At the meso level, ABM focuses on stakeholder behaviors, regional variations, and market dynamics, determining how different actors, such as recyclers and manufacturers, respond to policy changes and economic incentives.

Discrete Event Simulation (DES) (Step 3, Figure 1) simulates dismantling, transportation, and processing at the micro-level, capturing variability in blade condition and material composition (Banks, 2005; Robinson, 1994). At the micro level, DES enables bottleneck identification and resource optimization as well as value chain mapping and CBM strategy assessment.

Circular Business Model Life Cycle Assessment (CBM-LCA) (Step 0, Figure 1)
CBM-LCA provides critical insights into the environmental, economic, and social trade-offs of various CBMs (e.g., solvolysis, pyrolysis, mechanical recycling). According to Goffetti et al., 2022, Böckin et al., 2022 and Mukoro et al., 2022, in the CBM-LCA,

- the CBMs are taken as the object of analysis, and their economic performance is taken as the basis of comparison, since the purpose of a CBM is to make money
- In LCA terms, this means using an economic indicator as a functional unit (the unit of comparison in LCA), such as profit or rate of return, instead of product functionality as in conventional LCA.

Decision-making process

Multicriteria-decision making (MCDM) (Step 4, Figure 1) ranks alternative EoL strategies by integrating macro, meso, and micro-level sustainability indicators. Based on Nieto-Cerezo and Mendoza (2025) and Kara and Işik (2022), it involves:

- Analytical Hierarchy Process (AHP) for decision structuring.
- Fuzzy Logic or Monte Carlo simulations to handle uncertainties.
- Sensitivity Analysis to test ranking robustness and identify key influencing factors.

The key sustainability indicators for evaluating WTB EoL value chains, as proposed by Deeney et al. (2021) and Mishnaevsky (2021), are defined below.

Environmental:

- Material recovery rates (MRR)

$$MRR\% = \frac{Recovered\ Material\ Mass}{Total\ Decommisioned\ Blade\ Mass} x\ 100$$

- Landfill diversion rates (LDR)

$$LDR\% = \frac{Landfill\ Diverted\ Mass}{Total\ Decommisioned\ Blade\ Mass} x\ 100$$

- Green House Gases (GHG) Emissions.

$$SWE\ (Kg\ CO_{2e}) = \sum(Emissions\ recycling + transport + Process) - Emissions\ avoided$$

Economic:

- Cost Per Unit of Recovered Material (CPRM)

$$CPRM(€/Ton) = \frac{Total\ Recycling\ Cost}{Mass\ of\ Recover\ Material}$$

- Revenue from Recovered Materials (RRM)

$$RRM(€) = Mass\ of\ Recovered\ Material \cdot\ Market\ Price\ per\ Ton$$

- Long-Term Cost Trends (LTCT)

$$LTCT(€) = CAPEX\ in\ Recycling\ Infrastructure + OPEX\ over\ time$$

Social:

- Job creation potential

$$JCP(Jobs) = Recycling\ Jobs\ per\ Ton \cdot Total\ Blade\ Mass\ Recycled$$

- Infrastructure equity.

$$IE(\%) = \frac{Regions\ with\ Recycling\ Facilities}{Total\ Regions\ with\ WTB\ Waste} x100$$

- Worker Safety Index (WSI)

$$WSI(\%) = \frac{Total\ Recycling\ Hours\ Worked}{Number\ of\ Incidents\ Reported} x100$$

Table 1 provides an explanation of how these indicators apply at the macro, meso, and micro levels. At the macro level, these indicators are analyzed from a system-wide perspective to assess long-term trends, policy impacts, and overall sustainability performance. At the meso level, they are evaluated based on stakeholder interactions and

decision-making dynamics, while at the micro level, they are assessed through process-level efficiencies and operational parameters

Table 1 Sustainable indicators evaluated at the macro, meso and micro level.

Indicator	***Macro-level (System-Wide trends - SD)***	***Meso-level (Stakeholder Interactions - ABM)***	***Micro-level (Process-Specific - DES)***
Material recovery rates (MRR%)	Total MRR at the system level	MRR per recycler, region, or technology	MRR at the process level (e.g., dismantling efficiency)
Landfill Diversion Rate (LDR%)	Overall landfill diversion from WTB waste	LDR by recycler, region, or policy	LDR per processing method (e.g., shredding efficiency)
System-Wide Emissions (SWE, kg CO_2e)	Total emissions from recycling, transport, and processing	Emissions from different stakeholders (e.g., recyclers, transporters)	Emissions per process (e.g., per ton of material processed)
Cost Per Unit of Recovered Material (CPRM, €/Ton)	Industry-wide average recycling costs	Cost per recycler, region, or technology choice	Process-specific cost per ton recovered
Revenue from Recovered Materials (RRM, €)	Total revenue from recycled WTB materials	Revenue per recycler, technology, or market condition	Revenue per ton recovered at a specific facility
Long-Term Cost Trends (LTCT, €)	Overall CAPEX and OPEX trends across the industry	Cost trends for recyclers, policy incentives, and market shifts	Cost reduction from specific process improvements
Job Creation Potential (JCP, Jobs)	Total jobs created across the industry	Jobs per region, stakeholder, or activity type	Jobs created per specific activity (e.g., dismantling, transportation)
Infrastructure Equity (IE, %)	Percentage of regions with recycling infrastructure	Availability of recycling plants by location	Accessibility and logistics of specific facilities
Worker Safety Index (WSI, %)	Industry-wide safety performance	Safety compliance at company or regional levels	Incident rates per process stage

Discussion

This section intuitively and qualitatively presents the application of the methodological framework to two case studies representing distinct value chains for WTB EoL management. The analysis is structured into two parts. First, a contextual explanation provides the background and assumptions for the Closed-Loop and Open-Loop systems. Second, a discussion of the sustainability trade-offs between the two systems enables us to compare their performance.

Case Study Overview

A WTB EoL Recycling value chain represents the series of interconnected steps, processes, and stakeholders involved in handling, processing, and transforming WTBs that have reached the end of their operational life into usable materials or products, as outlined in Figure 1. It encompasses all activities from decommissioning blades at wind farms to the final use of recycled materials.

The EoL process initiates with the WTBs manufacturer selling WTBs made of virgin or recycled materials to the WT owner/operator under the Extended Producer Responsibility (EPR) mechanism. EPR is an environmental policy framework that assigns producers the responsibility for the entire lifecycle of their products, especially the take-back, recycling, and final disposal stages. By extending a producer's responsibility beyond the point of sale, EPR encourages product designs that are environmentally friendly and promotes the reuse and recycling of materials to minimize waste (Agamuthu, 2010). To satisfy EPR obligations, the WTB manufacturer contracts a recycler to process decommissioned WTBs at the end of their lifecycle, thereby preventing landfilling. Building on Walls, (2005) work on how local governments structure contracts with private firms in solid waste and recycling, the contractual relationship between manufacturers and recyclers can take various forms. For instance, it may involve a fixed payment supplemented by incentives tied to the recycling rate, particularly when recovered GFRP and CFRP are used to manufacture new WTBs from recycled materials. Alternatively, a revenue-sharing arrangement can be established when recycled products are sold to third-party end-users, such as the automobile or construction industries. Potentially, the contract may specify whether the recycler provides "Decommissioning as a Service" (DAS). Under DAS, the recycler offers a comprehensive turnkey solution, managing all aspects of decommissioning, including dismantling, transportation, and recycling of WTBs. This model ensures seamless integration of decommissioning and recycling operations, potentially reducing costs and improving efficiency. Alternatively, the recycler might outsource specific tasks to a separate decommissioner, who specializes in dismantling and logistics. This approach can introduce more complexity in coordination but allows leveraging the expertise of a specialized decommissioning service provider (Sakellariou, 2018). Following this approach, the WT owner/operator sells the blades to the decommissioner.

The decommissioner is then responsible for dismantling and sectioning the WTBs into smaller, transportable sections, preparing them for transport and recycling. This process involves tools such as jaw cutters, diamond saws, handheld saws, water jet cutters, and wire cutters (Fayyaz at al., 2023). The sectioning can be performed either at the decommissioning site or at dedicated decommissioning premises, depending on logistical

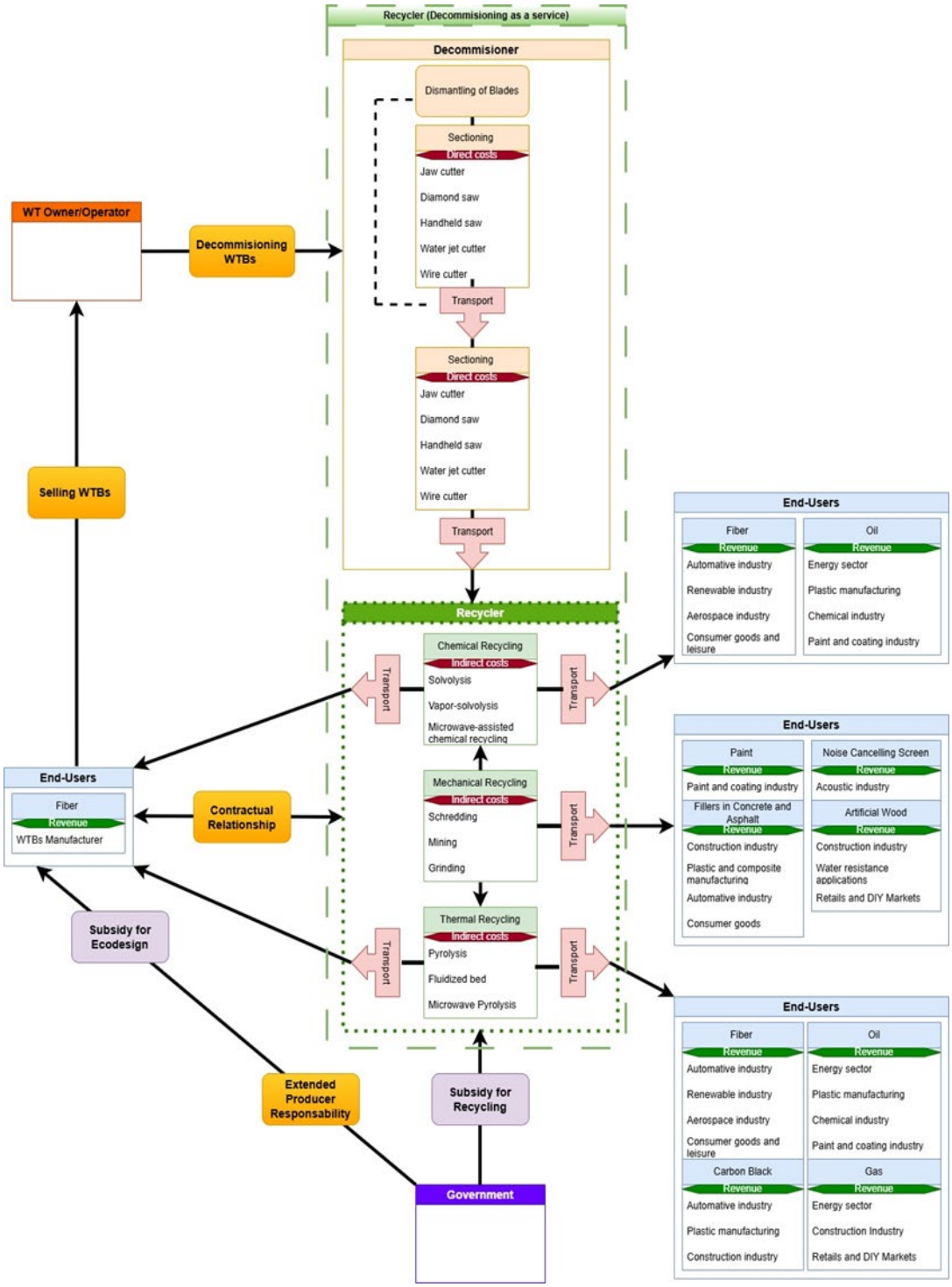


Figure 2 Value chain configurations for the EoL recycling of WTBs

and operational considerations. Sectioning incurs direct costs that are determined by the tool used and the complexity of the task and indirect cost including labour, logistics, and safety measures.

The recycler processes the dismantled and sectioned blade materials using various recycling technologies to recover valuable components or convert them into usable materials. For instance, according to Fayyaz at al., 2023 chemical recycling allows to obtain high-value materials like fibers and oils through processes such as solvolysis, vapor-solvolysis, microwave-assisted chemical recycling allows to obtain high-value materials like fibers and oils. Thermal recycling processes like pyrolysis, fluidized bed, microwave pyrolysis, enables recovering products such as carbon black, oils and gases. And finally, mechanical recycling allows us to obtain recycled fillers for concrete, composites and other industrial applications. It is important to note that indirect costs are noted for all recycling methods, influenced by factors like energy consumption, technology, and transportation.

End-users repurpose recycled materials from WTBs into new products across various industries, generating revenue by transforming them into value-added applications.

The government plays a crucial role in facilitating the value chain through policy, financial support, and regulatory oversight. It may provide subsidies to WTB manufacturers to encourage eco-design, supporting the development of recyclable WTBs while maintaining the mechanical properties of recycled materials (Yu et al., 2021). Additionally, the government can subsidize recycling efforts to finance recycling facilities and research aimed at making recycling processes more cost-effective (Yu et al., 2021). By holding WTB manufacturers accountable for the full lifecycle of their products, the government incentivizes sustainable design and recycling practices through the EPR initiative.

As aforementioned, Figure 2 illustrates the possible configurations for WTB EoL recycling, highlighting the pathways leading to CLRS and OLRS. This diagram serves as the basis for analysing the two case studies.

Closed Loop Recycling System (CLRS)

In CLRS, the *value proposition* focuses on recovering high-quality fibers from EoL blades to manufacture new ones, thereby ensuring material circularity, superior mechanical performance, and compliance with Extended Producer Responsibility (EPR) obligations.

Value creation is achieved through a series of advanced and highly specialized processes. The dismantling phase employs precision tools such as diamond saws, which, despite their energy-intensive operation due to high rotational speeds and cooling system demands,

offer highly accurate sectioning with minimal damage to the composite materials (Huang and Xu, 2011). Following sectioning, the blades are subjected to pyrolysis, a controlled thermal decomposition method that efficiently breaks down the resin matrix while preserving the structural integrity of carbon and glass fibers. Studies such as Smoleń et al. (2022) demonstrate that fibers recovered through pyrolysis can retain up to 80% of their original tensile strength, making them suitable for reuse in new blade manufacturing. Although pyrolysis is an energy-demanding process requiring high temperatures (Chen et al., 2014), the environmental impact can be significantly mitigated when powered by renewable energy sources (Gracida-Alvarez et al., 2023). Additionally, recyclers streamline operations by offering turnkey dismantling, aggregation, and supply (DAS) services, facilitating material recovery and reintegration for manufacturers with minimal logistical burden.

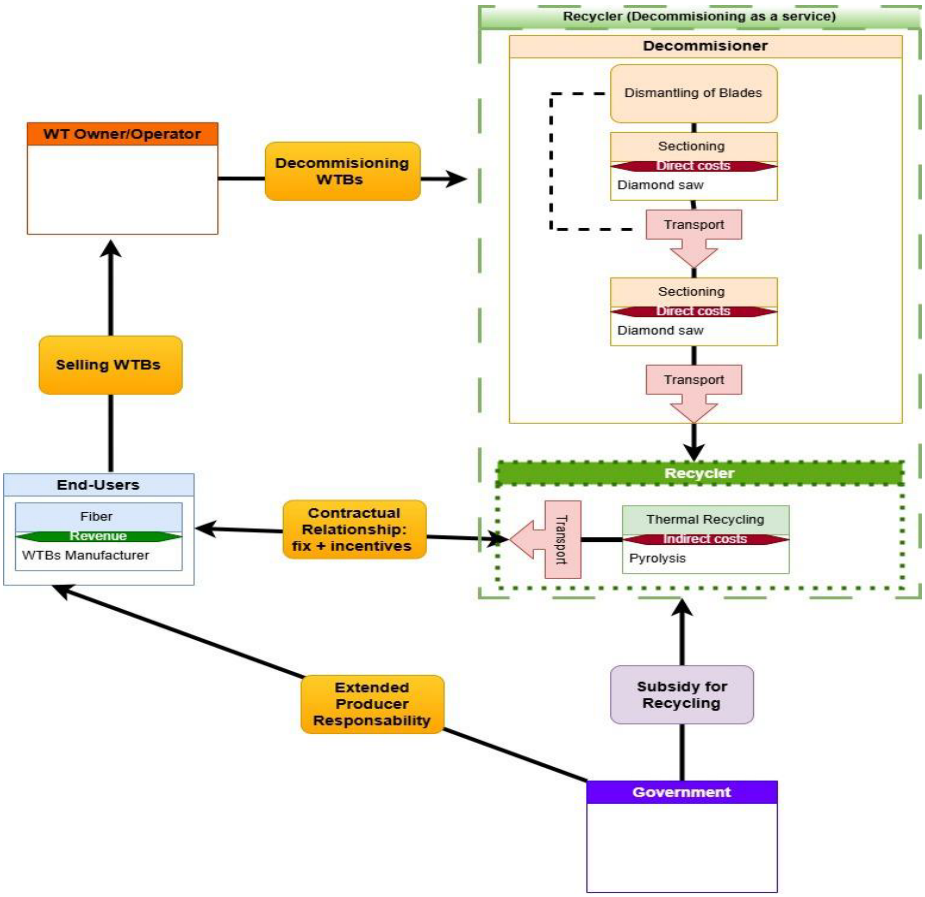


Figure 3 CLRS for the EoL management of WTBs.

Value capture is realized through multiple complementary mechanisms. Recyclers sell high-value, high-performance recycled fibers back to wind turbine manufacturers, providing a steady and premium revenue stream. For manufacturers, these recycled fibers help reduce

reliance on virgin materials, leading to substantial cost savings while supporting environmental targets. The contractual model typically involves a fixed fee covering essential recycling services such as collection, transportation, dismantling, and pyrolysis, ensuring financial stability for recyclers. Government subsidies targeted at enhancing recycling rates further bolster the economics of the system, compensating for the substantial energy costs associated with high-end recycling technologies.

Open Loop Recycling System (OLRS)

In OLRS, value *proposition* is focused on extending the lifespan of composite materials by redirecting recovered resources from EoL blades into external markets. This model reduces landfill disposal and generates a broad portfolio of recycled outputs, such as fillers, reinforcement materials, and composite substitutes, that are well-suited to industries with lower mechanical requirements such as construction, automotive, acoustics, and consumer goods.

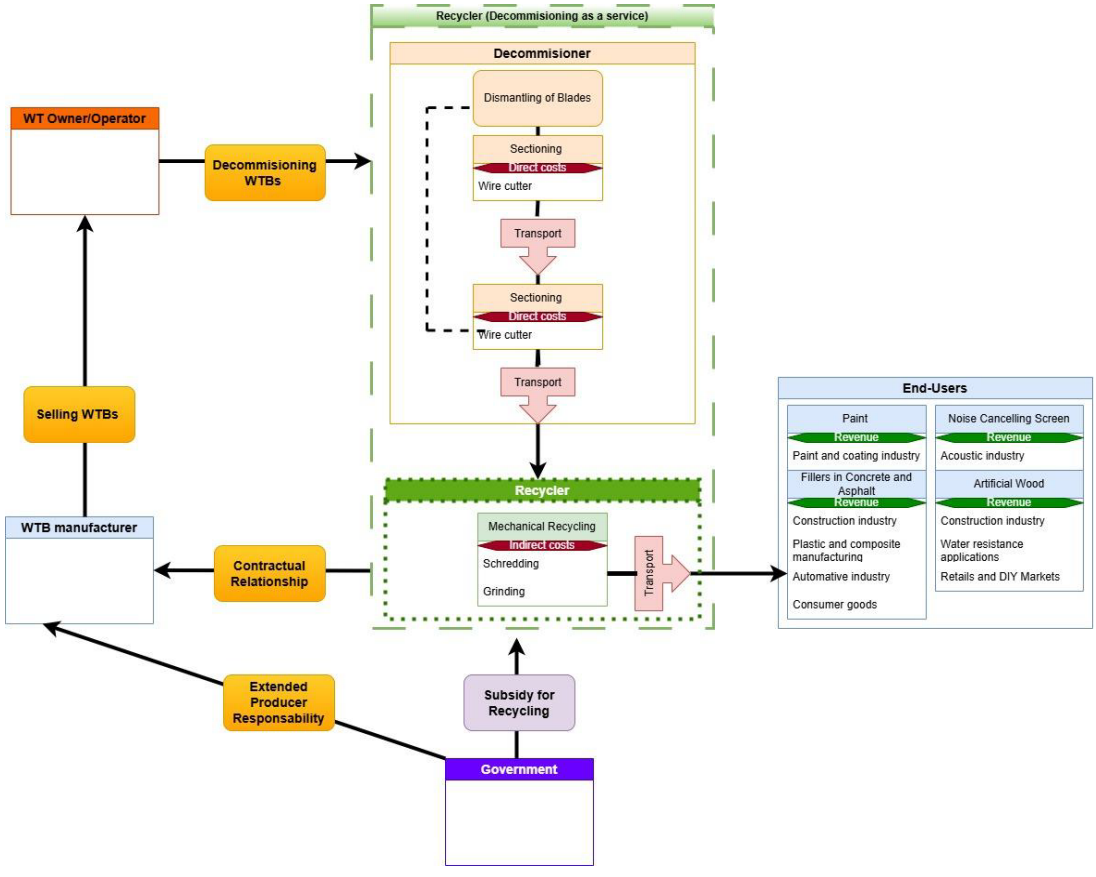


Figure 4 OLRS for the EoL management of WTBs.

This diversification of end uses allows the system to distribute environmental benefits across multiple value chains while also contributing to Extended Producer Responsibility (EPR) compliance through the diversion of waste from landfills.

Value creation is achieved using relatively inexpensive and scalable mechanical recycling method. The process begins with dismantling the blades using wire cutters, which has operational flexibility and require lower initial energy compared to high-precision tools like diamond saws. As Seeholzer et al. (2023) explain, wire cutting utilizes tensioned wires coated with abrasive materials, such as diamond granules, to slice through the dense composite materials of WTBs. Although this method is less precise than sawing and entails variable energy consumption depending on operational parameters, such as wire speed, tension, and material density, it remains efficient for large-scale processing. Moreover, the use of wire cutters often necessitates auxiliary cooling systems to dissipate heat, adding to operational costs, as noted by Fatima & Syed (2020). Following sectioning, the blades undergo mechanical recycling through shredding and grinding. These steps break down the materials into progressively smaller fragments and powders, yielding recyclable outputs such as fillers. While these processes are more energy-efficient and cost-effective than advanced alternatives like pyrolysis (Sorte et al., 2023), they frequently result in degraded fibre quality, thereby limiting the application of recovered materials to lower-value uses.

Nonetheless, the breadth of potential markets, ranging from concrete and asphalt fillers to acoustic panels and plastic reinforcements, broadens the avenues for material reintegration, providing value across sectors with high-volume material demands.

Value capture is structured around a revenue-sharing model that aligns the financial interests of manufacturers and recyclers. In this arrangement, the recycler assumes the responsibility and financial burden of collection, processing, and marketing of the recycled outputs, while the manufacturer avoids upfront payments and benefits from shared returns. Recyclers generate revenue by selling recovered materials to external industries, and a portion of this income is distributed to the manufacturer, thus fulfilling EPR obligations in a cost-effective way. This model encourages recyclers to maximize both the quantity and quality of material recovery, although it inherently transfers market risk to the recycler. If demand for recycled fillers and fibers is strong, such as in the construction and automotive sectors, the recycler can realize substantial profits and share significant returns with the manufacturer. Conversely, weak market conditions or lower-quality outputs may threaten financial viability. According to Fonte & Xydis (2021), case studies in Europe have demonstrated that revenue-sharing agreements can successfully recover 20–30% of total recycling costs through sales of recycled fillers used in asphalt and concrete applications. This flexible and performance-linked revenue model makes open-loop recycling financially

feasible and adaptable, particularly in economies with established markets for secondary composite materials.

Sustainability trade-offs

Table 2 summarizes how the indicators perform under both systems, highlighting the trade-offs and benefits of each approach. To enhance clarity, we distinguish between indicators using colour coding: green highlights indicators that perform better under one system, while red indicates those that perform worse.

Closed-loop systems excel in achieving higher material recovery rates and landfill diversion by reintegrating high-quality fibers and resins into high-value applications, such as new blades. This approach aligns strongly with circular economy principles, delivering significant environmental benefits, including reduced emissions and avoided reliance on virgin materials. Economically, closed-loop systems offer high revenue potential from premium recycled materials and promise lower costs over time through economies of scale. However, they face barriers such as high initial capital investment, significant energy consumption, and uncertainty due to the lower Technology Readiness Levels (TRL) of advanced methods like pyrolysis.

In contrast, *open-loop systems*, characterized by simpler processes like mechanical recycling and wire cutting, are more accessible due to lower upfront costs and operational complexity. They generate lower emissions and energy consumption per unit in the short term but recover materials of lower quality, limiting their reuse to low-value applications like construction fillers. Open-loop systems are a cost-effective solution in regions with constrained resources, but their scalability and long-term economic viability may be hindered by market saturation for low-value recycled materials.

The dynamic nature of these systems highlights how performance evolves over time. Closed-loop systems can become more efficient as technologies mature, while open-loop systems may struggle to meet increasing blade volumes. Additionally, both systems face intrinsic uncertainty, particularly related to market demand for recycled materials, policy changes, and evolving technological efficiencies.

Ultimately, the choice depends on contextual factors such as regulatory frameworks, regional infrastructure, and financial resources. While closed-loop systems hold promise for long-term sustainability, open-loop systems offer a viable stepping stone for regions and stakeholders seeking more immediate, resource-constrained solutions.

Table 2 Sustainability trade-offs for both systems under each criteria.

Aspect	Criteria/Indicators	Closed-loop system	Open-loop system
Environmental	*Material Recovery Rate*	High-quality fibers and resins recovered can be reintegrated into high-value applications.	Lower, limited to downcycled materials.
	Landfill Diversion Rate	Higher, minimal residual waste.	Moderate, some waste still landfilled.
	Emissions	Lower due to advanced processes, high avoided emissions and recycled locally,	Higher due to inefficiencies, low avoided emissions and longer transportation distances to disposal facilities.
	Energy Consumption	Higher due to energy-intensive pyrolysis and precision cutting with diamond saws.	Lower, as mechanical recycling and wire cutting are less energy intensive.
Economic	*Cost Per Unit of Recovered Material*	Higher due to advanced technologies.	Lower due to simpler processes.
	Revenue from Recovered Materials	Higher, driven by high-value outputs.	Lower, limited to low-value markets.
	Long-Term Cost Trends	Lower costs due to economies of scale.	Higher operational costs over time.
	Capital Investment	Higher due to advanced technologies like pyrolysis and diamond saw equipment.	Lower, as mechanical recycling and wire cutting require simpler machinery.
Social	*Job Creation Potential*	Higher, requiring skilled labor.	Moderate, limited to simpler processes.
	Infrastructure Equity	Improved with decentralized facilities.	Limited, centralized facilities dominate.
	Worker Safety	Higher, stringent safety measures in advanced facilities. Potentially higher risks from complex recycling operations, requiring better safety protocols.	Moderate, less advanced safety standards. Lower safety risks due to simpler processes but less oversight.
	Training requirements	High, as workers need specialized training to operate pyrolysis equipment and diamond saws.	Moderate, as mechanical shredders and wire cutters are simpler to operate
	Community impact	Potentially higher local economic benefits if decentralized, advanced facilities are established.	Less localized economic impact due to centralized, lower-value recycling operations.

Conclusion

The proposed conceptual framework provides a comprehensive approach for comparing and evaluating EoL WTB value chains by integrating analyses at the macro, meso, and micro levels.

A key advantage of this framework is its ability to support evidence-based policymaking by providing a structured approach to evaluate trade-offs between economic feasibility, environmental impact, and social outcomes. Policymakers can use this tool to assess long-term sustainability impacts of different EoL strategies, identify bottlenecks and opportunities in WTB recycling infrastructure, develop targeted policies and incentives to promote circular economy principles in wind energy and ensure alignment with climate and waste management goals, guiding investment in sustainable technologies.

When evaluating EoL WTB value chains, risks related to material recovery processes, the lack of standardized blade dismantling methods, and uncertainties in infrastructure availability further complicate the assessment. This framework enhances decision-making by incorporating uncertainty analysis through Fuzzy/Stochastic AHP and sensitivity analysis, enabling it to account for variability in critical parameters and support robust scenario evaluation.

To enhance the sustainability of EoL WTB management, future research should focus on economic and policy instruments, including the role of public-private partnerships (PPPs) in scaling up recycling infrastructure and logistics networks. Furthermore, the comparative CBM LCA of emerging recycling technologies, such as chemical recycling, solvolysis, and bio-based alternatives, will need to be further developed to ensure its seamless integration into the overall framework. Once integrated, we can assess their performance both independently and as part of the broader value chain system.

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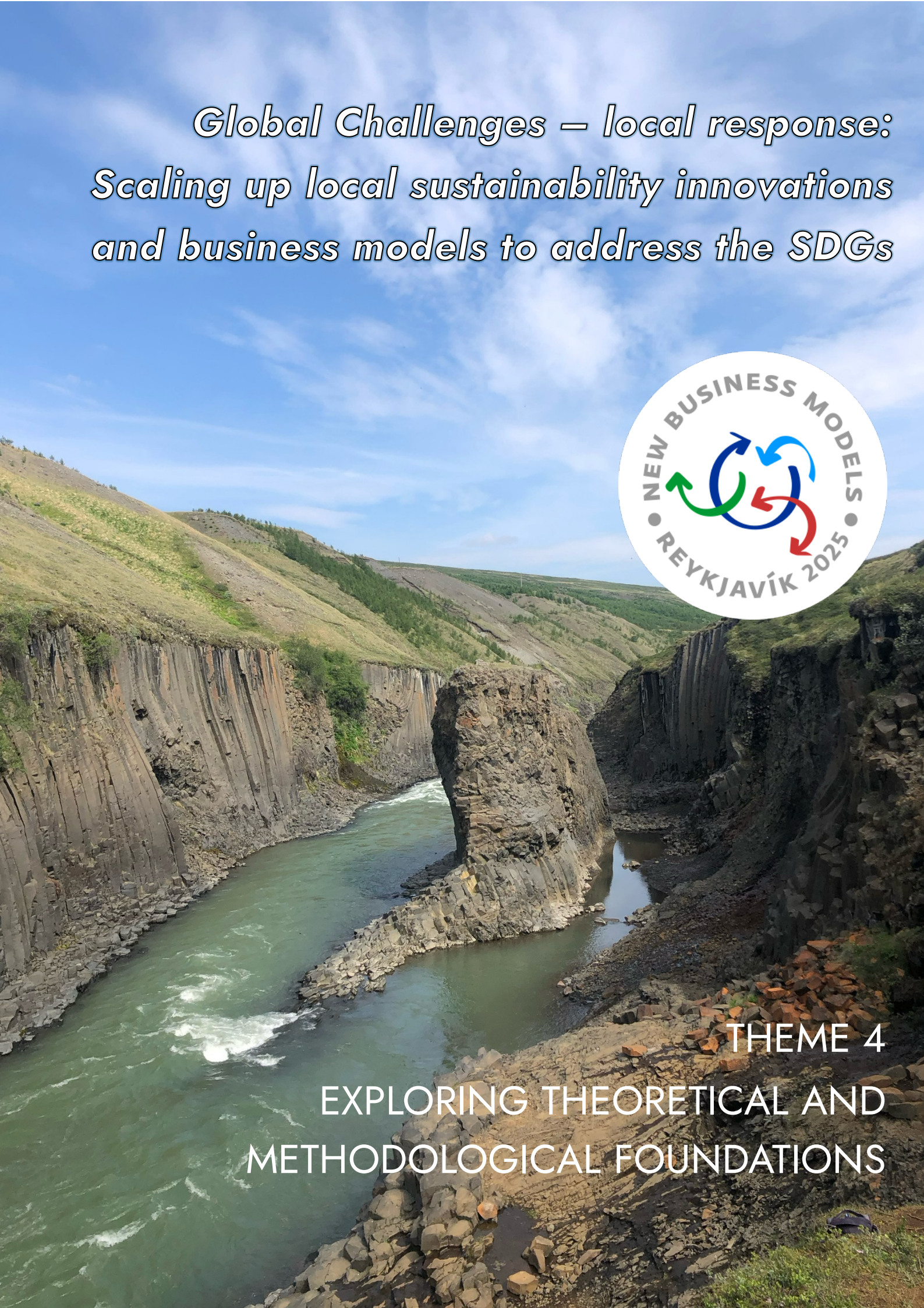
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Global Challenges – local response: Scaling up local sustainability innovations and business models to address the SDGs



THEME 4

EXPLORING THEORETICAL AND METHODOLOGICAL FOUNDATIONS

EXPLORING THEORETICAL AND METHODOLOGICAL FOUNDATIONS

Rethinking Business Models for Sustainability

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Extended abstract

All businesses make various impacts, regardless of the form or type, and whether the impacts are intentional or unintentional, or good or bad. Nonetheless, business models for sustainability (BMfS) are distinguished to have extra goals or missions of social/environmental impact *in addition to* profit, *unlike* the conventional counterparts that focus solely on profit (*italics* added for emphasis; Dembek & et al., 2023; Preghenella & Battistella, 2021). This approach, while intuitively appealing given the widely practiced shareholder primacy norm around the world (Hansmann & Kraakman, 2000), poses critical challenges to achieving the ultimate goal of BMfS, which is, for all businesses to partake in making the world more long-lasting in regenerative conditions. Those challenges are:

Firstly, the concept of stakeholders beyond shareholders that BMfS are supposed to incorporate, is ambiguous and inconsistent (Bainbridge, 2021; Bebchuk & Tallarita, 2020; Miller, 2022). In the U.S., stakeholder groups stipulated in the constituency statutes of the 35 U.S. states vary widely (e.g., employees, customers, suppliers, and/or creditors, etc.). In the Europe's Corporate Sustainability Reporting Directive (CSRD), stakeholders are broadly categorised as "affected stakeholders" and "users of sustainability statements" and each company is tasked to select some of them, based on their perceived materiality to the company (The European Union, 2023). This obscurity impedes clear measurement, enforcement, and accountability about sustainability, which can propagate green/social/purpose-washing and increased insulation for management decision-making (Bebchuk & Tallarita, 2020) which is also destined to be political in nature (Miller, 2022).

Secondly, empirical evidence supporting the rhetoric of BMfS is limited, despite its increasing popularity. For example, no evidence of action for the highly touted 2019 'Business Roundtable Statement' signed by 183 CEOs of the largest U.S. corporations (Business Roundtable, 2019) has been found about prioritising the interests of stakeholders other than those of shareholders (Bainbridge, 2021; Bebchuk & Tallarita, 2020). Latest

outcomes also unveiled regression in the global CO2 emission reductions (The International Energy Agency, 2024) and declining progress for 83% of Sustainable Development Goals (SDGs) (The United Nations, 2024).

Thirdly, the role of profit in BMfS remains mainly negative and is often perceived as basically distinct from sustainability, although the concept of 'business case for sustainability' (Schaltegger & Wagner, 2006) upon which BMfS was developed, had been intended to reconcile the persistent conceptual separation between sustainability and profit. While profit is essential for any business to survive, thrive, grow and scale positive impact, it has negative connotations when it comes to business and sustainability. This is reflected in the concept of 'mission drift' which denotes the situation where a business focusses on profit *instead of or more than* on social/environmental mission (e.g., *italics* added for emphasis; Ebrahim, Battilana, & Mair, 2014). Profit is also perceived to be *opposite to* social/environmental mission, having the characteristics conflicting with the latter, as reflected in the concept of '*tensions* between social and commercial activities' (e.g., *italics* added for emphasis; Battilana & Lee, 2014). This is unfortunate irony, because the lack of financial self-sustainability is one of the major struggles for the companies that strive for social/environmental impact, such as TOMS Shoes (Hessekiel, 2021) and Renewcell (Hatch & Friedman, 2024). The discussion on financials in BMfS is particularly timely because the EU's CSRD requires 'double materiality' whereby companies are to report on their impact on society and environment as well as the financial implications of sustainability issues on the company (The European Commission, 2019).

This study aims to explore the second and third challenges, utilising two theoretical lenses. The second challenge about the lack of action on sustainability is explored through credible commitment theory (North, 1993) to explain how businesses can genuinely commit to making profit-generating activities enable meaningful social and environmental impact. To address the third challenge about the negative status of profit and to move away from the dichotomous conceptualisation about business and sustainability, two-factor theory (Herzberg, 1968) is applied to argue that profit is a fundamental necessity to all businesses and is a dimension in BMfS that is different from, not contrary to, social/environmental impact. This repositioning of profit can help reconcile the perceived clashing duality of profit versus social/environmental mission that constrains the existing theories and models. Furthermore, it can facilitate embedding financial accountability into BMfS, enabling business accountability to become more comprehensive.

By examining the overlooked challenges of BMfS and business and sustainability in general through two theoretical lenses, this conceptual study seeks to contribute to the growing body of research on BMfS. This exploration can foster the development of more innovative logics, paradigms, frameworks, and theories, leading to truly novel and impactful BMfS toward a better world. In this sense, this study will be suitable for the session, 4.1 New

Theoretical Foundations of Business Models for Sustainability, and for the overall conference theme, as part of the continued effort to develop the business models that are better and new for the world.

Keywords

credible commitment theory, financial sustainability, profit, business models for sustainability, two-factor theory

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Regenerative Business Models: A Conceptual Framework

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Abstract

The current economic system is degenerative, exploiting people and the environment through unsustainable practices, which has significantly weakened the planet's regenerative capacity. With six planetary boundaries now exceeded, businesses need to move beyond sustainability toward regenerative business models. Unlike sustainability, which focuses on minimizing harm and maintaining balance, regenerative business models seek to create net-positive impacts by actively improving planetary health and societal well-being. Originally rooted in biology, the concept of regeneration remains underexplored in the context of business models. The fundamental components, principles, and characteristics of regenerative business models are still undefined. Although an increasing number of companies have established regenerative strategies, it is unclear if truly regenerative business models exist.

This paper aims to address this gap by integrating concepts from multiple disciplines to develop an initial conceptual framework of value exchange systems for regenerative business models. This paper argues that regenerative business models require value exchange activities that generate net-positive impacts on the firm and stakeholders (including the natural environment and society), and leave the planet, society and economy system healthier over time. The framework introduces two new components, i.e., value enhancement and value replenishment, as important activities for value regeneration. The framework suggests that a regenerative business model describes a firm's value proposition, how the firm creates and delivers value for its stakeholders in a way that continuously enhances stakeholders' well-being, and how the firm captures value from its stakeholders in a way that replenishes firm's resources and capabilities to improve planetary and social health.

Extended abstract

Introduction

The current economic system follows a degenerative model – we take, dam, enslave, frack, drill, poison, burn, cut and kill – exploiting people and the environment (Kawken, 2021). As a consequence, the planet's regenerative capacity has been significantly weakened (Dasgupta, 2021). With six of the nine planetary boundaries now crossed out of the safe operating spaces, the risk of irreversible environmental changes has massively increased (Richardson *et al.*, 2023). These challenges highlight the urgent need for companies to move beyond sustainability toward regenerative business (Das and Bocken, 2024). Unlike sustainability, which focuses on minimizing environmental and social impacts while maintaining economic benefits, regenerative business models seek to create net-positive impacts by actively improving planetary health and societal well-being (Konietzko, Das and Bocken, 2023).

The concept of regeneration originates from biology and has been applied in fields such as agriculture, medical science, ecology and environmental science (DeWitt, 2008; Schulte *et al.*, 2022). However, it remains at an early conceptual stage in the context of business models. A search of " regenerative business model" in academic search engines (such as Scupos) and Google resulted in a limited number of literature and practical articles. Many examples and cases provided in existing articles are not significantly different from sustainable or circular business models, except for those highly relevant to regenerative agriculture and forestry. This highlights the lack of clarity regarding the definition of a regenerative business model, and its components, principles and characteristics.

This paper aims to address this gap by exploring the concept of regenerative business models and advancing the understanding of their value exchange. Due to the interdisciplinary nature of this concept, this paper adopts Jabareen (2009)'s method, integrates concepts from multiple bodies of knowledge and develops a conceptual framework for regenerative business models. The framework aims to provide a foundation for further exploration and practical implementation of value exchange activities for regenerative business models.

Expected Outcome: A Conceptual Framework of Regenerative Business Models

Business model describes a firm's value proposition, how the firm creates and delivers value for its stakeholders and how it captures value from them (Richardson, 2008; Zott, Amit and Massa, 2011). In essence, business model is about the logic of value exchange between a firm and its stakeholders (Evans *et al.*, 2017). This paper argues that in a regenerative business model, the value exchange activities need to generate net-positive impacts on the firm, its stakeholders (including the natural environment and society), and leave the planet, society and economy system healthier and more resilient over time. To achieve this, the

paper proposes new components – **value enhancement and value replenishment** – as important activities for value regeneration. Figure 1 illustrates an initial conceptual framework for a regenerative business model, offering a structured approach to redefine value exchange systems in a way that aligns business practices with planetary and societal well-being.

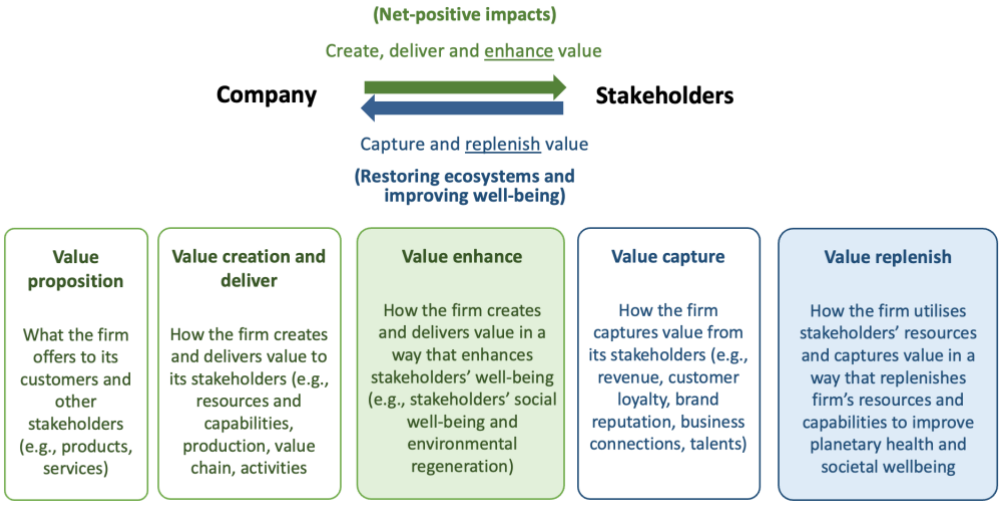


Figure 1. A conceptual framework of regenerative business models

Value enhancement focuses on continuously improving the value delivered to stakeholders in a way that positively impacts their well-being. The value enhancement activities include environmental regeneration (e.g., restoring ecosystems, regenerative agriculture, carbon sequestration) and improving social well-being (e.g., community engagement, improving health and safety, equity and inclusion, investing in local economies) for stakeholders. These activities can be either integrated into the design of the value proposition or implemented alongside value creation and delivery activities.

Value replenishment focuses on actively engaging stakeholders and capturing value from stakeholders in a way that restores and replenishes the firm's resources and capabilities to improve planetary health and societal well-being. For example, value replenishment activities include collaborating with local communities to regenerate ecosystems, such as replanting forests and rehabilitating degraded lands.

The proposed framework suggests that a regenerative business model describes a firm's value proposition, how the firm creates and delivers value for its stakeholders in a way that continuously enhances stakeholders' well-being, and how the firm captures value from its stakeholders in a way that replenishes the firm's resources and capabilities to improve planetary health and societal wellbeing. The expected outcome of a regenerative business

model is that the planet and society are better off because of this value exchange. This framework provides a foundation for further exploration and practical implementation of regenerative business models.

Potential Regenerative Practices

Although an increasing number of companies have established regenerative strategies and claimed to be regenerative, it is unclear whether a truly regenerative business model has existed. This is partly due to the complexity of the measurement systems particularly those relevant to societal well-being. However, these challenges should not stop the exploration of regenerative practices and hinder the transition towards a more regenerative business model. Table 1 provides a few business examples of current sustainable practices and their potential regenerative practices.

Company	Current Sustainable Practices	Potential Regenerative Practices
Interface	Carbon-neutral flooring production	Carbon-negative flooring that sequesters CO2
Patagonia	Sustainable materials, repairing programs	Investing in large-scale ecosystem restoration projects
Nespresso	Recycling used capsules	Regenerative coffee farming to restore soil health (already implementing)
Tesla	Producing electric vehicles	Repairing the roads while driving through (imaginary)

Keywords

Regenerative business models, business model innovation, regeneration, sustainable business models, regenerative

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Strong Sustainability for Circular Economy Models: Capturing and Harmonizing Transdisciplinary Approaches

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Extended abstract

The current business model landscape faces challenges in addressing the complexities of sustainability within Circular Economy (CE) frameworks. While sustainability-driven business models have evolved, they often align with a Weak Sustainability (WS) paradigm, where ecological, social, and economic dimensions are treated as substitutable, and trade-offs are allowed. However, planetary boundaries (Rockström et al., 2009) and planetary health show the growing need for critical natural capital preservation and linkages between human and natural health. This needs a transition toward Strong Sustainability (SS), which recognizes the non-substitutability of ecological systems and demands a systemic approach (Velenturf & Purnell, 2021). Unlike WS, which focuses on isolated solutions (e.g., increased recycling rates, material efficiency, stakeholders), SS requires business models to be designed within planetary health limits, aligning with circular economy principles while ensuring ecological and social regeneration.

Existing frameworks in business models for sustainability (BMfS), such as the **Triple-Layered Business Model Canvas (TLBMC)** (Joyce & Paquin, 2016), the **Stakeholder Value Flow Model (SVFM)** (Freudenreich et al., 2020), notable works by Bocken et al. (2014) showcasing eight BMfS archetypes, and a taxonomy of 45 BMfS patterns by Lüdeke-Freund et al. (2018) have contributed to embedding sustainability into business strategies. However, these models primarily **extend traditional business logic** rather than requiring its transformation. They showcase sustainable elements, which, when not combined holistically, often lead to WS operating under a growth-oriented economic model that minimizes harm without actively regenerating ecological and social systems. The TLBMC, for instance, adds environmental and social layers but **retains a firm-centric, trade-off-based approach**, which can result in **incremental optimizations rather than systemic**

transformations. Similarly, the SVFM, while advancing stakeholder engagement (particularly societal stakeholder's contribution to value creation activities for ecological and social impacts), **lacks explicit integration of planetary boundaries and biophysical constraints**, making it challenging to ensure sustainability beyond economic value redistribution. These limitations highlight the need for a framework that fully incorporates **SS principles** and addresses the interconnections between ecological, economic, and social dimensions. We build on these important works and take it a step further.

Integrating Multi- and Transdisciplinary Perspectives among Systemic Challenges

Upward and Jones (2016) provide an initial framework for addressing SS in business models. Their transdisciplinary focus on stakeholder engagement offer valuable insights into linking firm-level actions with broader systemic environments. However, their framework has limited applicability for capturing the full interplay between multi- and inter-disciplinary dimensions for all types of capitals. BMfS predominantly originate from management and economic perspectives, remaining in disciplinary silos, often missing insights from engineering, environmental sciences, and social-ecological resilience theory (Velenturf and Purnell, 2021). SS in business models cannot be meaningfully operationalized within a single disciplinary lens. This transdisciplinary approach is not just an extension of existing frameworks; rather, it sits at the core to ensure that sustainability is not defined in terms of economic optimization but through real-world ecological and social thresholds. Circular BMfS, while often framed as sustainable solutions, rarely contribute to sustainable development across all three dimensions (Velenturf and Purnell, 2021). There is a tendency to focus on very narrow terms, such as recycling or re-designing, without addressing social capital and natural capital, even when a variety of stakeholders are included (Teigiserova et al., 2020; Velenturf and Purnell, 2021; Dewick et al., 2022; Dewick and Sarkis, 2023). The need to integrate complexities and holistic approaches to circular-BMfS has been brought about in many fields, from manufacturing industry (Bjørnbet et al., 2021) to food waste (Teigiserova, Hamelin and Thomsen, 2020) to the sharing economy (Tukker, 2015; Teigiserova and Schraven, 2024). To bridge this gap, SS-based circular BMfS must incorporate insights from a) Engineering and Material Sciences, ensuring technological solutions align with ecological limits, b) Biology and Ecology -aligning with ecosystem services and nature preservation within BMs, c) Social Sciences - addressing value distribution, just transitions, and stakeholder equity.

Addressing the Gaps: SS and Circular Economy Models

The research question guiding this study is: How can transdisciplinarity be integrated in SS circular BMfS to ensure the restoration of ecological systems, social justice in the supply chain, and enhance planetary health, linking firm-level action to systemic level?

To answer this, a systematic literature review (PRISMA protocol) was conducted, analyzing 84 papers (from 258 sources) spanning multiple disciplines, included on Scopus over the

past decade. Given the limited SS-business literature, this study incorporates both conceptual and empirical research across industries (including forestry, agriculture, fashion, and services) and fields of circular, regenerative, and sustainable models and sustainable supply chains. The latter is essential to address material elements, social justice, and burden-shifting throughout the life cycle stages (particularly at the beginning, and end stages) in the BMfS. Models that failed to integrate both biosphere and sociosphere dimensions were excluded, particularly those that: address sustainability only as efficiency-based innovation (e.g., product redesign) or social measures limited to economic value, or *treated* nature as an externality (e.g, LCA, carbon capture as primary metrics). Since social considerations remain significantly underrepresented in CE literature (10%) (Velenturf & Purnell, 2021), this study emphasizes their role in BMfS to ensure holistic SS integration. Furthermore, co-creation in business model development (Lüdeke-Freund et al., 2021) and patterns classification (Lüdeke-Freund, Massa & Breuer, 2024) were incorporated to refine SS across value proposition, value creation and delivery, and value capture. We further extended our search via a Google search to identify relevant empirical frameworks and cases, as implemented by Das and Bocken (2024).

Preliminary Findings

Critics have raised credible questions about whether the CE can result in SS (Schroeder *et al.*, 2019; Sarkis *et al.*, 2022). By mapping distinctions between WS and SS BMfS, we provide actionable insights into enhancing CE models to prioritise genuine sustainability. This study is part of ongoing research and our preliminary findings of SS circular BMfS include:

1. *Align Complex Systems* – Business models must integrate ecological, social, and economic interdependencies, ensuring operations respect planetary boundaries (e.g., biodiversity, climate limits) while addressing social equity (e.g., fair labour, resource justice). This requires moving beyond compliance and isolated solutions toward holistic, regenerative strategies.
2. *Guide Long-Term Outcomes* – Sustainability must be embedded throughout supply chains and life cycles, ensuring resilience in both environmental and social value-chain. SS BMfS prioritize regenerative practices, fair economic structures, and ecosystem restoration, rather than short-term efficiency gains.
3. *Clarify Value Implications* – Many BMfS focus on narrow, firm-centric sustainability metrics, failing to capture externalities or systemic trade-offs. SS models must help stakeholders assess whether a business creates net-positive impact across environmental and social dimensions. This means moving beyond weak indicators (e.g., “carbon neutral” claims without biodiversity restoration) to holistic impact measurement that informs better decision-making and accountability.
4. *Resolve Value Creation Tensions* – SS models prioritise multi-stakeholder co-creation, ensuring fair value distribution across businesses, workers, communities, and ecosystems. For instance, regenerative agriculture should benefit farmers (fair wages, land rights), businesses (sustainable sourcing), and ecosystems (soil restoration) equally.

5. *Link Firm- & System-Level Transitions* – SS BMfS must scale micro-level solutions into macro-level transformation, ensuring circular practices contribute to broader sustainability shifts, including policy, regional resilience, and industry-wide decarbonization.
6. *Facilitate Transdisciplinary Alignment* – SS requires bridging business, engineering, ecology, and social sciences. This means integrating technical feasibility (e.g., biomaterials), ecological principles (e.g., land use), and social justice (e.g., cooperative governance) into a systemic, stakeholder-inclusive model at the same time.

Despite claims of sustainability, many BMfS continue to operate within WS paradigms. For example, recycled polyester in fashion is frequently cited as a sustainable business model, yet it exemplifies WS due to i) omission of labor equity considerations (opaque supply chains, underpaid workers) ii) failure to restore ecosystems (being "less harmful" does not equate to sustainability), iii) planetary health risks (microplastic pollution, endocrine disruptors in textiles). Similarly, regenerative cotton initiatives showcase ecological benefits through soil restoration and carbon sequestration, yet frequently fail to integrate social justice mechanisms, with farmers locked into exploitative contracts and water resources diverted from critical local needs. These examples demonstrate how single-focus sustainability efforts remain insufficient, necessitating transdisciplinary insights for holistic SS implementation.

We recognize a challenge to formulate SS for BMfS in operational BM terms for value proposition, value creation and delivery, and value capture, which requires nuanced understanding and focus on all types of value, as pointed out by Freudenreich, Lüdeke-Freund and Schaltegger (2020), as it involves complexities from a variety of disciplines and fields. To transition to SS, these values need to incorporate (in tandem) non-substitutable ecological capital, social justice, and regenerative systems thinking on top of existing taxonomies and patterns in BMfS. By mapping SS-aligned and WS-aligned business models, we provide:

- A clearer differentiation between weak and strong sustainability in BMfS
- Insights into how transdisciplinary integration improves circular BMfS
- Applied examples that link BMfS to systemic and holistic sustainability

As CE initiatives risk reinforcing WS paradigms without a fundamental reconfiguration of business logic, this research advances a structured SS BMfS framework that moves beyond harm reduction to systemic restoration, ensuring business (and firm-level) alignment with global sustainability objectives, planetary and social well-being, and economic resilience.

Keywords

strong sustainability, circular economy models, systemic perspectives, transdisciplinary approach, value capture

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Enhancing Sustainable Food Business Models: Integrating Personal Values into the Value Proposition Canvas Using the Laddering Technique.

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Extended abstract

Introduction

Addressing global sustainability challenges necessitates transformative behaviour change, particularly in food consumption. However, deeply ingrained routines and cultural norms make eating habits difficult to change (Wansink, 2004). Even when individuals acknowledge the ecological urgency of transitioning to sustainable alternatives, behavioural change remains limited or delayed (RWI – Leibniz-Institut für Wirtschaftsforschung, 2021). Values, as defined by Schwartz (2012), play a critical role in

predicting food-related behaviour but are often overlooked in designing and marketing sustainable products.

The Value Proposition Canvas (VPC), introduced by Osterwalder et al. (2014), aligns consumer needs with product attributes but focuses primarily on functional aspects. This study integrates the Laddering Technique, a qualitative method exploring intrinsic consumer motivations through in-depth interviews, with the VPC to uncover deeper psychological drivers behind food choices. By combining these methodologies and mapping findings to Schwartz's value scheme, this research develops a framework for value-centric communication strategies tailored to sustainable food transitions.

This aligns with recent calls for a normative turn in innovation management, where values are not only seen as consumer preferences but as guiding principles in sustainable business model design (Breuer, Lüdeke-Freund, and Bessant, 2022). Sustainable Business Models integrate environmental and social concerns into value creation mechanisms, and our work builds on this perspective by examining how consumer values can enhance sustainable business model development. This study contributes to Business Models for Sustainability (BMfS) by proposing a methodology to integrate consumer value systems into value proposition design—supporting alignment between value creation and long-term sustainability goals (Bocken et al., 2014; Geissdoerfer et al., 2018). In line with this, Breuer, Lüdeke-Freund, and Bessant (2022) argue for a values-based innovation management approach, highlighting how values can serve not only as consumer-oriented indicators but as guiding principles across the innovation process, from idea generation to business model configuration.

Problem Statement

Despite the recognition of values as key drivers of eating behaviour (Connors et al., 2001; Lusk & Briggeman, 2009; Hauser et al., 2013), consumer studiesoften lack a systematic assessment of these values. This gap leads to a misalignment between value propositions and strategic communication for sustainable food products. Traditional methods, such as focus groups, primarily capture functional needs but fail to address underlying psychological values. Bridging this gap requires integrating functional and psychological aspects into product design and communication strategies to support sustainable consumption.

As noted in SBM literature, value proposition development needs to consider both economic and societal value creation to contribute to sustainability transitions (Bocken et al., 2014). This study extends that approach by integrating psychological value drivers, which can shape how consumers perceive and engage with sustainable offerings.

Research Objective

This study examines how consumer insight methodologies influence USP definition by comparing focus groups with laddering interviews in populating the VPC with personal values. The goal is to enhance value-centric communication strategies to foster sustainable transitions. This research extends SBM theory by demonstrating how incorporating value-centric communication strategies into value proposition design can strengthen sustainable business models. It contributes to sustainable business model innovation by linking consumer psychology with value creation mechanisms, providing a structured framework for designing businesses that align with long-term sustainability transitions (Geissdoerfer et al., 2018).

Methodology

Two consumer research methodologies were compared: (1) Focus Groups and (2) Laddering Technique Interviews. Two focus groups (n=6, n=5) and 13 laddering interviews (n=7, n=6) were conducted with flexitarian participants from Fontys campuses. Two themes were selected: (1) Meat alternatives and (2) Sports nutrition, with results presented for meat alternatives. One focus group and one set of interviews (sports nutrition) were online, while the others were conducted in person.

Thematic coding extracted insights, categorising statements under expectations, benefits, and concerns (focus groups) and attributes, functional consequences, emotional consequences, and values (laddering interviews). Transcripts were analysed using manual coding and AI (ChatGPT 4.0) to classify statements under the Schwartz Value Scheme, ranking values by frequency, intensity, and centrality.

Findings were applied to the VPC, and USPs were formulated based on prioritisation of values. A comparative analysis evaluated how personal values influence product positioning.

Preliminary Results

The findings demonstrate notable differences between insights derived from focus groups and laddering interviews, particularly in how participants' values correspond to the Schwartz value scheme. Focus group discussions revealed a strong emphasis on the values of Universalism and Hedonism, reflecting concerns for sustainability and the importance of sensory enjoyment. In contrast, laddering interviews identified the dominance of Security, particularly in relation to health, alongside a significant preference for Tradition, highlighting priorities such as safety, freshness, and cultural continuity.

These divergent value prioritizations led to differing applications within the Value Proposition Canvas (VPC), as the weighting of values shaped the categorisation of pains, gains, and jobs to be done. This resulted in two distinct Unique Selling Propositions (USPs). The first USP focuses on ethical alignment and sensory enjoyment: "Delivering

ethical, delicious, and convenient meat alternatives that align with your values, elevate your dining experience, and support a sustainable future." The second USP centres on health and tradition: "Our product offers a healthier, fresher alternative rooted in tradition, while respecting ethical values and contributing to a sustainable future—all without compromising on taste."

These results underscore how methodological differences in assessing consumer values can significantly influence marketing strategies and product positioning, suggesting that tailoring research approaches is critical for developing value-centric strategies.

Next Steps

Future research will iteratively refine findings through additional focus groups and laddering interviews. Transcripts will continue to be analysed using both manual coding and AI tools to validate value classifications. AI personas will also be tested in virtual simulations for their potential to streamline consumer research. Additionally, the effectiveness of value-centric communication strategies derived from this study will be assessed in follow-up consumer engagement settings to measure their impact on behaviour change.

Expected Contributions

This research integrates psychological values into the VPC, providing a framework for aligning personal values with product USPs. By focusing on intrinsic consumer motivations, it offers a method for designing value propositions that are aligned with sustainability-oriented business models. While grounded in food transitions, the framework contributes to theory by linking personal values with sustainable business model design across sectors.

Conclusion

Incorporating psychological values into product positioning enhances strategic alignment with consumer motivations for decision making. Laddering interviews identified Security and Tradition as key drivers of meat alternative consumption, while focus groups emphasised Universalism and Hedonism. These discrepancies suggest laddering uncovers intrinsic personal values, whereas focus groups reflect perceived gains. If Security and Tradition dominate, campaigns should highlight safety, certifications, and cultural continuity. When Universalism and Hedonism are prioritised, marketing should focus on environmental impact and taste. Addressing dominant values while considering secondary values enhances marketing effectiveness.

Keywords

Values-Based Innovation, Laddering Technique, Value Proposition Canvas, Schwartz Value Scheme, Sustainable Food Transition

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Scrutinizing street vendor inclusion and sustainability

A Case Study of the inclusive business 2SCALE-Yedent Partnership in Ghana

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Summary

Street vending is a major source of – informal - livelihood for many people worldwide. International organizations, governments and NGOs deploy inclusive business initiatives to include marginalized groups like street vendors in formal value chains. Such sustainable business models are typically implemented through cross-sector collaboration. Although there is increasing insight in governance dynamics of collaboratively implemented sustainable business models, there is room for critical scrutiny of these dynamics vis-à-vis sustainability performance. This research explores the 2SCALE-Yedent partnership in Ghana, an inclusive business initiative to include street vendors in the soybean agribusiness value chain, implemented between 2012 and 2017. The study utilises the Terms of Inclusion Framework, developed for smallholder farmers, to study the distribution of voice, ownership, risk, and rewards among vendors and other value chain actors. Through document analysis and interviews, it analyses the terms of inclusion during project implementation and after project termination, to scrutinize the temporal evolvement of their inclusion and assess the sustainability of social impact. It furthermore explores organisational logics of collaborative initiatives that informed inclusion of street vendors over time. The findings show critical gaps in ensuring sustainable and long-term inclusion. The limited involvement of street vendors in key decision-making processes coupled with challenges with accessing sustained funding, credit and market fluctuations relegated them to passive actors, hence they were unable to negotiate for better terms. Yedent prioritized its business interests above the partnership's inclusive benefits, thereby undermining the set objectives of the partnership. As such the business model failed to adapt to their realities.

Extended abstract

Introduction

Street vendors are critical to the functioning of informal economies and street vending serves as a major source of livelihood for many people across the world (Romero et al., 2024). The inclusion of marginalized groups, such as street vendors, in formal value chains through collaborative inclusive business initiatives is believed to be critical for fostering social impacts including poverty reduction and economic resilience (Ros-Tonen et al., 2019; Mangnus, 2023; Likoko & Kini, 2017). Collaboration among low-income actors like smallholder farmers and street vendors, lead business entities and development agencies is believed to facilitate market access and foster sustainable socio-economic development (Vermeulen & Cotula, 2010). Inclusive business initiatives presume the commercial interests as well as trading relations among value chain actors inform financial sustainability and long-term profitability, as such safeguarding the longevity of development results (Bocken et al., 2014; Vorley et al., 2009).

Inclusive business initiatives can be interpreted as sustainable business models that create value for marginalized and low-income groups through their productive engagement in value chain activities (so-called inclusive value creation archetypes) (Ludeke-Freund et al., 2016; Schoneveld, 2020). These initiatives are typically implemented through collaboration between state, market, and civil society (Pedersen et al., 2020). There is consequently growing interest in understanding the governance conditions and dynamics of cross-sector collaborations cocreating value in the context of differing interests (see Pedersen et al., 2020; DiVito et al., 2021). However, the SBM literature's focus on the business model directs scrutiny to sustainability intent rather than sustainability performance (Schoneveld, 2020). As collaborative inclusive business initiatives frequently devolve – at least partly – from development policies and objectives, their inclusive performance should be interpreted as both process and outcome. Furthermore, public funding to advance development objectives necessitates durable inclusive outcomes, beyond termination of support. However, the link between governance modalities and business model characteristics on the one hand and durability of inclusive outcomes, e.g. for street vendors, remains yet to be studied (DiVito et al., 2021). Whereas inclusive business initiatives are assumed to facilitate long-term development benefits due to commercial interests in continuing the business, and while research demonstrates some positive development outcomes resulting from inclusive business initiatives, literature largely indicates that the sustainability of results in largely unknown. Those cases where the sustainability of results is monitored give reason to be pessimistic. The sustainability of inclusive business initiatives appears to be largely uncertain, though there is limited knowledge about the conditions that inform sustainability of inclusive business initiatives relative to the inclusion of the marginalised in inclusive value chains.

The aim of this study is to explore how conditions and dynamics of governance and resulting value creation and capture of inclusive business initiative inform inclusive outcomes for street vendors. The quality and sustainability of participation by marginalized such as street vendors often depends on the conditions under which marginalized actors are included in the value chain (Thorpe & Reed, 2016), more specifically the division of ownership, risks, rewards, and voice among value chain actors (Vermeulen & Cotula, 2010; Schouten & Vellema, 2019). However, there is yet limited insight in the conditions under which street vendor should be included to advance development outcomes (Ros-Tonen et al., 2019).

This research focuses on 2SCALE-Yedent partnership in Ghana, an example of inclusive business model designed to empower street vendors as key actors in the agribusiness value chain for soy-based products. This programme was implemented between 2012 and 2017.

Methods Applied

This study utilises a qualitative research approach to investigate the inclusion terms and sustainability of the 2SCALE inclusive agribusiness partnership in Ghana's Kpandai District, focusing on the Banda Borae women, a group of 18 street vendors who traded mainly soy khebab and soy flour products from Yedent Agro Limited. Semi-structured interviews were held with 10 street vendors engaged under the 2SCALE-Yedent partnership, as well as 2SCALE project team members and a project officer in charge of marketing at Yedent Agro. These 13 participants across the 3 categories constituted the primary respondents for this research. Project documentation, including meeting minutes, annual reports, and monitoring data, as well as relevant academic literature were analysed to triangulate findings and contextualize the research within broader discussions on inclusive business initiatives.

In conducting data analysis, both transcripts of interviews and relevant documents were coded and analysed thematically. Coding was done inductively and deductively, utilising open coding to identify emerging themes and used pre-defined codes based on the theoretical framework. The inductive coding allowed for the emergence of themes right from the data such as unexpected challenges that street vendors encountered, while deductive coding was applied regarding business model and terms of inclusion: ownership, voice, risk and reward, to the data (Creswell and Creswell, 2017). The adoption of this hybrid approach ensured that the analysis captured both the specific experiences of street vendors and how these experiences aligns with the inclusive business framework.

Preliminary results

Results focus on the evolvement of the terms of inclusion – voice, ownership, risk, rewards, over time, as well as business model and governance dynamics informing the evolvement of the terms of inclusion over time.

The 2SCALE-Yedent partnership's evolving dynamics highlight critical business model and governance issues determining the durability of inclusive business initiatives. Originally, the partnership aimed to enhance inclusion by improving productivity for smallholder farmers while strengthening market linkages for street vendors in order to create an ecosystem for equitable participation. However, the terms of inclusion deteriorated over time. This reflects critical challenges in the governance structure, power asymmetries and adaptation of the business model.

Relative to the governance structure of the inclusive business initiative, the 2SCALE-Yedent partnership faced hurdles in sustaining equitable collaboration among actors in the formal value chain. The evolving power dynamics put Yedent in a dominant position while smallholder farmers and street vendors had their influence in decision-making significantly reduced. While initial participatory mechanisms in the partnership provided opportunities for stakeholder input, these mechanisms deteriorated over time in view of the shifting strategic business priorities of Yedent. The lack of institutional mechanisms that safeguards sustained mutual benefits resulted in declining participation by marginalised actors, eventually affecting long-term inclusion of the partnership.

From the perspective of a business model, the 2SCALE-Yedent partnership highlights crucial insights regarding the interplay between value proposition, value creation and delivery, as well as value capture (Schoneveld, 2020). While the initial value proposition aimed to create livelihood opportunities for street vendors and smallholder farmers, some challenges emerged. While the Yedent involvement provided access to improved equipment, raining and processing services, there were inefficiencies in translating these benefits into sustained productivity and enhanced income. The business model did not provide mechanisms to translate the enhanced production capacities of street vendors into stable and sustainable market access. Street vendor integration into the value chain was hampered by inadequate coordination, limited institutional support and insufficient market linkages. This created a gap between intended and actual benefits as street vendors struggled to access the full benefits of the partnership. Yedent's business strategy over time prioritised firm-level sustainability above fair sharing of benefits. Street vendors had to deal with diminishing returns due to market fluctuations and deteriorating contractual guarantees, resulting in gradual disengagement by some street vendors. The inability of the business model to safeguard equitable distribution of value among stakeholders contributed to increased dissatisfaction and declining participation.

The above findings show critical gaps in ensuring sustainable and long-term inclusion. The limited involvement of street vendors in key decision-making processes relegated them to passive actors, hence they were unable to negotiate for better terms. Also, not addressing the challenges faced by street vendors such as access to sustained funding or credit, fluctuating market conditions and logistical problems, meant that the business model failed to adapt to their realities. The shift in priorities by Yedent in value capture underscores the

firm's sustainability above inclusive benefits, undermining the initial objectives of the partnership.

In strengthening the durability of inclusion, cross-sector collaborations need to reconsider their governance structure and business model by addressing existing power asymmetries to ensure continued stakeholder engagement in decision-making processes. Institutional safeguards to guarantee equitable participation of all actors beyond donor-driven project timelines would support durability. Lastly, business model adaptability could provide an opportunity to contain the evolving needs of street vendors.

Keywords

Inclusive Business, Value Chains, Street Vendors, Sustainability, inclusion.

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Advancing Circular Business Models for Sustainability

Addressing Theoretical Gaps and Underexplored Dimensions

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Abstract

This study conducts a systematic review of existing reviews on Circular Business Models published between 2017 and 2024 to identify theoretical gaps and underexplored dimensions. By synthesizing key insights, the study consolidates existing knowledge, pinpoints critical research directions, and provides guidance for advancing CBMs as a strategic pathway to sustainability.

Keywords

Business Models for Sustainability, Circular Business Models, Circular Economy, Sustainability Transition, Review

Main text

Introduction

The Circular Economy (CE) has emerged as a transformative approach to global sustainability, aiming to address critical challenges such as resource depletion, climate change, and escalating waste generation (Kirchherr, Reike, and Hekkert, 2018; Geissdoerfer et al., 2017). Unlike the traditional "take-make-dispose" model, CE emphasizes resource efficiency, waste minimization, and regenerative practices that restore natural systems (Murray, Skene, and Haynes, 2017). This shift is not only a response to ecological crises but also an opportunity to rethink economic systems and their interaction with the environment.

Central to this transition are Circular Business Models (CBMs), which enable businesses to operationalize CE principles by integrating circular practices into their value creation, delivery, and capture processes (Antikainen and Valkokari, 2016). CBMs provide a framework for companies to transition from linear economic models to practices that prioritize resource longevity, efficiency, and closed-loop systems (Pieroni, McAloone, and Pigosso, 2019). Examples of such models include product-service systems, sharing economies, and closed-loop supply chains, each offering distinct pathways for aligning business operations with CE objectives (Kirchherr, Reike, and Hekkert, 2018). CBMs also intersect with the broader concept of Business Models for Sustainability (BMfS). BMfS encompass a wider range of sustainability goals, integrating environmental, social, and economic dimensions to achieve transformative change (Breuer & Lüdeke-Freund, 2017). Situating CBMs within the broader discourse of BMfS highlights their role as a foundational mechanism for achieving sustainability transitions, while recognizing opportunities to expand their scope and dimensions. While their practical applications have gained traction, the theoretical foundations of CBMs remain fragmented and underdeveloped (Laasch, 2018). This disparity limits the systematic understanding and optimization of CBMs, especially in addressing the complex interplay of economic, environmental, and social factors (Bocken et al., 2016).

This study seeks to explore the theoretical opportunities within CBM research while also shedding light on underrepresented dimensions critical to their advancement. By addressing these gaps, the review provides strategic insights to guide future research and practical applications, fostering a deeper understanding and more effective implementation of CBMs in sustainability transitions.

Method

The rationale for conducting a review of reviews stems from the rapid growth and interdisciplinary nature of CBM research. Given the fragmented landscape of existing studies, this approach provides a meta-analytical synthesis that identifies overarching trends, highlights unresolved theoretical gaps, and reduces redundancy in analyzing primary research findings (Snyder, 2019; Geissdoerfer et al., 2020). By focusing on higher-order insights, this review offers a comprehensive perspective on the evolution of CBM research and its implications for theory and practice. To ensure rigor, transparency, and replicability, this study adheres to established best practices for systematic literature reviews (Snyder, 2019). The review focuses on 45 scholarly review articles published between 2017 and 2024, selected based on their relevance to CBMs within the CE and their contributions to theoretical advancements (Kirchherr, Reike, & Hekkert, 2018). Articles were retrieved from three major databases—Scopus, Web of Science, and Google Scholar—using a structured search strategy with key terms related to CBMs, circular economy, sustainability transitions, and business model innovation. The final sample of 45 articles reflects a deliberate selection process, ensuring a focused and meaningful synthesis. The findings contribute to advancing CBMs as a strategic pathway to sustainability, providing a structured foundation for future research while aligning with prior studies and charting new avenues for investigation (Goyal et al., 2021).

Table 1 - The selection process employed during the Systematic Literature Review

Inclusion Criteria	Review Articles Only Relevance to Circular Business Models Publication Period (2017–2024) Peer-Reviewed Journals English Language
Exclusion Criteria	Empirical Studies, Conceptual Papers (Non-Reviews) Studies without Business Model Focus Non-Peer Reviewed Sources (Grey Literature, Conferences, Book Chapters)
Databases	Scopus Web of Science Google Scholar
Keywords	("sustainab*" OR "circular*") AND "business model*" AND "review*"
Journals	Management journals

Findings

The findings are presented to illustrate the theoretical gaps and the underexplored dimensions identified through the systematic review, providing a comprehensive analysis of the current state of CBM research and its potential pathways for advancement. Table 1 provides an overview of the sample articles addressing CBMs, categorizing them based on the identified theoretical gaps and underexplored dimensions. It highlights the theories and perspectives suggested in the literature to address these issues.

Table 2 - Overview of Sample Articles Addressing Circular Business Models

Theoretical Gaps & Underexplored Dimensions	**Sample Articles**	**Suggested Theories and Perspectives**
Fragmented Frameworks	Urbinati et al. (2017); Rosa et al. (2019); Geissdoerfer et al. (2020); Pieroni et al. (2019); Munaro et al. (2020)	Systems theory, Institutional theory
Dynamic and Temporal Aspects	Pieroni et al. (2019); Geissdoerfer et al. (2020); Jabbour et al. (2019)	Dynamic capabilities theory
Paradoxes and Tensions	Hahn et al. (2015); Hofmann (2019); Jabbour et al. (2019); Rosa et al. (2019); Bressanelli et al. (2021)	Paradox theory, Stakeholder theory
Social Equity and Inclusion	Merli et al. (2018); Valencia et al. (2023); Munaro et al. (2020); Antwi-Afari et al. (2021)	Capabilities theory
Governance and Policy Alignment	Pieroni et al. (2019); Puntillo (2023)	Institutional theory
Multi-Level Integration	Lahane et al. (2020); Scipioni et al. (2023); Geissdoerfer et al. (2020); Antwi-Afari et al. (2021); Basile et al. (2021)	Multi-level perspective
Geographic and Sectoral Scope	Islam et al. (2021); Antwi-Afari et al. (2021); Nascimento et al. (2019)	Contextual and comparative frameworks

Source: authors' own elaboration based on the analysis

Discussion

Addressing Theoretical Gaps

Theoretical development in the study of CBMs has been hindered by fragmented approaches, limited attention to dynamic aspects, and the underutilization of established theoretical lenses. These gaps restrict the ability to comprehensively describe, analyze, and explain the functioning of CBMs, particularly their role in enabling sustainability transitions.

Fragmented Frameworks

Urbinati et al. (2017) propose a taxonomy of CBMs but it falls short of addressing the broader social dimensions of sustainability. Similarly, Geissdoerfer et al. (2020) call for a more cohesive theoretical foundation that integrates multiple dimensions of sustainability, including economic and environmental aspects. Rosa et al. (2019) identify archetypes like Product-Service Systems (PSSs) and reuse/remanufacturing models, which focus on environmental sustainability but highlight a gap in addressing the social equity aspects of CBMs. Fragmentation in existing CBM frameworks limits their ability to capture the full complexity of circular systems. Many frameworks focus on specific dimensions of sustainability—such as environmental, economic, or social aspects—without integrating them into a cohesive model. This siloed approach fails to address the interconnectedness of circular systems and restricts the potential of CBMs to operationalize CE principles effectively. Addressing this gap requires adopting interdisciplinary and systemic perspectives to account for the interdependence of these dimensions. The application of systems theory and institutional theory can offer valuable insights into these challenges. Systems theory, for example, emphasizes the interconnectedness of components within a system, making it well-suited to analyzing CBM dynamics. Institutional theory highlights the role of norms, cultural contexts, and regulations in shaping organizational behaviors and responses.

Dynamic and Temporal Aspects

Pieroni et al. (2019) emphasize the importance of dynamic capabilities in enabling firms to adapt their CBMs over time, highlighting the role of technology and market shifts in shaping CBM evolution. Jabbour et al. (2019) illustrate how dynamic capabilities support the adoption of circular transitions in operations management, demonstrating how firms can build capacity to adapt their CBMs to changing circumstances. CBMs are often treated as static constructs in existing research, with limited exploration of their dynamic and temporal nature. However, in practice, CBMs must evolve continuously in response to external changes such as technological advancements, regulatory shifts, and evolving societal expectations. This oversight restricts understanding of how businesses can adapt their CBMs to maintain competitiveness and sustainability in dynamic environments. Theories like dynamic capabilities theory provide a useful lens for exploring these adaptive

processes, as they focus on organizations' abilities to integrate, build, and reconfigure competencies in response to changes in their operating environment.

Paradoxes and Tensions

Hofmann (2019) critiques the normative assumptions underlying CBMs, highlighting the tension between incremental resource efficiency improvements and the systemic changes required for sustainability transitions, also echoed by Rosa et al. (2019) Jabbour et al. (2019) explore the role of green human resource management in aligning organizational objectives with stakeholder needs, offering a framework for navigating these contradictions. The transition from traditional business models to CBMs often creates tensions between competing objectives, such as short-term profit maximization versus long-term sustainability. These tensions can manifest in various forms, including conflicts between economic and environmental goals, stakeholder demands, and organizational priorities. Understanding and managing these tensions is critical for the successful adoption of CBMs. Paradox theory, which examines how organizations manage competing yet interdependent demands, offers a promising framework for addressing these challenges. Stakeholder theory further provides insights into balancing the diverse and sometimes conflicting expectations of different stakeholders.

Highlighting Underexplored Dimensions

The analysis of existing reviews reveals several underexplored dimensions critical to advancing CBMs and their scalability. These dimensions, social equity, governance and policy alignment, multi-level integration, and the geographic and sectoral scope of CBM research, represent key opportunities for expanding the understanding and application of CBMs in diverse contexts.

Social Equity and Inclusion

Valencia et al. (2023) expand the traditional 9Rs of circularity to include additional concepts such as regeneration and rethinking economic models and emphasizing the importance of social value creation. Similarly, Merli et al. (2018) critique the limited focus on social outcomes in CE research, noting that most studies prioritize environmental performance. Social equity and inclusion remain underexplored dimensions in the study of CBMs, despite their critical importance in fostering just and equitable sustainability transitions. Most CBM research prioritizes environmental and economic outcomes, often neglecting the social dimensions of sustainability, such as inclusivity, community engagement, and equitable value distribution. Based on the literature, it is in the social dimensions largely where sustainability and circular economy seem to diverge, when in essence they both aim to reduce the dependence on resources whilst allowing the planet to regenerate.

Governance and Policy Alignment

Pieroni et al. (2019) discuss the role of regulatory frameworks in enabling or constraining CBM adoption, citing examples of policies that promote extended producer responsibility. Governance structures and policy interventions play a pivotal role in shaping the adoption and effectiveness of CBMs. Regulatory frameworks can act as both enablers and barriers, depending on their design and implementation. Well-aligned policies, such as extended producer responsibility or subsidies for sustainable innovations, can significantly accelerate the adoption of CBMs (Hartley et al., 2023). However, the impact of governance and policy alignment remains underexplored in the literature.

Multi-Level Integration

Bidmon and Knab (2018) emphasize the importance of linking firm-level practices with broader systemic transitions to achieve sustainability. Lahane et al. (2020) highlight the role of collaborative networks in aligning micro- and meso-level efforts, such as circular supply chain management. CBMs operate at multiple levels—micro (firm-level practices), meso (industry networks), and macro (systemic transitions)—but research often isolates these levels without exploring their interactions. Understanding the connections between these levels is essential for fostering systemic change and ensuring the scalability of CBMs but also linking across scales from a supply chain perspective.

Geographic and Sectoral Scope

Islam et al. (2021) call for more research on consumer behavior and e-waste management in developing regions, highlighting the potential for CBMs to address unique socio-economic and environmental challenges. Antwi-Afari et al. (2021) propose tailored CE strategies for the construction industry.

The geographic and sectoral focus of CBM research remains narrow, with most studies centered on developed economies and industries like manufacturing and retail. This limited scope overlooks sectors such as agriculture and healthcare, as well as developing regions, where CBMs could have transformative impacts. Expanding the geographic and sectoral focus of CBM research would help uncover unique challenges and opportunities, enriching the understanding of how CBMs can adapt to diverse contexts.

Implications and opportunities for further research

This study offers five contributions to advancing CBMs as pivotal mechanisms of BMfS within the CE framework.

First, the research seeks to strengthen the theoretical underpinnings of CBMs by addressing gaps in existing frameworks and proposing integrative approaches that better reflect the complexity of CE dynamics. This includes a critical examination of how CBMs navigate competing priorities, such as economic viability, environmental stewardship, and social responsibility (Hahn et al., 2015). By building more cohesive and interdisciplinary

frameworks, the findings aim to provide a nuanced understanding of CBMs, enabling a more comprehensive approach to their design and implementation.

Second, the study identifies several underexplored dimensions of CBM research that hold significant potential for advancing the field. These include social equity, governance and policy alignment, multi-level integration, and the geographic and sectoral scope of CBM applications. While much of the existing literature focuses on environmental and economic outcomes, the social dimensions of CBMs, such as inclusivity, equitable value distribution, and community engagement, remain underexplored (Murray, Skene, and Haynes, 2017; Kirchherr, Reike, and Hekkert, 2018). Similarly, governance structures and policy interventions are critical factors influencing CBM adoption and scalability but are often overlooked (Pieroni et al., 2019). The interactions between micro-, meso-, and macro-level applications of CBMs remain insufficiently studied. Expanding CBM research to diverse geographic regions and underrepresented sectors such as agriculture and healthcare could also reveal unique challenges and opportunities, enriching the theoretical and practical understanding of CBMs (Goyal et al., 2021).

Third, the findings aim to bridge the persistent divide between academic research and practical application. By addressing theoretical fragmentation, exploring dynamic aspects, and incorporating underexplored dimensions, this study supports the development of CBMs that are not only theoretically robust but also adaptable and scalable in diverse contexts. The alignment between theory and practice ensures that CBMs remain actionable tools for achieving sustainability goals across industries and regions. Furthermore, for application into practice and achieve true outcomes, empirical applications are critical. The 'proof of the pudding' is in the ability to truly reach our sustainability goals.

Fourth, the study underscores the importance of systemic thinking and interdisciplinarity in advancing CBM scholarship. The interconnected nature of CE dynamics requires collaboration across academic, industrial, and policy domains to create holistic and impactful solutions. For example, integrating insights from systems theory and dynamic capabilities theory can help address the challenges of fragmentation and static models, enabling more adaptive and comprehensive CBMs (Antikainen & Valkokari, 2016). Encouraging interdisciplinary approaches not only advances CBM research but also strengthens its relevance for policymakers and practitioners engaged in sustainability transitions.

Finally, the study provides actionable guidance for researchers, practitioners, and policymakers. By advancing theoretical innovation and addressing emerging dimensions, the findings equip stakeholders with the tools and knowledge to design CBMs that effectively tackle the multifaceted challenges of sustainability.

These contributions emphasize the transformative potential of CBMs, positioning them as central to the broader goal of achieving systemic and impactful sustainability transitions.

Conclusions

As the world grapples with escalating sustainability challenges, the need for effective, scalable, and theoretically robust Circular Business Models (CBMs) is more pressing than ever. This study advances CBM research by identifying critical gaps, synthesizing key theoretical contributions, and outlining pathways for their evolution. Specifically, it contributes to enhancing conceptual clarity, integrating interdisciplinary insights, and bridging the gap between theory and practical implementation. By fostering collaboration and continuous innovation, both in research and practice, this study helps ensure that CBMs realize their full potential in driving transformative sustainability transitions globally.

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Systemic Perspective in Patterns for Business Models for Circular Economy – Review and Ontology

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Abstract

Scarce resources force companies to operate more sustainably, making the transition from a linear to a Circular Economy (CE) essential. Beyond new technologies and products, Business Models for CE (BMfCE) are key to this shift, emphasizing extended product life cycles and reduced resource use. A CE results from the collaboration among multiple stakeholders and their interdependent BMfCE. However, implementing BMfCE faces barriers, notably a lack of structured support for their development. Researchers and practitioners have developed pattern-based approaches to support the design of BMs in general and BMfCE in specific through the generalization and reuse of proven solutions. The collaborative nature of CE requires decision-makers to adopt a systemic perspective when designing their BMfCE embedded within a CE. We conduct a systematic literature review analyzing to what extent pattern-based approaches consider such systemic perspective. Our findings reveal that existing approaches address different levels of analysis, offering patterns for individual value dimensions, entire BMs, or supply chain configurations. While some consider stakeholders or ecosystems, none focus on BMfCE interdependencies or their embedded nature within a CE. We propose a conceptual multi-level, multi-perspective ontology that embeds patterns for BMfCE in a systemic context considering interdependencies between them. This paper contributes theoretically and practically to the use of patterns in the design of BMfCE.

Keywords

Pattern, Business Model, Sustainability, Systemic Perspective, Circular Economy, Innovation

1 Introduction

Companies traditionally prioritize profit maximization and cost reduction. However, resource scarcity and rising global resource consumption demand more sustainable operations (Geissdoerfer et al. 2018). Besides new technologies and processes, Business Model (BM) innovation is crucial for achieving sustainability (Marczewska and Kostrzewski 2020). BM for Sustainability (BMfS) expand the economic focus to include value creation for various stakeholders while fostering positive environmental and social impact (Bocken et al. 2015; Boons and Lüdeke-Freund 2013).

The Circular Economy (CE) offers a promising approach to closing material loops, reducing resource use, and lowering environmental impacts (European Commission 2020). BMs for CE (BMfCE) can be seen as a specific type of BMfS (Geissdoerfer et al. 2020). CE can be understood as the interplay of interconnected BMfCE (Mennenga et al. 2025) and requires systemic thinking (Dormeier and Asghari 2024).

To bridge the design-implementation gap in BM innovation (Schroedel 2023), scholars have developed various tools, including pattern-based approaches – abstracted repeatable solutions to specific problems (Leitner 2015) – to guide decision-makers (Abdelkafi et al. 2023). While numerous approaches have been developed for BMfCE and BMfS, no comprehensive overview exists. Although the need for systemic thinking in BMfS and BMfCE is widely recognized (Dormeier et al. 2024), it remains unclear whether pattern-based approaches go beyond a focal company focus. This broader perspective is essential for effectively designing BMs in the CE context.

This paper has two objectives: first, to analyze the status quo of pattern-based approaches for BMfS and BMfCE, with a focus on systemic thinking; second, to propose a conceptual ontology for a multi-level, multi-perspective pattern-based approach for BMfCE embedded within a CE.

To achieve these objectives, the paper is structured as follows. First, we introduce BMfS, BMfCE, and the concept of patterns in BM innovation. Then, we highlight the need for systemic thinking for BMfCE and BMfS. We conduct a systematic literature review (SLR) on pattern-based approaches for BMfS and BMfCE, focusing on their integration of a systemic perspective. Based on this, we propose an ontology for a multi-level, multi-perspective pattern-based approach for BMfCE. We discuss the implications before concluding with key findings and future research directions.

2 Background

2.1 BMfS and Circular Economy

Discussed in the scientific literature for over two decades, BMs are now a widely accepted concept in strategic management (Lüdeke-Freund and Dembek 2017; Wirtz et al. 2016). Although no single definition exists (Evans et al. 2017), BMs are generally understood as a company's way of converting capabilities and resources into value (Zott and Amit 2010) (Teece 2010). Framed around the concept of value and its exchange (Evans et al. 2017; Teece 2010), BMs encompass four value dimensions (proposition, creation, delivery, capture) (Richardson 2008).

Derived from conventional BMs, Sustainable BMs (SBM) (e.g., Bocken et al. 2014), sustainability-oriented BMs (e.g., Breuer et al. 2018), or BMfS (e.g., Schaltegger et al. 2016) extend the traditional value concept by integrating a broader set of stakeholders with and for whom value is created (Stubbs and Cocklin 2008). This assumes that intentional BM design can support sustainable practices (Boons and Bocken 2018).

A specific type of BMfS aims at enabling a CE (Geissdoerfer et al. 2020). While BMfS address multiple dimensions of sustainability, these BMs emphasize economic and environmental factors by reducing resource use, enabling closed material loops, and extending product life cycles (Manninen et al. 2018). Although often termed circular BMs (CBM) (e.g., Geissdoerfer et al. 2020; Lüdeke-Freund et al. 2019), we adopt the term BM for CE (BMfCE), recognizing that no single BM is inherently sustainable or circular—instead, multiple BMfCE collectively contribute to sustainability and CE (Dormeier et al. 2024; Lozano 2018). Consistent with traditional BM definitions, BMfCE represent a company's approach to creating, delivering, and capturing value within a CE-aligned value chain (Nußholz 2017; Urbinati et al. 2017). From Mennenga et al.'s perspective, such a CE value chain emerges from interconnected BMfCE (2025).

2.2 Pattern-based Approaches to Support BM Design

Researchers have developed various methods to support BM design. Among these, pattern-based approaches have gained interest in guiding decision-makers (Abdelkafi et al. 2023).

Patterns are generalized, proven solutions to recurring problems designed for repeated use (Alexander et al. 1977; Leitner 2015; Lüdeke-Freund et al. 2018). Originating from architecture (Alexander et al. 1977), they systematically codify implicit knowledge into explicit forms (Lüdeke-Freund et al. 2018). Many BM scholars base their pattern-based approaches on this logic (e.g., Curtis 2021; Lüdeke-Freund et al. 2018). The so-called Alexandrian format describes patterns with minimal required information through name, problem, context, solution, examples, sketch, and related patterns (Leitner 2015).

In BM literature, various terms describe best practices or solutions to specific problems, including patterns (e.g., Lüdeke-Freund et al. 2019), archetypes (e.g., Bocken et al. 2014), taxonomies (e.g., Ünal and Shao 2019), and typologies (e.g., Henry et al. 2020).

Amshoff et al. distinguish three pattern types: frameworks (e.g., BM canvas) as abstract reference models, prototypical patterns that describe a general logic of an actor's role within the supply chain, and solution patterns that define BM elements for specific companies (Amshoff et al. 2015). The literature includes both approaches focused on specific pattern types and mixed-pattern approaches (Curtis 2021).

Prototypical and solution patterns can refer to entire BMs or combinations of BM components (Amshoff et al. 2015; Lüdeke-Freund et al. 2018). They are typically defined for specific value dimensions (Abdelkafi et al. 2023) and combined to design complete BMs (Amshoff et al. 2015). Patterns are derived from successful configurations of the building blocks of BMs (Amshoff et al. 2015). The identification of BM patterns follows either review-based or empirical-based approaches (Curtis 2021), integrating analogical and combinatorial thinking (Abdelkafi et al. 2023). This approach assumes that successful BMs can serve as guidance for other companies (Doganova and Eyquem-Renault 2009).

Pattern-based innovation is a promising approach to bridge the design-implementation gap in BM innovation, particularly in sustainability (Remane et al. 2017; Schroedel 2023). Patterns provide decision-makers with design options for BM innovation (Gassmann et al. 2014; P. P. Pieroni et al. 2019), and can support stakeholder communication, e.g., facilitating collaborations (Breuer and Lüdeke-Freund 2017; Rohrbeck et al. 2013). For BMfS and BMfCE, patterns can help decision-makers create sustainability-focused BMs (Lüdeke-Freund et al. 2018). They are recognized as important tool for BM innovation (Remane et al. 2017, particularly for BMfCE (P. P. Pieroni et al. 2019).

The practical value of BM patterns is evident in tools like the St. Gallen Business Model Navigator (Gassmann et al. 2017) and supported by literature (Egge and Waitzinger 2022; Schroedel 2024). However, the process of pattern use remains underexplored (Romero et al. 2016).

2.3 Need for a Systemic Perspective

The need for a systemic perspective in BM design, particularly for BMfCE, is widely recognized, as highlighted in an SLR by Dormeier et al. (2024). Sustainability challenges cannot be addressed by individual companies alone but require collaboration among stakeholders (Boons and Lüdeke-Freund 2013; Fobbe and Hilletofth 2021; Orefice and Nyarko 2021). Businesses operate within an interconnected system that directly and indirectly influences them (Lau and Terzidis 2019). Thus, a BM extends beyond a company's internal structure (Fraccascia et al. 2019), involving multiple firms in value co-creation, capture, and resource provision (Berglund and Sandström 2013).

BMfCE are networked and require system-wide changes (Antikainen and Valkokari 2016; Centobelli et al. 2020). They rely on interdependent stakeholders within supply chain networks (Antikainen and Valkokari 2016; Batista et al. 2018). Mennenga et al. describe CE as the interplay of BMfCE, connected through flows and interfaces (2025). Therefore, BMfCE analysis requires a systemic perspective beyond a focal company (Dormeier and Asghari 2024; Kanda et al. 2021). A multi-level (micro, meso, macro), multi-perspective (focal company vs bird's eye) approach to understanding BMs as embedded within a broader system is needed (Dormeier et al. 2024).

Dormeier and Asghari emphasize the need for a systemic perspective in BMfCE design, as highlighted in their review of sustainability-oriented process models for BM innovation (2024). As discussed in 2.2, pattern-based approaches are useful for BMfCE design, but following the above arguments, they must incorporate a systemic perspective. This aligns with Alexander's principle that pattern languages should be applicable at the micro, meso, and macro levels. (Alexander 1979). Similarly, Lüdeke-Freund et al. conclude that pattern-based approaches for BMfS and BMfCE must account for individual BMs, BM groups, and their interactions (2018).

In the following section, we, therefore, analyze to what extent existing pattern-based approaches take a systemic perspective.

3 Systemic Perspective in Patterns for BMfCE and BMfS – Systematic Literature Review

3.1 Method

We conducted an SLR in December 2024 using Scopus and Web of Science, focusing on pattern-based approaches for BMfS and BMfCE design. The search combined synonyms for patterns with BMs, circular economy, and sustainability-related terms and was restricted to journal articles and conference papers in English. Thereby, terms frequently used in literature to describe patterns (e.g., taxonomy, typologies) were included in the search string. Although the primary focus is developing a pattern-based approach for BMfCE, studies on BMfS were included since many also cover BMfCE patterns. Additionally, as discussed in Section 2.1, the link between BMfCE and BMfS and the need for systemic thinking (2.3.) justify drawing insights from a broader set of publications. While pattern-based approaches have been applied in practice and appear in grey literature, these sources were excluded to maintain scientific rigor in the development and validation of approaches.

Figure 1 depicts the search strings and research protocol.

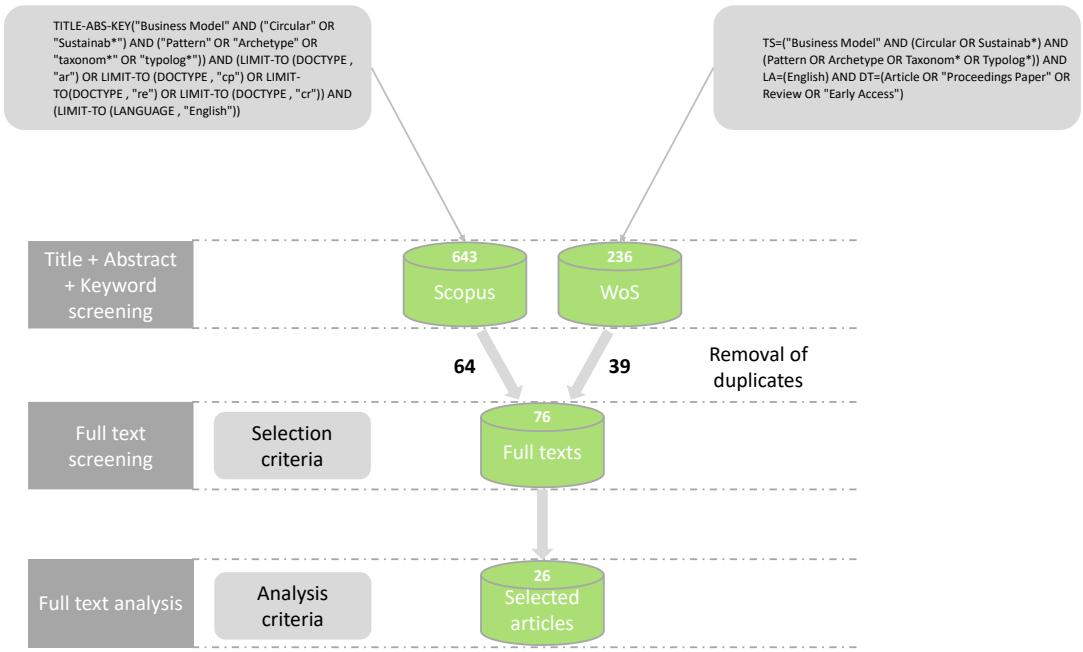


FIGURE 1: PROCESS OF SYSTEMATIC LITERATURE REVIEW

The search yielded 643 (Scopus) and 236 (Web of Science) results. In the initial screening of titles and abstracts, only publications explicitly focused on pattern-based approaches as reusable solutions in the context of BMfCE or BMfS were selected for full-text review. After removing duplicates, 76 papers remained. Publications focused on similar concepts, such as taxonomies, were also considered. During the full-text screening, specific selection criteria were applied to determine inclusion in the final review:

1) BMs: Reference to BMs, their components, or value dimensions
2) Sustainability: Focus on patterns for BMfCE or BMfS
3) Reusable design options: Patterns are understood as reusable solutions
4) Pattern for design: Patterns are intended for BM design

Regarding criteria 3), we also included publications that did not strictly follow pattern theory as described in 2.2, formally describing patterns. Rather, classifications, taxonomies, or similar concepts were considered if the description of regularities within different BMs contained the relevant information needed for pattern description, according to Leitner (2015). A total of 26 publications met these criteria. The authors followed a strict protocol for in- and exclusion of publications and their analysis. Both authors assessed each publication independently at every stage, resolving conflicting decisions. Despite these measures, it cannot be guaranteed that all relevant publications were included, nor that additional keywords in the search strings would not have yielded further results.

3.2 Classification of Pattern-based Approaches

The SLR and this section aim to provide an overview of the characteristics of pattern-based approaches rather than compiling a data set of patterns. As outlined in 2.3., CE is inherently

systemic and can be understood as the interplay of different BMfCE. Therefore, this study examines the extent to which existing pattern-based approaches incorporate a systemic perspective. For this, we derived the following analysis criteria (AC) after an initial screening of the selected literature to define the properties described in parentheses.

AC1: Level (micro: BM, meso: group of BMs, macro: ecosystem) and unit (BM components, value dimensions, general description) of patterns

AC2: Type of pattern (framework, prototypical, solution)

AC3: Derivation (literature review, case studies, mixed method)

AC4: BM type (BMfCE, BMfS)

AC5: Industry (general, industry-specific)

AC6: Systemic perspective (no, low, medium, high, and how?)

AC7: Interdependency, interfaces, and interoperability considered (no, yes, how?)

Both authors reviewed the selected publications and categorized them independently. The classification of papers regarding AC1, AC2, and AC4 is based on the definitions provided in Section 2. For the assessment of AC6 and AC7, we adopted the properties defined by Dormeier et al. for a systemic perspective in approaches for sustainability-oriented BM innovation (2024).

Table 1 gives an overview of the selected approaches based on the ACs.

TAB. 1: CLASSIFICATION AND ANALYSIS OF SELECTED PATTERN-BASED APPROACHES

Paper	AC1	AC2	AC3	AC4	AC5	AC6	AC7
Abdelkafi et al. 2023	Micro/Meso, BM components	Literature review	Prototypical/ Solution	BMfS	General	Medium: BMs embedded in a larger system with which flows are exchanged	Other companies' development considered in contingency factors
Behnert et al. 2024	Micro, value dimensions	Mixed method	Prototypical	BMfCE	General	Medium: need for systemic and open thinking through collaboration, co-creation, and synergistic partnerships	No
Blomsma et al. 2019	Micro, general description	Mixed method	Prototypical	BMfCE	Industry-specific (manufacturing)	Medium: patterns are linked on an abstract level	No
Bocken et al. 2014	Micro, value dimensions	Literature review	Prototypical/ Solution	BMfS	General	No	No
Chirumalla et al. 2024	Micro/Meso, value dimensions	Case studies	Prototypical/ Solution	BMfCE	Industry-specific (electric vehicle battery)	High: BMfCE based on resource flows, collaborative ecosystem engagement	Collaboration need is visually represented within the ecosystem. Not defined for BMfCE interdependencies
Curtis 2021	Micro, BM components	Mixed method	Framework/ Prototypical/ Solution	BMfS	Industry-specific (sharing economy)	No	No
Hansen and Revellio 2020	Meso, value creation architecture	Literature review	Framework/ Prototypical	BMfCE	General	High: Focus on value creation architecture from a systems perspective	Value creation architectures put different actors in relation without specifying interdependencies between BMfCE

TAB. 2: CLASSIFICATION AND ANALYSIS OF SELECTED PATTERN-BASED APPROACHES (CONTINUED)

Paper	AC1	AC2	AC3	AC4	AC5	AC6	AC7
Heesbeen and Prieto 2020	Micro, general description	Literature review	Prototypical	BMfCE	Industry-specific (construction and industrialized manufacturing)	No	No
Keyser and Mathijs 2023	Micro, BM components	Literature review	Prototypical	BMfCE	Industry-specific (bioeconomy)	Medium: some patterns involve interactions with other companies	No
Latino et al. 2024	Micro, BM components	Literature review	Prototypical	BMfS	Industry-specific (agribusiness)	Low: other stakeholders considered in the process	No
Lüdeke-Freund et al. 2018	Micro, BM components	Mixed method	Prototypical/ Solution	BMfS	General	No	No
Lüdeke-Freund et al. 2019	Micro/Meso, BM components	Literature review	Prototypical	BMfCE	General	High: Six BMfCE patterns intended to support six main reverse cycles in the Ellen MacArthur butterfly diagram; take an ecosystem perspective	Indirect through linkages within the butterfly diagram
Mais and Bauernhansl 2024	Micro, BM components	Literature review	Solution	BMfS	General	No	Indirect through open BM approach
Palmié et al. 2021	Micro, value dimensions	Case studies	Solution	BMfS	Industry-specific (electrical power sector)	No	No
Pieroni et al. 2020	Micro, BM component	Literature review	Prototypical/ Solution	BMfCE	General	Low: upstream and downstream architecture	No
M. Pieroni et al. 2021	Micro/Meso, BM components	Mixed method	Solution	BMfCE	Industry-specific (manufacturing companies)	Medium: context (upstream, downstream) considered in pattern description	Recommendations for collaborations

TAB. 3: CLASSIFICATION AND ANALYSIS OF SELECTED PATTERN-BASED APPROACHES (CONTINUED)

Paper	AC1	AC2	AC3	AC4	AC5	AC6	AC7
Reinhardt et al. 2020	Micro, value dimensions	Mixed method	Prototypical/ Solution	BMfS	Industry-specific (electric vehicle battery)	No	No
Salvador et al. 2023	Micro, value dimensions	Mixed method	Solution	BMfCE	Industry-specific (bioeconomy)	No	No
Schroedel 2023	Micro, general description	Literature review	Solution	BMfS	General	No	No
Schroedel 2024	Micro, general description	Literature review	Prototypical/ Solution	BMfS	Industry-specific (fast-moving consumer goods)	No	No
Trapp and Kanbach 2021	Micro, value dimensions	Literature review	Prototypical	BMfS	Industry-specific (Greentech)	No	No
Uvarova et al. 2023	Micro, strategies	Literature review	Prototypical	BMfCE	General	Low	No
Woldeyes et al. 2022	Micro, general description	Literature review	Solution	BMfCE	General	No	No
Woldeyes et al. 2023	Micro, value dimensions	Literature review	Prototypical/ Solution	BMfCE	General	No	No
Yip and Bocken 2018	Micro, value dimensions	Case studies	Prototypical	BMfS	Industry-specific (banking)	No	No
Zufall et al. 2020	Micro, value dimensions	Case Studies	Prototypical/ Solution	BMfS	Industry-specific (smartphone)	Medium: patterns in the context of the life cycle phases	Indirect through organization along the life cycle

3.3 Results

The review indicates that most approaches, whether for BMfS or BMfCE specifically, primarily focus on the micro level, offering patterns for individual companies. These mainly describe individual BM components, their combinations, or patterns for value dimensions. Only a few exceptions extend to both the micro and meso levels, considering patterns within a system (Lüdeke-Freund et al. 2019) or the value chain (e.g., M. Pieroni et al. 2021). Specific meso-level patterns are only described by Hansen and Revellio in the form of circular value creation architectures (CVCA) (Hansen and Revellio 2020). Assigning approaches is often challenging regarding the pattern classification discussed in Section 2.2. Most patterns are prototypical, describing generalized problems and solutions that cannot be implemented directly. However, some approaches qualify as solution patterns, offering granular descriptions for BM components (e.g., Mais and Bauernhansl 2024), value dimensions (e.g., Palmié et al. 2021), or entire BMs (e.g., Lüdeke-Freund et al. 2018). Both general and patterns for specific industries exist.

Mostly, patterns are described by a name, short description, problem statement, solutions, and examples – implicitly adopting the Alexandrian form (see 2.2.). While the most common method for pattern derivation is a literature review, many case study based or mixed-method approaches exist.

Overall, existing approaches are company-centric, describing patterns for individual companies with a narrow perspective without consideration of interdependencies or interfaces. However, some emerging approaches extend this view, particularly for BMfCE. These include recognizing stakeholder involvement (Latino et al. 2024), integrating the upstream and downstream architecture (M. Pieroni et al. 2021, 2020), emphasizing collaboration (Behnert et al. 2024), defining patterns in the context of life-cycle phases (Zufall et al. 2020), adopting an ecosystem perspective (Chirumalla et al. 2024; Lüdeke-Freund et al. 2019), or outlining CVCAs (Hansen and Revellio 2020).

Interdependencies, interoperability, and interfaces between BMs are rarely considered. Some approaches link patterns at an abstract level, such as the circular ecosystem (e.g., Chirumalla et al. 2024; Lüdeke-Freund et al. 2019), propose possible collaborations (M. Pieroni et al. 2021), or include other companies' development as contingencies (Abdelkafi et al. 2023). However, none specifically address pattern alignment or the flows between them.

To support companies in designing BMfCE, they must be able to assess patterns within the embedding system. Despite the recognized need for BM alignment (Brown et al. 2021), no existing approach is designed for use by multiple companies during that process. Based on 2.3, it can be concluded that existing pattern-based approaches do not sufficiently reflect the systemic perspective needed for BMfS and BMfCE. They lack multi-level (micro, meso, and macro) and multi-perspective (focal company and bird’s-eye view) approaches, as well as descriptions of interdependencies, interfaces, and interoperability within patterns.

These gaps hinder both the application of patterns across companies and the development of a comprehensive pattern language, as suggested by Lüdeke-Freund et al. (2019).

4 Ontology for a Multi-Level, Multi-Perspective Pattern-based Approach for BMfCE

4.1 Setting the Scene – CE as Interplay of Interconnected BMfCE

To describe the conceptual multi-level, multi-perspective ontology, we first clarify levels, perspectives, and the understanding of a CE as an interplay of interconnected BMfCE. We adopt Dormeier et al.'s multi-level, multi-perspective approach to systems of interconnected BMs (2024) and Mennenga et al.'s representation of CE based on BMfCE, interfaces, and flows (2025). Figure 2 schematically illustrates a CE as the interplay of interconnected BMfCE of an exemplary set of stakeholders (a).

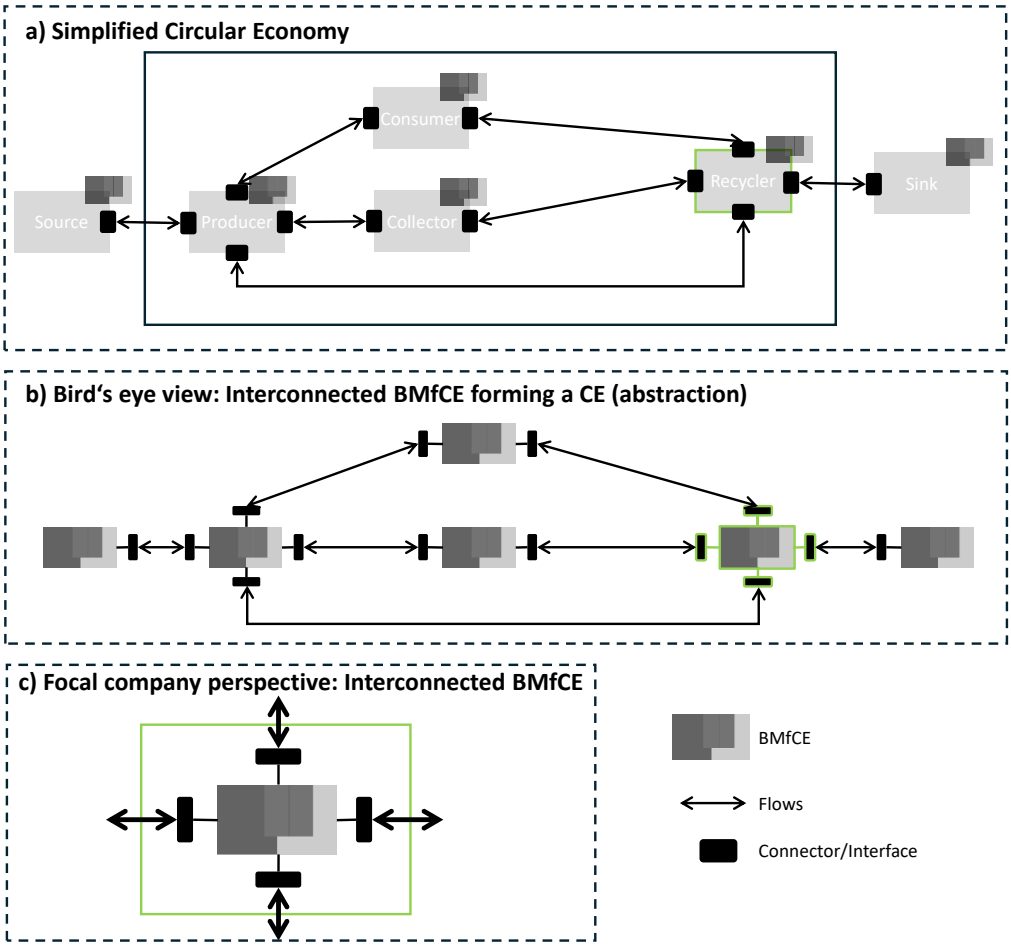


FIGURE 2: SCHEMATIC DEPICTION OF CE AS THE INTERPLAY OF INTERCONNECTED BMFCE

We distinguish mirco- (individual company) and meso-level (group of companies forming a CE). Each company operates its BMfCE, which defines the company's interfaces. A CE is formed by connecting interfaces of different BMfCE through flows (e.g., material, energy, financial, or information).

A focal company perspective (c) views the CE from the standpoint of an individual company, such as a recycler, emphasizing its direct connections with other stakeholders. In contrast, a bird's-eye perspective (b) considers the CE as a whole, treating individual companies as grey boxes within the embedding system.

4.2 Logic of Linking Micro- and Meso-Level Patterns

A pattern-based approach must understand BMfCE as embedded within a CE. Figure 3 shows a schematic overview of the relations between micro- and meso-level patterns, proposing an ontology.

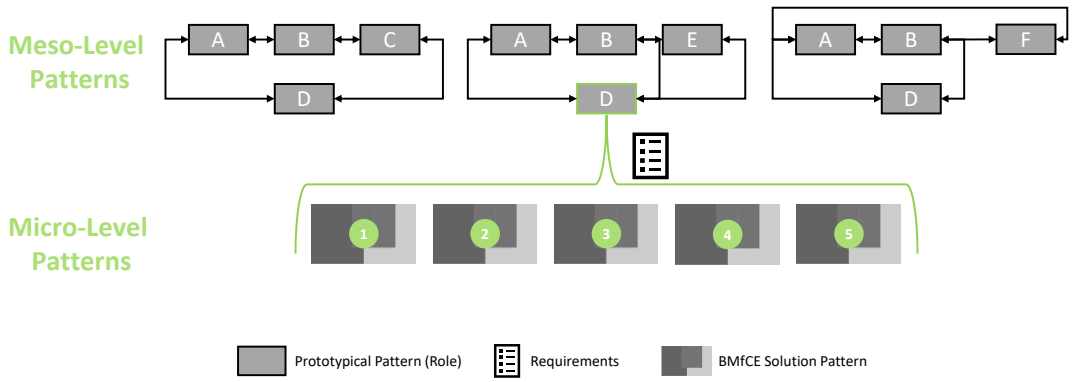


FIGURE 3: SCHEMATIC OVERVIEW OF LINKS BETWEEN PATTERN TYPES

Meso-level patterns define CVCAs (e.g., based on Hansen and Reviello) that can be implemented depending on industry characteristics. In Fig. 3, three CVCA are sketched. As argued in Section 4.1, these architectures constitute different BMfCE, treated as grey boxes. According to Amshoff et al. (2015), these grey boxes function as **prototypical patterns**, outlining a stakeholder's general role within the CVCA. In the example, the prototypical patterns A–F exist. Some prototypical patterns are present in different CVCA (e.g., A) and co-occur with other prototypical patterns. Meso-level patterns further describe interdependencies between these prototypical patterns through interfaces and flows. Extending the interface depiction in Figure 2 by adopting connections between BMs by Boldrini and Antheume (2021) Figure 4 outlines relevant flows between prototypical patterns A and B. Thereby, a prototypical pattern may have interconnections with different other prototypical patterns in different CVCAs (e.g., B can be linked to A, C–F, while A is only linked to B, D, or F). The pattern description should include properties of flows and linked prototypical patterns.

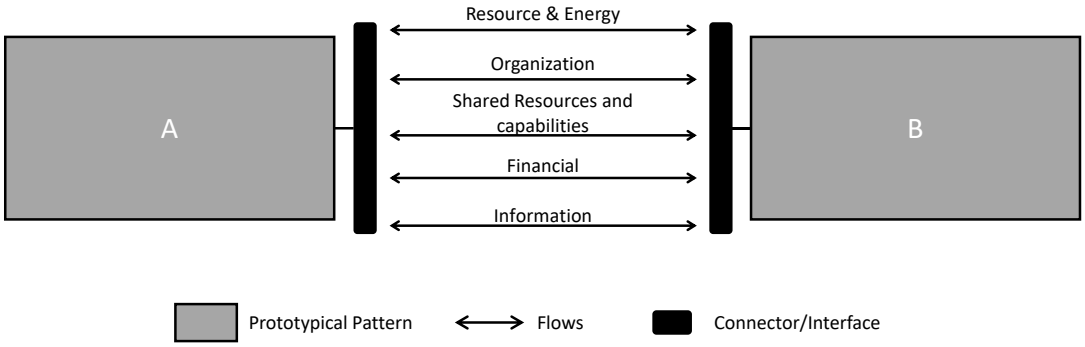


FIGURE 4: CONNECTING PROTOTYPICAL PATTERNS THROUGH FLOWS

On the Micro-level, prototypical and solution patterns are differentiated. Solution patterns are derived from the corresponding prototypical pattern, inheriting its characteristics and defining a specific BMfCE configuration. The superordinate prototypical pattern establishes the general requirements for the specification of the solution pattern, including interfaces and flow properties. This ensures the incorporation of interdependencies with other BMfCE patterns in the solution patterns. One or multiple solution patterns (here, five) can be defined for each prototypical pattern.

4.3 Contents and Description of Patterns

Our ontology requires describing three pattern types: meso-level, micro-level prototypical, and micro-level solution patterns. While defining specific patterns is beyond the scope of this publication, we briefly discuss their content and potential descriptions.

Since no standard pattern description format has been established in the literature (see Section 3.3), we adopt the Alexandrian form. However, we propose modifying the terminology to name, purpose, context and applicability, solution, visual representation, examples, and related patterns. Applied to the three pattern types in our ontology, these adaptations are outlined in Table 2.

TAB. 2: CONTENTS OF DIFFERENT PATTERN TYPES

Pattern element	Meso-level pattern	Prototypical pattern	Micro-level pattern
Name	summarizes the main aspects of the CVCA	summarizes the role of the stakeholder (e.g., recycler, refurbisher)	specification of the name of the superordinate prototypical pattern
Purpose	pattern aim (e.g., closed material loops, reduction of virgin material use)	role of the stakeholder within the CVCA (e.g., refurbish, recycle)	BMfCE purpose within the specific CVCA
Context and applicability	conditions and context in which the pattern can be used (e.g., industry, product characteristics, legal frameworks)	conditions and context in which the pattern can be used (e.g., industry, product characteristics, legal frameworks)	conditions and context in which the pattern can be used (inherited from superordinate prototypical pattern)
Solution and visual representation	graphical depiction of the CVCA, including roles (prototypical patterns) and interdependencies	solution description on a general level using value dimensions or BM components representation as morphological box (e.g., Lüdeke-Freund et al. 2018), table, or BM canvas	solutions for value dimensions or BM components visually represented, e.g., in BM canvas
Examples	exemplary CVCA implementations in industry	general examples (e.g., as proposed by Lüdeke-Freund et al. (2019))	examples of specific companies
Related patterns	refer to the prototypical patterns representing roles within the meso-level pattern	1) list of meso-level patterns that the prototypical pattern occurs in 2) interdependencies with other prototypical patterns in the CVCA through the definition of requirements for properties of flows and interfaces (e.g., based on Mennenga et al. 2025) 3) list of affiliated solution patterns	1) list of interdependent solution patterns 2) interdependencies with other BMfCE in the CVCA through the definition of requirements for properties of flows and interfaces (e.g., based on Mennenga et al. 2025)

4.4 Process of Multi-Level, Multi-Perspective Pattern-based Design of BMfCE

Based on the linkage between meso- and micro-level patterns illustrated in Figure 3, guidance for practical application is needed. We propose two main scenarios:

Scenario A "Use by an individual company": A focal company intends BMfCE desig without direct communication with other stakeholders. It is assumed that the company cannot change the general structure of the CE (meso-level) but can design or align its BMfCE (micro-level). The company consults the meso-level patterns to identify the CVCA of the given industry and its role (prototypical pattern) within it. This selection provides specifications and defines the range of possible BMfCE solution patterns. If multiple solution patterns meet the specifications, multi-criteria decision-making can be applied.

Scenario B "Use by a group of companies": A group of companies – ideally, all relevant stakeholders within the CE – aims at designing or improving the CVCA (meso-level) and their individual BMfCE (micro-level). Here, the process could be bottom-up (start with micro-level), top-down (start with meso-level), or simultaneous (design micro-level and meso-level iteratively). Given the complexity, we propose a top-down approach. First, the companies jointly develop the CVCA using meso-level patterns, treating individual companies as grey boxes represented by prototypical patterns. Companies can introduce specific requirements not yet covered by existing prototypical patterns. With the design of the CVCA, the identification of prototypical patterns, and the definition of additional requirements, each company can proceed independently on the micro-level within the given constraints. The selection of solution patterns for each company may be carried out as described in Scenario A.

5. Discussion and Implications

The proposed multi-level, multi-perspective ontology requires empirical validation. On the one hand, this can be achieved theoretically through the development of a pattern database following the above-defined contents and relations, showing that patterns can be linked in the described form (c.f. 4.2). This requires the derivation of meso-level, prototypical, and solution patterns according to the contents described in Table 2 from empirical case studies or through literature reviews. Thereby, meso-level patterns could describe possible circular supply chain configurations, prototypical patterns could differentiate relevant roles in the CE, and solution patterns could describe specific circular business strategies. From a theoretical perspective, the pattern ontology offers the possibility to structure existing patterns to leaverage embedded knowledge and to build a complete pattern language.

On the other hand, validation could be provided by applying the pattern ontology for the design of BMfCE. Companies cannot directly use the proposed pattern ontology. Rather, it can inform the development of respective BM innovation tools to enable systemic thinking and bridge the design-implementation gap in the design of BMfCE. Such tools could be implemented as card decks (e.g., Konietzko et al. (2020)) to be used in a collaborative setting (c.f. 4.4 Scenario B) – or decision support tools (e.g., Pieroni et al. (2021)) to be used by individual companies (c.f. 4.4 Scenario A). Compared to these and other approaches included in Table 1, tools adopting the proposed ontology would provide various advantages. The multi-level approach changes the classical focal company perspective to a systemic perspective of being embedded within a CE, providing a better understanding of the role and interdependencies with other stakeholders based on the prototypical patterns. By considering interfaces during the BMfCE design, interoperability could be increased, fostering the alignment of BMfCE, allowing other stakeholders to connect into the CE, and potentially increasing circularity or value capture. The application on multiple levels of abstraction through different pattern types enables the use for various purposes while maintaining inherent consistency, i.e., the definition of the CVCA and individual circular business strategies are linked directly.

Future research should focus both on theoretical and practical validation to contribute to BM pattern theory and support the practical realization of systemic thinking in BMfCE design.

6. Conclusion

Pattern-based approaches can be useful for BMfCE design. The embedded nature of BMfCE within a CE necessitates pattern-based approaches to take a systemic perspective beyond a focal company. While existing research provides extensive insights into micro-level patterns for individual BMfCE, the interconnectedness of BMfCE remained underexplored.

This paper contributes to the growing field of pattern-based approaches in BM innovation. Our findings enhance BM pattern theory by providing an ontology that can be the basis for a complete pattern language for BMfCE. They guide future research and provide a basis for the development of practical applications. By conducting an SLR on pattern-based approaches in the context of BMfS and BMfCE, we provide an overview that can guide future combinations and harmonization of approaches. Our ontology introduces the first multi-level, multi-perspective pattern-based approach for BMfCE within a CE, linking the meso- and micro-levels to better align BMfCE in the embedding CE. The proposed pattern interdependencies, types, contents, and recommended usage scenarios offer conceptual guidelines for developing practical tools. Tools following this ontology will be applicable in different scenarios. Individual companies can adopt it from a focal company perspective for informed decision-making, while it is also the first pattern-based approach explicitly

designed for collaborative use by multiple companies, facilitating BMfCE alignment within a CE.

However, this publication is not without limitations, as the definition of patterns, their interdependencies, and the implementation of the proposed ontology remain work in progress. While this paper does not address implementation, future research should focus on practical validation and application. Existing pattern descriptions can be leveraged to create a pattern database, ultimately supporting the development of a decision support system.

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The Relationship between Sustainable Finance and Sustainable Business Models

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Extended abstract

The connection between sustainable finance and sustainable business models has often seemed self-evident – i.e., to attain sustainable finance, organizations would need to have a sustainable business model, or at the very least, show commitments to make their current business model more sustainable (Stubbs and Cocklin, 2008). Perhaps, more unusually, studies have been outlining how the introduction of sustainable finance can influence the level of sustainability of an organization's strategy and business model (Mitchell et al., 2024). In this paper, we are primarily interested in looking at the relationship between firm financing and business models with a specific focus on sustainability. The research question is: What is the relationship between sustainable finance and sustainable business models in the literature?

Methodology: Employ the systematic literature process as outlined by Tranfield et al. (2003) of three basic stages: planning (identifying the need), conducting the review (selection of studies and synthesizing the data), and reporting (applying the findings into recommendations). We further leveraged approaches by Cooper (1988) and Basias and Pollalis (2018) to consider six significant characteristics – focus, goals, perspective, coverage, organization, and audience – throughout our research process.

Results: The aim is to uncover how literature within sustainable finance and, separately, sustainable business models references and relates to one another. The intended result is that the two help strengthen one another—i.e., a company has a better chance attracting

sustainable finance with a sustainable business model, and vice versa, a company has a more sustainable business model when it is financed using sustainable instruments.

Research Limitations: The main limitation and challenge is within the naming conventions of key concepts. For example, “strategy” has considered “financing choices” within the literature for decades, however, since the early 2000s, the concept of “business models” has grown, which is closely tied to strategy with some inherent differences. We aim to confront the limitation by covering the major research strands from “strategy” and “business model” literature.

Practical and Academic Value and Contribution: The paper's main contribution is to document how sustainable finance and sustainable business models might strengthen one another. For example, if the business model is more sustainable, is it more likely to attract sustainable finance? In reverse, does having sustainable finance make the business model itself more sustainable?

Keywords

Sustainable business models; sustainable finance; strategy; capital structure

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Influence of Institutional Investors on Corporate Decision-Making

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Abstract

The aim of this paper is to answer the question of whether and how institutional investors influence the decision-making of the companies they invest in. The focus is on institutional investors such as pension funds, banks, investment funds, and insurance companies. Additionally, the perception of institutional investors themselves regarding other stakeholders who may influence corporate decision-making is examined. Within corporate governance, there has been considerable academic debate about the involvement of different stakeholders in corporate operations, with stakeholder theory being a prominent perspective. However, less research has been conducted on how shareholders influence corporate decision-making and what aspects they affect. Among shareholders, institutional investors have become an increasing group of company owners, yet their activism and involvement in decision-making remain relatively unknown. An online survey was conducted among Icelandic institutional investors to explore their attitudes towards their own shareholder activism, that of other institutional investors, and the stakeholders most involved in corporate decision-making. The research is particularly interesting as institutional investors may have previously unrecognized effects on corporate decision-making. The main findings indicate that institutional investors relatively rarely interact with CEOs, CFOs, and boards of directors of the companies they invest in. They primarily contact board chairpersons when necessary. Institutional investors seek greater influence over decisions related to sustainability, executive compensation policies, and board member selection.

Keywords

Corporate governance, stakeholder theory, shareholder activism, decision-making, institutional investors.

Introduction

Institutional investors, such as pension funds, banks, investment funds, and insurance companies, have traditionally been passive in monitoring executives and corporate decision-making. Although they hold significant ownership stakes in companies and thus possess voting rights, they have generally utilized these rights only to a limited extent (Bebchuk, Cohen, & Hirst, 2017; Lewellen & Lewellen, 2022). Private investors, who invest their own capital rather than managing funds for others as institutional investors do, typically hold smaller stakes in companies, limiting their incentives to monitor operations and attempt to influence decisions. Furthermore, the costs associated with obtaining information are generally proportionally higher for smaller investors, reducing their financial incentive to exert ownership influence (Williamson, 1964; Grossman & Hart, 1980; Khalfan & Wendt, 2020). Over the past two decades, however, shareholders have shown greater interest in engaging in corporate decision-making, leading to the emergence of the term shareholder activism (Ryan & Schneider, 2002; Goranova & Ryan, 2014; Brochet, Ferri, & Miller, 2021). International research indicates that institutional investors have become more active than before by voting more frequently at general meetings and engaging in informal discussions with company executives (Carleton, Nelson, & Weisbach, 1998; Appel, Gormley, & Keim, 2016; McCahery, Sautner, & Starks, 2016; Lewellen & Lewellen, 2022).

From a corporate governance perspective, shareholder influence on decision-making may appear straightforward, as it fundamentally involves the principal-agent relationship between shareholders as principals and managers as agents (Jensen & Meckling, 1976; Fama & Jensen, 1983). However, when examined in a broader governance context, the issue becomes more complex due to the role and involvement of other stakeholders such as creditors, employees, customers, suppliers, and the public (Freeman, 1984; Donaldson & Preston, 1995; Becht, Bolton, & Röell, 2003). For instance, creditors can influence decisions through loan and bond agreements (McDaniel, 1986; Ivashina et al., 2009; Wendt, 2011; Nini, Smith, & Sufi, 2012); employees through labor unions (Schwab & Thomas, 1998; Woods & Tan, 2018; Cho, Chung, & Lee, 2019); and suppliers and customers through bargaining power and industry associations (Chang et al., 2015). Governments can also significantly impact corporate decision-making through legislation, taxation, and regulatory oversight (La Porta et al., 1998; Roe, 2003).

From a corporate governance perspective, shareholder influence is often framed within the principal-agent relationship, where shareholders act as principals and managers as agents.

However, governance complexities arise due to the involvement of other stakeholders, such as creditors, employees, suppliers, and governments, who also exert influence through contracts, regulations, labor unions, and industry associations. The purpose of this study is to address this broader governance context, highlighting the multifaceted nature of decision-making in corporations, extending beyond shareholder-manager dynamics to include diverse external pressures.

Literature

The 2.1. Shareholder and Stakeholder Approaches in Corporate Governance

Corporate governance discussions often take place from either a shareholder or stakeholder perspective. The two dominant theories are shareholder theory and stakeholder theory. Shareholder theory asserts that shareholders, as owners of companies, assume the highest financial risk associated with corporate operations (Fama & Jensen, 1983). Other stakeholders, such as creditors, employees, suppliers, and customers, have contractual claims that are predefined and typically independent of corporate performance. Shareholders, however, receive residual earnings only after all other claims have been met. This perspective views companies as networks of contracts (Alchian & Demsetz, 1972; Jensen & Meckling, 1976; Fama, 1980), meaning shareholders have voting rights and the authority to elect boards or influence corporate strategy. The ultimate objective in this theory is maximizing shareholder value.

Stakeholder theory, by contrast, contends that all entities affected by corporate activities should have a role in governance (Freeman, 1984; Donaldson & Preston, 1995). Stakeholders may bear substantial risks due to uncertainties surrounding corporate decisions, necessitating safeguards for fair representation. In some corporate governance structures, stakeholders hold direct decision-making power, such as labor unions securing seats on company boards (Becht, Bolton, & Röell, 2003). Other models emphasize collaboration, where management balances competing interests among shareholders, employees, creditors, suppliers, and society at large.

A major debate between the two theories centers on corporate responsibility. Shareholder theory proponents argue that businesses should focus on profit maximization within legal constraints, while stakeholder theorists advocate for a broader consideration of social, environmental, and economic impacts. Over the years, global regulatory frameworks have evolved to incorporate elements of both perspectives, particularly regarding corporate social responsibility (CSR) and sustainability practices (O'Rourke, 2003; King & Gish, 2015; Perrault & Clark, 2016).

2.2. Shareholder Influence and Stakeholder Involvement

Shareholder activism refers to the actions taken by investors to influence corporate governance, financial policies, and strategic decisions. These actions can include direct engagement with executives, voting at shareholder meetings, filing shareholder proposals, litigation, and public campaigns (Ryan & Schneider, 2002; Goranova & Ryan, 2014; Brochet, Ferri, & Miller, 2021). The objective of activism can vary, from maximizing shareholder value to promoting environmental and social governance (ESG) issues (O'Rourke, 2003; Logsdon & van Buren, 2008; King & Gish, 2015; Perrault & Clark, 2016; Goranova et al., 2017; Wei, 2020).

Lenders also exert influence through contractual agreements, such as loan covenants and bondholder rights (Smith & Warner, 1979; Nini, Smith, & Sufi, 2009). These agreements often include restrictions on corporate actions, reporting requirements, and financial performance targets. Furthermore, some investors, particularly institutional investors, seek direct representation on corporate boards to influence decision-making (Kaplan & Strömberg, 2003; Lerner, 1995).

Employees and labor unions can also play a significant role in corporate governance. In some countries, employees have legal rights to board representation or consultation on corporate decisions (Becht, Bolton, & Röell, 2003). Labor unions may negotiate directly with management to influence wage policies, working conditions, and corporate social responsibility practices (Schwab & Thomas, 1998; Woods & Tan, 2018; Cho, Chung, & Lee, 2019).

This study examines the shareholder and stakeholder approaches to corporate governance, comparing the perspectives and influence of each. Shareholder theory prioritizes profit maximization and shareholder rights, emphasizing that shareholders bear the highest financial risk and have the authority to influence corporate decisions. In contrast, stakeholder theory advocates for broader governance, where various entities, including employees, suppliers, and communities, are involved in decision-making due to the risks they face. The research also explores shareholder activism, stakeholder involvement, and the evolving role of corporate responsibility, highlighting the impact of environmental, social, and governance (ESG) concerns and global regulatory frameworks.

Method

The study aims to contribute to the discussion on shareholder activism in Iceland among institutional investors. The data was collected using a quantitative survey methodology, enabling an assessment of how institutional investors perceive their own activism and that of others in the companies they invest in. The survey included both open-ended and closed-ended questions, providing an opportunity for deeper insights into participants' perspectives (Bryman & Bell, 2007; Creswell, 2014).

First, a pilot test was conducted on the questions and the format of the online survey, where three governance experts answered the survey and provided feedback. A cover letter was then prepared in collaboration with the board of Iceland SIF, which includes experts with experience in corporate governance. The association sent the survey to its members within investments decisions, on January 13, and it was open until January 17, 2025. A reminder was sent to recipients to encourage participation. The online survey was thus distributed to members of Iceland SIF, an association of financial institutions aimed at raising awareness and promoting discussions on methods for sustainable and responsible investments. Members who are responsible for direct investments received the survey via email, where the research was introduced and a link to the online survey was provided. In total, 32 individuals from 32 financial companies received the survey.

The content of the survey is based on academic discussions of shareholder engagement. Key themes were identified, and indicators were designed for each. The survey included three main sections: characteristics of institutional investors, their influence on decision-making, and finally, their self-assessment of the impact they have on others. Questions also addressed the direct effects of institutional investors, both on how they perceive their impact and what they believe their impact should be. The survey included both open and closed-ended questions; the questionnaire can be found in the appendix.

For the closed-ended questions, participants responded using a ten-point Likert scale, where 1 represented strong disagreement and 10 represented strong agreement. "Not applicable" was not an option in these questions, meaning participants were required to take a position. Open-ended questions were sometimes used to gain a deeper understanding of the closed-ended responses. These questions mainly focused on institutional investors' experiences of active ownership, and through their responses, they provided more detailed accounts of the impact investors can have on corporate decision-making. Themes addressed in the open-ended questions include (i) types of interventions that give institutional investors influence on decision-making, (ii) assessment of actual impact, (iii) assessment of expected impact, (iv) whether economic conditions affect institutional investors' involvement in corporate decision-making, (v) the value of general meetings for institutional investors to influence decisions, and (vi) how important involvement in the company’s board can be for influencing decision-making.

There were 13 participants, or nearly 41%. Excel was used to process the raw data into descriptive statistics. The number of responses behind each answer, the percentage of the total, and the percentage of the sum were analyzed. It should be noted that this is not a large participation rate, and the number of participants does not allow for extensive statistical analysis beyond descriptive analysis, nor for analysis of subcategories (characteristics) of the participants. This means that careful consideration is needed when interpreting the results and making generalizations based on them. Nonetheless, the

response rate can be considered satisfactory for descriptive statistics according to Olson and Slater (2002).

Findings

The 4.1 Participant Characteristics in the Survey

The first part of the survey involved gathering information about the background of professional investors, focusing on the type and size of their investments and what their investment strategies indicate regarding the impact those investments are intended to have. The sample is divided as follows: most participants (61,5%) are from pension funds, and 23,1% are from securities companies and others are from operating companies (15,4%). There is overlap between the types of investments of these different participants. They were given the option to select from six different types of investments (they could select any number of options). Bonds are part of the portfolios of 78,6% of participants, stocks in listed companies are part of 92,9% of portfolios, while 64,3% have investments in unlisted companies.

Table 1. Size of Investments as a Percentage of the Share Capital of the Invested Company

Size of Investment	**Percentage of Respondents**
<1%	15,4%
1% to 4,99%	46,2%
5% to 9,99%	23,1%
10% to 50%	15,4%
>50%	0,0%

When asked about the size of these investments as a percentage of the share capital of the company, 15,4% of investments are below 1%, 46,2% are between 1% and 4.99%, 23,1% are between 5% and 10%, 15,4% are between 10% and 50%, and none are over 50%. Table 1 shows these results. This suggests that most participants have ownership stakes that give them significant voting rights and financial incentives to maintain active oversight.

4.2 Impact of Professional Investors

The second part of the survey contained questions regarding the impact of professional investors on decision-making within companies. The potential impact of investors on companies can be influenced by laws, regulations, as well as restrictions set by the investors

themselves, which may appear in investment and ownership strategies and shareholder agreements. This was among the topics inquired about, with Table 2 showing the results both in terms of what investors believe the regulatory framework allows and what their actual impact is. There is no difference in the responses when it comes to voting at annual general meetings. While 84,6% believe that internal and external rules allow participation, and the same indicate they actually have an impact. Having an influence through regular communication with the chairperson of boards is an option that 30,8% of participants affirm, the same % believes the regulatory framework allows for this. The survey does not reveal whether investors act beyond the framework or if the regulations simply do not address this issue. Participants believe the internal and external regulatory framework allows investors, to a limited extent, to influence boards (30,8%), but 46,2% believe this is a path that is actually used. Regular communication with the CEO is an option marked by 92,3% of participants, and when asked if the "framework" allows for this, the response rate was 53,8%. Thus, it can be said that those who can do this, do so, and more so. The influence of other stakeholders is more limited. As mentioned earlier, a number of participants do not allow statistical analysis, so no assessment is made regarding whether there is a statistically significant difference between what is allowed and the actual impact.

Table 2. Ways the Rules Allow for Influence Compared to Actual Influence

Ways to Influence	**Framework Allows**	**Actual Impact**
Vote at Annual meetings	84,6%	84,6%
Regular Communication with Chairperson	76,9%	76,9%
Regular Communication with Board	30,8%	46,2%
Regular Communication with CEO	53,8%	92,3%
Regular Communication with CFO	38,5%	30,8%
Regular Communication with Other Executives	30,8%	23,1%
Nominate a Board Member	53,8%	53,8%

Participants were also given the option to mark "other" in an open question. One participant wrote: "We contact and communicate with the CEO and other executives, but then mainly the CFO, simply if we believe that to be necessary". One participant believed the type of investment greatly influences what can be done to affect corporate decision-making.

Traditional communication between CEOs and investors has primarily focused on boards. The survey asked if communication between CEOs and professional investors is common, and the results are shown in Table 3. There, 21% of investors marked "often" and "very often," while 43% marked "sometimes." About one-third, or 36%, marked "never." Thus, 21% appear to be in regular contact with CEOs.

Table 3. How Often Is the CEO in Contact with You Regarding Decision-Making?

Never: 36%	Sometimes: 43%	Often: 14%	Very often: 7%

Investors can use different methods to communicate their views to companies. The survey asked if they use the media (radio, television, social media, etc.) to express their opinions. The results show that a large majority, 71%, do not use the media for this purpose.

Table 4. Do You Use the Media (Radio, TV, Social Media, and More) to Communicate Your Opinions About the Companies You Invest In?

Yes: 29%	No: 71%

Participants were then asked to describe how much influence they want to have on different types of decisions and to evaluate how much influence they actually have. Table 5 shows the results, with the values being averages, where the highest indicates the most influence (using a Likert scale from 1 to 10). Professional investors most want to influence decisions regarding dividends, share buybacks, remuneration and the selection of board members. On all of these areas, they believe their influence is currently too limited.

Table 5. Actual Impact on Decisions

Type of Decision	**Want to have Influence**	**Actual Influence**
Financial	7,4	6,0
Sustainability	5,1	5,3
Mergers and Acquisition	5,1	6,1
New Markets	3,7	5,1
Vision and Strategy	4,7	6
Operational	2,5	4,9
Select Board Members	7,5	5,5

Remuneration of Executives	8,3	5,9

The external regulatory framework (laws, rules, recommendations, and regulators) is important when it comes to supporting investors so they can have an impact on decision-making when they believe it is necessary. Participants were asked whether they believed laws and regulations support investors in influencing corporate decision-making. The average response was 7,6 on a Likert scale from 1 to 10, where 10% of participants believed the regulatory framework supports this as well as possible (10.0) and 80% very well (7.0–9.0).

4.3 Impact of Professional Investors on Other Stakeholders

Those who influence corporate decision-making can be individuals playing different roles. Participants were asked about this, in terms of who they believe has power in decision-making. These stakeholders can include the investors themselves, lenders, bond buyers, CEOs, CFOs, board members, board chairs, regulators, government authorities, and trade unions. Participants could also name other stakeholders under the "other" option. Table 6 shows the results.

Table 6. Actual Power Today (1 is highest value, 10 is lowest value)

Actual Power	**%**
Shareholders	5,3
Lenders and Bond buyers	7,3
CEOs	3,3
CFOs	5,5
Board Chairs	3,9
Boards	3,4
Government	5,9
Trade Unions	9,1
Regulators	5,4

Participants believe CEOs have the most power when it comes to decision-making (3,3). Board follow closely behind (3,3), and board chairs less but still strong (3,4). They mention themselves (shareholders) next in terms of decision-making power (5,3). CFOs are believed

to have less power (5,5). Lenders and bond buyers are believed to have some influence (7,3). Other stakeholders (government, trade unions, and regulators) are viewed by professional investors as having less influence over corporate decision-making.

Discussion

The purpose of this study is to shed light on the shareholder activism of Icelandic institutional investors by focusing specifically on their involvement in decision-making processes in the companies they invest in. Furthermore, this section investigates the experiences of institutional investors regarding the involvement of other stakeholders in corporate decision-making. International studies indicate that shareholders have become more active in this regard in recent years (Brochet, Ferri, and Miller, 2021). Responses to the survey sent to institutional investors reveal that participants primarily exert their influence by utilizing their voting rights. They use shareholder meetings to vote on issues that underpin decisions. It is interesting to note from the results that institutional investors vote exactly as frequently than they are allowed to, but they engage more frequently with boards and much more with CEOs than their regulatory frameworks (such as investment policies and shareholder policies) seem to allow.

Institutional investors primarily want to influence financial decisions (such as dividends and stock buybacks) and the selection of board members. Additionally, remuneration policy is an important factor for institutional investors, as it is closely followed. Investors have the impact on sustainability matters they want. These findings align with international research, where institutional investors have begun to view sustainability issues as part of increasing shareholder value (King and Gish, 2015; Perrault and Clark, 2016; Goranova et al., 2017; Wei, 2020). Institutional investors prefer to limit their involvement when it comes to operational decisions. This reflects findings from international studies showing that investors want to have strategic influence over the company's operations, as they appoint managers precisely for the task of handling day-to-day operations.

Icelandic institutional investors want to have more influence on corporate decision-making than they feel they currently have, according to this study. Contrast to some other countries, where employees often have significant influence over decisions, for example, through board seats and via labor unions, Iceland does not have that according to the study (Woods and Tan, 2018; Cho, Chung, and Lee, 2019).

However, the findings of this Icelandic study are similar to those from abroad in that investors believe that those who take the most risk should have the most influence, which certainly applies to those who invest in stocks. In this context, it is also worth noting that investors have the most influence in difficult times and the least influence when things are going well. During periods of uncertainty, risk increases, and then investors want more influence over matters. The results of the study contribute to the ongoing discussion about

the role, rights, and duties of investors, as well as other stakeholders, regarding corporate governance. Furthermore, the findings highlight that it is the strategic factors, rather than the operational ones, that institutional investors emphasize when it comes to communication and involvement with the companies, they invest in.

Limitations of the study must be considered. First, the number of participants is too low for statistical analysis to yield meaningful results. While the results provide interesting insights into the involvement and influence of institutional investors in corporate decision-making in the companies they invest in, caution should be taken when drawing conclusions and generalizing the results. Secondly, some participants play a dual role as owners of both equity and lenders, so some answers may reflect their influence both through ownership and lending. The survey, as it is designed, does not allow for differentiation between the two. Thirdly, the survey was sent to institutional investors in Iceland, meaning that the influence of foreign institutional investors in Iceland is not part of the results unless they are members of Iceland SIF and participated in the survey.

Further research is needed on the influence of institutional investors on decision-making in companies they invest in. It would be particularly valuable to reach out to more institutional investors than were included in this study. One potential approach would be to offer incentives for participation or use alternative methods, such as conducting surveys through phone or video conference. Nonetheless, the authors recognize that questions about the influence of institutional investors on decision-making can be a sensitive issue and may have legal implications, meaning that some institutional investors may prefer to avoid answering such questions. Another approach could be to ask managers and board members about how institutional investors influence decision-making within companies and what factors institutional investors prioritize over others. This study has focused on institutional investors, but future research could explore other types of investors, such as private investors. Different interests and incentives may lie behind how these investors seek to influence decisions.

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Interdisciplinary Approaches to Integrating ESG Practices for Sustainable Business Innovation and Growth

Evidence from Europe

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Short Paper

SUBMITTED TO TRACK 1.2 ECOSYSTEMS OF ACTORS IN SUPPORT OF SUSTAINABILITY OF THE 10TH NEW BUSINESS MODELS CONFERENCE, 2025, ICELAND

Keywords

ESG, integration, sustainability, interdisciplinary collaboration, Europe

Abstract

This study explores interdisciplinary approaches to ESG integration across Europe, emphasizing collaboration among businesses, financial institutions, and policymakers. Findings highlight scalable ESG business models aligned with SDGs, regulatory challenges, and financial innovations like green bonds. Key recommendations include standardizing ESG metrics and fostering stakeholder engagement to drive sustainable business model innovation.

Introduction

In December 2022, the European Union passed the Corporate Sustainability Reporting Directive ("CSRD"), considered by many as "the world's most far-reaching mandatory environmental, social, and governance ("ESG") reporting regime", aiming to create detailed, audited, public, and comparable ESG reporting for both public and non-public companies. EU Member States must adopt national laws implementing the CSRD, by mid-2024, with the first reports due in 2025. ESG becomes an integral part of a business, regardless of size or industry.The integration of Environmental, Social, and Governance (ESG) practices into business operations has become a critical focus for contemporary enterprises, particularly within the context of evolving business models and regulatory landscapes (Li et al., 2024). The importance of ESG integration lies in its potential to enhance corporate sustainability and accountability. ESG principles encompass a wide range of factors, including environmental stewardship, social responsibility, and governance structures, which collectively contribute to the long-term success and ethical standing of businesses (Pérez Báez and Remond, 2022).

In recent years, many institutes/corporations have conducted surveys to examine ESG's impact on business performance. According to McKinsey (2019), ESG strategies can affect operating profits by as much as 60% and climate-related weather events are expected to cost businesses $1.3 trillion by 2026 (CDP, 2020). The importance of ESG integration is also assessed from stakeholders' perspectives. According to Marsh & McLennan (2019), organisations with the highest employee satisfaction had ESG scores 14% higher than the global average, likely due to their strong environmental performance. In addition, NASDAQ (2021) found that 51% more institutional investors and 45% more investment fund selectors actively sought ethical and socially responsible investment opportunities compared to prior years. Although there is a great demand for environmentally, economically and socially responsible businesses, as indicated in the various studies, there is a gap experienced by the latter in understanding the "why" and "how" of adopting ESG practices. This is confirmed by the CFA Institute and The United Nations-supported Principles for Responsible Investment (PRI) Initiative's study. This

hinders its implementation (Friede et al., 2015), particularly among small and medium enterprises (SMEs). The integration of ESG principles poses both challenges and opportunities ESG adoption, as it requires overcoming uncertainties in data acquisition and quality, adapting to regulatory changes, and enhancing market awareness and understanding of ESG values. This study addresses critical gaps in understanding how interdisciplinary collaboration among businesses, financial institutions, policymakers, and civil society drives ESG integration. By synthesizing empirical evidence from European case studies and peer-reviewed literature, this research proposes actionable frameworks for scaling sustainable innovation. The study aligns with the conference's focus on ecosystems of actors by demonstrating how collaborative networks overcome systemic barriers to ESG adoption, such as data inconsistencies, cultural resistance, and financing gaps.

Literature Review

The integration of ESG principles into business models is rooted in the recognition that sustainability and profitability are mutually reinforcing (Eccles & Krzus, 2018). Theoretical frameworks emphasize ESG as a holistic approach that transcends compliance, embedding ethical considerations into core strategies (Bocken & Geradts, 2020). The shift toward circular economy models exemplifies ESG-driven environmental innovation. Environmental factors within ESG focus on the impact of business activities on the natural environment. This includes practices aimed at reducing carbon footprints, enhancing resource efficiency, and promoting eco-friendly initiatives. Companies are encouraged to adopt measures that mitigate environmental risks and contribute to climate action, such as reducing greenhouse gas emissions and managing waste effectively. The emphasis on environmental sustainability is driven by the growing awareness of climate change and the need for businesses to operate within ecological limits. For instance, Schröder et al. (2019) highlight how European firms reduce waste by 30–40% through partnerships with academia to redesign supply chains. The EU Taxonomy further standardizes environmental goals, mandating alignment with climate neutrality targets (European Commission, 2021).

Social factors in ESG address the relationships between businesses and their stakeholders, including employees, customers, suppliers, and communities. This dimension emphasizes the importance of social responsibility, diversity and inclusion, and community engagement. Companies are expected to foster a positive social impact by ensuring fair labor practices, promoting equal opportunities, and contributing to the well-being of the communities in which they operate. The integration of social considerations into business strategies helps in building trust and strengthening stakeholder relationships, which are crucial for long-term success. Stakeholder inclusivity and fair labor practices are central to social sustainability. Van Zanten and Van Tulder (2021) argue that businesses prioritizing

community engagement and employee well-being achieve stronger long-term loyalty and brand equity.

Governance factors pertain to the internal systems and processes that govern an organization. This includes the structures and practices that ensure accountability, transparency, and ethical behavior. Effective governance is characterized by strong leadership, robust risk management, and adherence to regulatory requirements. Companies with sound governance practices are better equipped to navigate challenges and maintain the confidence of investors and other stakeholders. The role of leadership in driving ESG initiatives is particularly significant, as it sets the tone for organizational culture and priorities. Transparent decision-making and ethical leadership are critical for ESG credibility. Eccles and Krzus (2018) demonstrate that firms with robust governance frameworks, such as independent sustainability boards, outperform peers in risk management.

Inconsistent ESG metrics however hinder cross-sector benchmarking (WEF, 2020). SMEs, in particular, lack resources to navigate complex reporting standards. Short-term profit motives often clash with long-term ESG goals. Bocken and Geradts (2020) identify leadership inertia as a key obstacle, with 40% of surveyed firms prioritizing quarterly earnings over sustainability. The EU Taxonomy's classification system incentivizes green investments by clarifying eligibility criteria for sustainable activities (European Commission, 2021). Cooperative banks in Poland, for example, offer ESG-linked loans with preferential rates for SMEs adopting renewable energy (Kozłowski & Sokołowski, 2020).

The scope of ESG extends beyond mere regulatory compliance. It involves embedding sustainability principles and ethical considerations at the core of business operations. This comprehensive approach acknowledges the interconnected nature of environmental, social, and governance issues and their collective impact on the long-term viability of businesses. The integration of ESG factors into business models is not only about mitigating risks but also about seizing opportunities for innovation and value creation (Grima *et al.*, 2024). The significance of ESG integration is underscored by its potential to enhance financial performance, improve risk management, and bolster corporate reputation. Companies that effectively incorporate ESG principles are likely to experience increased access to capital, as investors are increasingly prioritizing sustainability in their investment decisions (Friede, Busch, & Bassen, 2015). Moreover, ESG integration can lead to strengthened stakeholder engagement, as businesses that demonstrate a commitment to sustainability are more likely to gain the support and loyalty of their stakeholders(Friede, Busch and Bassen, 2015).

In summary, the integration of ESG practices in business operations is a multifaceted endeavor that requires careful planning, effective communication, and a strong ethical foundation. This research is part of EU Project Project no 2024-1-PL01-KA220-VET-000253738 which aims to present best practices from various European countries,

providing valuable insights into the successful implementation of ESG principles in contemporary business models

Methodology

This study employs a mixed-methods approach to analyze ESG integration across Europe:

- Systematic Literature Review: A PRISMA-guided analysis of peer-reviewed articles (2015–2024) will be conducted to identify key themes, barriers, and best practices in ESG adoption. The review will synthesize findings from business, environmental science, and policy research to provide a comprehensive understanding of ESG integration.
- Case Studies: A selection of European firms across multiple sectors, including energy, finance, and manufacturing, will be examined to highlight industry-specific ESG practices. Case study examples will provide in-depth insights into interdisciplinary collaboration, regulatory adaptation, and ESG performance measurement.
- Stakeholder Interviews: Semi-structured interviews will be conducted with corporate executives, ESG specialists, policymakers, and sustainability consultants to gather firsthand perspectives on challenges and success factors in ESG implementation.
- Comparative Analysis: Thematic coding and cross-case comparisons will be used to assess variations in ESG strategies across different regulatory environments, corporate structures, and market conditions.

The combination of qualitative and quantitative data enhances the robustness of findings and provides actionable insights for scaling ESG-driven business models across industries and geographic regions.

Initial findings

Austria: Pioneering Renewable Energy and Green Finance

Austria has established itself as a leader in ESG through its ambitious renewable energy policies and green finance initiatives. The country's focus on hydropower and wind energy has driven substantial reductions in carbon emissions. One notable example is Verbund AG, Austria's largest electricity provider, which has shifted towards 100% renewable energy production. Additionally, Austrian banks such as Erste Group have launched green bonds and sustainable investment funds to encourage ESG-compliant business practices.

Poland: Advancing ESG Through Corporate Sustainability Initiatives

Poland has made significant progress in integrating ESG, particularly within its corporate sector. Large enterprises, such as PGE Polska Grupa Energetyczna, have committed to reducing their carbon footprint by investing in offshore wind farms and energy efficiency programs. Furthermore, Polish companies like InPost have introduced sustainable logistics solutions, including eco-friendly parcel lockers and low-emission delivery fleets, contributing to greener urban mobility. Cooperative bank BPS enabled 52% of farmers to adopt organic practices via ESG-linked loans.

Cyprus: ESG-Driven Blue Economy and Sustainable Tourism

Cyprus, with its strong reliance on tourism and maritime industries, has integrated ESG into its economic framework through sustainable tourism initiatives and the blue economy. Organizations such as Cyprus Sustainable Tourism Initiative (CSTI) promote eco-friendly tourism practices, reducing water and energy consumption in hotels and preserving local ecosystems. Additionally, the Cyprus Shipping Chamber has spearheaded efforts to decarbonize the maritime sector by adopting cleaner fuels and energy-efficient vessel designs.

Cross-Cutting Findings:

- Actor Ecosystems Matter: 60% of ESG implementation challenges (e.g., data gaps, financing) were resolved through cross-sector collaboration.
- Policy as a Catalyst: Firms in regulated sectors (e.g., energy, manufacturing) adopted ESG practices twice as fast as peers.
- Leadership Commitment: Companies with CEO-led sustainability committees reported 35% higher ESG performance scores (Bocken & Geradts, 2020).
- Innovation as a Driver for ESG Implementation - circular economy models and digital sustainability solutions showcase how technological innovations enhance ESG outcomes.
- Challenges in Measuring ESG Impact - standardized ESG performance metrics remain a challenge across Europe. Companies struggle with data collection, reporting inconsistencies, and the cost of compliance with evolving regulations.

Conclusion

This study underscores the significance of interdisciplinary collaboration in successfully integrating ESG principles into business models for sustainable innovation and

long-term economic growth. The findings highlight that ESG adoption is most effective when supported by ecosystems of actors, including businesses, policymakers, financial institutions, and academia. By fostering cross-sector partnerships, organizations can overcome systemic barriers such as data inconsistencies, cultural resistance, and financing gaps. Key contributions include:

- A Framework for Stakeholder Alignment: The proposed model will integrate financial institutions, policymakers, and academia to harmonize ESG priorities with the UN Sustainable Development Goals (SDGs).
- Financing Innovations: Cooperative banking models, as seen in Poland, demonstrate how localized financial instruments can democratize access to ESG resources.
- Policy Recommendations: EU-wide standardization of ESG metrics, inspired by Sweden's approach, could mitigate data fragmentation and enhance accountability.

Implications for Practice

Businesses should prioritize partnerships with universities and social entrerpreneurs to co-design ESG solutions. Policymakers must balance regulatory rigor with incentives to avoid stifling SME participation.

Limitations and Future Research

The study focuses on Europe; comparative analyses with Asian and North American models are needed. Longitudinal data on ESG financial returns remain sparse, warranting further investigation.

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Extended Abstract: Accounting and reporting adjustments for a circular construction economy

Insights from a Living Lab

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Extended abstract

Problem statement: The Dutch government aims to transform the linear economy into a sustainable, fully circular economy by 2050. Transition agendas have been set for five industries, including the building sector, to achieve this. In 2018, the Dutch government, in collaboration with stakeholders from the construction sector, developed the Transition Agenda for the Construction and Infrastructure sector (Transitieteam, 2018). This agenda includes activities and projects to help shape the transition to a circular economy. The Circular Economy Implementation Programme was developed to realise this ambition, translating the five transition agendas into concrete actions and projects to be implemented between 2019 and 2023. However, as far as we know, the investigation of the accounting guidelines for a circular economy has not been included in this programme. Current accounting and reporting guidelines are based on principles in a linear economy. This lack of alignment hinders businesses from capturing the circular initiatives' value and positive impact. According to the Coalition Circular Accounting, the transition to a circular economy will require rethinking the present way of doing business, and the critical role of accounting cannot be overlooked (Coalition Circular Accounting, 2022). Research is needed to develop new forms of accounting to support sustainable production and consumption patterns and relevant information for managers adopting circular economy strategies (Aureli, et al., 2023). Recognising the need for more research on this topic, financial graduates participating in the " Living Lab Circular Accounting in the Building Sector " studied potential adjustments to accounting and reporting guidelines to

enable companies to contribute effectively to the transition to a circular economy. This research is based on their findings.

Current understanding: Accounting and reporting guidelines are practical tools for transitioning to a circular economy (Maksymiv, et al., 2024). The existing accounting systems are ineffective in a circular economy because of their limitations in providing complete information (Heikkilä, 2023). We use the definition of the Coalition Circular Accounting, a diverse group of experts and scientists in finance, accounting and law to describe circular accounting. “Circular Accounting describes the practice of measuring, analysing and reporting on a company’s financial and non-financial performance, to truly reflect the value and impact of circular businesses on all relevant stakeholders” (Coalition Circular Accounting, 2022). One of the key barriers that has limited the implementation of circular business models in the past decade is the insufficient utilisation of accounting and reporting capabilities, which are tools that support informed managerial decision-making in building and maintaining circular business models and processes (Maksymiv, et al., 2024). This research explores how these capabilities can be adapted and expanded within the context of new EU directives. Although there are different international reporting frameworks available for non-financial reporting, there is still a need for standardised reporting principles and procedures for communicating progress on circularity (Opferkuch, et al., 2021). Different studies identify the need for a change in accounting but provide little guidance on how that should occur (Aureli, et al., 2023). In the current academic literature, suggestions are given on what needs to be changed in the accounting guidelines. Social and environmental impacts should be included in the income statement and balance sheets. Besides, a new holistic risk assessment should be developed to take the long-term impact on humans and the natural environment (Coalition Circular Accounting, 2022). Waste management by type and recycling directions are being seen as statistical data to support management decisions (Maksymiv, et al., 2024). Other elements mentioned are reassessing what waste is, introducing concepts such as residual value on this topic, and moving away from the existing approach where a product is purchased and then disposed of to an approach where materials are used for as long as possible (Coalition Circular Accounting, 2022). These academic contributions closely align with the goals of the EU’s Corporate Sustainability Reporting Directive (CSRD). This research builds on that by identifying practical changes in accounting and reporting that can support circular business practices and help align current practices in the construction sector with new EU reporting requirements.

Research question:
To realise a circular construction economy, organisations need to rethink how value is created, reported, and shared. Current accounting and reporting systems, developed for linear business models, are not equipped to reflect the environmental and social value of circular strategies. This mismatch makes it difficult for organisations to make informed decisions or show the positive impact of circular practices. Through the Living Lab,

financial graduates explored how reporting guidelines could be adapted to support the transition towards a circular construction economy. This research builds on their work to identify the adjustments needed in accounting and reporting practices. The central research question is: What adjustments in accounting and reporting guidelines can facilitate the transition towards a circular construction economy?

Research design: The Professorship Sustainable Finance & Accounting within the Centre of Expertise Wellbeing Economy and New Entrepreneurship has set up a living lab, Circular Accounting in the Building Sector, in 2021 as part of the 'Circulaire Sprong' programme. Living Labs are physical environments where students, lecturers and researchers collaborate with the business sector to research their circular challenges.

The living lab is part of a joint initiative of Fontys University of Applied Sciences and Avans University of Applied Sciences to unlock new economic earning potential and social impact in the southern Netherlands. In the living lab, financial graduates work with stakeholders from the building sector to analyse how accounting and reporting guidelines can be adjusted to gain more transparency. Based on this practice-oriented approach, they develop methods to report on circular performance. This explorative research is designed as a thematic analytic study in which the findings from eight theses of graduate students between 2021 and 2024 in the living lab are analysed. The findings will be analysed through coding using Atlas.ti to extract the main themes. These identified themes will be refined and linked to the research question. Based on the findings, suggestions are made for adjustments in accounting and reporting guidelines to facilitate the transition towards a circular construction economy.

Preliminary findings:
Standardised definition: The findings indicate that there needs to be consensus on definitions when reporting on circularity. Without a clear and generally accepted definition, valuation is not clear. As a result, the various parties in the construction chain cannot work with circularity as a variable. *Internalising social and ecological impact:* Findings indicate that both the negative and positive social and environmental impacts should be incorporated into the cost price of materials and the overall financial budget of construction projects, such as those for apartment complexes. Applying true pricing methodologies—by adding environmental and social costs to the market price—supports more transparent and responsible budgeting and enables a fuller understanding of the environmental and social impact of materials and projects while supporting alignment with ESG frameworks and the broader goals of the CSRD. When social and environmental impacts are accounted for, circular materials are not necessarily more costly than conventional alternatives. Systematic reporting of primary data: The findings show that current financial calculations rely heavily on secondary data sources to estimate environmental and social impacts. Without primary data (direct, project-specific measurements) on environmental and social impacts, true pricing calculations remain

based on generic averages. To address this, financial models and accounting systems must incorporate mechanisms for systematically collecting and reporting primary data on environmental and social factors, such as CO_2 emissions, waste, and labour practices. This shift is essential to produce reliable valuations and support more informed, impact-driven financial decision-making in circular construction.

Preliminary conclusion: The results show suggestions within the finance and accountancy perspective that can be changed to facilitate the transition towards a circular construction economy. These range from having a consensus on definitions in reporting regarding circularity to internalising social and ecological costs when calculating the cost price of a product or preparing a project budget, and the importance of a systematic collection and reporting of primary, project-specific data to support more accurate and reliable assessments of circular performance.

Keywords

Circular economy, circular accounting, building sector, integrated reporting, non-financial reporting

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Why Circular Startups Fail: The Role of Funding Amid Other Causes of Death

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Extended abstract

The Circular Economy (CE) disrupts established systems and norms, promoting sustainable development (Murray et al., 2017) by replacing the take-make-waste model with a focus on reducing, reusing, recycling and recovering materials in production, distribution and consumption processes (Kirchherr et al., 2017). However, transitioning from linear to circular thinking requires established actors to adapt their models and rethink existing practices, which can be challenging (Suchek et al., 2021). In this context, circular startups (CSUs) are positioned to play a vital role in accelerating the transition to a CE (Bauwens et al., 2019). Research suggests startups may offer the most significant opportunity for developing innovative and sustainable business models (De Angelis et al., 2018).

Startups play a crucial role in the CE by disrupting established markets and challenging the traditional business models of incumbents (Tuladhar, Iatridis and Dimov, 2023). Their lack of rigid processes and extensive goodwill (World Economic Forum, 2018) allows them to remain agile quickly adapting to market changes and staying ahead of the competition (Van Opstal and Borms, 2023). In the CE, CSUs drive systemic change by developing and implementing innovative business models that promote resource efficiency, waste reduction, and sustainable practices (Henry *et al.*, 2024). Several well-known CSUs illustrate this shift towards a CE. For example, Too Good To Go aims to reduce food waste by

providing a marketplace for surplus food, while Fairphone designs modular smartphones that are easy to repair and upgrade, ultimately extending the product's lifespan and reducing electronic waste.

However, not all CSUs are as successful as Too Good To Go and Fairphone. In general, startups face high failure rates. Analysing startup ages shows that 14% failed within a year, 44% lasted about 2 to 3 years, 28% between 3 and 5 years, while another 14% operated for over 5 years (Cantamessa *et al.*, 2018) and approximately 66% of startups fail to deliver a positive return (Eisenmann, 2021). Other research indicates that mortality rates are approximately 90% within the first three years of life due to their vulnerability as they are in a new and unpredictable stage where the main concern is survival (Font Cot et al., 2021). In terms of causes, the literature suggests that they can be the result of individual mistakes made by the entrepreneur or external problems beyond the entrepreneur's control (Cardon, Stevens and Potter, 2011) that led to “the end of the road for the startup” (Pollman, 2023). The success or failure of a startup is rarely due to a single factor; rather, it depends on a combination of various elements (Cantamessa *et al.*, 2018).

The failure of startups and Small Medium Enterprises (SMEs) has been analysed through various frameworks. Lussier (1995) developed a non-financial model to predict SME success or failure, tested in several regions, including the USA (Lussier, 1995) and Israel (Marom & Lussier, 2014). Cantamessa et al. (2018) used a multidimensional framework from aviation to analyse entrepreneurial failures. Pisoni et al. (2023) identified four main categories of new venture failure: resources, strategic decisions, product-related issues, and contextual factors. Pollman (2023) examined the inadequacy of bankruptcy law for venture-backed startups, emphasising alternative management methods for failed ventures that ease financial and social challenges for a strong venture capital ecosystem. Eisenmann (2021), studied over 470 startups and found key patterns that lead to failure. He highlighted six main pitfalls for entrepreneurs to watch out for.

While there have been numerous studies on the failure of general startups, to our knowledge, there is only one study that examines the failure of circular economy business models from an empirical perspective (Baldassarre and Calabretta, 2024). They proposed a preliminary empirical framework that connects the implementation of circular business models—specifically regarding value proposition, creation, delivery, and capture—with various cultural, regulatory, economic, and technical barriers that could impede their implementation. Despite these insights, our understanding of failed CSUs remains limited. These types of startups are particularly vulnerable to failure because they operate in emerging fields, typically do not offer investors quick payback periods, and often rely on

collaborations within circular ecosystems. This study aims to identify what are the key factors that have hindered the development of CSUs and analyze these factors based on specific types of circular business models (Achterberg, Hinfelaar and Bocken, 2016). Furthermore, we emphasize the significance of funding and resource access, as these present considerable challenges for CSUs (Awana *et al.*, 2023; Kanda *et al.*, 2024). This is why we are eager to participate in session 4.2, which focuses on transitioning business models towards sustainability through finance.

This paper aims to contribute to the literature on circular business models by examining the experiences of circular entrepreneurs who failed. Gaining a deeper understanding of failure in circular business models would be beneficial for both existing and aspiring entrepreneurs, as well as for various stakeholders, including those who support and advise them, investors, funding organizations, and the broader community (Marom and Lussier, 2014). Behind each failure lies more than just a closed company; it involves frustration, wasted time and capital, all of which have an impact on society as a whole (Eisenmann, 2021).

This study will employ a mixed-method approach, combining semi-structured interviews and a survey of entrepreneurs from failed cases. Next, FSQCA (Fuzzy-Set Qualitative Comparative Analysis) will be performed. FSQCA is a research methodology that analyses complex causality in the social sciences. It is especially valuable when trying to comprehend how distinct combinations of factors (or independent variables) influence a result (dependent variable) (Ragin and Fiss, 2008). FSQCA has gained popularity in entrepreneurship research and is especially beneficial for small sample sizes (Nikou *et al.*, 2024). The limited number of startups available for study poses a challenge, as unsuccessful entrepreneurs may be reluctant to participate (Pisoni, Aversa and Onetti, 2020). Furthermore, there are few sources for identifying failed startups (Getautopsy, 2024), and registrations are scarce, particularly when focusing on the circular economy. However, we will collaborate closely with ecosystem partners in Flanders, such as Circular Flanders, VLAIO and Start-it@KBC, to have access and guidance to circular startups who experienced difficulties.

This study is a work in progress and is in its early stages; therefore, the results are still forthcoming. We hypothesise that the findings may be related to the different types of circular business models (Vermunt *et al.*, 2019). We consider three types of circular business models: pre-use, use, and post-use (Achterberg, Hinfelaar and Bocken, 2016), each focuses on a different phase and presents distinct challenges that can lead to failure. Pre-use models present significant technological and operational risks, including reliance on

specific inputs, unproven performance, and uncertain costs. Investments in product innovations face competition, feedstock variability, product acceptance, and repair issues (FinanCE Working Group, 2016). Use models focus on value retention through ownership, utilising approaches like Product Service Systems and buy-back models, which can impact cash flow and complicate tracking and ownership (Achterberg and van Tilburg, 2016). Post-use models relate closely to recycling facilities that extract raw materials and face similar risks as pre-use models (FinanCE Working Group, 2016). In conclusion, understanding the challenges of circular business models is crucial for developing strategies that enhance viability and sustainability. This study aims to provide insights for their successful implementation.

Keywords

Failure, circular business models, circular startups, finance.

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Financing in social entrepreneurship: Insights from the Global Entrepreneurship Monitor

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Extended abstract

Social entrepreneurship arises from the need to address pressing social and environmental challenges. It has been defined as “the activities and processes undertaken to discover, define, and exploit opportunities in order to enhance social wealth by creating new ventures or managing existing organizations in an innovative manner" (Zahra et al., 2009, p. 519). Despite their importance, social businesses often struggle to secure funding due to their prioritization of social or environmental missions over profit (Eiselein and Dentchev, 2021).

This article examines the effect of different funding sources on the likelihood of becoming a social entrepreneur (Social Entrepreneurship Entry), using multilevel models and data from the 2015 Global Entrepreneurship Monitor (GEM) Adult Population Survey (APS). The analysis reveals that funding obtained from a boss or coworker has a stronger positive influence on the decision to pursue social entrepreneurship than funding from private investors. Crowdfunding also increases this likelihood, though to a lesser extent. Furthermore, the results show that receiving or expecting external financial support enhances the probability of becoming a social entrepreneur, whereas a higher reliance on personal financial resources is associated with a lower likelihood.

1. Conceptual background

1.1. Funding sources in social entrepreneurship

Bootstrapping or self-funding

Financial bootstrapping is perhaps the most important strategy for funding a startup venture (Lam, 2010) and plays a significant role in the growth of small businesses, which often encounter challenges in acquiring the necessary resources to initiate operations (Winborg and Landström, 2001). Many entrepreneurs might also have to recur to bootstrapping strategies to deal with the lack of finance from other formal sources (Jones and Jayawarna, 2010).

Inner circle financing: Family, friends, and colleagues

Most entrepreneurs start funding their ventures by informally borrowing from their closest network such as family and friends (Lee and Persson, 2016). This network stands as one of the most robust forms of social capital for entrepreneurs (Groza, Groza, and Barral, 2020). According to Edelman et al. (2016), the initial funding phase for entrepreneurs typically stems from this close circle.

External financing: Government, NGO, banks, and private investment

Given the limitations of bootstrapping and informal funding from family, friends and colleagues, many social entrepreneurs need to look for funding from external sources such as governmental programs, loans, or private investors. The availability of external funding for social entrepreneurs can vary depending on the region. In more developed countries the support and financing of social entrepreneurship is mostly carried out by foundations, international organizations, and governmental programs (Akbulaev et al., 2019). In fact, the structure of support to social entrepreneurship in different countries can vary. For instance, United States relies on a stable system of private support from charitable foundations, while in European countries, it is based on grants, private donations, and self-sustaining methods such as payments for goods or services (Akbulaev et al., 2019). In the case of Latin America, research suggests that national public funding constitutes an important funding source, however, surpassed by the economic return from the own products or services (Domanski, Howaldt and Schröder, 2017).

Crowdfunding

Crowdfunding has allowed entrepreneurs to expand their financing horizons beyond conventional methods, tapping into small contributions from a widespread audience (Groza et al., 2020). This approach involves an open call, often conducted through social media platforms, typically offering non-monetary compensations such as products, services, or rewards in return for monetary contributions (Akbulaev et al., 2019; Lehner, 2013; Wright, 2017). This type of financing source can be interesting for entrepreneurs due to its flexibility in repaying investors, the free advertising opportunities it provides, and the exposure and feedback it generates for their projects (Wright, 2017).

2. Hypotheses development

2.1. Inner circle financing as a driver for social entrepreneurship entry

In emerging economies, scarcity of financial resources is prevalent and can hinder entrepreneurial activity (Cao and Shi, 2021). Nonetheless, in such contexts, social ventures can navigate their challenges with the support of strong bonds of trust within their community (Hidalgo, Monticelli, and Vargas Bortolaso, 2021). Thus, we hypothesize that close social networks play a critical role in addressing the financial challenges faced by entrepreneurs, thereby influencing their decision to engage in social entrepreneurship activities. Accordingly, we propose the following hypothesis:

H1: Receiving financing from close social networks, such as family, friends, and colleagues, positively influences the propensity of entrepreneurs to engage in social entrepreneurship.

2.2. External financing as a driver for social entrepreneurship entry

Resources are integral for shaping and executing entrepreneurial strategies. Within this framework, we can posit that while social ventures develop internal assets and capabilities through bootstrapping and relying on their closest networks, it is equally important for them to secure supplementary financial resources from other external social networks (Lee, Lee, and Pennings, 2001). This notion is underpinned by the Resource Based View (RBV) principles, emphasizing the significance of aligning a firm's internal strategic resources with external factors, such as the challenge of obtaining funding (Wai, Liston-Heyes, and Liu, 2022).

Drawing from the previous discussion, we propose the following hypothesis:

H2: Receiving financing from external entities, including banks, government agencies, and private investors, positively influences the propensity of entrepreneurs to engage in social entrepreneurship.

2.3. Crowdfunding as a driver for social entrepreneurship entry

Entrepreneurs facing resource constraints, particularly in terms of financial, may leverage crowdfunding platforms as an innovative mechanism to overcome early-stage funding challenges and manage funds effectively (Harrison, 2013). Beyond securing new funding, crowdfunding also creates opportunities for resource exchange among stakeholders in the entrepreneurial ecosystem (Lambert and Schwienbacher, 2010). Thus, we posit that individuals utilizing crowdfunding platforms are more likely to enhance their prospects of securing funding from a diverse array of clients and stakeholders.

H3: Receiving financing from crowdfunding activities positively influences the propensity of entrepreneurs to engage in social entrepreneurship.

3. Methodology

We use data from the Global Entrepreneurship Monitor (GEM) adult population survey (APS) conducted in 2015. There is a total sample of 52,130 surveys corresponding to 3 types of economies: factor-driven, efficiency-driven and innovation-driven. Factor-driven economies include countries that are primarily based on natural resources and unskilled labor, with entrepreneurship often driven by necessity. Efficiency-driven economies focus on increased productivity, while innovation-driven economies rely on knowledge, technology, and highly skilled labor, with higher prevalence of opportunity-driven entrepreneurship.

The method used is a multivariate model of binary dependent variable commonly known as Logit or multiple logistic regression (Wooldridge, 2019), this type of model is useful when the dependent variable is not continuous but discrete, i.e. it can take values of 0 (non-social entrepreneur) and 1 (social entrepreneur), it also allows us to identify the probability of belonging to one or another of the categories established for the dependent variable (LaValley, 2008).

4. Preliminary results

In factor-driven economies, the most influential types of financing on the decision to be a social entrepreneur are having received or expecting to receive money to start the business (Startup funding), receiving money or expecting to receive money from the employer or co-workers (Employer or colleagues) and having received or expecting to receive money from private investors (Private investors).

In efficiency-driven economies, the most influential type of external financing is having received or expecting to receive money from government programs, donations, or subsidies (Governmental programs), having received or expecting to receive money from the employer or co-workers (Employer or colleagues) and having received or expecting to receive money to start the business (Startup funding).

In innovation-driven economies, the variables with the greatest impact are having received or expecting to receive money from government programs, donations, or subsidies (Governmental programs), having received or expecting to receive money to start the business (Startup funding) and having received or expecting to receive money from the employer or co-workers (Employer or colleagues).

5. Discussion and Limitations

In factor-driven economies, where access to formal financial institutions is limited, social entrepreneurs might be more inclined to seek support from personal networks. In efficiency-driven economies, external financing sources, such as government programs and subsidies, seem more significant alongside personal networks. Governmental support through grants or subsidies can play a crucial role in enabling social entrepreneurs to scale their ventures. In innovation-driven economies, which are more developed and

technologically advanced, government funding should go beyond basic support to focus on initiatives with higher potential for innovation and societal impact.

The main limitation of this study is that the analysis is based on data from 2015, meaning economic and social conditions may have shifted over the past decade. However, the GEM has not included a special issue on social entrepreneurship in subsequent years. Despite this time gap, the study remains relevant, as it examines both traditional and emerging funding sources in social entrepreneurship. Furthermore, the landscape of financing for social businesses has not changed significantly in the past decade.

Keywords

Social ventures, Social Entrepreneurial Intention, inner circle funding, external funding, crowdfunding.

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Living Labs as Catalysts for Circular Business Innovation: a combined systematic literature and practice review

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Extended abstract

Background

As the global economy increasingly grapples with the challenges of sustainability, the circular economy has emerged as a promising model to shift away from the linear "take-make-dispose" approach (Khanna et al., 2022; Vann Yaroson et al., 2024). The circular economy concept of slowing, closing, narrowing and regenerating resource loops has been adopted by businesses to tackle these increasing sustainability issues (Bocken et al., 2016; Leipold et al., 2023; Konietzko et al., 2023). Circular business innovations, which seek to design out waste, extend product lifecycles, and regenerate natural systems, are essential in achieving this paradigm shift (Geissdoerfer et al., 2017). However, implementing these innovations requires technological advancements and reimagining business models, value chains, and stakeholder collaborations through experimentation. In recent years, policymakers and scholars ignited a debate about the ability of Living Labs (LLs), including geographically bounded Urban Living Labs, as arenas that can be used by stakeholders to jointly set up spaces for such circular innovation experiments, to explore, examine, experiment, test, and evaluate creative ideas and innovative solutions in complex and everyday contexts (Amenta et al., 2019; Bulkeley et al., 2017; Bassens et al., 2020; Kębłowski et al., 2020). This is where living labs create experimental environments that foster real-world testing, and co-creation can play a critical role in advancing circular transitions.

Living labs offer a unique space for businesses, researchers, governments, and citizens to collaborate in designing, testing, and scaling circular innovations (Inella et al., 2024). By embedding experimentation within real-life settings, these labs help address the complex socio-technical challenges of transitioning to circularity (Bulkeley et al., 2017). They enable iterative development, stakeholder participation, and the validation of business models that emphasise sustainability and resource efficiency. Iterative development, i.e. a transdisciplinary process with dynamic feedback loops, is essential for refining innovations and ensuring their scalability and adaptability in diverse contexts (Cuomo, 2024). Policymakers and practitioners have increasingly recognised the critical role of living labs in advancing circular transitions and designing, often urban, experiments to fulfil such circular ambitions. For instance, the European Network of Living Labs (ENoLL) showcased more than 30 such living labs all over the world that are dedicated to advancing circular innovations, either focusing on specific sustainability issues such as mobility and well-being or supporting local circular entrepreneurs in a more broad sense (ENoLL). For example, BlueCity Lab (BCL) is a living lab in the city of Rotterdam that aims to facilitate trials and demonstration projects for successful business models of the Circular Economy (von Wirth et al., 2018). Their implemented practices have been observed to contribute to the diffusion of more circular infrastructures, cultures, and ways of doing business differently in cities (von Wirth et al., 2018).

In line with policymakers in practice, the concept of living labs has also become more popular in recent circular innovation and sustainable transition discourse (e.g. Amenta et al., 2022; Ascione et al., 2021; Cuomo, 2022; Florez Ayala et al., 2022; Inella et al., 2024). Lakatos et al. (2024) conducted a bibliometric analysis to explore the role of living labs in driving innovation in sustainability and bioeconomy. Many have also explored living labs for circular innovation in different geographic contexts, such as Italy (Cuomo et al., 2020) and France (Tyl & Allais, 2021). In the context of the circular economy, living labs are seen as a methodological framework for co-production and co-creation (Amenta et al., 2022; Inella et al., 2024), pathways of circular transitions (Florez Ayala et al., 2022) and as circular ecosystems that can enable urban sustainable development (Engez et al., 2021). Despite these more recent contributions, the positioning and impact of living labs for circular innovation remains vague, with the discourse still scarce and fragmented. As well, despite the industry playing a crucial role as a co-creator in living labs, their potential contribution remains unclear. To fill these knowledge gaps, we propose a systematic literature and practice review to critically examine and synthesise the extant papers. The objectives of this review are to offer clarity to the linkage between living labs and circular innovations, analyse to what extent living labs have been a basis for innovation, and contribute to building the theoretical foundation on this subject. The research questions we plan to address with this study are: 1) *How can living labs advance circular business model innovation? 2) What could be the role of businesses in them?*

Methods

This study combines a systematic literature review and practice review.

For the systematic literature review, we followed the methodology Snyder (2019) and Macpherson & Jones (2010) described. As recognised by many authors (e.g. Mihalache & Mihalache, 2015; Spina et al., 2013; Wang & Chugh, 2014), this method has numerous advantages compared with traditional unstructured reviews. It adopts a replicable, scientific and transparent process (Tranfield et al., 2003, p. 209) that allows: (1) minimisation of bias and errors (Tranfield et al., 2003); (2) improvement in the quality of the review process and outcomes (Mihalache & Mihalache, 2015); (3) confirmation of their validity through the replication of clear steps during the review process (Wang & Chugh, 2014); and (4) synthesising and organising the literature accumulated in a specific field (Wang & Chugh, 2014), often providing academics and practitioners with frameworks of the existing knowledge (e.g. Kunisch et al., 2015; Mihalache & Mihalache, 2015). We chose the PRISMA method as a guide for this review. It provides the benefit of integrating specific procedures that foster consistency, transparency, and adherence to high standards in producing qualitative research reports. (Albhira et al., 2024; Page et al., 2021). Figure 1 depicts the systematic review process for identifying relevant articles for the literature review.

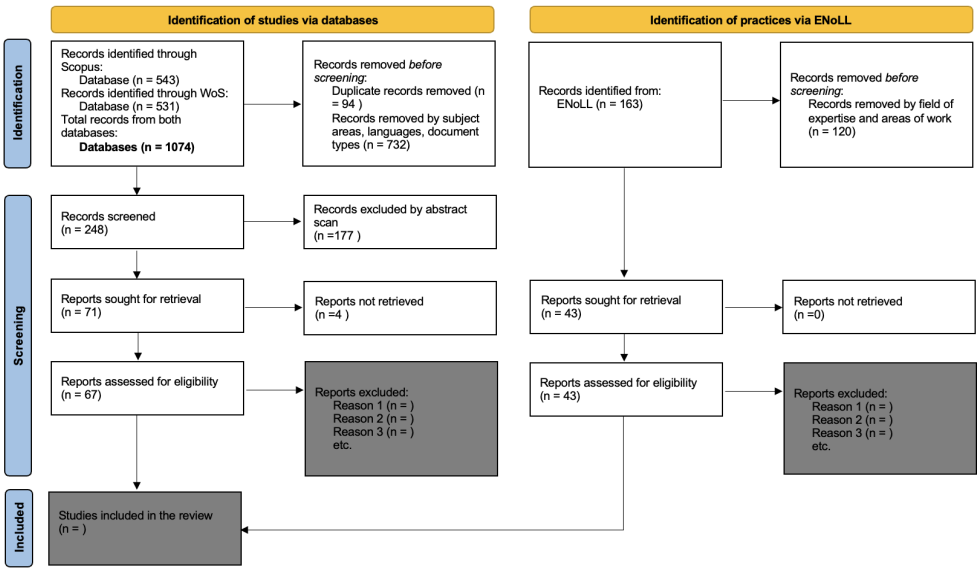


Figure 1. PRISMA Flow Diagram (Partial)

This analysis relies on two online research databases: Scopus and Web of Science. In the first phase of PRISMA, a series of keyword searches (search strings) are conducted using different search tools within the two databases. During this process, we utilised the thesaurus keyword matches and the databases' Boolean operator functions. For example, we used other alternatives to "living labs", such as "urban labs" or "urban experiments). The search string of *("living lab*" OR "urban lab*" OR "urban experiment*" OR "citizen lab*") AND ("circular economy" OR "circular*" OR "regenerat*" OR "sharing econom*" OR "zero waste" OR "bioeconom*" OR "industrial symbiosis" OR "material recovery" OR sufficiency OR "cradle to cradle" OR "repair*" OR "remanufactur*" OR "resource recovery" OR "reuse" OR "recycling" OR "upcycling" OR "reduce" OR "waste minimi*")* was used. This initial search generated 543 results from Scopus and 531 from Web of Science. We removed duplicates and used exclusion criteria (Table 1) to narrow our search. The subsequent 248 articles were exported into an Excel sheet and subjected to screening for relevance based on title, abstract, and keywords (Moher et al., 2009). This preliminary screening resulted in n=67 articles for full-text screening.

Table 1. Inclusion and exclusion criteria for article screening

	Criterion	Inclusion	Exclusion
Pre-screening	**Document Type**	Journal articles	Review articles, book chapters, books and proceedings
	Language	English	Other languages
	Subject Area	Environmental science, business and management, economics, social sciences, urban studies	Other subject areas (e.g. computer science, medicine, arts and humanities)
	Timeframe	Published during 2014-2025	Published before 2014
Title, abstract, keywords screening	**Key terms**	Contained key terms (living labs & circular economy)	Did not contain key terms
Full-text screening	**Relevant concepts**	Discussed business model characteristics *E.g. co-creation, experimentation*	Did not discuss business model characteristics

For the practice review, we collected cases from the European Network of Living Labs (ENoLL). A practice review is useful for complementing a literature review when practice is ahead of academia and can potentially enrich the current theoretical understanding (Bocken et al., 2014; Niessen et al., 2021). ENoLL has characterised LLs based on the field of expertise and areas of work. To narrow down the LLs suitable for this study, we selected "*Business Model Innovation*" under the field of expertise and "*Circular Economy*" under the areas of work. With these filters, we identified 43 LLs for further screening.

Preliminary Results and Intended Contributions

Our preliminary analysis shows that living labs can contribute to circular business innovation in multiple ways. They can provide the necessary infrastructure, processes, and stakeholders for developing, testing, and implementing circular business models in real-world contexts (Arciniegas et al., 2019; Greer et al., 2020). First, living labs are designed for the co-creation of innovation through the involvement of users in a real-life setting (Greer et al., 2020; Dell'Era et al., 2019). This means that the users are actively involved in the innovation process, and their feedback is used to shape the final product or service (Dell'Era et al., 2019). This may lead to more robust business models that are more likely to be adopted by users. Second, living labs can provide a platform for collaboration between different stakeholders, such as businesses, governments, citizens, and institutions (Arciniegas et al., 2019). These partnerships can lead to new and innovative business models that would not be possible otherwise. Finally, living labs can create an environment where stakeholders can experiment with circular initiatives in context and in real time, which is conducive to gathering data and refining approaches that may lead to the more successful implementation of circular business models (Spinelli et al., 2019).

This combined literature and practice review seeks to synthesise the emerging body of literature and cases on living labs for circular innovations. This review intends to elucidate the relationship between living labs and circular innovations, analyse the extent to which living labs have served as a foundation for innovation, and contribute to a foundational understanding of this topic. Based on our analysis, we propose research agendas for future studies and practice. Other researchers can build on this review with semi-structured interviews with practitioners and longitudinal studies. With this study, policymakers should recognise the strategic value of living labs as platforms for experimentation and co-creation, catalysts for circular transitions, and integrate them into broader sustainability agendas.

Keywords

Circular business model innovation, living labs, systematic literature review, business experimentation, circular economy

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From Sea to Sustainability

Transitioning the Blue Bioeconomy through Responsible Design Thinking and the Sustainable Business Model Canvas

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Abstract

This study examines the integration of Responsible Design Thinking and the Sustainable Business Model Canvas to foster sustainability transitions in the blue bioeconomy. Using the Horizon Europe BlueRev project as a case study, it demonstrates how participatory methodologies can help transform abstract sustainability concepts into actionable, context-sensitive business models.

Keywords

Responsible design thinking, Sustainable business model canvas, Co-creation, Circular economy, Blue bioeconomy.

Main text

Introduction

The global transition toward sustainability requires innovative approaches to address intertwined ecological, social, and economic challenges. As traditional linear models of production and consumption give way to circular economy principles, there is an increasing focus on actions and strategies that promote resource efficiency, reuse, and regeneration (Bocken et al., 2016). These shifts demand not only technical innovations but also systemic changes in the way businesses create and deliver value, emphasizing collaboration, inclusivity, and adaptability.

Within this broader sustainability landscape, the blue bioeconomy—encompassing industries reliant on marine and aquatic resources—plays a critical role. From fisheries and aquaculture to algae cultivation, the blue bioeconomy holds significant potential for advancing sustainability transitions by leveraging its unique natural assets. However, this sector faces complex challenges, including resource depletion, habitat degradation, and socio-economic disparities in coastal communities (Geissdoerfer, Bocken & Hultink, 2016). Notably, the fishing industry only utilizes a fraction of the fish products, with a significant portion going to waste. Circularity offers a pathway to address these issues, emphasizing strategies such as “slowing resource loops,” “closing resource loops,” and “narrowing resource flows” to enhance ecological resilience and socio-economic equity.

This study explores the role of responsible design thinking (RDT) and visual tools like the Sustainable Business Model Canvas (SBMC) to facilitate the development of actionable and context-sensitive business models in the blue bioeconomy. Using the Horizon Europe BlueRev project as a case study, it examines how these methodologies address region-specific challenges while contributing to systemic sustainability transitions. The research question guiding this investigation is: *How can the integration of Responsible Design Thinking and the use of visual tools like the Sustainable Business Model Canvas foster the co-creation of actionable and context-sensitive business models for sustainability transitions in the blue bioeconomy?*

The findings reveal four emerging mechanisms facilitated by the intersection of RDT and the SBMC: (i) transforming abstract concepts into actionable solutions; (ii) fostering stakeholder ownership and accountability; (iii) aligning global goals with local realities; and (iv) operationalizing systemic innovation through collaboration.

Theoretical Background

Responsible Design Thinking

Design thinking is widely recognized for its human-centered, iterative, and collaborative nature, offering a structured approach to solving complex challenges through creativity and user-focused solutions (Brown, 2009; Martin, 2009). Building on this foundation, RDT integrates ethical considerations and prioritizes environmental and social impacts alongside economic feasibility, creating a more holistic framework for sustainable innovation (Elkington, 1998; Voegtlin & Scherer, 2017). RDT is particularly suited to addressing "wicked problems," which are characterized by high complexity, interdependencies, and the absence of straightforward solutions. Issues such as climate change, resource depletion, and socio-economic inequalities demand systemic and inclusive responses (Ferraro et al., 2015; Von Schomberg, 2013).
The process of RDT typically unfolds in iterative phases. The initial phase, empathy and discovery, involves a deep engagement with stakeholders to uncover explicit and latent needs while aligning with regional socio-economic and ecological priorities. Techniques like value mapping and ethnographic research ensure that proposed solutions resonate with the specific challenges and opportunities of a given context (Bocken et al., 2013). Ideation follows, facilitating the collaborative generation of creative, sustainability-driven solutions. This phase leverages methods such as scenario mapping and brainstorming to encourage diverse perspectives and the exploration of innovative ideas that integrate ecological, social, and economic objectives (Leavy, 2010). In the prototyping and testing phase, solutions are iteratively developed, tested, and refined to ensure their feasibility and alignment with stakeholder expectations and sustainability goals. Prototypes serve as tangible representations of ideas, allowing stakeholders to visualize and evaluate their potential in real-world settings while enabling flexibility and adaptability to evolving constraints (Hillgren et al., 2011).

The Sustainable Business Model Canvas

The Sustainable Business Model Canvas (SBMC) adapts Osterwalder and Pigneur's original Business Model Canvas by explicitly incorporating ecological and social dimensions into the design and analysis of business models. It provides a structured yet flexible framework for aligning business strategies with circular economy principles, enabling stakeholders to create, refine, and implement models that balance environmental, social, and economic objectives (Osterwalder & Pigneur, 2011; Bocken et al., 2015). Unlike traditional business model tools, the SBMC emphasizes sustainability by embedding eco-social considerations across its interconnected building blocks, including value propositions, customer segments, revenue streams, and eco-social costs and benefits. This enhanced focus ensures that

businesses not only achieve financial viability but also contribute to resource regeneration, waste reduction, and community well-being (Geissdoerfer et al., 2016). By explicitly linking sustainability with core business processes, the SBMC serves as a vital tool for operationalizing circular economy transitions.

Method

This study employs a qualitative case study approach, centering on the Horizon Europe project BlueRev as a rich and context-specific example of how RDT and visual tools such as the SBMC can facilitate the development of sustainable business models. The case study method is particularly well-suited to exploring complex phenomena within their real-life context, offering in-depth insights into the dynamics of stakeholder collaboration, innovation processes, and sustainability transitions in the blue bioeconomy (Yin, 2018).

Research Context

BlueRev is a Horizon Europe initiative aimed at fostering sustainability transitions in the blue bioeconomy. BlueRev can be described as an alliance for sustainable development, uniting a broad spectrum of stakeholders to co-create actionable solutions that balance ecological, social, and economic objectives (Baldassarre et al., 2024). By leveraging participatory methodologies and responsible design thinking (RDT), the project seeks to develop innovative and business models tailored to the unique socio-economic and ecological contexts of its pilot regions: Denmark and Greenland, Italy, and Estonia.

Data collection

This study employed a multi-method approach to capture the co-creation processes and outcomes within BlueRev. Participant observation was conducted during co-creation workshops across the three pilot regions, engaging local businesses, policymakers, civil society, and researchers. Additionally, semi-structured interviews with key stakeholders provided deeper insights into engagement, social innovation, governance, value creation, and barriers to implementing circular business models. Document analysis of project materials—workshop agendas, participant materials, and reports—further enriched the data. To enhance objectivity, one author joined the project after data collection and focused solely on analysis, providing an independent perspective to strengthen the rigor and validity of the findings.

Data Analysis

The data analysis followed a thematic approach, integrating insights from workshop observations, interview transcripts, and document analysis to provide a holistic

understanding of the dynamics of the BlueRev project. The analysis unfolded iteratively, beginning with an open coding process to identify key themes and concepts. Subsequently, relationships between the identified themes were examined to uncover how various factors influenced the co-creation process. The final phase of analysis synthesized the findings into a cohesive narrative that aligned with the study's research objectives and theoretical framework.

Findings

Responsible Design Thinking in Practice

The application of RDT in the BlueRev project demonstrated its ability to address the diverse and complex challenges faced by the blue bioeconomy in the pilot regions. The co-creation workshops were structured around three iterative phases—empathy and discovery, ideation, and prototyping and testing—each of which played a critical role in ensuring the relevance and feasibility of the proposed business models.

The initial phase, empathy and discovery, emphasized the importance of deeply understanding the specific socio-economic and ecological challenges in each region. Stakeholders, including local companies, policymakers, and researchers, worked collaboratively to identify explicit and latent needs. In Greenland, this phase brought attention to the untapped potential of fish by-products, such as heads and shells, which are often discarded but could be repurposed into high-value nutraceuticals. Similarly, in Estonia, participants explored opportunities for algae-based innovations, recognizing the potential of integrating algae cultivation with offshore wind farms to enhance marine spatial efficiency. This phase ensured that the solutions developed were grounded in local realities and aligned with the unique priorities of each region. In Italy, one key insight was the potential for valorizing underutilized seafood resources, such as lesser-known fish species and processing by-products, to create high-value food products and bio-based materials.

In the ideation phase, collaborative brainstorming sessions facilitated the generation of innovative solutions tailored to the identified challenges. These sessions encouraged stakeholders to think beyond traditional practices, resulting in creative proposals such as sustainable aquaculture models in Denmark and multi-use marine systems in Estonia. The ideation process leveraged the diverse expertise of participants, fostering a dynamic exchange of ideas that combined ecological, social, and economic considerations. By prioritizing inclusivity and creativity, this phase laid the groundwork for practical and context-sensitive solutions.

The prototyping and testing phase enabled the iterative refinement of the proposed business models. Stakeholders worked collaboratively to translate abstract concepts into tangible prototypes, allowing for real-time evaluation and adaptation. In Greenland, ideas for fish by-product valorization were evaluated in terms of scalability and economic viability, while in Estonia, algae-based business models were tested for alignment with regulatory frameworks and ecological conditions. This iterative process ensured that the solutions were robust, adaptable, and aligned with the overarching sustainability goals of the blue bioeconomy.

The Role of the Sustainable Business Model Canvas

The SBMC played a fundamental role in facilitating the collaborative and iterative nature of the workshops, serving as both a guiding framework and a dynamic tool for co-creation. Its adaptability and modular structure provided stakeholders with a practical means to systematically address complex challenges while fostering engagement and inclusivity.

As a structured framework, the SBMC enabled stakeholders to dissect and analyze business model components in a systematic manner. Each segment of the canvas—ranging from value propositions to customer segments, revenue streams, and eco-social costs—was explored in depth, ensuring that no aspect of the business model was overlooked. For example, in Denmark, stakeholders utilized the SBMC to identify opportunities for integrating wastewater treatment innovations into aquaculture systems, aligning ecological goals with revenue generation strategies. This structured approach ensured that all components of the business models were thoroughly examined and interconnected, fostering a comprehensive understanding of the proposed solutions.

The SBMC also facilitated engagement and accessibility by providing a common language that bridged gaps between participants with varying expertise and backgrounds. Local entrepreneurs, government officials, academic researchers, and industry representatives were able to engage in meaningful discussions, aided by the visual and interactive nature of the tool. The canvas's clear and tangible format helped demystify complex concepts, making them accessible to all participants and encouraging active contributions. In Sicily, for instance, the SBMC enabled participants to collaboratively explore how culinary traditions could be integrated with circular economy principles to valorize seafood by-products.

Together, responsible design thinking and the SBMC proved to be complementary methodologies that empowered stakeholders to collaboratively design innovative, context-sensitive solutions for the blue bioeconomy. By integrating these approaches, the BlueRev project demonstrated how participatory methodologies can effectively address systemic challenges and advance sustainability transitions in resource-dependent sectors.

Discussion

The intersection of RDT and the SBMC revealed key mechanisms, discussed in the four emerging themes below.

(i) Turning abstract concepts into actionable solutions

The integration of RDT and the SBMC exemplifies how abstract sustainability concepts can be operationalized into actionable business models. RDT's iterative processes—empathy, ideation, and prototyping—are pivotal in breaking down complex, systemic challenges into localized, practical solutions. As Brown (2009) emphasizes, design thinking's human-centered approach is particularly effective in addressing "wicked problems" by fostering creativity and user-centered insights. The SBMC complements RDT by offering a structured framework that systematically visualizes key components of a business model, including eco-social costs and benefits (Bocken et al., 2015). Together, these methodologies bridge the gap between theoretical frameworks and actionable outcomes, particularly in the blue bioeconomy where sustainability challenges are both multifaceted and context-specific.

(ii) Fostering stakeholder ownership and accountability

RDT and the SBMC foster inclusivity, accountability, and trust by actively engaging diverse stakeholders, including academia, industry, government, and local communities. Participatory processes are crucial for democratizing innovation, as they ensure that all voices contribute to and take ownership of co-created solutions (Freudenreich et al., 2020). This inclusivity promotes shared responsibility and long-term commitment, which are essential for addressing systemic challenges in resource-dependent sectors (Voegtlin & Scherer, 2017). By fostering a sense of ownership, the methodologies enhance trust and accountability among stakeholders, creating a solid foundation for sustainable and scalable solutions.

(iii) Aligning global goals with local realities

The adaptability of RDT and the SBMC enables stakeholders to tailor solutions to regional socio-economic and ecological contexts while aligning with global circular economy objectives. This dual alignment underscores the importance of context-sensitive approaches in sustainability transitions (Geissdoerfer et al., 2016). For instance, in the BlueRev project, stakeholders were able to address region-specific challenges—such as valorizing fish by-products in Greenland and scaling algae-based innovations in Estonia—while contributing to overarching sustainability goals. Such context-specific implementations highlight the methodologies' ability to reconcile global aspirations with practical, localized strategies, which is critical for fostering systemic change in diverse settings (Korhonen et al., 2018).

(iv) Operationalizing systemic innovation through collaboration

The combination of RDT and the SBMC facilitates interdisciplinary and cross-sectoral collaboration, essential for navigating systemic barriers to innovation. The SBMC acts as a shared language, bridging diverse stakeholder perspectives and enabling joint problem-solving, a necessity when addressing complex sustainability challenges (Osterwalder & Pigneur, 2011). Furthermore, RDT's iterative nature ensures that these collaborative efforts remain flexible and adaptive, accommodating the evolving dynamics of socio-economic and environmental systems (Hillgren et al., 2011). Together, these methodologies operationalize systemic innovation, enabling stakeholders to co-create solutions that are both innovative and scalable in resource-dependent sectors like the blue bioeconomy.

Implications

Theoretical Implications

First, this study advances the discourse on sustainable business model innovation by illustrating how RDT and visual tools, such as the SBMC, can be integrated to address complex sustainability challenges. RDT's iterative and human-centered approach complements the SBMC's structured framework, enabling the translation of abstract sustainability principles into actionable strategies (Brown, 2009; Geissdoerfer et al., 2016). This integration aligns with calls for systemic approaches to sustainability transitions that prioritize inclusivity and adaptability (Voegtlin & Scherer, 2017; Bocken et al., 2018). Furthermore, the study contributes to the literature on interdisciplinary and participatory methodologies by emphasizing the role of co-creation in bridging gaps between theoretical constructs and practical implementation (Freudenreich et al., 2020; Leavy, 2010). Second, it demonstrates the applicability of the SBMC as a dynamic tool for addressing "wicked problems" in resource-dependent sectors. The SBMC's modular structure and visual format support iterative refinement, allowing stakeholders to address complex interdependencies between economic, ecological, and social dimensions (Osterwalder & Pigneur, 2011; Korhonen et al., 2018). By facilitating cross-sectoral collaboration and stakeholder engagement, the SBMC operationalizes sustainability transitions, making it a critical enabler for aligning diverse priorities within complex systems (Geissdoerfer et al., 2017; Baldassarre et al., 2024). This study underscores the need for frameworks like the SBMC that not only align with circular economy principles but also actively integrate local contexts and global sustainability goals (Bocken et al., 2015; Evans et al., 2017).

Practical Implications

First, this study provides a replicable framework for fostering sustainable innovation across diverse geographic and socio-economic contexts. By showcasing how participatory methodologies and visual tools can align local capacities with circular economy goals, it offers actionable pathways for other resource-dependent sectors. Second, it underscores the critical role of participatory methodologies in enhancing stakeholder engagement and aligning multi-actor priorities. Through the integration of RDT and the SBMC, the study highlights how inclusive processes foster trust, shared ownership, and long-term accountability, which are essential for achieving systemic change.

Conclusions

This study highlights the transformative potential of RDT and the SBMC in advancing sustainability transitions within the blue bioeconomy. By integrating ethical, ecological, and economic dimensions, these methodologies offer a robust and actionable framework for fostering circular innovation. Their capacity to translate abstract sustainability principles into practical, context-sensitive solutions demonstrates their relevance in addressing complex, systemic challenges in resource-dependent sectors.

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An Extended Abstract Submitted to the NBM Conference 2025

Actor Engagement in Circular Society Innovations: Leveraging Design Thinking for socially inclusive, economically resilient and ecologically regenerative practices

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Extended abstract

Introduction

The "economic prosperity, ecological integrity and social well-being" outcomes of circular economy (CE) initiatives cannot be taken for granted (Ashton *et al.*, 2022, p.1174). While the CE framework has gained traction for addressing environmental challenges through strategies like reuse, repair, and recycling, its broader societal implications are often neglected. These include critical dimensions such as social equity, justice, human well-being, and employment quality (*ibid*.; Kirchherr, 2021; Mies and Gold, 2021). Scholars have argued that a narrow focus on economic and environmental efficiencies within the CE paradigm fails to address the systemic social issues that intersect with sustainability goals (Schroeder et al., 2020). Our research responds to growing calls for a shift from a circular economy to a broader conceptualisation of a 'circular society,' one in which equity, inclusivity, and justice are embedded as foundational principles (Jaeger-Erben *et al.*, 2021).

Circular societies demand a "profound social-ecological" transformation that reimagines the relationships among people, places, and resources (*ibid.*, p.1). This study investigates how design thinking can catalyse this transformation by fostering collaboration among diverse actors and enabling the co-creation of socially inclusive, just and equitable,

economically resilient and ecologically regenerative practices. Design thinking provides a flexible, iterative methodology to address complex challenges by centring human needs and encouraging participatory engagement (Dell'Era *et al.*, 2020). Participatory approaches such as storytelling and co-production enable communities and organisations to articulate shared visions, navigate tensions, and create actionable pathways toward circular transformations. By drawing on these methodologies, our research explores how local communities can be empowered to lead the transition to circular societies.

The concept of place is central to this research, shaping and being shaped by the circular initiatives there-in. Places are more than geographic locations; they are imbued with meanings, histories, and relationships that influence how circular practices unfold (Ansell and Torfing, 2021). By understanding the specific conditions and resources of a place, circular initiatives can better respond to local needs and capacities. We posit that place-based approaches not only enhance the efficacy of circular initiatives but also foster deeper connections between communities and their locales. Our thinking aligns with Dell'Era et al.'s (2020) focus on participatory design methods as mechanisms for aligning diverse perspectives and creating shared value.

Research Design

Using Greater Manchester as a test bed, our study examines Circular Society Innovations (CSI): initiatives that prioritise social equity, ecological regeneration, and economic resilience within local projects and organisations. CSIs are characterised by the integration of social objectives into circular practices, ensuring that environmental and economic outcomes do not come at the expense of well-being, justice and inclusion. We are at the beginning of our three year study, but have already found early examples in Greater Manchester: The Boiler House, Manchester Urban Diggers, and the Renew Hub. Each of these initiatives exemplify how locally grounded initiatives can align community values with circularity goals. The Boiler House, for instance, transformed a former power station into a vibrant community space for repair, reuse, and skill-sharing; Manchester Urban Diggers repurposed disused urban spaces to address food insecurity through sustainable urban agriculture. The Renew Hub, home to the UK's largest reuse facility, combines circular practices with community reinvestment by directing proceeds from its operations to support local social projects. Over the next eighteen months we will identify more CSI projects and organisations, and take a deep dive into 20 CSI initiatives to better understand the roles of key actors and networks, the innovation at the heart of the initiative, the social impacts and the importance of place-based approaches that are sensitive to the cultural, historical, and social contexts in which they operate.

The final year of our study is dedicated to the translation of knowledge into recommendations for policy makers and practitioners to stimulate place-based CSI. To that end, we are establishing a Knowledge Action Network (KAN): a collaborative network that brings together universities, policymakers, practitioners, and communities. The KAN will serve as a conduit for sharing best practices, aligning goals, and co-developing strategies that address systemic challenges in circularity. Rooted in Ansell and Torfing's (2021) call for co-creation as a strategy for revitalising governance and fostering social

innovation, the KAN will enable the translation of research findings into actionable recommendations that support the scaling and adaptation of CSI across diverse contexts.

Contribution to knowledge and understanding

One aim of our study is to advance the discourse on circular societies by integrating insights from design thinking literature. Dell'Era et al. (2020) identify four key dimensions of design thinking: creative problem-solving, sprint execution, creative confidence, and innovation of meaning. Of these, 'innovation of meaning' is particularly relevant to this study, as it emphasises the redefinition of value and the creation of new interpretative frameworks that align with the principles of circular societies. This focus on reimagining the relationship between actors, systems, and outcomes aligns with the research's exploration of how CSI integrate social equity, ecological sustainability, and economic resilience. Our study draws on this dimension of design thinking to investigate how actors collaboratively redefine and adapt practices to address systemic challenges in circularity. These methods echo Jaeger-Erben et al.'s (2021) emphasis on the social-ecological dimensions of circular societies, where meaningful participation is essential for achieving transformative change.

Our study also contributes to emerging discussions on actor engagement in circular business model innovation. As noted by Verleye et al. (2024), actor engagement is a critical factor in the success of circular initiatives, as it determines the extent to which actors can co-create value and align their efforts toward shared goals. By focusing on participatory practices and place-based approaches, this research provides a framework for enhancing actor engagement in circular societies. It underscores the importance of aligning diverse perspectives and fostering social cohesion to address the intersecting challenges of sustainability, equity, and community resilience.

In essence, our research aims to bridge the gap between theory and practice by demonstrating how design thinking can advance circular societies through participatory and place-based approaches. By emphasising the social dimensions of circularity, it challenges the traditional economic focus of the circular economy and highlights the potential for circular initiatives to serve as vehicles for transformative societal change. The findings of this study will not only contribute to the academic discourse on circular societies but also offer practical guidance for universities, policymakers, practitioners, and communities seeking to build more equitable, inclusive and sustainable futures.

Keywords

Circular Society Innovations (CSI), Design Thinking, Social Equity, Participatory Practices, Place-Based Approaches

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From Production to Reuse: Waste Analysis in a Street

Market in Northeast Brazil

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Abstract

Street markets, one of the oldest forms of commerce, represent an invaluable cultural and economic heritage. These traditional spaces promote the sale of local products, significantly contributing to the regional and local economy by offering consumers greater variety and accessibility while generating income and employment. However, environmental degradation in urban areas has worsened due to improper waste disposal, particularly in regions such as the Submédio Vale do São Francisco and Petrolina-PE. Street markets are significant generators of organic waste, and inadequate management of these materials exacerbates urban environmental challenges, including soil and water contamination.This research aimed to analyze the generation and disposal of organic waste from the sale of

fruits, vegetables, and greens in Petrolina-PE's street markets, with the goal of better understanding the dynamics of waste management and providing a basis for future sustainable business models that can transform these residues into valuable resources within the circular economy. The methodology included a bibliographic review, semi-structured interviews with market administrators, and on-site observations of storage, handling, and market infrastructure. Findings show that the Areia Branca Street Market produces 24,000 to 27,000 kg of organic waste weekly, yet lacks an effective waste management system. Solutions such as composting and biochar offer viable alternatives to reduce environmental impacts, but further exploration is needed to address existing implementation challenges. The valorization of organic waste can foster sustainable businesses, promoting recycling, reducing waste, and strengthening the circular economy to create environmentally responsible markets.

Keywords

Street Market, Waste Management, Circular Economy, Sustainability, Brazil

Introduction

Street markets, one of the most traditional forms of commerce, represent a cultural and economic heritage of enormous value. This centuries-old practice, which encourages the sale of local products, has a significant impact on the regional and local economy, providing consumers with a wide variety of products and options for conscious and accessible consumption. Additionally, it plays a crucial role in income generation and job creation. This study aims to analyze the generation and disposal of organic waste resulting from the sale of fruits, vegetables, and greens in street markets in the municipality of Petrolina-PE, Northeast Brazil.

According to the Brazilian Standard (NBR) 10.004 ABNT (2004), solid waste is defined as the residue resulting from industrial, domestic, agricultural activities, among others, which cannot be discharged into public sewers or the environment.

The increase in organic waste production in street markets, often without proper disposal, represents a significant challenge for waste management in urban and rural areas. In Petrolina, Pernambuco, this problem is particularly relevant due to the large local agricultural production. Poorly managed waste can lead to environmental impacts, such as greenhouse gas emissions and soil degradation. This work aims to lay the groundwork for

future sustainable and innovative interventions for the proper disposal of waste, promoting circular economy practices and contributing to the socio-environmental development of the region. (Ellen Macarthur Foundation, 2013)

The lack of precise data on the quantity and type of this waste, as well as potential solutions, limits the implementation of effective strategies for waste management. This study addresses this issue by conducting a survey of waste data and exploring sustainable technological solutions such as composting, biochar, and biofertilizers. The goal is to provide a foundation for future implementations and foster discussions on public policies and circular economy practices in the region. (Ghisellini et al, 2016)

The Areia Branca Street Market is an important local trading point, contributing to the regional economy and offering alternatives for conscious and accessible consumption. This study aims to elaborate a diagnosis of the generation and disposal of organic waste in street markets in the municipality, identifying sustainable and viable solutions based on data, theoretical foundation, and legislation to guide future implementations of the circular economy.

Theoretical Framework

Waste Management in Street Markets: Challenges and Needs

Street markets play a fundamental role in urban economies, offering fresh food and products from small local producers, in addition to being important for community supply (Silva et al., 2019). However, one of the greatest challenges faced by these markets is waste management. This waste varies from organic materials, such as fruit peels and food scraps, to plastics, paper, and packaging, which are often disposed of improperly, without any treatment or recycling (Pereira et al., 2019). Therefore, it is considered a challenge for urban environmental management, requiring specific approaches to deal with the quantity and nature of these materials. Much of the organic waste, such as fruit peels, vegetable stalks and food waste, has the potential for composting and could be reused as organic fertilizer. However, the lack of adequate infrastructure for the collection and treatment of these materials means that many of them end up in landfills, increasing the volume of waste and generating emissions of greenhouse gases, such as methane, due to their anaerobic decomposition.

The production of solid waste in street markets has become a growing problem in Brazilian cities, especially in large metropolitan areas, where high population density and consumption dynamics exacerbate the amount of waste generated. According to Lima and

Souza (2020), ineffective waste management can lead to environmental contamination, soil and water pollution, and contribute to public health issues due to the improper decomposition of organic materials and the disposal of chemical products.

The lack of proper infrastructure for waste collection and disposal is one of the main difficulties observed in street markets. Many of these markets operate informally, without the necessary public policy support for waste management. The lack of awareness among vendors and consumers about practices related to reduction, reuse, and recycling further aggravates the situation (Gomes et al., 2021). Furthermore, the absence of waste separation systems within the markets contributes to the mixing of recyclable materials with organic waste and rejects, which hinders the sorting process and effective recycling (Sousa et al., 2019).

Studies indicate that in some Brazilian cities, initiatives such as selective collection and composting have been successfully implemented in street markets. However, the lack of continuity and the lack of engagement from all parties involved (vendors, consumers, and public managers) result in ineffective long-term solutions (Costa & Almeida, 2017). For waste management in street markets to be efficient, it is essential to strengthen public policies, promote environmental education, and create incentives for adopting sustainable practices.

The implementation of appropriate technologies, such as composting systems and machines for recycling plastics, metals and other materials, can transform the way waste from street markets is treated, significantly reducing the environmental impact and improving the sustainability of these spaces (Silva-Júnior et al , 2022). Composting systems, for example, allow organic waste, such as fruit and vegetable remains, to be transformed into natural fertilizer, which can be used in urban vegetable gardens, community gardens and even sold as a product, generating value from waste. Machines for recycling plastics and metals can process materials on site, promoting the circular economy and reducing the need for transport and storage of waste.

Finally, raising public awareness about the benefits of proper waste management is another crucial point. Educational programs, awareness campaigns, and the implementation of public policies focused on sustainability have the potential to promote behavior changes and more efficient waste management in street markets. Integrating these markets into formal urban waste management systems and creating designated spaces for material separation should be prioritized strategies to reduce environmental impact and promote a more sustainable future for these commercial spaces (Mello & Oliveira, 2023).

Environmental Education and Waste

Environmental education aimed at solid waste management is an essential tool in promoting a sustainable and conscious society. This educational process allows the population to understand the importance of proper waste disposal while also promoting responsible consumption practices and reducing waste generation.

In Brazil, the National Solid Waste Policy (PNRS), established by Law No. 12,305/2010 and regulated by Decree No. 10,936/2022, sets specific guidelines for waste management. The PNRS incorporates environmental education as a fundamental strategy to achieve its goals and objectives, proposing an integrated waste management approach that emphasizes shared responsibility and the need for cultural changes in favor of sustainability (Brazil, 2022).

Data from the 2022 Panorama of Solid Waste in Brazil, published by the Brazilian Association of Public Cleaning and Special Wasting Companies (ABRELPE), indicate that the country generated 81.8 million tons of solid waste that year, of which 39% were inadequately disposed of. Furthermore, organic waste accounted for about half of the total urban waste generated (ABRELPE, 2022).

According to Abdalla and Sampaio (2018, p. 86), as cited by Custódio, Junqueira, and Manrique (2024), "the reuse of materials and greater efficiency in recycling 'waste' [...] can even stimulate the economy and reduce dependency on natural resources," thus fulfilling the necessary and expected basis of sustainability today.

Given this scenario, environmental education plays a central role in involving society in waste management processes, promoting not only technical knowledge about proper disposal but also a behavioral shift regarding consumption and waste generation. Additionally, environmental education strengthens the principle of shared responsibility, one of the core guidelines of the PNRS, which involves the joint participation of consumers, companies, governments, and recyclable material collectors, with the aim of advancing the circular economy.

Theoretical Framework on SDGs and Biochar

Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) are a set of 17 global objectives established by the United Nation as part of the 2030 Agenda, a global initiative that aims to address social, economic and environmental challenges (United Nations, n.d.a).

The Sustainable Development Goals (SDGs), established by the UN in 2015, are global targets to promote balance between the environmental, social and economic dimensions by 2030. They seek to eradicate poverty and ensure a dignified life for all, within the limits of the planet (United Nations, 2015). The definition emphasizes the interconnection between different areas of development and the need for integrated actions to achieve the SDGs.

An example of an innovative solution that can contribute to these objectives is the production of biochar and composting. This biomass pyrolysis product, as well as the composting process, have environmental and agricultural benefits that align with objectives numbers 6, 7, 11, 12 and 13.

Biochar

Biochar is a carbon-rich product obtained from the thermal decomposition of organic materials (biomass) in an oxygen-limited environment, a process known as pyrolysis (Lehmann et al., 2006). The resulting material is highly stable and can persist in soil for centuries, making it a valuable tool for carbon sequestration and soil enhancement (Lehmann, 2007).

Primarily composed of carbon, biochar exhibits a range of important properties such as high pH, large surface area, and significant recalcitrance (Cross & Sohi, 2013). These characteristics contribute to its stability and longevity in soil, as well as improving water and nutrient retention, neutralizing acidic soils, and enhancing microbial activity (Lehmann & Joseph, 2015).

Biochar has various applications, including its use as a soil amendment, where it can increase fertility, improve soil structure, and promote microbial activity (Glaser et al., 2002). Additionally, it is an effective tool for carbon sequestration, aiding in climate change mitigation by reducing atmospheric CO2 levels (Woolf et al., 2010). Its porous structure also allows for water retention, which is beneficial in drought-prone areas, and its contaminant adsorption capacity makes it useful for soil and water remediation (Beesley et al., 2011).

The environmental and economic benefits of biochar are significant. It can contribute to climate change mitigation through the reduction of greenhouse gas emissions, support sustainable agricultural practices by improving soil health and productivity, and promote a circular economy by utilizing agricultural and forestry residues for its production (Schmidt et al., 2014).

However, the production and application of biochar face challenges such as feedstock availability, production costs, and the need for an adequate regulatory framework

(Lehmann et al., 2011). The production of biochar requires a steady supply of biomass, which may compete with other uses, such as food production or energy generation (Roberts et al., 2010). The initial investment in pyrolysis technology can be high, although these costs may be offset by the long-term benefits. Additionally, it is necessary to develop policies and regulations that ensure environmental and public health safety during the production and use of biochar (Shackley et al., 2012).

In summary, biochar represents a promising technology for improving soil health, sequestering carbon, and promoting sustainable agricultural practices. Its application can significantly contribute to environmental conservation and climate change mitigation efforts (Lehmann & Joseph, 2015).

Composting

Composting is an aerobic method of recycling and treating organic waste that seeks to replicate ideal conditions of the natural process of degradation of organic matter, in addition to ensuring the safety of the process. Efficient composting depends on the control of key factors such as humidity, temperature, aeration (oxygen level) and nutrient balance (carbon and nitrogen) (Sayara et al., 2020).

Haug (1993) explains that composting involves the biological decomposition and stabilization of organic substrates, under conditions that allow the development of thermophilic temperatures as a result of biologically produced heat, to produce a final product, which is stable, free of pathogens and plant seeds and can be beneficially applied to the land" (Haug, 1993).

According to Ayilara et al. (2020), composting is a sustainable practice due to several factors, such as the reduction of waste sent to landfills, the prevention of greenhouse gas production associated with the anaerobic decomposition of organic waste, and the promotion of soil health by increasing its fertility and water retention capacity.

This technique is widely used in sustainable agriculture, and waste management on domestic and commercial scales. Composting reduces the amount of waste sent to landfills, such as fruit and vegetable peels, coffee grounds, and food scraps. Composting these materials is one of the most effective ways to help the environment, preventing them from ending up in landfills where they decompose anaerobically and release methane, a potent greenhouse gas (Manea et al., 2024).

In addition to reducing waste, composting promotes soil health, as the resulting compost is a natural fertilizer rich in essential nutrients for plant growth, such as nitrogen, phosphorus, and potassium. When added to the soil, the compost improves its structure, increases its

water retention capacity, and promotes beneficial microbial activity. This not only benefits cultivated plants but also helps restore the health of degraded soils, promoting biodiversity and reducing erosion. (Manea et al., 2024)

As pointed out by Manea et al. (2024), composting also plays a crucial role in resource conservation and recovery. By improving soil structure and increasing its water retention capacity, the resulting compost reduces the need for irrigation, which is especially important in regions affected by water scarcity, where agriculture consumes large amounts of this natural resource. Additionally, by promoting soil health and reducing erosion, composting helps protect water resources from contamination by nutrients and agricultural chemicals. (Ayilara et al., 2020)

Methodology

The methodology used in this study included a bibliographic review, and a field research involving semi-structured interview, with the administrator. Furthermore, on-site observations were conducted, assessing the storage and handling of products, as well as the structural environment of the market.

This case study is of waste management in a street market. The Areia Branca Street Market was chosen as the main focus of the study. Located in the eastern zone of Petrolina, on Jasmim Street, without a specific number, the "Feira da Areia Branca"1 operates from Monday to Sunday, from 5 AM to 5 PM. Known for its wide variety of products, the market offers everything from dried spices, fruits, clothes, meats, and vegetables to fish, tapioca, sugarcane juice, and pastries. Currently, the market is undergoing renovation and expansion, aiming to improve the facilities and offer a more modern and spacious area for vendors and consumers. During the renovation, the market is temporarily operating in a parking lot. named Areia Branca, in the municipality of Petrolina, in Northeast Brazil.

The Areia Branca Street Market in Petrolina-PE is a significant local trading point, contributing importantly to the regional economy and offering consumers alternatives for conscious and accessible consumption. This study aims to analyze the generation and disposal of organic waste resulting from the sale of fruits, vegetables, and greens, by weighing the waste generated weekly, as well as to evaluate possible implementations, such as composting and biochar production, as strategies for managing this waste. Data collection was conducted through interviews and questionnaires with managers to understand waste disposal practices and perceptions about organic waste. Additionally, on-

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site observations were made to examine the handling and packaging of products, as well as the structural environment of the market.

Quantitative data was analyzed based on information provided by the management, detailing the number of vendors and the quantity of containers used for disposal. These estimates enabled a representative analysis of the weekly and annual production of organic waste, allowing for an accurate estimation of the amount generated based on the containers sent to the landfill, which is frequently full.

Discussion and Results

Currently, the Areia Branca Street Market in Petrolina-PE faces a considerable challenge regarding the management of generated waste. There is no formal separation of the produced waste, which means that all discarded material is collected indiscriminately and deposited in four containers, each with a capacity of 1,500 kg. Subsequently, these containers are taken to the municipal landfill, located in the rural area of the city, for disposal.

The collection and heavy cleaning of the generated waste, predominantly between Friday and Sunday, occur on Mondays and are carried out by prisoners from the state prison through a partnership between the municipal administration and the Justice of the State of Pernambuco, allowing those involved to have their sentences reduced. During the rest of the week, cleaning is the responsibility of both the vendors and the street sweepers hired by the city hall. However, interviews revealed that there is currently no formal structure for waste reuse, and that reuse practices are improvised by vendors and passers-by. Some examples include distributing food still fit for consumption to family and friends and collecting scraps for animal feed.

Thus, it was observed that the generated waste is quite varied, including fruits, vegetables, greens, coconut shells, decomposing meat, plastic, paper, among others. In terms of volume, it is estimated that the market produces between 24,000 to 27,000 kg of waste per week, with the days of highest waste generation being Fridays, Saturdays, and Sundays. On these days, the containers are filled and, on Monday, collected by the municipal waste collection service for final disposal in the landfill.

The Department of Agriculture of the Municipality is the body that manages and coordinates all the markets in the municipality, and in particular, the market in the Areia Branca neighborhood, which is one of the oldest and best-known markets in the municipality. Currently, the Areia Branca Street Market, as it is known, comprises 474

vendors and stall owners who are registered in the department's database. Each registered vendor contributes a weekly fee of R$ 5.00, while the box owners pay R$ 30.00 per week. The collection of these fees is done by inspectors linked to the department. Thus, the distribution of vendors in sectors is varied and reflects the diversity of products offered as specified in Table 1:

Table 1: Distribution of vendors by sectors in a Free Market in Northeast Brazil.

Sector	Number of Market Vendors
Meat	85
Fish	30
Chicken	4
Fruits and Vegetables	156
Organic Products	2
Coconut Water	1
Sugarcane Juice	12
Grains and Dry Spices	20
Clothing and Others	164

Source: Municipal Secretariat of Agriculture of Petrolina - PE, Brazil (2024).

The production and application of biochar present several challenges that need to be addressed to ensure the viability and sustainability of this technology. Firstly, the availability of raw materials stands out as one of the main obstacles. The production of biochar requires a constant supply of biomass, which can compete with other crucial uses, such as food or energy production. This factor can limit large-scale implementation, especially in regions where biomass resources are scarce or highly demanded by other industries. (Garcia et al., 2022)

Furthermore, the initial investment costs in pyrolysis technology are considerably high. The installation and operation of the necessary equipment for biochar production require significant capital, which can be a barrier for small producers or regions with less access to financing. However, these costs can be offset in the long term by the benefits provided by the use of biochar, such as soil fertility improvement and carbon sequestration, suggesting a positive return on investment over time.

Another critical challenge is the need to develop an appropriate regulatory framework for the production and use of biochar. Policies and regulations are essential to ensure that biochar is produced and applied safely for the environment and public health. The absence of clear guidelines can lead to inadequate or harmful practices, compromising the potential benefits of this technology.

The implementation of a medium-scale composting for the Areia Branca Street Market in Petrolina represents a strategic and sustainable initiative, but it also faces several challenges. Among the main obstacles are the need for engagement from the market community, the logistics of collecting and processing organic waste, and raising awareness about the importance of composting. Initial resistance to changing disposal habits and adapting existing infrastructures to accommodate the new system are also significant challenges. (Fernandes & Silva, 1998)

The structure should be well-defined, with designated areas for collection, sorting, processing, and storing the compost. Selective collection of organic waste should be efficient, requiring the installation of strategically placed and well-signposted collection points at the market. A specific area for composting, preferably away from the stalls, should be prepared with suitable containers and aeration systems to ensure efficient decomposition of organic materials. Additionally, it is crucial to install washing and decontamination points to maintain the cleanliness of the environment.

The implementation costs can be an initial barrier, encompassing the acquisition of equipment and materials to hiring specialized personnel for the operation and maintenance of the composting system. Costs may include the purchase of collection containers, shredders, thermometers for temperature monitoring, and materials to cover the compost piles. Additionally, expenses for training market vendors and staff, awareness campaigns, and possible needs for electrical or hydraulic infrastructure should be included in the budget.

To ensure the intervention's success, partnerships and collaboration between municipal administration, market vendors, and the local community are essential. Continuous education and training on proper waste segregation practices and the benefits of composting are fundamental. Creating incentives for vendors who actively participate, such as fee reductions or offering free compost, can encourage adherence. Continuous monitoring and evaluation are also necessary to identify and resolve problems quickly.

A viable alternative for managing organic waste generated at the Areia Branca Street Market is to seek partnerships with companies that already carry out composting. These companies have the expertise and infrastructure needed to process large volumes of organic waste efficiently and sustainably. By establishing these partnerships, the market can ensure that its waste is treated properly, contributing to reducing the amount of waste sent to landfills and minimizing environmental impacts.

Furthermore, these partnerships can offer significant economic and logistical benefits. Composting companies often have well-established collection and transportation systems,

which can reduce operational costs associated with waste management for the market. Additionally, by collaborating with specialized companies, the Areia Branca Street Market can focus on its core activities, leaving waste management to experienced professionals. This can also open opportunities for exchange agreements, where the market provides waste and, in return, receives organic compost for use in local green areas or for sale.

According to the bibliographic survey conducted, the two possible solutions for implementing waste management at the Areia Branca Street Market in Petrolina are biochar and composting, which meet the Sustainable Development Goals (SDGs) 6, 7, 11, 12, and 13. SDG 6 aims to ensure the availability and sustainable management of water and sanitation for all. According to the UN, efficient water resource management is essential for environmental sustainability and human well-being. (United Nations, n.d.b)

SDG 7: Affordable and Clean Energy Biochar production represents a promising source of renewable energy, using biomass sustainability and reducing greenhouse gas emissions. This process offers a sustainable energy alternative and contributes to mitigating climate change by reducing carbon emissions. Composting, in turn, transforms organic waste into natural fertilizer, promoting efficient waste management and contributing to clean energy production by reducing methane in landfills. (United Nations, n.d.c)

SDG 11: Sustainable Cities and Communities The application of biochar in urban areas has the potential to improve soil quality and promote urban agriculture. Additionally, it contributes to city sustainability by reducing soil and water pollution, creating greener and healthier urban spaces. Biochar use promotes a more sustainable and resilient urban environment. Urban composting can complement these benefits by transforming organic waste into useful compost, reducing the amount of waste sent to landfills and improving city sustainability. (United Nations, n.d.d)

SDG 12: Responsible Consumption and Production Producing biochar from organic waste exemplifies responsible consumption and production practices. This approach promotes recycling and material reuse, reducing waste and improving soil health and agricultural productivity. As a result, a circular economy is promoted, where resources are used more efficiently and sustainably. Composting also contributes significantly by reintroducing nutrients into the soil, closing the nutrient cycle, and promoting more sustainable agricultural production. (United Nations, n.d.e)

SDG 13: Climate Action Biochar plays a crucial role in mitigating climate change by sequestering carbon and reducing the amount of CO2 in the atmosphere. Besides improving soil health, carbon sequestration by biochar is an effective strategy to reduce greenhouse gas emissions and promote ecosystem resilience to climate change.

Composting also contributes by reducing methane emissions from landfills and promoting carbon capture in the soil, mitigating climate change impacts. (United Nations, n.d.f)

Final Remarks

The Areia Branca Street Market in Petrolina-PE plays a crucial role in the socio-economic dynamics of the region, providing a wide variety of products and services to the local community. However, the challenge of managing the waste generated is a significant problem that requires attention and effective solutions. The absence of a formal system for separating and reusing waste results in undifferentiated collection and inadequate disposal at the municipal dump, which can cause adverse environmental impacts.

The current partnership between the municipal administration and the Justice of the State of Pernambuco, which uses the labor of inmates for waste collection and cleaning, represents a valid initiative but is insufficient to meet the environmental and social needs of the street market. Sustainable waste management requires the implementation of an organized structure for the proper separation and reuse of discarded materials, as well as awareness campaigns directed at vendors and the community.

The analysis of the waste profile reveals a wide variety of materials, including organic and inorganic, that could be recycled or composted, significantly reducing the volume destined for the dump. The Secretariat of Agriculture of the municipality of Petrolina, in Northeast Brazil manages the street market, and must adopt strategies that encourage selective collection, reuse, and recycling, aligning with best sustainability practices.

Additionally, the weekly contribution fee from vendors and stall owners can be directed towards implementing these sustainable strategies, ensuring a cleaner and healthier environment for both sellers and visitors. The sectoral distribution of vendors, as illustrated in Table 1, also facilitates the organization and implementation of specific waste management programs for each type of product sold.

Therefore, efficient waste management at the Areia Branca Street Market is essential to promote environmental sustainability and improve the quality of life for residents and visitors. Investing in adequate infrastructure, environmental education, and strategic partnerships is fundamental to transforming current challenges into opportunities for sustainable development.

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Power relations in value co-creation: Insights from the Finnish forest-based sector

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Extended abstract

It is widely known that firms need to collaborate with diverse societal actors to create value to both companies and their stakeholders (Freeman, 2010). The aim of collaborative business models is to co-create value through different collaborative mechanisms and the engagement of diverse actors, including consumers, companies, NGOs and political actors (Pedersen et al., 2021). According to Derks et al. (2022, p. 8) Collaborative Sustainable Business Modeling is "an inter-organizational participatory design approach with the aim of creating multiple types of value for multiple actors, both regime and niche, that span the value network". Overall, collaborative business models are featured by elements of inclusivity, sustainable value co-creation, cross-sectoral partnerships, multi-actor approaches, value networks and joint initiatives, and are therefore seen as essential ways to promote sustainability transition (Bidmon and Knab, 2018; Aagaard et al., 2021; Tschiedel., et al, 2024).

However, empirical research on mechanisms, functionality and effectiveness of collaborative business modeling and value co-creation is largely lacking (Lüdeke-Freund et al., 2024). As argued by Brennan and Tennant (2017), company's activities are interdependent with its partners, and relations dynamics - including power relations - between diverse actors would deserve more focus. Lüdeke-Freund et al. (2020) emphasize that the share of value capture by a particular stakeholder depends on the power relationships in which this stakeholder is involved. They also highlight that these power relationships are often asymmetric, and analysis of value creation and capture should thus be conducted together with analysis of the power relationships that lead to certain allocations of value among the stakeholders. In addition to business management studies, also transition research have remarked the significance of power and power relations of

different actors especially from the perspective of societal change (Avelino and Wittmayer, 2016; Avelino, 2021). Geels and Schot (2007) view power as a perspective on agency, arguing that diverse societal actors have various conflicting goals, and change can happen through conflicts and power contestations.

In Finland, as well as in many other countries with plentiful forest resources, forests and forest utilization are important to diverse societal actors. Forests are also the target of numerous goals, demands and hopes from a variety of stakeholders, often leading to disagreements, power struggles and polarized discussion on the acceptable ways of utilizing forests (Halla and Laine, 2022; Halonen et al. 2022; Näyhä and Wallius, 2024). Näyhä and Wallius (2024) found in their recent media study that politicians are seen as the most powerful actors steering the forest-related transition in Finland. Their study also indicated that market sector actors -namely large forest companies and their interest organizations- hold onto existing structures, creating structural power that prevents the change. However, power relations of diverse forest-related actors are rarely discussed and studied in the Finnish society, and there is need for better understanding on the issue.

This study is part of a research project funded by the Research Council of Finland (project no. 340756), and the project's main goal is to develop a transition framework based on future-oriented collaborative business models. The framework can be utilized by firms in their strategic management and in the stakeholder dialogue but also by a variety of other actors. The project explores elements of collaborative business models and participatory foresight, and their joint contribution to macro-level societal transition. The study presented in this conference focuses on exploring the position and relations of actors which are part of the forest-related value creation, putting emphasis on their power relations. We will define the most distinct features in power relations, identify actors with and without power and explore the types of power they hold. We also reflect these outcomes revealing details on power dynamics between the actors from the perspective of value co-creation, and further, its potential influence on sustainability transition.

The study is based on semi-structured interviews conducted in Finland in between May 2023 and January 2024. In its entirety the data consist of 72 interviews among different forest-based sector companies and forest-related societal actors. The sample includes many different types of firms, meaning the businesses varied in terms of business models, product portfolios, maturity, size and networks. Various stakeholders included groups such as NGOs, artists, interest organizations, researchers and authorities. The data is initially analyzed thematically (Brown and Clarke, 2022) whereas more nuanced analyzed is conducted by applying critical discourse analysis (Fairclough, 2010.)

At the moment, the data analysis is ongoing. Initial results highlight the prominent and powerful role of large, traditional forest-based companies and their interest organizations in forest-related value creation. Also forest owners, largely represented by their strong interest organization in the societal discussions, are seen to hold a notable power. Many of

the interviewees also highlighted the significance of political power, stemming both from national and EU-level sources. Role of the environmental organizations is constantly increasing, and they are seen to affect decision-making both in public and private sectors. In addition, media -both traditional and social- was seen as powerful channel through transmitting information (from a certain perspective), influencing attitudes and especially in selecting the issues and actors to be given space in the media. As a negative manifestation of power relations, cronyism is seen to be embedded deeply in the Finnish value networks. The more advanced outcomes and reflections based on these will be presented in the conference.

Keywords

Value co-creation, collaborative business models, power relations, Finland, forest-based sector

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From “Evolutionary Myth” to Reality? A Study of How Single Innovation Projects Can Catalyze Sustainable Business Model Transformation

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Extended abstract

1. Introduction

Researchers have explored several strategies to transform business models for sustainability (Bocken *et al.*, 2014), which have been grouped into archetypes (Bocken *et al.*, 2014) and patterns (Lüdeke-Freund *et al.*, 2018). Product and process innovations, such as adoption of environmental-friendly technologies, resource cascading, and shifts to renewable resources, are part of such strategies (Bocken *et al.*, 2014). However, not all business model adaptations based on these strategies contribute to profound sustainability transitions (Hofmann, 2019). Some innovations may even reinforce existing business models and delay systemic change (Schot and Geels, 2011; Christensen, 2015; Giampietro and Funtowicz, 2020).

Much of sustainable business model literature is built on the contrary argument. It suggest that it is exactly these single innovation projects that are the beginning of an evolutionary innovation process that ultimately leads to the transformation of the business model. Bocken & Short (2021) suggest that firms must integrate multiple sustainable business model (SBM) innovations to support a flourishing society, implying that single innovations alone are insufficient.

Despite this perspective, little empirical evidence exists of firms using single innovation projects (such as adopting environmentally friendly technologies or recycling measures) as stepping stones toward sustainable business model transformation. This study explores how single innovation projects influence antecedents for sustainable business model innovation. It does so by using an combined design of design-oriented research synthesis across two fields and an empirical study examining this phenomenon within specialty chemicals firms, drawing on 18 semi-structured interviews and three workshops.

2. State of the art

To investigate how single innovation projects influence business model transformation, we integrate two distinct literature bodies: sustainable business models (section 2.1) and project management, specifically project lineage and sequencing in multi-project management (section 2.2).

2.1 Sustainable business models: Business models for sustainainability transition

A business model is a system of interdependent activities centered around a firm to create and exchange value (Zott and Amit, 2010; Lüdeke-Freund *et al.*, 2024). Sustainable business models create environmental and social value (Brehmer, Podoynitsyna and Langerak, 2018; Schlüter, 2024). To drive sustainability transitions, firms must shift innovation from product/process improvements to systemic change (Boons and Lüdeke-Freund, 2013; Schaltegger, Hansen and Lüdeke-Freund, 2016). Business models can act as vehicles for transforming industries (Johnson and Suskewicz, 2009; Demil and Lecocq, 2010).

Sustainable business model transformation

Business model transformation refers to firms innovating their business models for sustainability (Geissdoerfer et al., 2018). Achieving sustainability requires radical transformations that substantially depart from prior business models (Taran, Boer and Lindgren, 2015; Inigo, Albareda and Ritala, 2017).

The evolutionary approach: Single, incremental innovation projects as a stepping stone to sustainable business model transformation

Firms may pursue radical change or take an evolutionary approach, making incremental adjustments to business models (Inigo et al., 2017). Radical innovation projects often face corporate resistance, while incremental projects with low risk and immediate rewards are preferred, particularly in large firms (McDermott and O'Connor, 2002). Incumbent firms tend to integrate new technologies into existing business models rather than fundamentally changing them (Bohnsack, Pinkse and Kolk, 2014).

The evolutionary approach suggests that cumulative minor innovations can lead to significant transformation (Siguaw, Simpson and Enz, 2006; Taran, Boer and Lindgren, 2015). Iterative incremental innovations can ultimately enable business model evolution (Geels, 2010; Bourreau, Gensollen and Moreau, 2012). Bocken & Short (2021) argue that firms must integrate multiple SBM innovations to drive transformation.

Although some firms undergo evolutionary business model innovation, little empirical evidence shows that single innovation projects act as stepping stones toward sustainability. Nonetheless, the belief in incremental innovation persists, motivating support for incremental improvements (Schlüter, 2024).

2.2 Insights from project management: Project lineage and sequence in multi-project management

Sustainability-driven innovations typically occur through projects, operating outside routine business processes. Project management literature has evolved from focusing on individual projects to recognizing their interconnections (Engwall, 2003), emphasizing project sequences or lineages (Midler, 2013; Maniak and Midler, 2014).

Projects serve as learning mechanisms within firms (Blomquist and Packendorff, 1998; Brady and Davies, 2004; Midler and Silberzahn, 2008), building capacities for future innovations (Ayas, 1998). Some research highlights how breakthrough projects, such as skunkworks or exploration projects, can initiate critical "multi-project learning cycles" (Maniak and Midler, 2014). This aligns with the concept of dynamic capabilities (Nelson and Winter, 1982; Teece, Pisano and Shuen, 1997), where firms leverage prior innovations as a knowledge base.

However, project management literature primarily focuses on product development rather than business model innovation. Moreover, innovation projects typically aim to improve firm performance (Ayas, 1998) and this strand of literature does not pay attention to sustainability as a normative goal yet.

Concluding, sustainable business model as well as project management literature provides a strong basis to explore whether the evolutionary approach is a myth or to what extent single innovation projects can pave the way for particular event sequences and patterns for transitions (Engels *et al.*, 2024).

3. Methodology

Research design for exploring the myth of the evolutionary approach: The impact of single innovation projects on contextual conditions for sustainable business model transformation

For this purpose, we focus on the contextual conditions driving sustainable business model transformation. A short- or long-term focus, existing innovation structures and processes (Bocken and Geradts, 2020), organizational culture, and interactional opportunities, such as exposure to new stakeholders (Brodie *et al.*, 2019; Verleye *et al.*, 2024), impact the engagement and motivation of actors in adopting sustainable business models. Current SBM literature paints a detailed picture of enabling as well as obstructing factors (drivers and barriers) for business model innovation, but does not examine how single innovation projects influence these contextual conditions. Examining how innovation projects interact with these factors provides insights into knowledge accumulation, adaptive learning, and institutional change for sustainable business model transformation.

The study employs a qualitative research design with a three-stage process:

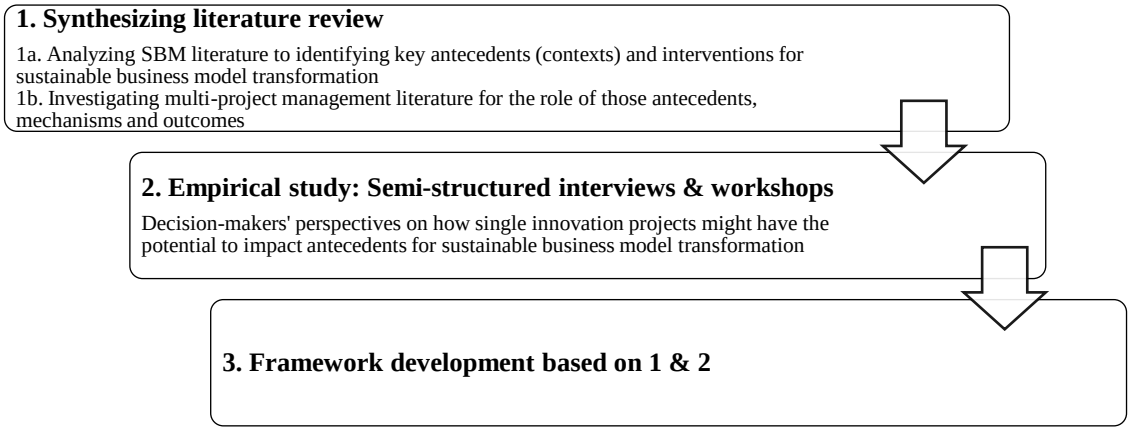


FIGURE 1: SIMPLIFIED PRESENTATION OF THE THREE PHASES OF THE RESEARCH PROCESS.

Stage 1: Systematic Literature Review

The first phase involves a review of scholarly literature (Snyder, 2019; Linnenluecke, Marrone and Singh, 2020) across two fields: sustainable business models and project management, particularly research on multi-project lineage. Aiming at design-oriented research synthesis, the review identifies interventions used, underlying mechanisms, context, and outcomes (Denyer, Tranfield and van Aken, 2008) related to evolutionary business model innovation for sustainability. The review first identifies key contextual conditions, such as innovation focus (short- vs. long-term), organizational structures, cultural readiness, and interactional opportunities, and interventions in the field of sustainable business models. In addition, the review draws on insights from multi-project lineage and sequence literature to establish how innovation projects accumulate and build capacities over time, focusing on mechanisms and potential outcomes. This forms the

conceptual basis for assessing the role of single innovation projects in broader business model transformation processes.

Stage 2: Semi-Structured Interviews and Workshops

In the second phase, empirical data is collected through 18 semi-structured interviews and three workshops. These interviews and workshops include innovation managers of specialty chemicals firms considering the adoption of a bio-based coating technology. This sector was chosen due to its environmental impact and numerous sustainability-oriented innovation projects (Bröring, Laibach and Wustmans, 2020). Interviews and workshops are focussed on recent innovation projects, the motivation behind them, how they were managed, and their perceived effects on contextual conditions for SBM innovation. This phase provides more nuanced, practice-based insights into how innovators make sense of innovation trajectories and transformation antecedents.

Stage 3: Framework Development

Building on the findings from the literature review and empirical study, the final phase develops an integrative framework. This framework maps how single innovation projects influence specific contextual conditions that may either enable or hinder SBM transformation. Particular attention is given to patterns of knowledge accumulation, actor engagement, and institutional learning. The framework serves both as an analytical tool and a conceptual contribution to debates about evolutionary approaches to sustainable innovation in incumbent firms. Thematic analysis (Castleberry and Nolen, 2018) identifies patterns in desk research, interviews, and workshops. Cross-source comparison reveals commonalities and divergences in how innovation projects influence SBM transformation, highlighting contextual enablers and constraints.

4. Expected results

Preliminary findings suggest that single innovation projects can enhance certain conditions for SBM transformation, such as innovation structures and processes. However, other barriers, such as a focus on exploitation and short-term growth, may not be influenced by single projects alone. Initial results indicate that strategically leveraging innovation, through planning and collaboration (Fobbe, 2020), can drive meaningful business model evolution, contributing to broader sustainability transitions beyond isolated technological improvements.

5. Preliminary conclusions

The study provides insights into how single innovation projects affect contextual conditions for SBM transformation, identifying whether they reinforce or challenge beneficial antecedents. It thereby contributes to the study of sustainable business model and project management.

Keywords

Sustainable business model transformation, Evolutionary innovation, Bioeconomy

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Strong Sustainable Business Models through Tools and Methods: Unpacking how Entrepreneurs Work with Value Co-Creation Process over Time

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Extended abstract

Startups, of all types and at varying stages of development, across industries and geographic locations, are today attempting to adapt their business logic and practices to reflect the need for integrated social, environmental, and economic sustainability (Niessen et al., 2024; Zollo et al., 2013). Entrepreneurs and investors are recognizing that if their business models continue to prioritize near-term profitability goals, the likelihood of unintended negative social, environmental, and economic consequences increases (Epstein and Yuthas, 2017). However, focusing beyond near-term profitability may increase the uncertainty for startups as they face significant product and market risks (Freeman and Engel, 2007). Business model innovation along with associated tools (e.g., business model canvas) and methods (e.g., lean startup) provide a means for decision-makers to ideate, experiment and evaluate the fitness of various business model designs (Niessen et al., 2024; Zott & Amit, 2024). This is especially so for business model designs that entail sustainability practices and values beyond reducing their negative impact towards positive contribution,

aka positive handprint, regeneration and strong sustainability (Bocken and Snihur, 2020; Bugg-Levine and Emerson, 2011; Das & Bocken, 2024; Laszlo et al., 2012; Seebode et al., 2012). Strong sustainability puts the emphasis on the complementarity and non substitution between economy and nature (Nilsen, 2010) and recognizes the biophysical limits for economic activity within the planetary boundaries (Rockström et al., 2009).

Upward and Jones (2016) are introducing an ontology for strongly sustainable business models which puts in the center on flourishing. Sustainability-as-flourishing expresses a normative goal beyond doing less harm to create a net positive impact (Laszlo et al., 2012). As Ehrenfeld (2020) states, the concept and the word flourishing imply that humans and humanity reach the highest potential in a meaningful way over time. Bocken and Short (2021) place the sustainability-as-flourishing on the top of the hierarchy as the most preferred and impactful alternative business models. In order to enable early-stage startups to align with sustainability-as-flourishing thinking, the role of tools and methods for business model innovation is vital (Breuer et al., 2018). Furthermore, within the ontology for strongly sustainable business models, the concept of value is revisited with emphasis on co-creation amongst all stakeholders of the organization (Upward & Jones, 2016).

A plethora of methods and tools to support business model innovation entailing sustainability practices have emerged in the recent years, yet as Niessen et al. (2024) state, those remain underutilized and not empirically tested to determine their usefulness and fit with the needs and expectations of the intended users to support and speed up the transition towards strong sustainability. Furthermore, Snihur and Zott (2019) observe once business models are established, they are challenging to change and stay stable during long periods. Thus, the early stages of startup development, when business model choices are made, are critical to establishing long-term goals (such as strong sustainability) and possibilities for near-term viability in current conditions. Even more, as Carle and Rayana (2024: 148) conclude “the integration of the triple bottom line … already in idea generation… in the entrepreneurial process has a major effect on startups” long-term sustainability work (i.e., impact assessment practices). Additionally, the focus on startups is important as they are seen to have a key role in addressing grand challenges (European Commission, 2013).

Thus, the aim of this paper is to explore how the application of flourishing business approaches in the early stages of startup development has influenced the way entrepreneurs perceive and work with a value co-creation process over time.

We explore this aim by a qualitative interview study with focus on one such approach - the Flourishing Startup Method (FSM). FSM was developed and described by Hogeboom and Upward (2021), has the aspiration to enable startups to proactively contribute to creating the conditions for the possibility of sustainability-as-flourishing. The FSM may be described as a systemic-design enhancement of the Lean Startup Approach for business model experimentation. It aims to provide a systems thinking, integrated experimental, iterative

learning procedure for entrepreneurs to follow to realize their startups purposes in moving from a core focus being profit-making to sustainability-as-flourishing – a socially, environmentally, and economically integrated over time.

In this paper, we focus on two learning events with a total of 64 participants, which took place in Canada 2017-2018. We take 2017-2018 as a baseline and will interview the participants during spring 2025 to follow up how the training in applying the FSM to their business idea and startup influenced their continued value co-creation process over time. We will compare those insights with the elicited feedback on the utility of the FSM and its facilitation collected directly after each event (2017-2018). In that way, we can create an understanding about how the application of flourishing business approaches (a.k.a FSM) in the early stages of startup development has influenced the way entrepreneurs perceive and work with value co-creation process over time.

This research contributes to the academic discourse on understanding business model innovation for novel and impactful business models beyond "weak" sustainability towards sustainability-as-flourishing (Bocken and Snihur, 2020; Bocken and Short, 2021; Niessen et al., 2024). It complements and extends this theoretical discussion by performing, to our knowledge, the first longitudinal empirical investigation on aspects of a business model innovation approach (in our case, FSM) and identifying how it has influenced the way early-stage entrepreneurs perceive and work with value co-creation process over time. (e.g., Bocken and Snihur, 2020; Bocken et al., 2016; Snihur and Zott, 2019; Upward and Davies, 2019; Weissbrod and Bocken, 2017).

Keywords

Strong sustainability, Sustainability-as-flourishing, Flourishing Enterprise; Business Model Innovation; Value co-creation process

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Platforms for collaborative value creation: Findings from the Finnish forest-based sector

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Extended abstract

Our society is currently facing many global sustainability-related challenges from climate change to biodiversity loss, affecting all life on planet. Consequently, we are in the urgent need of rethinking the ways how businesses operate and how value is created (Jonker & Faber, 2021). As a part of this, a transition from a linear economic model based on fossil resources towards a more sustainable, circular bioeconomy based on renewable resources, inclusivity and moderation are required. However, the current discussion on renewable natural resources and their sustainable use is challenging and based on multiple, differentiating value bases and approaches between different societal actors and actor groups. This creates difficulties in dialogue and discussion on joint future goals. To tackle these challenges, there is an immediate need to transition towards operating models that emphasize participation and collaborative value creation among diverse societal stakeholders, taking different viewpoints into account and making participation possible equally for all (Köhler et al., 2021). Therefore, it is necessary to aim at understanding what kind of sustainable business models could be promoted via collaborative value creation, in which sustainability and reasonability would serve as essential parts of the business rather than add-on competitive advantage for a company. Additionally, multi-actor participation and dialogue could both help multiple voices to be heard in the discussions and, thus, promote inclusivity and motivate in creating and promoting joint sustainability goals and discussions.

Collaborative business models that contain the elements of inclusivity, value co-creation and a multi-actor approach are therefore seen as essential for tackling sustainability challenges (e.g. Aagaard et al., 2021; Derks et al., 2022). These kinds of business models can produce various social and environmental benefits, along with economic value, by focusing on better-aligned collaborative approaches, dialogue and the inclusivity of different societal actors (Derks et al., 2022). As dialogue is considered as one of the most ethical forms of

communications characterized by a commitment, engagement and caring among the participants (Taylor & Kent, 2014), it is required that suitable platforms, whether physical or digital, for encounters and joint discussion are created and utilized.

This study brings forward insights regarding collaboration platforms and dialogue from the Finnish forest-based sector. In the transition towards a sustainable, circular bioeconomy, forests are seen to play a key role. For many forested countries such as Finland, forests are critically important from the environmental, social, cultural and economic points of views, and they offer a variety of ecosystem services. However, various societal actors and actor groups have different wishes, goals, values and aspirations related to forests (Halla et al., 2023). While many actors and actors groups agree on sustainability goals as such, it remains uncertain how sustainability is interpreted (Näyhä & Wallius, 2024). Consequently, visions regarding the future of forests and their utilization can be conflicting between different parties. Taking these different viewpoints and visions into account is important for achieving a just, effective and socially accepted sustainability transition. This, again, justifies the need for dialogue. However, reconciling them in forest-related decision-making can be challenging and thus create challenges for collaborative value creation and the creation of joint goals. Conflicting visions can lead to a lively, yet sometimes heated and polarized public forest-related discussion and debate taking place in many channels (Näyhä & Wallius, 2024). In addition to traditional channels, for example social media has gained a foothold as a platform for forest debate. Social media is accessible to most and thus enables different actors also outside the traditional forest-basef sector to participate in the discussion. However, it is often difficult to have a common, less polarized dialogue in these channels, which can further increase conflicts.

For the Finnish forest-based sector, the creation of sustainable business models and a shared understanding have been identified as the most essential for enhancing the sustainability transition (Näyhä, 2021). Finnish forest-based companies and their diverse stakeholder views, collaboration between forest-related actors, joint dialogue, and the current and future platforms for these are explored. To this end, in total 72 forest-based companies and stakeholder groups such as environmental organizations, policymakers, forest users and interest organizations were interviewed. Their collaboration networks and value creation were studied. Moreover, their views on the forest-related discussion and platforms for it were explored, studying what kind of platforms are currently most important for them, and what kind of platforms would be needed in the future to best support the collaborative business models and collaborative value creation for sustainability transition. Semi-structured individual interviews were carried out online between May 2023 and January 2024 and analyzed utilizing thematic analysis (*TA*; Clarke & Braun, 2017) and Critical Discourse Analysis (*CDA*; Fairclough, 2010). More specifically, the interviews were coded and categorized using the principles of TA and further analyzed with CDA, which aims to clarify the meanings of language used and, in particular, to examine how power and power relations are reflected in the discourses.

The analysis of the interviews is ongoing, but the preliminary results show that currently media, especially social media channels, are seen as important for forest discussion in Finland. However, these channels can be repulsive and stir up conflicts, and therefore new types of platforms, especially physical ones, would be needed for more inclusive participation, dialogue and collaborative value creation. Additionally, the preliminary results show that the public forest discussion lacks a holistic perception of forests and their utilization, and opportunities for face-to-face discussion according to the interviewees. They share a wish of more facilitated and/or moderated discussion platforms which could emphasize discussing in "a good spirit". Our presentation will show how various forest-related actors in Finland reflect upon the current public discussion regarding forests and how the various viewpoints on various platforms can be brought together to create collaboration instead of conflicts. Ultimately, this can aid forest-related policymaking and support the sustainability transition that is urgently needed. As a final result, we aim to create proposals on what kinds of opportunities and platforms for forest dialogue and cooperation between actors are needed so that they will support an environmentally sustainable, socially accepted and just sustainability transition.

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Keywords

Value co-creation, discussion platforms, dialogue, Finland, forest-based sector

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EPILOUGE

The commitment of the New Business Model Conference to successfully meet the United Nation's 17 Sustainable Development Goals (SDGs) is a constant in our purpose of a better world, gathering in this effort researchers, business leaders and policymakers. We, as the NBM team research and practice community, have together accumulated a large and valuable knowledge base which we have further advanced through the discussion at every single conference from the International Business Model Conference Series. This knowledge can support the advancement of the speed and scale of the progress towards the urgently needed radical social, environmental and economic transformation in the context of digital, green and inclusive transitions. Therefore, we carry a great responsibility to further and widely disseminate our work during and beyond the 10th International New Business Models Conference, organized by the School of Business, University of Iceland.

During the one-day pre-conference Doctoral Colloquium and two conference days that make up the NBM@Reykjavik2025, a dialogue with Madam President of Iceland, Halla Tómasdóttir took place. A keynote speech was delivered from the founder of the NBM conference series, Professor Jan Jonker. A panel discussion with representatives from key industries in Iceland (energy and infrastructure, tourism, and fishing), facing difficult challenges due to global pandemic and/or seismic activities and volcanic eruptions, was hosted by Dr. Hafdís Hanna Ægisdóttir, Director School of Social Sciences Sustainability Institute at the University. Great contributions and innovative ideas were then organized into four themes and four workshops:

- Theme 1: Exploring the system level.
- Theme 2: Exploring the sectoral and organisational level.
- Theme 3: Exploring the organisation impact.
- Theme 4: Exploring theoretical and methodological foundations.

The ideas presented in this book of abstract of NBM @Reykjavik 2025 are valuable contributions to the field. It is visible that the collection of papers touches upon all 17 SDGs.

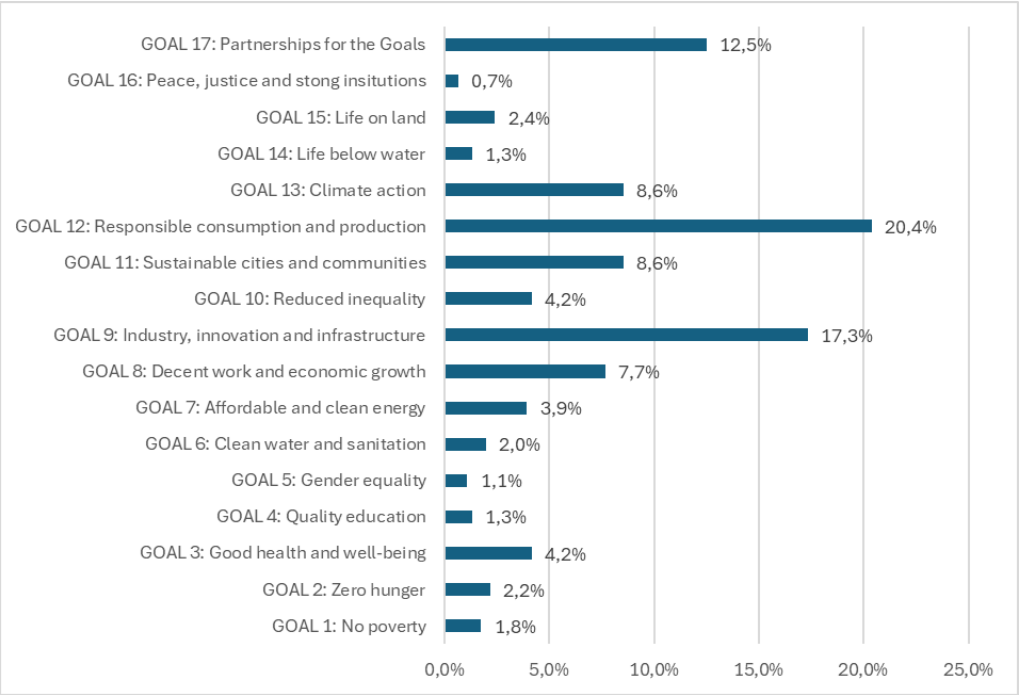


Figure 1. Distribution of papers by SDGs

Finally, during the preparation of this conference and while reviewing all submission, we understand the importance of the community, teamwork, and the need for many different skills. That is why we want to say thank to you, to the NBM community, and many people without whom this conference would not have been possible. Special thanks go to all participants and track chairs, as well as to NMB Conference board who have been supporting us on the journey of organizing this conference! We are looking forward to seeing you next year!

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ABOUT UNIVERSITY OF ICELAND

The University of Iceland was founded on 17 June 1911, on the centenary of 19th century Icelandic statesman Jón Sigurðsson, usually referred to as "president". The University was located in the Parliament House at Austurvöllur for the first 29 years. The University of Iceland was formed in a merger of the Seminary, the School of Medicine, and the School of Law, which each formed a faculty, in addition to the newly established Faculty of Philosophy.

Only 45 students, one of which was female, were enrolled during the 1911-1912 academic year; by comparison, the 2023-2024 academic year saw almost fourteen thousand students, around two thirds of which were female, studying at the University of Iceland. The University offers a variety of academic programmes on the undergraduate, graduate, and doctoral levels.

The University relocated to the Main Building (Aðalbygging) at Suðurgata in 1940. The University's facilities have grown considerably since then; the newest addition to the campus is the University Centre, which was taken into use on 1 December 2007, Veröld - House of Vigdís 2017 and Edda 2023.

A new structure and governance system for the University of Iceland entered into force on 1 July 2008. At the same time the University merged with Iceland University of Education on its centenary. The new University of Iceland has five academic schools, each comprised of a number of faculties. The academic schools are the School of Education, the School of Engineering and Natural Sciences, the School of Health Sciences, the School of Humanities, and the School of Social Sciences. In addition, the University operates a number of research and service institutions.

The University of Iceland's strategy for the years 2021-2026 (UI26) is entitled "A Better University - For a Better Society". The strategy emphasises the important role that the University has in shaping society and the creation of knowledge in the world.

The guiding principles of UI26 are:

Quality: We guarantee quality in all aspects of our work, ensuring international competitiveness in teaching and research.

Trust: We are accountable and conscious of the University's societal significance as an institution that attracts students and staff from diverse backgrounds.

Agility: We break down barriers to collaboration and take the initiative in responding to change and challenges, both within the University and in society at large.

Main Priorities of the University 2021-2026 are:

- Open and international
- Sustainability and diversity
- Strength based on quality
- A good place to work

SCHOOL OF BUSINESS ADMINISTRATION

The School of Business Administration is part of the School of Social Sciences at the University of Iceland and is committed to high standards in both teaching and research. The School of Business has a distinguished tradition of excellence, established in response to the growing need for structured business education in Iceland. It has become one of the country's most respected academic institutions.

The vision is to create knowledge and skills that contribute to Iceland's prosperity while maintaining a solid connection to the national and international business community to solidify its position as a leading business education and research institution in the Nordic region, thereby ensuring Iceland remains competitive and forward-thinking in an increasingly interconnected world.

The School of Business Administration offers a comprehensive and dynamic curriculum tailored to meet the evolving needs of students and the business sector. Programs range from undergraduate to postgraduate levels, strongly emphasizing bridging theoretical knowledge with practical, real-world business skills. The School of Business continually updates its course offerings to align with developments in the business environment, ensuring students receive a relevant and current education.

Professionalism is one of the Schools of Business Administration core values, underpinned by academic independence and critical thinking. Instructors are encouraged to foster an engaging and interactive learning environment, using diverse teaching methods emphasizing active student participation. In addition, the department focuses on assessment methods that prioritize continuous evaluation over traditional final exams, further enriching the learning experience.

In response to the demands of an increasingly globalized world, the School of Business Administration has expanded its offerings in English and introduced visiting professors to bring international perspectives into the classrooms. This emphasis on global business knowledge is crucial as the School of Business prepares its students for Icelandic and international business roles.

The School of Business Administration research focuses on generating internationally recognized knowledge, emphasizing the Icelandic business landscape. The School of Business has a strong tradition of integrating research and teaching, fostering a research-driven learning environment that benefits students and the academic community.

The research strategy emphasizes innovation, practical applications of research outcomes, and collaboration, but faculty members of the School of Business are encouraged to engage in international research partnerships and actively pursue funding from competitive research grants. Additionally, there is a concerted effort to support new academic employees by providing resources and mentorship to help them establish their research careers.

Aligned with the University of Iceland's broader research goals, the School of Business focuses on advancing research that contributes to the development of Icelandic society. Research is designed to be innovative and applicable and is maintained through strong connections to the needs of Iceland's business community. This approach ensures that the School of Business Administration remains a leading force in driving economic and social progress, reinforcing its position as a leader in academic inquiry and societal impact.
The School of Business has been at the forefront of business education and research in Iceland for nearly 80 years. It is recognized for its robust academic foundation and commitment to high-quality education, significantly contributing to the Icelandic economy and society.

ABOUT REYKJAVÍK

Reykjavík is the vibrant capital of Iceland! Nestled on the southwestern coast, Reykjavík is a city that beautifully blends rich history, unique culture, and stunning landmarks. As the world's northernmost capital, it is known for its rich history and modern significance.

Reykjavík, which means "Smoky Bay," was named by the first settler, Ingólfur Arnarson, who arrived around 874 AD. The name was inspired by the steam rising from the area's hot springs. Over the centuries, Reykjavík evolved from a small farming settlement into a bustling city. It officially became a trading town in 1786 and has since developed into the heart of Iceland's political, economic, and cultural life.

Today, with a population of 140,000 in the city and 248,000 in the Capital Region, Reykjavík stands as a model of sustainability, celebrated for being one of the cleanest, greenest, and safest cities globally. This blend of history, progress, and environmental consciousness makes Reykjavík a key destination and a vibrant urban hub.

Reykjavík is furthermore known for its vibrant cultural scene. The city hosts numerous festivals throughout the year, including the Reykjavík Arts Festival and Iceland Airwaves, a popular music festival. The local cuisine is a delightful mix of traditional Icelandic dishes and modern culinary innovations. Don't miss trying the famous Icelandic hot dogs and fresh seafood. Swimming is a significant part of Icelandic culture, and Reykjavík is no exception. The city boasts numerous geothermal swimming pools that are popular among locals and visitors alike. These pools are more than just places to swim; they are integral to the social fabric of the community.

Reykjavík is home to several iconic landmarks that reflect its rich heritage and modern spirit:

Hallgrímskirkja: This towering church is one of Reykjavík's most recognizable landmarks. Designed to resemble the basalt columns of Iceland's landscape, it offers panoramic views of the city from its observation tower.

Harpa Concert Hall and Conference Centre: A marvel of contemporary architecture, Harpa hosts concerts, conferences, and cultural events. Its glass facade, Icelandic-Danish artist Olafur Eliasson in collaboration with Henning Larsen Architects, inspired by Iceland's basalt landscape, is a sight to behold.

Sun Voyager: This striking steel sculpture by Jón Gunnar Árnason resembles a Viking ship and symbolizes the promise of undiscovered territory, a fitting tribute to Iceland's adventurous spirit.

Perlan: Perched on Öskjuhlíð hill, Perlan features a rotating glass dome and offers exhibitions on Iceland's natural wonders. The observation deck provides stunning views of the city and surrounding landscapes 2.

Reykjavík is a city that invites exploration and discovery. Whether you're wandering through its charming streets, enjoying its vibrant arts scene, or marvelling at its natural beauty, there's something for everyone to enjoy. Welcome, and enjoy your stay!



University of Iceland
School of Business
Administration