



Towards a dynamic value network perspective of sustainable business models: the example of RECUP

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Abstract

Sustainability research has increasingly emphasized the importance of value networks in the design and development of sustainable business models (SBM). This is because SBMs must incorporate economic, environmental and social goals to achieve their desired impacts, hence designing such models requires firms to develop an understanding of value creation from the perspective of all key stakeholders in their networks in order to co-create economic, social and ecological value. To advance our understanding of how value network activities shape SBM development, we conducted a longitudinal case study of RECUP, a born sustainable startup with a circular economy business model that has developed and worked with a broad value network to achieve a major reduction in waste from linear consumption. We identify three sets of value network activities that supported the continuous development of the firm's value proposition and contributed to mutual value creation among stakeholders from business, politics and society: *B2B-partnering*, *political agenda-setting* and *mobilizing end-consumers*. Our contributions to research on SBM innovation and design include demonstrating how value network activities initially emerge through experimentation and consolidate over time through iterative learning processes. Such learning and adaptation through dynamic value network activities is especially important, we argue, when value-creating factors are not sufficiently known in advance by startups and/or their stakeholders.

Keywords Sustainable business model innovation · Value network activities · Circular economy

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1 Introduction

Sustainability research aimed at solving complex challenges such as waste from linear consumption has increasingly focused on firms and their business models in recent years. As traditional business models are widely seen as contributing to the causes of sustainability problems, so alternative *sustainability business models* (SBMs) are now proposed as potential solutions to these problems (Howard-Grenville et al. 2014). Whereas traditional business models typically define only economic goals (Osterwalder and Pigneur 2009; Osterwalder et al. 2005), sustainable business models integrate economic, ecological and social goals in firms' value propositions and processes of value creation, capture and delivery (Elkington 1997; Pieroni et al. 2019a).

For incumbent firms and startups alike, developing such models entails innovative and dynamic efforts either to change an existing business model or to create an SBM from scratch (e.g., Demil and Lecocq 2010; Doz and Kosonen 2010). They also need to engage in network activities with other stakeholders when co-constructing SBMs so as to ensure the creation of economic, environmental and social value in exchange with the value network (e.g., Brehmer et al. 2018). However, while established companies often struggle to change their economically successful products and business models, the biggest challenges for startups working with an SBM from the outset are growth and gaining legitimacy (Ferasso et al. 2020; Geissdoerfer et al. 2016, 2018), which in turn can pose obstacles to network-building. It is therefore particularly difficult for startups to build the value networks that are essential for SBMs to achieve their economic, environmental and social goals (Geels 2010; Schaltegger et al. 2016b).

Since startups play a special role as drivers for market transformations towards greater sustainability and for established companies and other stakeholders to enter these transformation processes (Engwall et al. 2021; Hockerts and Wüstenhagen 2010), it is of great importance to address the dynamic processes of business model innovation in startups, and to deepen our understanding of the role of networks in the efforts of new ventures to develop and implement SBMs. In a study highlighting the risks faced by startups in achieving their sustainability goals in complex market-related networks without a sufficiently clear and developed business model for creating sustainable value across networks, Keskin et al. (2013) have emphasized the need for researchers to take a dynamic systems perspective on the development of SBMs within broader value networks. Answering this call, Bocken et al. (2019) applied an agent-based approach in their analysis of a double case study showing how systematically designing a startup's network activities with incumbent companies and NGOs can contribute to sustainable value creation. While the framework for SBM innovation developed by Bocken et al. (2019) advocates a more systematic approach to planned network activities, in practice the evolution of business models in startups is often unplanned and experimental (Bocken and Snihur 2020). Therefore, despite calls for more empirical research into the processes whereby startups develop SBMs and the importance of networks in these processes, we still know little about how

startups interact with their networks to create value. Our study takes a step in this direction by addressing the following research question: *How can value network activities shape the sustainable business model development of a startup?*

To address this question, we studied the “revelatory case” (Yin 2018) of RECUP, a “born-sustainable startup” in Germany’s catering sector that provides reusable packaging options for reducing waste from single-use takeaway packaging for takeaway food and beverages. Our analysis identifies three key sets of practices by which the case firm co-evolved a sustainable business model with and within its network through (i) *B2B-partnering*, (ii) *mobilizing end-consumers*, and (iii) *political agenda-setting*. We trace how RECUP’s network activities shaped the development of its value proposition over time from an “easy-to-understand” sustainable product to a broader portfolio of products and services supportive of sustainability, thereby expanding its value creation and delivery from a low- to a high-density network. Through continuous learning and adaptation in this way, RECUP created increasing economic, ecological and social value with and for the stakeholders in its value network. More specifically, the firm co-created economic value from higher sales of its products and from reduced waste-management costs for city authorities and B2B partners, and ecologic and social value for end-consumers and politicians responsible for sustainability goals of their constituencies by reducing waste and supporting societal transition to more sustainable “circular” consumption.

In sum, we contribute to scholarship on SBM innovation, design and experimentation with an in-depth exploration of how a startup’s value network activities shaped the evolution of its business model. Tracing three distinct value network activities undertaken by the case firm with actors from politics, business and society, we shed light on how value network activities can create mutual value among stakeholders. By documenting how the case startup’s network practices emerged experimentally at first and only consolidated over time, our study highlights the importance of learning processes in the development of an SBM, especially in cases when value-creating factors are not sufficiently known in advance by startups and/or their stakeholders.

2 Literature review

As summarized below, recent scholarship has significantly advanced our knowledge of SBMs, including the specific features that distinguish SBMS from traditional business models, their systemic nature, and the dynamics underlying their development and evolution, as well as the role of value networks in accomplishing the sustainability goals of these models. (For an overview of this research, see Pieroni et al. 2019a.)

2.1 The concept of sustainable and circular business models

Conceptually, sustainable business models apprehend a firm's business approach from a systemic perspective, integrating the creation of economic, environmental and social value for different stakeholders within a value network (Lüdeke-Freund et al. 2020):

A business model for sustainability helps describing, analyzing, managing, and communicating (i) a company's sustainable value proposition to its customers, and all other stakeholders, (ii) how it creates and delivers this value, (iii) and how it captures economic value while maintaining or regenerating natural, social, and economic capital beyond its organizational boundaries. (Schaltegger et al. 2016a, p. 6)

Accordingly, a key focus of research on SBMs has been on identifying the specific ways in which such models address the inherently complex challenge of simultaneously achieving not only economic objectives but also environmental and social objectives (Elkington 1997; Pieroni et al. 2019a).

To clarify the terms in the definition of SBMs given above, a firm's value proposition defines how its products and/or services add value by satisfying specific stakeholder needs (Norris et al. 2021). Such propositions thus reflect a "business-society dialog concerning the balance of economic, ecological, and social needs" (Boons and Lüdeke-Freund 2013, p. 13). The value creation and delivery dimension of SBMs encompasses all the key activities and partners that constitute the firm's network, answering the question of "how and by whom" value is created and delivered (Norris et al. 2021). Inevitably, the value creation process has different outcomes for different stakeholders in terms of ecological, social and economic performance (Freudenreich et al. 2020; Upward and Jones 2016). Since value creation in the case of SBMs involves multiple different stakeholders, it necessarily entails "value exchange processes" whereby inputs of exchange values by stakeholders are transferred into outputs of exchange values to stakeholders. Consistent with the sustainability-related aim of enabling inclusive value appropriation by diverse stakeholders, the value capture component of an SBM relates to how much and what kind of exchange value is created for each stakeholder (Norris et al. 2021).

In the literature on SBMs, circular business models (CBM) are conceptualized as a specific "archetype" (Bocken et al. 2014, p. 42) for the purpose of studying SBMs (e.g. Urbinati et al. 2017). CBMs build regenerative systems in which resource input and waste, emissions and energy leakages are minimized by narrowing loops to optimize resource efficiency and by slowing and closing loops to increase resource longevity (Pieroni et al. 2019a), i.e. by integrating the principles of long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing and recycling in the business model. As scholars have pointed out, however, the sustainability of CBMs cannot be taken for granted (Geissdoerfer et al. 2018), since "rebound effects" can occur if resource efficiency leads to higher consumption due to greater affordability and accessibility (Zink and Geyer 2017). Nevertheless, applying CBMs in SBM analysis can yield valuable

insights into how sustainability goals such as improving waste management and preserving biodiversity can be achieved (e.g., Rok and Kulik 2020).

2.2 Dynamic and network-oriented frameworks of SBMs

Our understanding of SBMs has been enriched by research adopting a “dynamic view” to analyze the sequences of activities and ongoing interactions among multiple stakeholders underlying SBM innovation and design (e.g., Doz and Kosonen 2010). A dynamic perspective to SBMs may be applied to “the process of designing a business model from scratch” or “the act of reconfiguring already existing business models for an established business” (Engwall et al. 2021, p. 3). Thus, whereas creating a new SBM may entail replacing an existing model with a fundamentally different model or running the new model in parallel with the existing model (Khanagha et al. 2014), changing or innovating existing business models involves introducing incremental changes to individual components of a business model or extending it by adding new components (Demil and Lecocq 2010).

A number of empirical studies have explored startup and incumbent settings to analyze the development of SBMs and the processes whereby sustainability goals are achieved through such models (e.g., Bocken and Geradts 2020; Hockerts and Wüstenhagen 2010; Schaltegger et al. 2016b). While established firms undergo challenging transition paths in changing their conventional profit-oriented and “unsustainable business models” into sustainability-oriented business models (e.g., Roome and Louche 2016; Ritala et al. 2021; Schaltegger et al. 2016a), startups pursue sustainability-related opportunities as market gaps and design of novel SBMs from scratch to reinvent conventional value streams (Henry et al. 2020; Parrish 2010; Rok and Kulik 2020).

To date, most research on startups and SBMs has focused on opportunity recognition processes in the initial creation of sustainable new ventures, with few studies yet exploring the dynamic processes involved in developing SBMs (Anand et al. 2021; Bocken et al. 2019; Keskin et al. 2013). Moreover, although the focus of these studies has tended to be at the level of single organizations, considerable evidence from research on SBMs has confirmed that the multiple goals of such a model cannot be achieved by individual firms alone, thus calling for an approach that takes into account the role of value networks (Freudenreich et al. 2020; Geissdoerfer et al. 2020).

A “network-centric” perspective of SBMs complements and extends “firm-centric” analyses (Pieroni et al. 2019a, p. 199) by placing a special focus on a firm’s inter-relationships with its stakeholders in the *co-evolution* of business models (e.g. Ferasso et al. 2020; Figge and Schaltegger 2000). By tracing the continuous activities unfolding between firms and their stakeholders, including interactions between startups and market incumbents, customers, political actors, and society at large (Engwall et al. 2021; Freeman 2010), this research approach aims to shed light on how value is created with and for stakeholders and how value is exchanged among stakeholders (Brehmer et al. 2018; Freudenreich et al. 2020; Geissdoerfer et al. 2020). In this joint value-creation process, stakeholders are understood as both

co-creators and recipients of economic, societal, and ecological value (Khanagha et al. 2014; Pieroni et al. 2019a). For example, SBMs create ecological value for stakeholders by closing loops to enable the reuse of materials and by reducing end-use consumption as well as economic value by facilitating the greater sharing and reuse of resources, knowledge, and property. These various value contributions can be co-created with stakeholders through customer involvement in product development, economic transactions with key stakeholder segments, and/or through business-society dialogues that identify trade-offs between optimal product and service performance and improved social and environmental outcomes for society as a whole (Boons and Lüdeke-Freund 2013).

Notable examples of research applying a network perspective include case studies by Roome and Louche (2016) exploring how network activities contribute to the development of SBMs and highlighting the importance of collaborative learning from inside and outside organizations. Schaltegger et al. (2016b) outlined interactions between startups and market incumbents to develop SBM and achieve overall market transformation. Adopting a dynamic capabilities perspective in a review of the literature on SBMs, Pieroni et al. (2019b) have emphasized the importance of network activities for identifying and making sense of sustainability opportunities. Drawing on evidence from three case studies of SBM innovation, Engwall et al. (2021) have developed the concept of “experimental network practices” to elucidate how interorganizational collaboration between incumbent firms can support the development of SBMs and create value at network level. While such research has generally emphasized the benefits of network activities in transitioning to or maintaining an SBM, some scholars have underlined the need for firms to develop sufficient capacities and appropriate internal and external structures to ensure that extensive interactions with a firm’s external stakeholders and business environment do not negatively affect any of the three core goals of SBMs (Boons and Lüdeke-Freund 2013; Stubbs and Cocklin 2008). Together, all these studies have advanced our knowledge of the collaborative practices of incumbent firms and the crucial role of interorganizational learning processes (Engwall et al. 2021; Pieroni et al. 2019b), with some further shedding light on the role of interactions between incumbents and startups (Hockerts and Wüstenhagen 2010; Schaltegger et al. 2016b).

More in-depth investigations into the network activities of sustainable startups have shown how network activities serve different purposes with different impacts for different stakeholders at different stages in a firm’s development. For example, a study of eight startups by Keskin et al. (2013) has identified how network activities in the idea generation phase serve primarily to attain external validation from stakeholders for the business idea, typically from investors or potential customers. In the design phase, by contrast, Keskin et al. (2013) found that network activities serve mainly to “insource” external knowledge for the co-development of technology and products, typically from academia, technology experts or potential customers, while network activities in the commercialization phase are typically undertaken with customers or end-users with the aim of generating insights into user and market requirements. Given that half of the startups in Keskin et al.’s (2013) study failed to achieve their sustainability goals despite engaging in broad network activities, however, the researchers concluded that

more research was needed on long-term and successful network building. Answering this call, a study by Bocken et al. (2019) has since highlighted the extent to which a startup's creation, delivery and capture of value is dependent on the "ecologies" of different business models, emphasizing the need for a systems-level perspective in designing more robust SBMs. For this purpose, Bocken et al. (2019) have proposed an "Ecology of Business Models Experimentation Map" for developing models that can "minimize symbiotic dependency on less sustainable business models" while "maximizing contributions to favorable institutional infrastructures for more sustainable business models" and thus ensuring system-wide transition.

While studies in the emerging research field of sustainable startups and the role of value networks in SBM innovation and design have confirmed that startups use network activities for different purposes over time, we still lack longitudinal research into the ways value is captured among a broader set of market and non-market stakeholders such as societal institutions and policymakers (see Schaltegger et al. 2016b). We thus still know little about how startups interact with their wider networks and how these interactions support mutual value exchanges and SBM development (Freudenreich et al. 2020). To shed light on these complex dynamic and evolutionary processes, we apply a dynamic value network perspective focused explicitly on the network activities of a startup and how these activities supported the development of its SBM and created value for an expanding range of stakeholders over time (Engwall et al. 2021; Ferasso et al. 2020).

3 Method and case setting

To attain an in-depth understanding of how startups develop SBMs and the role of network activities in this process, we applied an interpretive qualitative case study research design to study the "revelatory case" (Yin 2018) of RECUP and how this born sustainable startup successfully developed a broad network and a circular business model in the five year period 2016–2021. This research context was purposefully selected (Patton 2002) according to three criteria that qualified RECUP as an appropriate case for addressing our research question. The first of these criteria is that the startup was formed in response to a societal problem (waste) and has developed a business model that combines economic goals (generating revenues) with ecological goals (reducing waste) and social goals (changing linear consumption behavior). Second, as a startup with limited resources and capacity for public relations, RECUP has continuously engaged in social media activities aimed at connecting with relevant stakeholders in its network. Analyzing this social media output enabled us to study RECUP's network activities through "natural data" representing the startup's activities in real time. Third, the case of RECUP enabled us to capture how the effects a startup's network activities on its SBM unfolded over time, since RECUP has succeeded in establishing an enduring presence in the market and has built a broad network through various network activities and adaptations to achieve its SBM objectives.

4 Research context

The two initial founders of RECUP launched the firm in 2016 with the overarching goal of reducing and ultimately eliminating waste from disposable takeaway coffee cups by introducing a reusable cup for distribution through an easy-to-use deposit system. Soon after its foundation, RECUP became Germany's first nationwide provider of reusable coffee cups. Established as a circular startup, the firm's business model resembles what Bocken et al. (2016) have categorized as an "access and performance model" archetype based on a use-oriented product service system in which customers use products without owning them (Brehmer et al. 2018; Tukker 2015), offering a service linked to a product rather than making and selling physical products itself (Van Halen et al. 2005). Specifically, the firm offers reusable cups via a deposit system implemented through a variety of network partners in Germany's catering sector who pay RECUP a monthly fee for using the system. End-consumers pay a "rental fee" when they get their beverages in one of the cups, and this fee is refunded to them upon returning the cups. By reusing cups and recycling them when they reach the end of their product lifespan, RECUP follows the logic of creating, delivering and capturing value with and within closed material loops.

Since RECUP was founded it has extended its range of products to include reusable boxes for takeaway food, moving beyond the market niche of reusable coffee cups towards providing more holistic solutions to the problem of waste in takeaway catering (Clausen and Fichter 2019). The firm's business model serves two main customer segments: the end-consumers of its products (initially consumers of takeaway coffee and later also of takeaway food), and its B2B partners who pay a monthly fee to offer RECUP's deposit systems in their outlets (initially providers of takeaway beverages and later also providers of takeaway food). RECUP has also engaged with political actors, including roundtable discussions with politicians and partnerships with city authorities on special municipal programs to introduce its deposit system. The firm and its business model have been greatly supported by the passing of a New Packaging Act in 2019 that not only mandated reusable packaging in Germany as of 2023 but also explicitly mentioned RECUP as a viable solution for reusable packaging. By late 2021, RECUP had expanded its deposit system to over 10,000 distribution-points in Germany.

4.1 Data collection

To trace how value network activities shaped the evolution of RECUP's SBM, we first analyzed archival data and extensive social media data, subsequently checking our findings through two complementary interviews: one with a founder of the firm and the second with the manager of RECUP's social media communications.

Secondary data: social media data and archival data. RECUP produced its first social media content and launched a website soon after it was founded in 2016 and has made extensive use of social media ever since, consistently publishing several posts a week. Initially managed by the marketing team, this social media

content has been produced by a dedicated standalone team since 2019, reflecting the firm's recognition of the increasing importance of this communication channel. By drawing on this extensive social media content published on Instagram from August 2016–December 2021, we collected written, photo, and audio/video data from RECUP's social media content, saving text and photos and transcribing audio–video data from posts most relevant to our research focus. In this way we were able to capture both written data representing the 'sayings' of RECUP and photo data and visualizations representing the 'doings' of the firm and thus to consider these together in our analysis of the firm's network activities in relation to the evolution of its SBM. These data included posts published by RECUP whenever it launched a new product, typically in the form of a photo and/or audio–video content accompanied by text introducing the product and asking for feedback on product design. From the textual data of these posts we were able to capture information about the evolution of the firm's business model and practices, as in this example through the introduction and co-creation of products with its network by asking for feedback over social media.

The various archival data we collected included factsheets and press kits, annual reports and website information describing RECUP's business model, service offerings and new product announcements. These documents complemented our social media data in helping to reconstruct the case history and better understand RECUP's SBM development.

Our analysis of how the firm's business model evolved thus draws in large part on the firm's own representations of its new product designs, network partners and taglines, apprehending these activities as materializations of the firm's evolving business model (Geissdoerfer et al. 2016). Accordingly, one member of our research team was tasked with selecting social media data relevant to the case firm's business model, such as product launches, announcements of new partner cafés and restaurants, proactive appeals to end-consumers and customers, and posts about roundtables with politicians. In this selection process we jointly discussed the relevance of these posts to the evolution of the firm's SBM, excluding any posts we agreed were irrelevant, such as office news and team events, etc. From these secondary data we were able to observe the processes and components of the firm's business model development as these unfolded over time.

Primary data: formal interviews. To mirror the findings of our data analysis, we conducted an interview with one of the firm's two original founders and an interview with RECUP's social media manager. Through these interviews we obtained more context-specific information about the processes involved in the firm's network activities in developing its SBM, further avoiding misconceptions. This step was important for us to compensate for possible shortcomings of the social media data. Moreover, the positive feedback we received from "insiders" reinforced our confidence in our findings. (The data sources for this study are summarized in Table 1).

Table 1 Data sources

Data type	2016	2017	2018	2019	2020	2021	#
Secondary data							500
Social media data	9	45	97	99	102	118	470
Archival data	0	5	6	2	6	7	30
Primary data							2
Interviews	0	0	0	0	1	1	2

4.2 Data analysis

Our empirical analysis relies on an abductive variant of grounded theory that combines the basic coding techniques elaborated by Corbin and Strauss (2015) with more explicit iteration between data and theory, drawing on findings from the literature to sensitize our interpretations and generally approaching the relationship between empirical material and literature as one of *critical dialogue* (Alvesson and Kärreman 2007). Below we summarize the three successive steps of our analysis.

Constructing a visual timeline of events. We began the process analysis of our data by creating a mapping of key events and issues (Langley 1999). Building on this timeline, we developed an increasingly rich and comprehensive description of the entire case. Drawing on research into phase models of sustainable startups (Keskin et al. 2013), we used temporal bracketing (Langley 1999) to define three distinct entrepreneurial phases in the evolution of the case firm's SBM: the ideation, design and testing phase (August–December 2016); the implementation phase, i.e. the firm's market entry and diffusion of its products (January 2017–December 2018); and the phase of business model expansion and subsequent growth (January 2019–December 2021). Initially derived from our secondary data, our reconstruction of these temporal phases was later confirmed by our interviewees as actors who had been involved in these developments.

Analysis of the business model. We continued our analysis by thematically coding our data for important events, specific network activities, and the changing impacts of these on RECUP's business model over time. We then turned to the literature on SBMs (e.g., Bocken et al. 2014; Schaltegger et al. 2016a) to draw on general concepts related to business models, such as value proposition, value creation and delivery, and value capture. Similar to the approach taken by Roome and Louche (2016), we mobilized the concept of "value network" as a distinct empirical category to refer to all the key stakeholders in the SBM. Through these first two analytical steps we developed a comprehensive visual timeline summarizing the "what" of the case firm's network activities and SBM development (see Table 2).

Analysis of network activities. In the subsequent round of data analysis, we built on our understanding of how the SBM had evolved over time to ascertain the role of network activities undertaken by RECUP to address different stakeholders in this

Table 2 Visual timeline of events

Phase	Ideation and testing	Implementation	Extension and growth
Year	2016	2017–2018	2019–2022
Value proposition	Propose core value: simple use, no waste	Unfold value proposition: ease of use through the nationwide availability of cups and lids	Extension of value proposition: 'easy to be sustainable', with a broad and nationwide product portfolio of cups and boxes
Value network B2B partners	Test system with 3 local cafés	Expand to other cities; > 100 distribution points	New partnerships with chains and canteens; > 3000 corporates; > 5000 distribution points; distribution points test bowls
End-consumer and social media community	Post pictures on social media, win first 40 followers	Involve and mobilize a community of coffee providers and drinkers, grow to > 2000 followers	Target broader community with sustainability-related social media content, grow to > 10,000 followers
Politicians and local authorities	Contact local politician for advice	Participate in political roundtable, campaigning with city authorities	Engage in public discourse and comment on regulation processes with the national ministry of the environment
Value creation and delivery	Deliver prototype for testing a reusable solution via a deposit system	Implement nationwide system with B2B partners, cities, politicians and end-consumers	Anchor solution portfolio in sustainability discourse to target a wider base of partners and end-consumers; engage in climate strikes to convey political message
Value capture	Costs borne by RECUP, no value captured yet in test phase	RECUP generates revenues from system fee, direct sales and city partnerships; cities save on waste disposal costs; politicians achieve waste-reduction goals	RECUP generates revenues and becomes a taken-for-granted market solution; cities save on waste disposal costs and perform zero-waste city transformations; politicians achieve EU sustainability goals

process. For this purpose, we conducted another round of open coding, first coding each network activity and then grouping these activities according to the three main stakeholders we identified as most relevant for RECUP and its business model, i.e. B2B partners, end-consumers, and politicians. We then interpreted all of the firm's network activities in terms of their impacts on the development of its SBM to gain a deeper understanding of "how" these activities contributed to the evolution of the model and created value. To interpret our emerging findings, we drew from the literature on value networks and SBMs (e.g., Bocken et al. 2019; Keskin et al. 2013; Lüdeke-Freund et al. 2020) to inform and enhance our formulation of the constructs emerging from our data. To ensure the reliability and consistency of our interpretations, we critically discussed the data as a team in line with the strategy of "triangulating analysts" proposed by Patton (2002, p. 560). More specifically, these discussions were held between the two researchers most involved in data collection and the other authors less closely involved to allow for more neutral perspectives. We continued until we reached joint agreement on our interpretation of the emerging findings.

5 Findings

This section examines the effect of RECUP's network activities with B2B partners, end-consumers and politicians on the development of its SBM (see Table 3). Rather than seeking to offer an exhaustive account of these network activities, our aim here is to evidence and elucidate how working with stakeholders and incorporating their different needs contributed to the development of the case firm's SBM and to ever broader value creation.

5.1 Tracing value network activities and their effects on the case firm's SBM over time

Over the period we observed, RECUP developed a broad network in which the three key stakeholders comprised (i) end-consumers, who created use value by utilizing RECUP's products and whom the firm mostly addressed through its social media content, (ii) B2B partners offering RECUP's products and deposit system, ranging from small cafés to large multinational corporations, and (iii) political actors aiming to keep the circular economy topic high on the public agenda and who invited RECUP and other actors to participate in political roundtables, events and discussions. As we elaborate in the following sub-sections, the various network activities undertaken with these stakeholder groups and their effects on the SBM were linked to the different phases of the SBM design and innovation process.

Table 3 Effects of value network activities on startup SBM development

	Value network activities in ideation and testing phase	Effect on SBM	Value network activities in implementation phase	Effect on SBM	Value network activities in extension phase	Effect on SBM	Aggregated practice and overall value network effect
Politicians and local authorities	<p>Contacting local politician</p> <p>Get connected with co-founder</p> <p>Validation of value proposition</p>	<p>Engaging in partnerships with city politicians and city authorities</p> <p>Participating in roundtables and political events</p>	<p>New value proposition to cities</p> <p>Mutual value creation with cities: new partnership fees (financial value to startup), waste reduction goals of cities (ecological and social value)</p>	<p>Discussing regulation with national politicians</p> <p>leveraging RECUP as a best-practice example</p>	<p>Institutionalize a best practice example by anchoring the value proposition in regulation</p>	<p>Consolidation of network activities into <i>practice of political agenda setting</i></p> <p>Densification of the breadth and depth of the network of politicians and local authorities</p>	
B2B partners	<p>Testing prototype</p> <p>Using partner feedback to refine value proposition</p> <p>Integrate hygiene requirements into the value proposition</p>	<p>Expanding partner network to include coffee chains and canteens of large companies</p>	<p>Extending value proposition to new customer groups</p> <p>Intensifying financial and ecological value creation as a result of network effects</p>	<p>Network growth by gaining new partnerships with multinational corporations and fast-food chains</p>	<p>Translating new value proposition to involve large but controversial waste contributors</p>	<p>Consolidation of network activities into <i>practice of partnering</i></p> <p>Densification of the breadth and depth of the B2B-partner network</p>	

Table 3 (continued)

	Value network activities in ideation and testing phase	Effect on SBM	Value network activities in implementation phase	Effect on SBM	Value network activities in extension phase	Effect on SBM	Aggregated practice and overall value network effect
End-consumers	Articulating value proposition to social media community	Increase recognition of the value proposition through reference to known deposit systems	Offering complementary products and customer involvement to test product developments and learn from their experiences	- Integrating user feedback into new value proposition (new cup lids) - Integrating users into sales activities (B2B-partner acquisition)	- Addressing extended target groups (activists, society) with topics beyond reusable products and waste avoidance - Participating in climate marches	- Adapt value proposition of contributing to sustainability problems through and beyond their various products - Extended social media community and user base	- Consolidation of network activities into <i>practice of mobilizing end-consumers</i> - Densification of the breadth and depth of the end-consumers network

5.1.1 Ideating and testing a reusable cup system

Although the two original founders of RECUP had separately identified the need to tackle waste from the use of disposable takeaway cups, and though both attributed such waste to the wider issue of unsustainable linear consumption, they did not launch the startup with a clear business model. In the early phase of ideation and testing, therefore, they undertook various network activities to gain external validation of their formulation of the problem and to help them develop a proposed solution aimed at cafés and end-consumers. Through these initial network activities they developed a clearer value proposition and a plan for how they would deliver that value proposition to cafés and end-consumers.

Value network activities with a local politician. Before they officially launched RECUP, both founders had independently contacted a local politician running a campaign against the use of disposable cups. As this politician recalled five years later in a social media conversation with one of the founders, these initial contacts had far-reaching consequences for the firm:

And then you [Founder 1] got in touch with me. I think you also participated in my campaign. And your co-founder got in touch and told me that he would like to develop such a deposit system. And then I said “Why don’t you get together?” (Social media conversation with local politician, 12/05/2021).

By reaching out to this political actor, the founders were separately able to test the relevance of their emerging ideas for a business, validate their perceptions of the problem, and gain valuable initial help in developing their ideas. When these two founders met, they jointly elaborated their value proposition of reducing waste from disposable cups and decided to approach cafés with a prototype of a reusable cup and then further work out their value proposition in collaboration with these businesses.

Value network activities with local cafés. When RECUP first launched its reusable cups and deposit system, it partnered with three small local cafés in the hometown of one of the founders to test and implement the product and gather initial market feedback. The founder’s personal relationship with the managers of these cafés meant the founders could draw on their support in testing the system while also learning about the requirements of cafés and the wishes of end-consumers. In this way, for example, they learnt how important it was to select a texture for the reusable cups that allowed for washing in accordance with the hygiene standards that cafés are legally obliged to maintain. In this step, the founders used B2B partner feedback to refine their value proposition (*Interview 2*).

Value network activities with partners and end-consumers on social media. The founders complemented their initial efforts to test the system with social media content, including pictures of the prototype accompanied by text mentioning the three local cafés with whom they were partnering. Through posts with snappy phrases such as “*It’s as simple as that!*” and “*No waste.*” the founders effectively

articulated and conveyed the startup's value proposition, highlighting the ease of use of their waste-free system for cafés and end-consumers. By announcing that their reusable cups would be distributed through a deposit system, moreover, they further anchored the firm's value proposition of simplicity, since deposit systems were already established in other markets in Germany. The founders completed the two-month test phase in December 2016 and announced on social media that further steps would be taken in the following year, using the hashtag *#tobecontinued*.

Effects of RECUP's value network activities on its SBM. By the end of the test phase, RECUP had not only delivered a prototype of its product and performed an initial test run but also formulated a robust value proposition that met the needs of politicians, B2B partners, and end-consumers for a simple solution to waste reduction. Although the founders bore the costs of the test themselves and no significant financial, ecological or social value was created in this phase, they gained valuable insights from these early interactions into how their startup could create value by incorporating the needs of stakeholders. In particular, they learned from a politician's experience in campaigning against waste and from the needs of B2B partners. Following the successful trial phase, the next key challenge for the startup was to turn the tested prototype into a comprehensive market-ready system capable of generating exchange value for the stakeholders involved.

5.1.2 Implementing the reusable cup system

Once the firm's cup production was underway, the founders began implementing the system in Munich in 2017. At this point the firm acquired a third co-founder who had experience in testing a deposit system for reusable cups in Berlin. Building on their combined cross-city expertise, the three founders now expanded the value proposition to offer an easy-to-use system nationwide, using the tagline "*Our vision is for commuters in different cities to use RECUP. #No more isolated solutions!*" In this phase the firm's SBM evolved through an extension of the firm's value proposition based primarily on network activities to support the comprehensive implementation of its reusable cup system.

Value network activities with politicians and city authorities. Early in 2017, the founders of RECUP were invited to a local political roundtable organized by the Bavarian state ministry of environment. They later described their participation in this first political discussion as a "*lucky coincidence*" (Social media, 22/01/2021). As one founder later recalled on social media: "*We had just started. And 10 days later, that turned out to be us sitting in the Ministry of the Environment.*" (Social media, 22/01/2021). This participation afforded the founders valuable access to discuss the costs and waste problems of single-use products with multiple actors affected by these issues, including the local waste disposal authority and representatives of the food and beverage industry. The founders subsequently followed up invitations to similar events where they were asked to present their deposit system as a solution to the waste problem. Participation in these events

helped them gain a joint understanding of the problem and gather further feedback on the feasibility of their value proposition:

Catering firms were invited, the Munich waste disposal authority was there, and we were invited to participate as a firm offering a solution. We spoke there on-site to present the deposit system, and of course there's a lot of networking. We have participated in many such events to which we have been invited." (Interview 1)

As a direct consequence of these network activities, when RECUP first started operating in Munich the city's waste disposal authority promoted the firm's reusable cups as the only solution on the market at that time. On social media, RECUP supported the city authority's campaign by posting pictures with captions highlighting the name of the campaign and links to the authority's webpage (*Social media, 06/11/2017*). Through this first experience of working with local authorities, RECUP captured financial value from the distribution of its cups and gained visibility from the huge media response to the campaign in regional and national newspapers. At the same time, the local waste disposal authority benefited by gaining legitimacy through fulfilling its municipal tasks in cooperation with RECUP as an innovative solution provider.

Based on these positive experiences of initial collaboration with the city municipality in Munich, the founders resolved to integrate city partnerships in the value proposition of their startup (*Interview 1*). Throughout 2017 and 2018, numerous city partnerships were formed as an integral part of the firm's distribution network, now organized by a dedicated team of marketing and sales staff (*Social media 04/04/2019*). Entering multiple partnerships greatly supported the wider implementation of RECUP's system. For city authorities, this collaboration helped address the increasing waste problem through the introduction of sustainable solutions. For RECUP, engaging in these partnerships had three main advantages, enabling the firm to connect new cafés more quickly, to benefit from the city's promotional efforts, and to gain legitimacy from its public cooperation with local authorities. The firm's use of social media to amplify these benefits is reflected in the following excerpt from a post announcing a new city partnership in text accompanying a picture of one of RECUP's founders standing in a café with a city mayor, Jens Kerstan, who endorses the firm's system:

RECUP is the official deposit system for Hamburg! Senator for Environment and Energy, Jens Kerstan: "The deposit system is a crucial contribution to further reduce the amount of throwaway cups. We hope that many café chains, bakeries and stores will join the RECUP system." Thank you @environmentalauthority_hamburg (Social media, 13/04/2018)

Throughout this implementation phase from 2017 to 18, the firm's network activities with politicians and city authorities proved essential for enabling this initially small and fairly unknown startup to spread its product idea widely. By making such partnerships an integral part of the value proposition, the firm not only captured financial support but also created and raised awareness of the underlying

problem, further delivering social and environmental value by supporting cities in addressing the problem of municipal waste, thereby helping these institutional actors fulfil sustainability goals on their political agenda.

Value network activities with B2B partners throughout Germany. Whereas RECUP's partnering activities with cafés in the testing phase had proceeded by trial and error, in the implementation phase its value network activities with B2B partners became more regular and frequent and eventually consolidated an essential part of RECUP's business model. Based on lessons learned from the startup's initial experience of working with cafés, RECUP successfully expanded its B2B-partnering activities to scale up its distribution system. As the firm extended its partnerships with cafés to new cities throughout Germany, it created social media content in the form of photos of café owners in new locations alongside text presenting café owners' positive feedback to attract further cafés to become part of their network.

In 2018, RECUP started working with a national coffee chain and with the canteen of a multinational corporation, gaining its first experience of working with large companies and their very different logistics processes and requirements for ordering. As confirmed in an interview with one of the founders, meeting the needs of these larger customers required the firm to professionalize its processes and increase its technical capacities (*Interview 2*). The firm now further expanded its value proposition to include this new customer base. Through these activities, RECUP significantly expanded its distribution network, thereby capturing greater financial value and amplifying network effects.

Value network activities with end-consumers on social media. As part of its B2B business model, RECUP maintained relations with its end-consumers via social media and by offering complementary products and services such as coffee-cup lids and an app for locating distribution-points. Through these social media communications, the firm actively engaged with end-consumers in the re-design and advertising its products and services. The firm's posts regularly called on end-consumers to describe their experiences with the return of cups, and frequently elicited feedback on the design of cups and the firm's social media content itself. Testing ideas in this way enabled the firm to keep on improving its system and adapting to the needs of its end-consumers.

How RECUP created further value from its use of social media to gather feedback from end-consumers can be illustrated in the case of reusable coffee-cup lids. From the beginning of the implementation phase in 2017, RECUP had invited end-consumers to share pictures of themselves using its cups. By reposting these photos, RECUP increased the use value of its products for consumers by affording an opportunity to present themselves on social media as stylish and environmentally conscientious. At the same time, however, these pictures revealed that many end-consumers were using single-use lids, since no reusable lids were then available, prompting questions on social media such as "*Are the lids plastic? Or also reusable?*" (*Comment on social media 04/07/2017*) and concerns that single-use lids undermined sustainability goals.

RECUP responded to this feedback by exploring the possibilities of offering reusable lids for its cups. For reasons of hygiene and in accordance with its value

proposition of simplicity and ease of use, the firm now offered a reusable lid for sale that consumers could clean after each use. When launching these new coffee-cups lids, RECUP invited end-consumers to vote on different design options. Later, when the lids were distributed through coffee shops with a recommended retail price, RECUP also asked end-consumers to share their experiences of pricing. Also in 2017, the firm offered a free app to help consumers locate RECUP's coffee-shop partners. Throughout this phase, the firm's social media regularly invited end-consumers to recommend their favorite cafés with posts such as "Tell your favorite café and your friends!" (*Social media 17/07/2017*) or "You can recommend your favorite cafés via our app, then we'll write to them." (*Reply to a user comment on social media 20/07/2017*). Engaging consumers in its product development and the expansion of its distribution network further generated and amplified network effects, thereby increasing both economic and environmental value through increased revenues and reductions in waste.

Effects of RECUP's value network activities on its SBM. Based on its experiences of various network activities throughout the implementation phase, RECUP further refined and developed its value proposition to include multiple partnerships with city authorities, increased capacity to serve larger B2B-customer groups (including through more professionalized processes), and new offers of complementary products and services to end-consumers, such as an app for finding RECUP's partners and reusable lids based on feedback from these stakeholders. RECUP thus created and delivered value in this phase by (i) refining and expanding its products and services, (ii) working with a broader range of politicians and city authorities, (iii) expanding its network of B2B-partners, and (iv) maintaining and building a growing community of end-users. The ensuing expansion of its deposit network generated network effects that further benefited RECUP, its partners and end-consumers, since the increased availability of drop-off points for depositing the cups both increased revenues and eased the process of returning the cups. In sum, the business model captured financial value through the revenues gained by RECUP from its B2B partners and by reducing the costs of waste disposal for city authorities, further creating ecological and social value through waste reduction and the firm's overall contribution to a transition from linear to circular patterns of consumption.

Whereas RECUP's network activities in the implementation phase were strongly linked to establishing the widespread availability of reusable cups, the firm's announcement in 2018 that the following year would see the introduction of new regulations as well as the launch of new RECUP products and cooperation with even larger B2B partners marked a new phase in the evolution of the firm's SBM. This shift was catalyzed by and reflected a change in public discourse on issues related to sustainability, including a growing call for governments to tackle waste from single-use packaging. Regulatory efforts in Germany to address this issue further raised public awareness and established propitious conditions for RECUP to qualitatively expand its SBM in the third phase we identified from our data.

5.1.3 Extensions of the business model

In response to mounting public awareness of sustainability issues in Germany, RECUP shifted from a primarily product-related value proposition based on “*ease of use*” to a broader society-related value proposition. The tagline for RECUP’s various activities to this end became “*It’s easy to be sustainable*” (e.g., *Social media, 01/06/2021*), while the firm’s expanded range of products and network activities now served as a means of providing opportunities for an increasing number and range of actors in society to behave more sustainably.

Value network activities with a broader sustainability-oriented target group on social media. RECUP’s expanded value proposition was strongly driven by and embedded in social media communications, which took on new facets in this phase as RECUP extended its audience beyond coffee-drinkers to target a broader audience of environmental activists and society at large in drawing attention to general topics of sustainability and environmental protection. In this context, RECUP’s communications now addressed societal issues such as food waste and the global warming crisis through calls for participation in climate strikes and sustainable living. As a case in point, the entire team of RECUP participated in Fridays-for-Future marches in 2019, posting pictures from their preparations and calling for their followers to participate in the demonstrations, e.g. “*You don’t have a companion for the Global Climate Strike tomorrow and demonstrating alone is only half the fun? Then come with us!*” (*Social media, 19/09/2019*).

In this phase, RECUP continued to involve end-consumers actively in the development of its new products and services, including by responding to requests for solutions with broader societal impacts. In 2019, for example, the firm began testing reusable boxes for takeaway food and vending machines for facilitating the easier return of coffee cups, responding to calls from their B2B partners and end-consumers for solutions with increased ease of use and for more reusable products to increase reductions in waste (*Social media, 29/12/2020*). These initiatives were increasingly accompanied by communications conveying RECUP’s extended value proposition of contributing to sustainability issues through its various products.

In 2021, when new regulatory measures were established, RECUP took this opportunity to gain additional practical legitimacy and position itself as the firm best suited for helping businesses in Germany adapt to these regulations by framing these regulations as underscoring the relevance of its products for eliminating one-way plastic consumption as part of the firm’s broader mission to support a transition to sustainability:

Germany is becoming a reusable country! The law on reusable packaging is coming! Now it is 100% and finally certain! The law for reusable packaging in the catering sector will come into effect in 2023. Many caterers will need to offer a reusable alternative to disposable packaging for take-away food and beverages. This is an important and appropriate step towards sustainability and waste avoidance. We are ready for all caterers who want to join our deposit system and support them wherever we can. (Social media, 28/05/2021)

These active social media engagements with end-consumers contributed to the firm's adaption and extension of its value proposition beyond the positive impacts of its products on sustainable consumption to their benefits for adjacent areas such as food waste and climate change mitigation, thereby appealing to a much larger target audience. This expanded value proposition was translated into additional activities of value creation and delivery through a broader product offering and changed communications to account for broader societal discourses. Mutual value was thus created by involving end-consumers in policy discourses and thus facilitating business-society dialogues (e.g. by participating in strikes), as well as by offering sustainable solutions (e.g. reusable products).

Value network activities with national politicians on regulation. In line with its broadened value proposition of making it *easy to be sustainable*, RECUP intensified its exchanges with policymakers in this period to highlight the firm's contribution to sustainability and waste issues more prominently, including its support in the implementation of new regulations and in raising awareness through various networking events. This ongoing political engagement resulted in close links with policymakers, facilitating continuous exchanges on political developments, the implementation of regulations, and current problems in the market. Such continuous exchanges generated value for both sides, including through knowledge-sharing and keeping each other informed about developments in their respective fields of politics and business, leading to a better mutual understanding to bridge the discrepancies between political and economic developments and establishing a basis for discussing possible solutions.

A good example of how value was created through RECUP's network activities with national politicians can be seen in a public discussion arranged in 2021, just after the new Packaging Law had been introduced, between one of the founders of RECUP and Germany's then Minister of the Environment. Responding to a user's question as to when there would "*finally be no more disposable cups*", the minister replied that the RECUP system already had the capacities to replace disposable cups throughout Germany and that her new regulation was intended to support the fast diffusion of reuse systems: "*And to make it happen faster, I have now launched this amendment of the packaging law.*" (*Social media conversation with national minister of the environment, 08/02/2021*). From this it can be seen that the case firm's value network activities with national politicians helped raise sustainability issues to the top of the agenda of political debates, with RECUP being held up as an example of best practice, creating mutual value for RECUP and politicians in accelerating the growth of reuse systems and thereby contributing to ecological and social value by reducing waste and helping bring about a shift from linear to more circular consumption. The symbiotic character of this relationship is reflected in the following quote from a local politician in mid-2021:

I am responsible for economic policy in our political group, and I always like to use you [RECUP] as an example, because you have created many jobs and at some point you will reach a size where you will become relevant for us as a

municipality in terms of business taxes and so on. (Social media conversation with local politician, 12/05/2021)

Value network activities with B2B partners. RECUP's extended value proposition and broader product portfolio made the firm ever more attractive for potential B2B partners. For the first time, RECUP now engaged in partnerships with large companies, including corporations in the fast-food sector and international operators of service stations. Through these new B2B-partnerships the firm was able to scale up its distribution points and expand its target group from the niche of café visitors to the mass market of consumers of a broad range of takeaway products. For these large B2B-partners, the internal and external branding of their cooperation with RECUP brought benefits in terms of the perceptions of employees and customers that these companies were committed to transitioning to a sustainability orientation. Through these expanded value network activities with B2B partners, and especially with partners not typically seen as sustainably-oriented, RECUP managed to integrate key waste contributors within its network, thereby helping to push these companies to rethink their sustainability orientation:

People from the sustainability community complain that "Shell and McDonald's are the bad guys! How can you work with them?" But we tell them these are exactly the people we want to approach so that they'll also become aware of the topic in their companies. And the employees of these companies then respond by working with us. (Social media, 22/01/2021)

Effects of RECUP's value network activities on its SBM. As we have seen, RECUP substantially adapted its value proposition in this phase in response to changes in the environment, seeing these developments as an opportunity both to appeal to a broader group of end-consumers and B2B-partners beyond the niche of sustainability-oriented coffee drinkers and a chance to engage more actively in political agenda-setting. This broadened proposition was reflected in RECUP's new tagline for its value proposition—"It's easy to be sustainable"—with which it framed its diverse value creation activities in the network. RECUP thus created and delivered value by expanding its range of reusable products and services to offer solutions to a wider array of sustainability-related issues. By addressing broader sustainability issues, RECUP both leveraged its trusted position and augmented this position to create value for broader audiences. Among the impacts of these upscaled value network activities, the firm's end-consumers became more aware of sustainable living in many areas while policymakers were able to refer to RECUP's products and internalize the firm's success as a way of legitimizing their own policy efforts. In addition, and perhaps most consequentially, the firm's new partnerships with large and previously unsustainable companies led these firms to begin experimenting with sustainable solutions.

5.2 The effects of RECUP's value network activities on its SBM development

Our analysis reveals how the evolution of RECUP's SBM was shaped and constituted through different value network activities (see Table 3), highlighting the extent to which the case firm's value network activities with B2B-partners, end-consumers and politicians were intrinsic to the development of this business model. These activities contributed to generating *economic* value from higher revenues for RECUP and reduced waste-disposal costs for city authorities, *ecological* value through the reduction of waste and reuse of materials by B2B-partners, and *social* value for end-consumers and politicians by contributing to a societal change in consumption behavior (politicians, end-consumers). Value was thus mutually created in different ways by and for all of the firm's value network partners in the three phases of SBM development, i.e. the ideation and testing phase, the implementation phase, and the extension phase.

In the *ideation phase*, the firm's two original founders engaged in interactions with a politician to validate their formulation of the problem, with end-consumers on social media to articulate the value proposition, and with B2B-partners to develop and test value delivery. These initial value network activities proceeded largely by trial-and-error due to the lack of experience and capacity of the startup at this stage. Together, these value network activities enabled the startup to design a business model that took account of the different needs of its stakeholders and helped the firm prepare for and effectuate a rapid market introduction of its products.

In the subsequent *implementation phase*, the startup intensified its value network activities with politicians, broadening the scope of its exchanges to communication about problems and the implementation of solutions. Political actors facing sustainability problems in their own constituencies supported the implementation of RECUP's reusable system, leading to further value network activities with city authorities responsible for implementing the system and cafés that received financial support through these partnerships. In this phase, RECUP's development of its business model was additionally supported by value network activities with cafés and end-consumers, including efforts to involve end-consumers in the re-design of the firm's products and services and in advertising the system, further facilitating value network activities between end-consumers and café-owners when the former approached new cafés to join the system, harness network effects and increase demand.

Following the implementation phase, RECUP's transition to an *extended growth phase* was marked by significant adaptations to its value proposition in response to the changing socio-political environment. External developments, including growing calls for a more rapid transition to sustainability, induced RECUP to extend its value proposition and undertake new activities of value creation and delivery through a broader product portfolio and interactions with a broader target group of end-consumers and B2B partners. The firm's interactions with political actors served to institutionalize RECUP as an example of best practice for implementing reusable alternatives in compliance with the new regulations on packaging.

We identify two overarching and interrelated sets of activities and impacts that answer our research question of how the startup's value network activities shaped

the development of its SBM: (i) the *consolidation of value network activities* into *practices of political agenda-setting, partnering and mobilizing end-consumers*; and the *densification of the network* to support mutual value creation and the growth of the case firm.

Importantly, the practices we identified as constituting a *consolidation of value network activities* were stakeholder-specific. Thus, all value network activities with end-consumers were aimed at *mobilizing end-consumers* to participate in the development of the firm's products and later increasingly in wider social discourses on sustainability issues. We understand this as a feature of an SBM where the end-consumer is involved in the B2B business model to generate a demand pull and create greater value. All of the firm's interactions with its B2B partners were aimed at *partnering* with these stakeholders and continuously involving them in the development of RECUP's SBM rather than merely selling an end-product to a customer group. Interactions with policymakers, meanwhile, were aimed at *setting the political agenda*, including through continuous dialogue in which problems of waste and sustainability were continuously (re-)defined and reconceptualized to take increasing account of the systemic importance of these issues. These exchanges with policymakers helped institutionalize the deposit system as a viable solution to a major socio-environmental problem—another important feature of an SBM.

Over time, these practices not only became consolidated but further contributed to the *densification of the network* through engaging in more frequent network activities with different stakeholder groups and broadening the product/service offering. With this broadening and densification of the value network, RECUP extended its value proposition to adapt to different stakeholder needs and increase mutual value creation. The effects of these expanded value network activities materialized in the generation and capture of economic value in the form of revenues from business partners and cost savings for waste disposal authorities, ecological value in the form of waste reduction, and social value in the form of contributing to a broader change in consumption behavior in society.

In illustrating these processes of SBM development, with particular attention to the role of external stakeholders, the nature of value network activities, and the effects of these activities on the evolution of the case firm's SBM over time, our findings and analysis underscore the importance of value network activities in the development of an SBM and shed light on how these activities unfolded and created value for key stakeholders in the network.

6 Discussion

Sustainable business models are developed through network activities aimed at creating mutual economic, ecological and social value for stakeholders from business, politics and society. While these activities and processes can accelerate growth, they can also be overwhelming, especially for startups with limited resources. By addressing a gap in current knowledge of how network activities shape SBMs, our study can help inform startups in navigating the challenges of

business model innovation [for relevant prior research, see Bocken et al. (2019) and Keskin et al. (2013)]. We contribute to research on SBM innovation, design and experimentation with a fine-grained analysis of the value network activities of a startup aiming to address waste problems from linear consumption.

In particular, while our findings confirm the important role of different market and non-market stakeholders in achieving the sustainability goals of an SBM (Bocken et al. 2014; Freudenreich et al. 2020; Geissdoerfer et al. 2020), we also show that these stakeholders need to be treated differently and that their impacts on the business model vary over time (Lüdeke-Freund et al. 2020). By diving deep into these dynamic processes, we identified three key sets of stakeholders that constitute the main value network of a startup with an SBM: (i) B2B-partners, (ii) end-consumers, and (iii) politicians. We further identified three practices undertaken by the case firm with these stakeholders that impacted the development of its SBM over time: *B2B partnering*, *mobilizing end-consumers*, and *political agenda-setting*. These findings add to present research by revealing the different *rationales* for stakeholder activities and by shedding light on how these stakeholders were *addressed*. Our findings are summarized in Table 4.

We found that *B2B-partnering* supported the development of the case firm's SBM as the expansion of its B2B partner network led it to refine and adapt its value proposition to align with the needs of new B2B partners, including by broadening its range of products and services. More specifically, integrating feedback from its partners' direct contact with consumers into the firm's value proposition and reaching out to new consumer groups with new products and services through new partnerships facilitated the greater diffusion of value delivery, including through enabling a greater reduction of waste. Using B2B partners as accelerators and facilitators of value creation through the harnessing of network effects thus enabled the (co-)creation of mutual economic and ecological value from sales, reduced waste and the cyclical reuse of materials. These results add to current research on startups impacts on incumbent players (Hockerts and Wüstenhagen 2010; Schaltegger et al. 2016b).

By *mobilizing end-consumers* to support portfolio innovation and the development of its B2B partner network, the case firm's value network activities also contributed to a change in consumption behavior. These activities with end-consumers primarily involved utilizing social media to enable direct consumer contact and inclusion in product design and B2B-partner network development. The subsequent expansion of the firm's social media outreach to a broader audience further raised public awareness of more general sustainability issues. Using end-consumers as "ambassadors" in this way to create demand pull and as catalysts for product innovation facilitated the mutual creation of social value by helping to bring about a shift in consumption behavior. We show that mobilizing end-consumers integration of startups within value networks (Geels 2010).

Political agenda-setting also proved an effective means by which the firm gained legitimacy for its SBM, especially through its activities in support of the new regulatory framework. This finding is particularly relevant for startups facing growth and legitimacy challenges. In our case, network activities with politicians and local authorities contributed substantially to the stabilization and institutionalization of the SBM. These activities included participation in political roundtables to promote

Table 4 Summary of rationales for value network activities and effects on SBM

	Practice and rationale for value network activities	Underlying value network activities	Effect on SBM
Politicians and local authorities	<ul style="list-style-type: none"> - Political agenda setting practice - Politicians and local authorities as SBM <i>legitimacy</i> providers and <i>regulators</i> 	<ul style="list-style-type: none"> - Participating in roundtables to present and discuss own solution - Collaborating with local governments to introduce reusable alternatives to meet cities' sustainability goals - Exchanging with politicians on the need for regulation 	<ul style="list-style-type: none"> - Promoting a common understanding of the waste problem supports SBM diffusion - Legitimacy spillovers from policy debates helps stabilize SBM <p>Involvement in regulatory work institutionalizes SBM</p>
B2B partners	<ul style="list-style-type: none"> - Partnering practice - B2B partner as <i>accelerator</i> and <i>facilitator</i> of value creation through network effects 	<ul style="list-style-type: none"> - Seeking and integrating feedback from partners' direct consumer contact to extend value proposition - Instrumentalizing new partnerships to reach new consumer groups 	<ul style="list-style-type: none"> - Aligning value proposition with needs of new partners to increase breadth and depth of value creation - Expansion of the B2B partner network for diffusion of value delivery and waste avoidance via network effects
End-consumers	<ul style="list-style-type: none"> - Practice of mobilizing end-consumers - End-consumers as <i>ambassadors</i> to create demand pull and as <i>catalysts</i> for product innovation and changing consumer behavior 	<ul style="list-style-type: none"> - Utilizing social media to enable direct consumer contact for involvement in product design and in B2B-partner network development - Expanding social media outreach to a broader audience beyond consumers, e.g. activists, to spread attention to general sustainability issues 	<ul style="list-style-type: none"> - Mobilizing end-consumer drives network building and promotes product design and portfolio innovation - Upgrading of value proposition via coupling end-consumer targeting to overarching sustainability themes

a common understanding of the waste problem, collaboration in the implementation of reusable alternatives with local authorities pursuing urban sustainability goals, and regular exchanges with politicians on regulation-related issues. Using politicians as legitimacy providers and regulators contributed to the creation of mutual economic, ecological and societal value from sales, reduced waste-disposal costs, reduced waste, and a change in consumption behavior. As a result, political agenda-setting reduces legitimacy challenges and supports growth (Ferasso et al. 2020; Geissdoerfer et al. 2016, 2018; Schaltegger et al. 2016b).

Our research also has implications for research on the role of startups in transitioning to sustainability, especially as sustainability goals tend to be more frequently and ambitiously pursued by startups than established firms (see, e.g., Anand et al. 2021; Hockerts and Wüstenhagen 2010). Here we address a gap in current knowledge and understanding of the dynamic processes whereby the SBMs of startups evolve over time. Our longitudinal case study builds on and extends this emerging scholarship on startups, revealing that the network activities engaged in by these firms are subject to *consolidation* and *adaptive and collaborative learning*. Based on the example of RECUP, we elucidate the *constitutive* importance of network activities for the SBMs of startups. For startups, we conclude, such activities form the *core* of an SBM, serving a far more vital role than they do for incumbent firms, where network activities have been found to serve as temporary drivers of innovation (Engwall et al. 2021) in peripheral areas of these much broader organizations (Nicholls-Nixon et al. 2000). And while RECUP's initial use of network activities was very limited, targeted, and in some cases incidental, these activities later evolved into consolidated practices as the business model implications became clear. The activity of mobilizing end-consumers was initially practiced only through isolated efforts to gather consumer feedback for improving existing products, for example, but was later consolidated and expanded to include constant engagement with consumers in a broader range of sustainability activities.

Our findings indicate that initial value network activities can best be understood as dynamic processes of *adaptive and collaborative learning* through trial-and-error, later intensifying and becoming consolidated over time. By engaging closely with different stakeholder groups and learning to adapt to their needs, the case firm was much better able to address the special requirements of value creation for and with these stakeholders. While this is consistent with findings from earlier research on the role of adaptive learning for SBM development (Bocken et al. 2021; Engwall et al. 2021), our analysis places more emphasis on the importance of collaborative learning activities for startups and their value networks.

As with any single-case study, our study is subject to certain methodological limitations (Yin 2018); and we acknowledge and relate these boundary conditions here with a view to guiding future research. As our study is limited to a single startup, three stakeholder groups, and selected interviewees, future empirical research could usefully apply the three practices we identified to other contexts or extend them by adding additional stakeholder groups and practices. Moreover, while we assessed social media data as suitable for our analysis of historical processes insofar as such data represent events contemporaneously and are not biased by the inaccuracy of respondents' memories (Dixon et al. 2019), these data are inevitably

subject to survivorship bias due to the tendency of successful interactions to be far more visible than unsuccessful ones on social media, while undesirable events may not be reported at all. Future research could fruitfully analyse cases of failed practices, negative experiences in experiments with network activities and value destruction. Lastly, whereas our reliance on social media data mostly limited us to an external perspective of the case, future research could adopt an ethnographic approach and an internal perspective to investigate how startups with a longer history of network activities have managed these processes, including the key learning processes involved.

7 Conclusion

Sustainable business models (SBMs) are inevitably characterized by a high degree of complexity, since they not only need to create economic, environmental, and social value but also involve diverse stakeholders in value creation and capture. This complexity can be both supportive and overwhelming, especially in the case of startups launched to address a sustainability problem. Our longitudinal case study is a first attempt to investigate how such processes of SBM design and development unfold in practice. We hope our insights inspire further work to advance our understanding of how startups can interact with value networks to develop and support SBMs.

Our findings have several *practical implications for startups*; indeed together our results serve as a toolkit of networking activities that startup entrepreneurs can use to guide their interactions with stakeholders to effectuate stakeholder-driven SBM development. This toolkit includes practices and activities for startups to engage with B2B partners and end-consumers in developing a value proposition that addresses these stakeholders' needs and creates mutual value, including through complementary products and services, while also leveraging the pull that end-consumers can exert on the firm's B2B partners by actively demanding its products at the point of sale. We further specify measures that startups can take to facilitate knowledge exchange with political actors in roundtables and through partnerships with authorities, thereby rendering tangible and 'concrete' the essentially dialogical nature of the co-constitution of SBMs. By demonstrating how the interplay between these multiple network actors is not a result but an intrinsic part of constituting an SBM, our findings should also serve to sensitize startups and other stakeholders to these interdependencies.

Finally, it should be emphasized that the dynamic processes involved in developing a robust SBM for co-creating value across a network entail ongoing efforts and adaptation through recursive learning cycles and feedback loops. Our findings indicate that startups should engage actively with network actors from the outset, including by partnering with established market players, involving social media users in product development, and connecting with policymakers. Through such engagement, startups can integrate directly relevant feedback in their business idea prior to implementing it in the market. While constantly refining and adapting the firm's value proposition and business model, the different channels established in the network can also be used to gain legitimacy and harness network effects. In

sum, value network activities and SBM development require startups to engage in repeated experimentation, since it is above all by learning from and building on positive experiences with stakeholder engagement that firms can consolidate and sustain practices that create mutual value across networks. It is these enduring practices that constitute a robust SBM.

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Conflict of interest The authors have no competing interests to declare that are relevant to the content of this article.

Ethical approval Our article does not contain any studies with human participants or animals performed by any of the authors.

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