

Operationalizing leverage points in business model design for sustainable systems change

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Abstract

Systems change can help to address sustainability challenges and interventions at deep leverage points of a system can be applied to do so. By studying 9 sustainable entrepreneurial businesses, this paper looked at how entrepreneurial firms used their business to intervene at deep leverage points to facilitate systems change. We then proposed how deep leverage points can be operationalized by developing an approach for sustainable business model innovation and how entrepreneurs can consciously target leverage points when designing their business models to influence sustainable systems change.

Keywords: *business models, sustainability, ecosystem, systems entrepreneur*

1. Introduction

Sustainability is at the top of the global agenda and researchers and practitioners increasingly acknowledge the need to address global sustainability challenges from a systems perspective, considering the interconnectedness of a system. To tackle sustainability from a systems perspective, the use of leverage points has been gaining attention in sustainability transformation literature in recent years. Leverage points are places of intervention in a system where a relatively small intervention can lead to relatively big changes in other parts of the system (Meadows, 1999). In this stream of research, researchers call for the use of leverage points to transform our pathway toward sustainability (Abson *et al.*, 2017; Chan *et al.*, 2020; Davelaar, 2021; Fischer and Riechers, 2019; Nguyen and Bosch, 2013; Riechers *et al.*, 2022), with others designing methods and tools to analyze causal loops and identify leverage points (Egerer *et al.*, 2021; Komaki *et al.*, 2021).

One approach researchers have adopted to tackle sustainability at a systems level is based on the work of Meadows (1999) which identifies places to intervene in a complex system (e.g. a corporation, an economy, an ecosystem) to bring about transformative change. Meadows (1999) described twelve leverage points to intervene at to influence the behavior of a system. The leverage points range from 'shallow' to 'deep' where 'shallow' points are argued to be relatively easy to implement but may only bring about little change in the system, and 'deep' points are more difficult to change but can result in more transformational change. Drawing on the ideas of Meadows (1999), Abson *et al.* (2017) conceptualized that interventions applied at leverage points can be 'transformational sustainability interventions'. They aggregated the original twelve leverage points into four broad types of systems interventions (from shallow to deep) - parameters, feedback, design, and intent. Of the four parameters, design and intent are deep leverage points, where design refers to the structure of the system that manages the shallower leverage points of parameters and feedback, and intent is the values and goals of actors that shape the direction of the system. Abson *et al.* (2017) also pointed out that sustainability

research and policy have largely focused on shallow leverage points but deep leverage points are likely needed for transformational change.

From the perspective of identification of leverage points to tackle sustainability challenges (Egerer *et al.*, 2021), the researchers approach a complex socio-economic system to identify points where different groups of actors can act. In many studies on sustainability transformation, the leverage points and levers are acted upon from the top down, where region-, national-level, or higher action is required and actors of levers at leverage points are often governments and regulators who have resources to provide subsidies and policy incentives (Chan *et al.*, 2020). Though many studies have been conducted on how to identify and use leverage points for systems change, actors of change are frequently governments and regulators, and few studies suggest pathways for individual actors. Encouragingly, individual projects implemented by civil organizations tackling leverage points for sustainability change have been reported (Birney, 2021), suggesting that individual actors have the potential to intervene at leverage points.

In that vein, the concept of systems entrepreneur has been described in the context of transformations towards sustainability (Schlaile *et al.*, 2021). Systems entrepreneurs are described by Milligan *et al.* (2017) as "moving beyond delivering solutions and instead are focusing on the architecture of the system itself." Schlaile *et al.* (2021) combined the concept of systems entrepreneur and Meadows's leverage points to further conceptualize systems entrepreneurship. They suggest the deep leverage points systems entrepreneurs can intervene at to facilitate systems change towards sustainability. However, to our knowledge, there have been no empirical studies on how entrepreneurs use leverage points and the processes or actions that they take for sustainable systems change.

From a similar perspective of individual firms contributing to the sustainability transition, today it is widely accepted that businesses play an important role in supporting the transition toward sustainability (Lüdeke-Freund, 2010; Tukker *et al.*, 2008). To do so, firms need to integrate sustainability into their core business (Schaltegger and Wagner, 2006) and they can do so through sustainable business model (BM) innovation. Specifically, sustainable BM innovation encourages firms to rethink their perception of value and redesign their BM to integrate the triple bottom line perspective (Bocken *et al.*, 2014). To support firms in changing their BMs towards a sustainable BM, researchers have developed tools that firms can use (Bertassini *et al.*, 2021; Boldrini and Antheaume, 2021; Geissdoerfer *et al.*, 2017; Pieroni *et al.*, 2019; Short *et al.*, 2013) and a common theme is the need for firms to consider multiple stakeholders as they innovate their BM for sustainability. Moreover, certain types of sustainable BM would require system-level change to be materialized, especially when related to the circular economy, and thus research has also expanded to emphasize working with stakeholders at the ecosystem-level (Bertassini *et al.*, 2021; Konietzko *et al.*, 2020; Zucchella and Previtali, 2019). Despite so, existing approaches do not suggest how entrepreneurial firms can consider their sustainable BM from a systems change perspective and make use of leverage points when approaching their sustainable BM innovation. Focusing on deep leverage points for transformational change (Abson *et al.*, 2017; Meadows, 1999), this study aims to understand how entrepreneurial firms position themselves to intervene at deep leverage points when developing a transformative sustainable business model. Due to the lack of primary data in this area of research, an exploratory study in the form of multiple case studies (Yin, 2018) was conducted. The insights from the case studies were compared to deep leverage points described by Meadows (1999) and Abson *et al.* (2017) to understand how entrepreneurial firms made use of deep leverage points. Building on these leverage points, we then developed a framework to help entrepreneurs design their sustainable BM to influence sustainable systems change.

2. Methodology

The focus of this study was to understand how entrepreneurial firms can design and develop their BM to make use of deep leverage points for sustainable system change. Considering the lack of primary data on the phenomenon to be observed, we conducted an exploratory study using qualitative research in the form of case studies (Eisenhardt, 1989; Yin, 2018). Case study is a method to examine a phenomenon in-depth and in its real-life context and it is especially relevant to studying under-researched and context-dependent phenomena (Yin, 2018). In this research, multiple case design was selected as it is considered to be more robust (Herriot and Cirestone, 1983) and allows for cross-case analysis (Yin, 2018), allowing us to generate rich empirical insights.

2.1. Data collection

As recommended by [Eisenhardt \(1989\)](#), we adopted theoretical sampling to identify potential businesses where we could observe the phenomenon of interest. We used two criteria to identify potential businesses. The first was to consider start-up or scale-up businesses that have a sustainable value proposition that considers social or environmental sustainability in addition to economic sustainability. Secondly, we wanted to identify transformative sustainable businesses that have innovations or BMs with the potential to lead to an industry-level system change. This might include the value chain, and related regulators and consumers of the industry that the business is operating in. To identify the latter criterium, we looked for businesses, in the context or industry they are in, who share about changing the existing system, or whose business or innovation requires multiple parties in the system to make changes to their behavior or business processes.

We conducted our search via general internet search, market research sites, impact venture fund portfolios, and NGOs' sustainability white papers. We examined information published on the businesses' websites, social media accounts, and media reports to analyze whether the businesses fit our criteria. The businesses in our study span a range of industries and positions along the traditional industry value chain, providing the opportunity to capture variations in the data and include insights from diverse contexts. Data was collected from 9 entrepreneurial firms across different industries and their businesses are described in Table 1.

Data collection consisted of semi-structured interviews with leaders in the company. The interviews aimed to understand the business in general, the attitudes the businesses have towards sustainability, and how they work with stakeholders for sustainability. Questions for the semi-structured interview are listed in Table 2. The questions were designed to be open to prompt discussions and allow exploration of the topics during the interview ([Eisenhardt, 1989](#)). Supplementary secondary data was collected from firms' websites, public presentations and documents, social media accounts, and other media sources. The use of multiple data sources enables a deeper understanding of the cases ([Yin, 2018](#)) and allows for data triangulation to increase the validity of the study ([Guion et al., 2011](#)).

Table 1. Description of data set of sustainable businesses

Cases	Sustainable business descriptions	Interviewees
A	The firm is in the food sector and develops technology to upcycle food by-product into food ingredients.	Chief Technology Officer
B	The firm is in the food sector with a global footprint with technology and a commercial model for decentralized food production. It supports food brands to produce food globally through decentralized production.	Founder
C	The firm is in the food sector and develops technology and a commercial model to compute and reduce carbon footprint of food supply chains.	Chief Executive Officer
D	The firm is in the food sector and is developing the first commercial farm in their sector. They are cultivating the local value chain to develop this food sector nationally.	Chief Financial Officer and Chief Impact Officer
E	The firm is in the beverage sector with a global footprint with technology and a commercial model for circular beverage distribution.	Chief Executive Officer
F	The firm is in the beverage sector with technology for sustainable packaging.	Chief Executive Officer
G	The firm is in the fashion sector with technology and a commercial model for circular fashion.	Chief Sustainability Officer
H	The firm is in the ecommerce sector with technology and a commercial model for circular packaging.	Chief Commercial Officer
I	The firm is in the ecommerce sector with technology and a commercial model for circular ecommerce.	Co-founder

Table 2. Interview questions for the semi-structure interviews

Data to be collected	Interview questions
General business and attitudes towards sustainability	<p>What does your company do and how does it relate to sustainability?</p> <p>What were the key milestones of the business since you started?</p> <p>What is your business model and how has it changed since you started?</p>
Working with stakeholders for sustainability	<p>Which are the groups of stakeholders you engage with regarding your sustainable business model?</p> <p>How do you work with them?</p> <p>Are there any partners that are playing a big part to allowing you achieve your goals and how do you engage with them?</p>

2.2. Data analysis

The data analysis process was an iterative process. We first conducted open coding of interview data and secondary data collected to identify concepts from the data. Next, we compared the codes from the open coding to identify patterns and create first order categories. We then compared the categories to create aggregate categories. This process was done iteratively and constant comparison was used where new data collected was compared to previous codes and emergent categories (Glaser, 1965). Finally, we mapped the aggregate categories to the deep leverage points based on which aggregate categories when implemented would influence the deep leverage points. Figure 1 displays the way the data were structured into categories and mapped to the deep leverage points described by Meadows (1999) and Abson *et al.* (2017). Themes that are not relevant to the leverage points are not included in the results of this study.

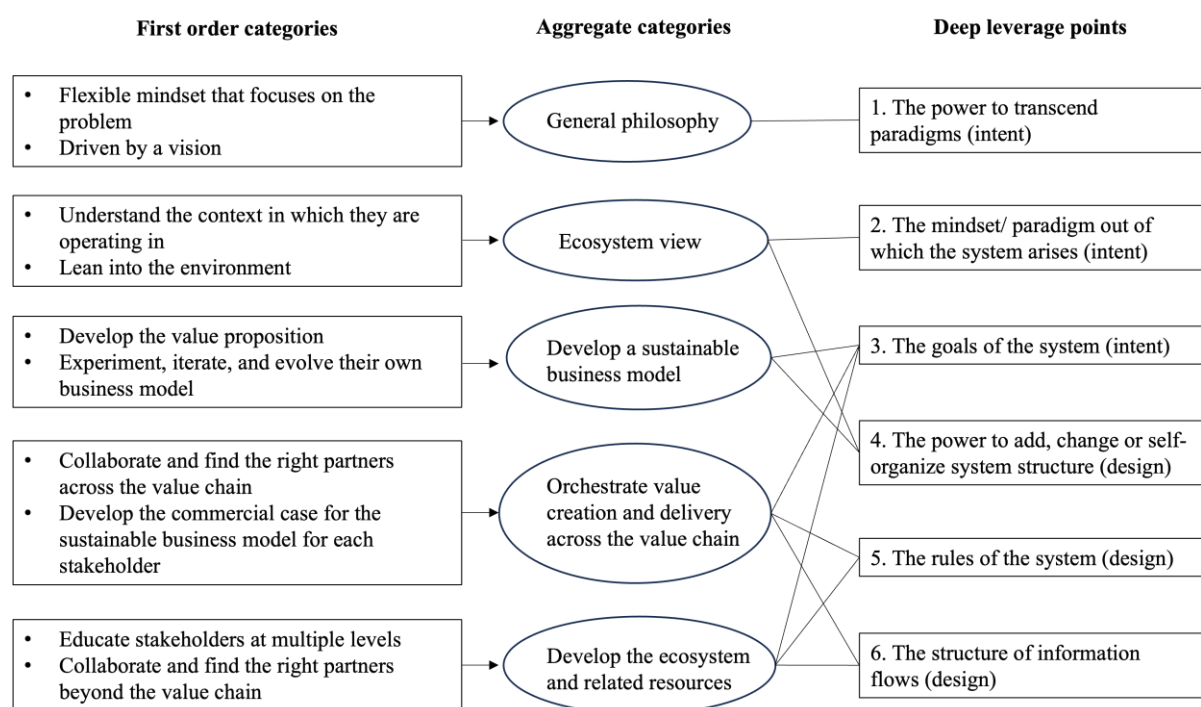


Figure 1. Data coding and mapping to deep leverage points described by Meadows (1999) and Abson *et al.* (2017)

3. Results and discussion

3.1. Alignment to deep leverage points

The themes that emerged from the data were mapped to deep leverage points in ways where intents and designs happening at the individual firm-level can position the firm to activate the deep leverage points at the systems level (Figure 1). This section details the results of the themes that emerged from the cases and how they are relevant to deep leverage points.

3.1.1. General philosophy

Across the majority of the cases, we found that the firms have a general philosophy of having a flexible mindset where they are concerned more about the problem and less about the specific solution. This allows them to have the mental flexibility to evolve their business and solutions based on their understanding of the challenges. Several interviewees described their firm as a solutions or innovation company without focusing on the specific solution or innovation. In Case F, the interviewee shared "[We have] the mandate to innovate sustainable solutions that are designed to in the first instance reduce carbon impact and secondly be easier or easy to recycle... We are a business that conceives the ideas, but then engineers the solutions."

Rather than focusing on a particular solution, the firms develop a set of competencies that will allow them to tackle challenges as they emerge. In addition, the firms are driven by a vision that has the characteristics of having a long-term perspective, design for scalability, and having ambitions for industry-level change.

The general philosophy observed in the cases suggests that the firms are unattached to a particular state of their business and industrial paradigm. They view the current paradigm to be unsustainable and realize that change is needed, however, they remain flexible to tackle the challenges they uncover.

3.1.2. Ecosystem view

Similar to the philosophy of the whole system design approach to sustainable design (Evans *et al.*, 2017), we found that case firms have an ecosystem view of the problem they are trying to tackle and the solution they are working on. Here, the ecosystem refers to the business environment in which the entrepreneurial firm is operating and growing in and includes a network of direct and indirect stakeholders (Moore, 2006). Entrepreneurial firms in our cases view themselves as a part of the ecosystem and other firms as dynamic stakeholders of the ecosystem, and that they are interdependent with stakeholders in the ecosystem. The ecosystem view emerges in two ways. Firstly, the firms work to develop a deep understanding of the context of the system that they want to or are operating in. They have an ongoing process to develop and update their understanding of the value chain that they are trying to tackle and understand stakeholders along the value chain. We found that firms also track the trends in the wider ecosystem which could include the regulatory, innovation, and social acceptance trends that are beyond the value chain. For instance, Firm G is in active communication with stakeholders across the fashion value chain, trying to understand the challenges actors at each position of the value chain face even though their business only exchanges value with firms in two or three positions across the whole value chain. This relates to the second deep leverage point where the firm can "step out of the system and see it as a whole" (Meadows, 1999). By doing so, the firm understands the structure of the value chain and the broader ecosystem they are operating in as well as the interdependencies of the parts of the ecosystem. This allows them to understand the challenges across the value chain, who the stakeholders are, and what are the challenges they face. They can then identify the touch points they need to have across the value chain to implement their solution and understand the incentives and disincentives of each stakeholder. This can be done through collaborative communication across the value chain.

Secondly, the case firms lean into the environment that they are operating in. We found that case firms are willing to confront complexities that they uncover as they develop their understanding of the context, and they actively target the challenges and problems in the value chain. In many of our cases, the firms were attempting to reorganize the value chain (cases A, E, G, H, I) or create a new value chain (B, D,

F). In the former, they work with existing value chain actors to change their behavior and business processes while in the latter, they create new connections among parties who were not involved or connected in the traditional value chain. In all cases, firms position themselves along, and in some instances along multiple positions, the reorganized or new value chain. They recognize their interdependencies with other stakeholders of the ecosystem and use their understanding of the environment and stakeholders as the basis for designing their solution and BM. By leaning into the environment, the firm sees itself as part of the ecosystem and positions itself where it can influence and change the ecosystem. This sets into action a process of self-organization and evolution, with the firm as part of what is driving the evolution.

3.1.3. Develop a sustainable business model

Two key themes identified in firms developing their sustainable BM were their development of the value proposition and their attitude of constant iteration and evolution of the BM. Case firms developed their sustainable value proposition based on their understanding of the context. In most cases, firms build on their technical and commercial strengths when considering their value proposition and continue to develop their core capabilities to tackle the challenges in the value chain. In developing their business value proposition, case firms have the ambition and belief that they can change the value chain and the broader ecosystem and aim to change the goal of the ecosystem they operate in. Specifically in Case C, the firm has the ambition to change the food system and its value proposition is to provide better supply chain data for the food system. In this case, the firm's ambition led to the development of their business which intervenes to change the structure of information flow in the food system to support brands and consumers to make better decisions.

We found that case firms, being at the start-up or scale-up phase of their business, constantly experiment and iterate their BM. They also have the mindset that their BM constantly has to evolve. Firm E shares that *"one thing to keep in mind is constant evolution is required. We're learning more as we go and that may require [the] evolution of business models, of commercial models."* This leads from their effort of continuously trying to understand the context and developing a better understanding of their ecosystem and resulting in them developing their technology or solution further to solve the challenges they uncover and correspondingly influences their BM. This mindset and active evolution by the firms position them to be a constant source of change in their ecosystem.

3.1.4. Orchestrate value creation and delivery across the value chain

In taking an ecosystem perspective, we observed that case firms identify and collaborate with the right partners across the value chain. Firms described that they start by identifying partners that have similar sustainability goals and values as them and who are complementary to them to develop the sustainable value proposition along the value chain. This allows them to gather a group of early partners in the value chain who they can work with to start to change the goal of the system. This is also suggested by [Schlaile et al. \(2021\)](#) as a directionality lever systems entrepreneurs can take where systems entrepreneurs take the role of aligning different stakeholders. Such vision alignment is also highlighted in the development of sustainable business ecosystems ([Bertassini et al., 2021](#)). Across our cases, we found that the early partners of the firm are not merely visionary early adopters ([Moore, 2014](#)), but they are also dynamic partners who have bought into the vision and invested or innovated in their own ways to create more value for the ecosystem. Firms can therefore change the rules of their ecosystem and orchestrate more sustainable value creation for the ecosystem by acknowledging and encouraging such dynamic partners and cultivating a spirit of innovation.

In line with research on sustainable BM innovation processes where the value to each stakeholder should be considered ([Short et al., 2013](#)), firms understand the incentives and disincentives for each stakeholder and have gone through cycles of communication and iteration with early partners to demonstrate the sustainable and commercial value to stakeholders at different positions of the value chain. Firm E shares that *"the best way to make a circular solution work or a sustainability solution innovation work, please make it work without the sustainability and make it better for your users, your customers, your consumers than the alternative, even if they don't care about sustainability."*

Especially important at this early start-up and scale-up phase, case firms keep in close communication with partners for feedback on the implementation and improvement of the sustainable solution. These feedback channels are built digitally through Internet-of-Things devices on their machines and, more personally, through dedicated customer service teams. In addition to building these feedback channels, in several cases, firms emphasize that it is important for communication to be open and transparent. This helps to uncover challenges and set expectations among partners and supports the development of a trustful relationship with their partners.

3.1.5. Develop the ecosystem and related resources

Many case firms in our study are trying to reorganize the current value chain or create a new value chain. In addition to the technical requirement and working with partners across the value chain, firms educate peers and potential customers about the new value chain and its value. They do this through thought leadership efforts, participating in industry events, and making use of traditional and social media channels to share about sustainability. They frequently do this in collaboration with their early partners. These efforts aim to increase acceptance of their sustainable innovation and new value chain but serve the additional purpose of encouraging a change in mindset towards sustainability.

Firms also educate and participate in advocacy work with regulators and non-value chain actors like trade associations and trade media, acting beyond the value chain. Firm A shares that *"we are trying to build awareness around this category of upcycled food. So that also requires us to engage with thought leaders in sustainability or [accept] ministers to come and visit the production so we can be used to showcase [how] a sustainable food system could be in the future."* Firm D also shared that in their work to create a new food value chain in the country, they have been involved in advocacy work with regulators with the intention that they can contribute to setting standards based on the firm's best practices. The firm also conducts training based on these best practices to propagate the knowledge for the benefit of building the value chain on a national level. These education efforts across multiple levels of the ecosystem are a step towards supporting information flow across the ecosystem.

3.2. A framework for designing sustainable business models to influence systems change

Based on the themes identified, we built a conceptual framework as a tool to help entrepreneurs design their sustainable BM to influence systems change (Figure 2). This framework includes a 'chain of leverage' points (Fischer and Riechers, 2019) adopted over cycles of BM iteration and evolution which influence each other. There is a procedural sequence in this framework where perspectives or actions taken in an earlier phase support subsequent phases. Approaches and actions that can be taken at different steps of the framework are listed in Figure 3.

In this framework (Figures 2 & 3), sustainability is present throughout. Importantly, the vision that the entrepreneur sets at the beginning embeds sustainability into the business decisions and activities. They then need to develop a good understanding of the context and ecosystem to identify the problems to tackle. When moving to develop their solution, their sustainability vision anchors the sustainable value proposition and the subsequent collaboration with early partners to reorganize or create the new sustainable value chain. The systems approach in this process is moving from intent (leverage points 1, 2, & 3) to design (leverage points 4, 5, & 6) by translating the ecosystem view into actions. Going beyond that of their BM and by leaning into their environment, the entrepreneur now orchestrates value creation and delivery across the new value chain and the ecosystem. Despite ecosystem and resource development not typically a part of a firm's BM, as firms taking the ecosystem view, this is important for building the ecosystem around which the BM can thrive. The continuous iteration and evolution of the business also suggest continuing efforts to position themselves and act at leverage points. Through the growth and development of their ecosystem, the entrepreneurial firms and their early partners can operationalize deep leverage points to influence and change the system in which they are operating in.

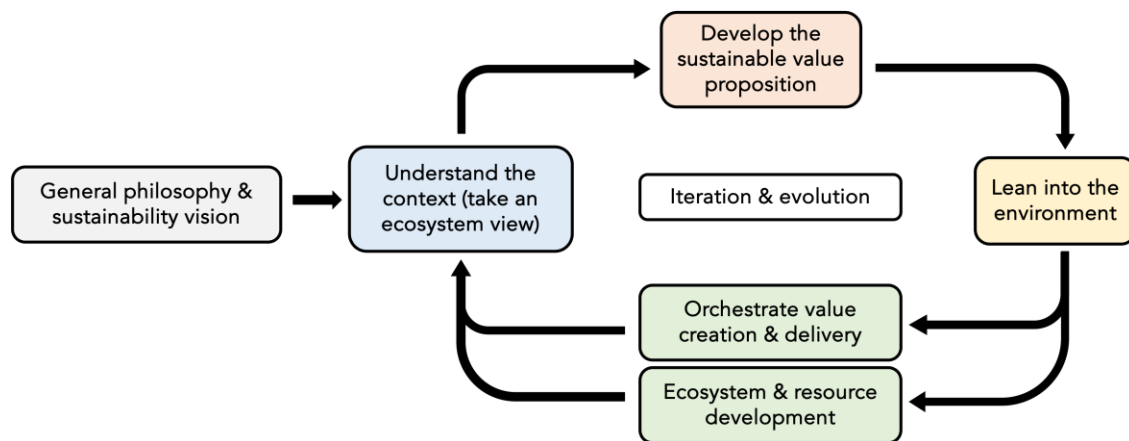


Figure 2. Framework to design sustainable business models to influence systems change

Approaches and actions

General philosophy & sustainability vision LP1 - The power to transcend paradigms (intent)	Understand the context (take an ecosystem view) LP2 - The mindset/paradigm out of which the system arises (intent)	Develop the sustainable value proposition LP3 - The goals of the system (intent)	Lean into the environment LP4 - The power to add, change or self-organize system structure (design)	Orchestrate value creation & delivery LP3 - The goals of the system (intent) LP5 - The rules of the system (design) LP6 - The structure of information flows (design)	Iteration & evolution LP4 - The power to add, change or self-organize system structure (design)
<ul style="list-style-type: none"> Flexible mindset, focus on problems instead of solutions Develop long-term vision and with scalability in mind 	<ul style="list-style-type: none"> Continuously develop understanding of the value chain and challenges across the value chain Understand incentives and disincentives to each stakeholder Identify touch points across value chain Collaborative communication across value chain 	<ul style="list-style-type: none"> Ambitions and belief that they can change the value chain / system Focus on and develop core competencies 	<ul style="list-style-type: none"> Use understanding of the environment as the a basis for business model design Recognize interdependencies with stakeholders Confront complexity, target the challenges and problems in the value chain Position the firm along and/or across the new value chain 	<ul style="list-style-type: none"> Identify complementary partners for sustainable value chain change and partners with similar sustainable vision Keep in close communication with partners for feedback, design feedback mechanisms View partners as dynamic partners, encourage them to create more value for the ecosystem Demonstrate sustainable and commercial value Open and transparent communication 	Ability to evolve

Figure 3. Sustainable business model innovation approach and actions for systems change. Numbers in the process correspond to the deep leverage points (LP) in Figure 1.

4. Conclusion

In this work, we used a leverage points perspective to study how entrepreneurial firms with transformational sustainable businesses build their business. Entrepreneurial firms are incentivized to find a solution that can work for stakeholders across the value chain, while educating and advocating beyond the value chain level to build alignment across different system levels. Therefore, in line with the perspective of [Schlaile et al. \(2021\)](#), we add empirical examples to research on systems entrepreneurs with the leverage point perspective for sustainability transformation. Here, we suggest that entrepreneurial firms can be actors to intervene at deep leverage points for sustainability transformation with their sustainable BM and ecosystem-level orchestration as the intervention. Specifically, entrepreneurial firms can be involved in changing the rules of the system by engaging with more powerful actors like regulators and large multinational corporations and be involved in designing best practices and regulations for the new system.

In addition, we bring insight to how entrepreneurial firms can influence and change the mindset of the system they are operating in. Despite entrepreneurial firms not having the power to apply top-down

interventions, they can take action and intervene at leverage points. This requires them to be engaged in ongoing dialogues with stakeholders to ensure that all stakeholders' concerns and needs are met.

From the learnings of the cases, we operationalized leverage points by developing an approach that integrates deep leverage points in BM innovation to target sustainable systems change. Despite none of the interviewees mentioning the use of leverage points, we found that their approaches were aligned with the literature on deep leverage points for systems change. Therefore, we suggest that entrepreneurial firms wanting to design their BM for sustainable systems change can more deliberately consider leverage points and use the approach developed in their process.

In this study, we focused on identifying deep leverage points that entrepreneurs can use to design their BM for sustainable systems change. However as described by Fisher and Riechers (2019), concrete steps based on system causality, or the shallower leverage points, need to be integrated for targeted actions to lead to systems change. This is an open issue that requires further research, and it would be worthwhile to incorporate the use of shallower leverage points in sustainable BM innovation in future studies. Due to the exploratory nature of this study, only a limited number of businesses across a few sectors were studied. Further studies to include businesses from different sectors should be conducted to understand the relevance to a wider sector of businesses.

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