



Irene Kuhmonen¹, Annukka Näyhä¹, Miisa Solaranta¹ and Janne Keränen²

Can small and medium-sized companies increase the value added from wood-based side streams?

Kuhmonen I., Näyhä A., Solaranta M., Keränen J. (2024). Can small and medium-sized companies increase the value added from wood-based side streams? *Silva Fennica* vol. 58 no. 5 article id 23080. 23 p. <https://doi.org/10.14214/sf.23080>

Highlights

- Upgrading the use of wood-based side streams is necessary for circular bioeconomy.
- Small and medium-sized companies offer innovative solutions for using wood-based side streams.
- Companies utilizing the side streams host a variety of dynamic capabilities.
- Strong technological orientation reduces horizontal networking among innovative small and medium-sized companies.
- The forest-based regime resists the spread of innovations aiming for higher value added.

Abstract

One of the central goals of circular bioeconomy in the Finnish forest-based sector is upgrading the use of wood-based materials, especially wood-based side streams, to higher value-added products. However, despite these ambitions, most wood-based side streams are used in energy production. Within the forest-based sector, innovative solutions for higher value-added production of wood-based side streams are being developed within small and medium-sized companies (SMEs). Therefore, to promote the process of upscaling these solutions, understanding the success of these companies is pivotal. For this end, we conducted a qualitative study with 10 forest-based SMEs utilizing wood-based side streams to understand both the internal and external factors affecting their ability to scale up their business models. By applying the dynamic capabilities approach from management research and the strategic niche management approach from sociotechnical transition studies, we found that even though the companies are internally well positioned to succeed in their growth aspirations, they face barriers from the dominant forest-based regime. The studied SMEs are facing a mismatch between their own business models and the rules and operating principles of the forest-based sector based on linear economy. Overcoming these barriers and challenging the dominant structures within the Finnish forest-based regime would require joint efforts from the companies. However, the companies have a strong technological orientation, which makes them hesitant with regard to horizontal networking. They also operate in diverse markets, making it difficult for them to find common ground. As a result, the pressure for systemic transformation within the forest-based sector remains nominal.

Keywords circular bioeconomy; dynamic capabilities; forest-based sector; strategic niche management; sustainability transition; wood-based SMEs

Addresses ¹University of Jyväskylä, School of Business and Economics, P.O. Box 35, FI-40014 University of Jyväskylä, Finland; ²VTT Technical Research Centre of Finland Ltd, P.O. Box 1603, FI-40101 Jyväskylä, Finland

E-mail irene.a.kuhmonen@jyu.fi

Received 22 December 2023 **Revised** 8 October 2024 **Accepted** 25 October 2024

1 Introduction

All the key political goals for forest utilization crafted over the past 10 to 15 years at both the national level in Finland and the European Union (EU) level express the aim of developing the forest-based sector (FBS) to promote innovative products and services with higher upgrading and value added (Ministry of Agriculture and Forestry of Finland 2008, 2019; Ministry of Economic Affairs and Employment of Finland 2017; European Commission 2018; Finnish Forest Industries 2020; Finnish Bioeconomy Strategy 2022). Behind these aspirations lie concerns regarding the possibilities for sustainably increasing harvests from forests when forests are needed not only to increase societal welfare but also to promote biodiversity and carbon sequestration in the face of biodiversity loss and climate change (Majava et al. 2022; Lintunen et al. 2023; Tyrväinen et al. 2024). At the same time, climate change mitigation increases the pressure to replace fossil-based materials with their wood-based counterparts (Antikainen et al. 2017; Dessbesell et al. 2020). As a response to these concerns, an often-cited solution is increasing the value added from wood-based materials through higher upgrading and more careful utilization of wood-based side streams (Finnish Bioeconomy Strategy 2022; Lintunen et al. 2023; Österberg et al. 2024). In this vein, numerous studies have acknowledged the role and potential of FBS companies in creating more value for wood-based materials in Finland (Hetemäki et al. 2017; Hurmekoski et al. 2018; D'Amato et al. 2020; Kunttu et al. 2020).

Creating more value from wood-based materials represents a transition toward a circular bioeconomy (CBE). CBE connects the goals of circular economy and bioeconomy, and it refers to the frugal exploitation of bio-based resources, in which the value of these resources is optimized via their cascading use (D'Amato et al. 2020; Toppinen et al. 2020; Stegmann et al. 2020). Thus, in a CBE, as well as prolonging the lifecycle of wood-based materials, these materials should be used to create as much value as possible (D'Amato et al. 2020). This calls for attention to the use of wood-based side streams in particular. However, despite the seeming consensus regarding the goals and potential of the Finnish FBS to shift toward products and services with higher added value and increasing revenue streams, the attainment of these goals seems slow (Hietala and Huovari 2017; Luhas et al. 2019; Donner-Amnell 2020). By contrast, the share of wood-based side streams used for energy production has been increasing (Peltola et al. 2019; Natural Resources Institute Finland 2020), and an increasing share of Finnish pulp is exported without further refining (Österberg et al. 2024). As a whole, the value added in the pulp and paper industry, which is where most of the value increment is supposed to take place, has been decreasing rather than increasing (Lintunen et al. 2023).

Small and medium-sized companies (SMEs) and start-ups within the Finnish FBS can play an important role in facilitating the transition to new, higher value-added products and business models and hence CBE (D'Amato et al. 2020; Näyhä 2019, 2020). SMEs can utilize different waste and side streams from other FBS companies and develop and produce novel products and services linked to them, including textiles, platform chemicals, plastics and packages (Keränen et al. 2019; D'Amato et al. 2020). These companies operate within and beyond the traditional FBS and are dedicated to developing innovative technologies that enable adding value to wood-based materials.

Previous research has indicated that the flexibility and agility of SMEs make them important actors in transforming the FBS according to CBE principles (Näyhä 2019, 2020). At the same time, the success of forest-based CBE business models is hindered by, for example, limited profitability and the lack of risk capital (Reim et al. 2017; D'Amato et al. 2020). New wood-based alternatives are not competitive compared to incumbent fossil products due to the long history of the latter's technical development and thus the competitive edge gained (Kunttu et al. 2020). To facilitate the spread of sustainable innovations and thus the transition toward CBE, these companies should be able to create new networks and business ecosystems between FBS companies (Mattila et al. 2016;

Näyhä 2019). However, the environment in which these companies are operating – the Finnish FBS – is characterized by strong lock-in mechanisms and power held by incumbent companies that can hinder new interests and innovations from entering the market (Stenzel and Frenzel 2008; Huttunen 2014; Lohas et al. 2019).

Accordingly, in this research, we focus on understanding the factors that contribute to or hinder the success of Finnish SMEs utilizing wood-based side streams. We understand the success of these companies as their ability to scale up their business models and thus act as catalysts for a CBE transition. Even though SMEs have the potential to act as transition agents, we do not know much regarding how this potential transforms into long-lived success that is visible in the added value created by these companies from wood-based side streams. Specifically, we ask what the key internal capabilities of the studied SMEs are and how these capabilities are aligned with their external operational environments. By conceptualizing the operational environment as a sociotechnical regime and the SMEs as niche actors, we also ask what kinds of relationships the studied companies have with the regime. We expect all these factors – the internal capabilities, alignment with the regime, and the regime itself – to contribute to the success of the companies, where success is understood in terms of scaling up business models based on the utilization of forest-based side streams.

In this task, we draw from two distinct theoretical traditions: the field of strategic management and the research stream on sociotechnical sustainability transitions. The field of strategic management offers tools to explore the internal capabilities and resources of these companies. Specifically, we apply the dynamic capabilities perspective to understand how organizations utilize resources in their changing operational environment to stay competitive and succeed (Tece 2007, 2023). The stream of transition studies takes a system-level view on the processes through which sociotechnical systems, such as the FBS, become more sustainable. A transition from a linear economic model toward a CBE is essentially a transformative shift, which changes the ways in which the FBS creates value. As the SMEs utilizing wood-based side streams represent a different kind of logic in comparison with the dominant way in which the FBS functions, positioning them in a transition framework can offer insights that are not accounted for by a focus solely on external factors or on the companies' internal worlds. The strategic niche management (SNM) approach (Kemp et al. 1998; Schot and Geels 2008) enables analyzing how the SMEs, whose business models deviate from the traditional FBS firms, curve their own positions in the sector.

Although the frameworks of strategic management and transition studies rarely meet, we argue that they provide a fruitful ground for understanding the challenges faced by the FBS companies as well as the strategies they use to overcome them while developing new uses for wood-based side streams. Theoretically, our key contribution is an amalgamated model of two distinct research approaches – namely dynamic capabilities and SNM – that can offer an understanding of the studied issues that neither of the approaches can offer alone. Our findings have practical contributions in terms of the strategic management of SMEs and the formulation of public policies for advancing CBE within and around the FBS. In particular, start-up companies in the field can benefit from the results of this study for navigating in their complex and changing operational environment. The results may also be of interest to other countries with plentiful forest resources and other natural resource-intensive fields in terms of creating private and public strategies and policies for the sustainable use of renewable resources. Overall, the suggested model is useful not only for companies in the FBS but also for other sectors seeking to scale up sustainability innovations. Our paper first discusses the theoretical framework, which is positioned within the Finnish FBS. Our research approach is qualitative, as we have collected data from interviews with representatives of companies utilizing wood-based side streams. The data and analysis are described in more detail in Section 3. Section 4 presents the results of the qualitative study, Section 5 discusses the results in light of the theoretical framework, and Section 6 provides conclusions.

2 Theoretical background

To understand the success of FBS SMEs utilizing wood-based side streams, there is a need to consider both these firms' operational environments and their internal organizational dynamics, which are not separate entities but reproduced in constant interaction. When discussed in isolation, both approaches tend to *black-box* the other while focusing on either the internal or external dynamics (Linnenluecke and Griffiths 2013; Avelino 2017; Bansal and Song 2017), which obstructs the formation of a comprehensive picture of the challenges that the forerunner firms are facing when trying to introduce disruptive technologies and products to markets. Consequently, combining these frameworks can tease out insights that neither can produce by itself.

To understand the operational environment of a firm, it is necessary to consider the concept of regime. In research on sociotechnical sustainability transitions, a regime is conceptualized as a dynamically stable mode of organization of a specific system (Kanger 2021). A regime, which can be seen as the institutionalized structure of a system, consists of rules, shared conceptions, value systems, infrastructures, and metabolic flows, as well as power relations and path dependencies that give stability to the system (Geels and Schot 2010; Fuenfschilling and Truffer 2014). However, the regime's stability becomes a problem when sustainability problems are embedded within the regime, as is almost always the case. Sustainability transitions then require the transformation of the regime. Such transformations usually take place as a response to broader landscape pressure, such as climate change or changing consumer preferences, coupled with the emergence of alternative technologies and innovations that challenge the old (unsustainable) solutions of the regime (Geels and Schot 2010; de Haan and Rotmans 2011).

New, sustainable alternatives to unsustainable technologies or practices oftentimes emerge from technological niches. Niches are protected spaces dedicated to nurturing radical and disruptive innovations, technologies, user practices, and regulatory frameworks that are incompatible with the logic of the contemporary regime (Rip and Kemp 1998; Schot and Geels 2008; Loorbach et al. 2017; Köhler et al. 2019). As the regime is set out to preserve the way it currently functions, mainstreaming and scaling up such innovations tends to mean *fighting an uphill battle* (Bakker and Budde 2012). The new technologies are almost always more costly than the existing ones. Moreover, while being in the underdog position from the start, companies developing such technologies typically face resistance from the regime's side (Smith 2007). This resistance can arise from the sheer incompatibility of the niche innovations with the regime rules but it can also take more active forms (Raven et al. 2010). Therefore, for these innovations to enter the regime and have an impact on the way the system functions as a whole (as can be observed in, for example, higher upgrading rates), there is a need to strategically shield the new innovations within technological niches before exposing them to the market forces prevailing in the regime.

Interactions between niches and the contemporary, dominant regime have been studied extensively within the framework of SNM. According to this framework, successful niche development occurs in three main stages: (1) the articulation of expectations and visions, (2) the building of social networks, and (3) the learning processes along multiple dimensions (Kemp et al. 1998; Schot and Geels 2008). The articulation of expectations and visions and the building of social networks occur (for the most part) within the niches, while the learning processes depict the regime–niche interactions that impede or facilitate the spread of sustainable innovations. The learning processes relate to technological factors, government policies and regulatory frameworks, cultural and symbolic meanings, market and user preferences, industry and production factors, infrastructure and maintenance factors, and the societal and environmental effects of the new technologies (Kemp et al. 1998; Schot and Geels 2008). These learning processes are essential for promoting regime shifts, as such shifts do not take place merely due to processes internal to a niche. Instead, they

need to be complemented with processes and developments external to the niche, such as public funding and long-term development programs. In this sense, the expectations held by various actors external to the niche are essential to the development of sociotechnical niches (Borup et al. 2006; Geels and Raven 2006; Bakker and Budde 2012).

From the perspective of SNM, the success of SMEs utilizing wood-based side streams is thus dependent on how successfully the technological niche shields and nurtures the innovative new technologies on which the processing of wood-based side streams is based. The Finnish forest-based regime is characterized by industrial forestry, the goal of which is to maximize forest growth and thus secure the supply of wood, particularly for large-scale industrial pulp and paper production (Kotilainen and Rytteri 2011; Peltola 2007). The regime encompasses not only the actors and networks that are operating in this dominating rule system but also the cultural meanings and value systems, the infrastructures, and the forest policies and governance systems. The regime operates on the logic of a linear economy, where a significant amount of wood is used to produce relatively short-lived products and where the side and waste streams are used mostly as energy (Hassan et al. 2019). The structure of the regime has, on the whole, been described as strong, rigid, and deep rooted (Kasanen and Heikkinen 2012; Korhonen et al. 2018; Lohas et al. 2019). The focus of the technological innovations is on incremental developments (Lohas et al. 2019). Together, these tendencies may obstruct the scaling up of new innovations for the use of wood-based materials.

The transition framework, especially the SNM approach, sheds light on the system-level processes that affect the success of SMEs. However, their success also essentially hinges on how they operate and make decisions. The field of strategic management focuses on how firms can generate and sustain competitive advantage (Guerras-Martín et al. 2014). Strategic management is about analyzing companies' internal and external environments so that they can restructure their strategies and capabilities based on this information to stay competitive and meet future challenges (Bishop and Hines 2007; Johnson et al. 2008; Grant 2010; Vecchiato and Roveda 2010). One of the most central theories within the field of strategic management is the resource-based view of the firm. This theory leans on the idea that the resources and capabilities of a firm are the main source of competitive advantage and that these need to work in alignment (Collins and Montgomery 1995; Barney 2001). The dynamic capabilities approach is an extension of the resource-based view that addresses its limitations, especially with regard to how companies create valuable resource bundles or how the current stock of valuable, rare, inimitable, and non-substitutable resources can be refreshed in the changing environment (Amit and Schoemaker 1993; Teece 2007). The main dynamic capabilities theorists (Teece et al. 1997; Eisenhardt and Martin 2000; Helfat and Peteraf 2003) agree that performance and competitive advantage arise from the reconfiguration of resources in congruence with the environment, and organizational processes are the point of origin.

In this study, we seek to understand specifically how dynamic capabilities emerge, which requires attention to their microfoundations (Wei and Lau 2010). Eisenhardt et al. (2010: p. 1263) define microfoundations as “the underlying individual-level and group actions that shape strategy, organisation, and, more broadly, dynamic capabilities.” While the traditional view of microfoundations is centered around organizational routines (Teece et al. 1997), Eisenhardt et al. (2010) argue that microfoundations are related to managerial balancing between efficiency and flexibility in favor of flexibility in order to be able to navigate unstable, complex, and dynamic environments. Such dynamism is central to transition processes. Microfoundations underpin enterprise-level sensing (identifying and assessing opportunities) and seizing (mobilizing resources to address an opportunity and capture value), as well as the reconfiguration of capabilities that are difficult to develop and deploy (Teece 2007). They consist of distinct skills, processes, procedures, organizational structures, decision rules, and disciplines (Teece 2007).

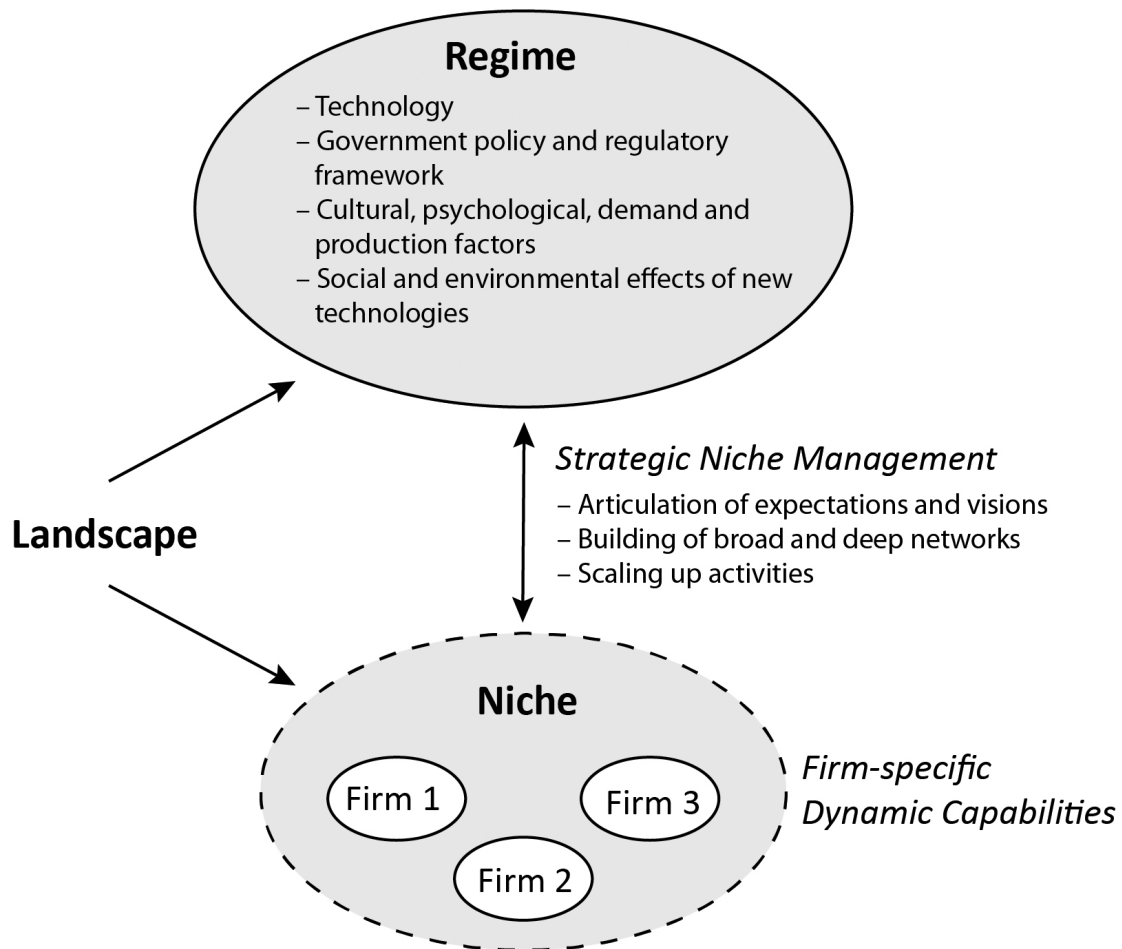


Fig. 1. Theoretical model of the study. The studied companies are part of a loose niche that operates beyond the forest-based regime. The success of the companies is the result of both niche–regime dynamics and the companies’ internal dynamic capabilities.

To understand both the internal and external factors affecting the success of wood-based SMEs, we have formulated a model that merges the dynamic capabilities perspective with the approach of sociotechnical sustainability transitions, specifically SNM. Our model is depicted in Fig. 1. Even though the wood-based SMEs are a heterogeneous group of firms and do not form a uniform market niche, they share a dedication toward creating more value from wood-based side streams and a similar challenger position in relation to the dominant forest-based regime. Thus, the SMEs are loosely positioned as forming a niche that deviates in many ways from the contemporary forest-based regime. The landscape consists of forces external to both the regime and the niche, such as pressures to act on climate change or biodiversity loss, changing consumer preferences, and changing EU-level regulations. The integration of these frameworks can shed light on the individual success of these firms as well as on how their success can contribute to the transformation of the Finnish FBS to achieve CBE goals.

3 Method

3.1 Data acquisition

We have adopted a qualitative research strategy in our study. Qualitative research can provide in-depth understanding of the lived realities and perceptions of informants, which can lead to insights regarding why practitioners act as they do or why they think certain phenomena take place (or not) (Korstjens and Moser 2017). The empirical data for our qualitative study were obtained from semi-structured interviews with representatives from 10 companies. The companies were involved in the study by invitation. Invitations were sent to companies that varied in terms of their products, size, maturity, business models (business-to-business vs. business-to-consumer), and organizational cultures. While the aim was to cover a variety of companies that utilized wood-based side or waste streams in their operations, they were all growth-oriented and developing or involved in the development of novel products. The products or services they provided were based on forest biomass resources, both virgin and recycled, including solutions in textile fibers, packaging materials, construction and building materials, biocomposites, design products, and biomedicines. Some key features of the studied firms and their representatives are presented in Table 1. Due to the small number of SMEs operating in the sector in Finland, it is not possible to disclose detailed information about these firms in relation to the type of wood materials and products that the firms are producing without compromising their identity.

The aim of the interviews was to uncover the factors contributing to the success of the forest-based SMEs. The interviewees were either the founders of the companies or top managers. All the interviews were conducted face-to-face in 2019 in Finnish. A questionnaire was sent to the interviewees in advance by email. The topics discussed in the interviews included the future visions and ambitions of the firms, the internal and external resources and factors that either promote or hinder each firm's transition to CBE, and the innovation procedures of each firm (for an outline of the interviews, see the Supplementary file S1, available at <https://doi.org/10.14214/sf.23080>). The interviews were recorded and transcribed.

The interviews were conducted as semi-structured, as this approach offers the possibility of an in-depth dialogue that can eventually lead to emerging or new topics (Kvale and Brinkmann 2009; Hair Jr and Page 2015). Semi-structured interview is a qualitative research method that often involves a relatively small number of participants. These interviews are designed to provide in-depth insights and a comprehensive understanding of a specific topic or issue. The goal of the interviews was to gather rich and meaningful data leading to deep insights and understanding

Table 1. Characteristics of the studied small and medium-sized companies (SMEs) utilizing wood-based side streams and interviewees' positions within the companies. B2B: business-to-business; B2C: business-to-consumers; CEO: chief executive officer.

Firm	Firm maturity	B2B vs. B2C	Interviewee position
1	5–10 years	B2B	CEO, founder
2	5 years	B2B	Development & quality manager
3	15–20 years	B2C	CEO
4	20–30 years	B2B	Chairman of the board
5	<5 years	B2B	CEO, founder
6	<5 years	B2B	CEO, founder
7	10–15 years	B2C	CEO
8	>50 years	B2C	Development manager
9	0–5 years	B2C/B2B	CEO
10	0–5 years	B2B	Chief technology officer, founder

rather than trying to generalize the findings to a larger population. In this kind of research setting, a relatively small sample size can be used to achieve data saturation, that is, the point at which new data no longer provide substantially new information and insights.

3.2 Data analysis

The analysis of the data was based on a qualitative approach in which the transcribed data were analyzed in two rounds: first, by means of thematic analysis (Braun and Clarke 2006; King and Brooks 2018), and second, by means of directed content analysis (Hsieh and Shannon 2005). The aim of the analysis was to identify factors contributing to the success of the upscaling efforts within the SMEs utilizing forest-based side streams. The dynamic capabilities and SNM frameworks offered conceptual tools for this task.

In the first phase of the analysis, the data themes were generated iteratively from the data. During this phase, the reoccurring themes and the positions that the interviewees took in relation to them were explored in an inductive manner. This phase helped in identifying the relevant conceptual and theoretical frameworks needed to interpret the data further. The interview questions originally concentrated on the factors contributing to firm success from the viewpoint of strategic management and dynamic capabilities. However, the SNM framework was introduced at the analysis stage to help interpret the system dynamics that were clearly an issue for the companies' success but could not be explained through the concepts originating in the field of strategic management.

In the second step, we used directed content analysis. This phase of the analysis relied on the conceptual frame offered by the dynamic capabilities perspective as well as the SNM approach. The results presented in this paper rely on this second phase of the analysis. Directed content analysis is deductive in nature and allows for a theory-driven interpretation of the data (Hsieh and Shannon 2005). The aim of the content analysis was to interpret the interview data specifically from the viewpoints of dynamic capabilities and SNM. Our overall research approach can be described as abductive, that is, informed by theoretical viewpoints but firmly rooted in empirical reality (Eriksson and Kovalainen 2008).

The content analysis was built on three main themes: the organizational capabilities of the firms, the niche-level activities, and the regime dynamics. First-order concepts identified in the first round of the data analysis, the thematic analysis, were utilized in this phase as the content matter of these second-order themes. We started the content analysis by identifying the organizational capabilities of the case firms, which reflected the firm-specific microfoundations of dynamic capabilities (Teece 2007). Second, drawing from the SNM approach (Kemp et al. 1998; Schot and Geels 2008), we identified the niche-level activities in which the case companies were involved (the articulation of expectations and visions, the building of broad and deep networks, and the scaling-up activities). Third, still relying on the SNM approach, we identified the learning processes related to technological issues; the government policies and regulatory frameworks; the cultural, psychological, demand, and production factors; and the social as well as environmental effects of the new technologies. These processes concern learning about the regime and its rules and thus illustrate the relationships of the case firms with the dominant forest-based regime.

4 Results

In this section, we report the findings from the content analysis. In Table 2, we present the themes and concepts derived from the content analysis, including the number of interviewees discussing them. We identified 46 first-order concepts and 12 second-order themes that related to the

Table 2. Frequencies of coding categories in the directed content analysis of the interviews with SMEs utilizing wood-based side streams. n = the number of interviewees mentioning the theme.

1. Organizational capabilities	n
Organization structure	
Decentralization	4
Organizational culture	
Openness, trust, flexibility, agility	7
'Dare to disagree' ethos	3
Diversity of backgrounds	10
Values	6
Employee commitment and loyalty	5
Leadership	5
Organizational routines and practices	
Learning, access to information, expertise	6
Integration of employees in decision-making	3
Customer understanding	3
Innovativeness	10
Routines for innovations	8
Incentives, human resource management	4
Formality and hierarchy of processes	5
2. Niche-level activities	
Articulation of expectations and visions	
Core vision	10
The role of the cascading principle	4
Building broad and deep networks	
Partnerships, networks and cooperation to achieve the aims of the CBE	9
Deep vs. broad partnerships	7
Acquiring resources from networks	4
Partnerships with end-users and customers	4
Partnerships with regime actors	4
Innovations resulting from partnerships	4
Scaling-up	
Growth strategy	7
Market creation	7
From niche to regime substitution	4
3. Learning processes	
Technological factors	
Quality of raw material, maintaining stable quality	7
Understanding the behavior of materials	3
Government policy and regulatory framework	
Standardization, labelling	3
Patents	7
Categorization	4
Monitoring in public procurements	2
Legislation	6
Extended producer responsibility	4
Cultural and psychological factors	
Credibility	6
Demand factors (customers/consumers)	
Customer acceptance	4
Brand building and communication	5
Customer willingness to pay premium	3
Production factors	
Production technology renewal	3
Production ecosystems	5
Access to financial capital	5
Availability of raw material	6
Price of raw material	3
Designing for circularity	3
Social and environmental effects of new technologies	
Evidence of environmental performance	2

theoretical frames. The main theme of organizational capabilities included 14 first-order concepts organized under three second-order themes: organizational structure, organizational culture, and organizational routines and practices. These reflected what is done within the firm (routines and practices), how it is done (culture), and in what kind of organizational context (structure). The concepts derived from the SNM approach are presented in two categories: niche-level activities and learning processes with the regime. Within the niche-level activities, we identified 11 concepts organized under three second-order themes: the articulation of expectations and visions, the building of broad and deep networks, and scaling up. The second SNM theme of learning processes included 19 concepts organized under six second-order themes. Many of the second-order themes reflected the barriers that niche-level actors typically face from the side of the regime, as outlined within the SNM approach. In the rest of this section, we discuss these findings in more detail. At the end of the results section, we summarize the results by analyzing the case companies' relationships with the regime.

4.1 Intra-organizational resources: Dynamic capabilities perspective

In this study, organizational capabilities are the microfoundations of the case firms' dynamic capabilities. The organizational capabilities of the studied firms related to organizational structure, organizational culture, and organizational routines and practices. Based on the frequency of the themes showing up in the data, issues related to both organizational routines and practices (39 mentions) and organizational culture (36 mentions) were a common point of discussion, whereas organizational structure appeared less in the data (four mentions).

Capabilities related to organizational culture were built around a liberal ethos that was reflected in how the firms were organized as well as in the practices that they adopted. The interviewees emphasized features such as agility, low hierarchy, and innovativeness, built on common values and employee commitment toward promoting a greater cause. Such a culture engenders loyalty and high motivation among the employees. It also requires an empathetic leadership style and allowing room for diversity regarding both the employees' backgrounds and their perspectives on the everyday activities. The interviewees considered the diversity of employee backgrounds—and thus having the right kind of combination of various skills and capabilities—to be important. Some interviewees highlighted the tolerance of disagreement, seeing it as the cornerstone of their company culture. This perception was well reflected by I6, who stated that: *“It’s one of our values: the courage to challenge. This is what all these things like mutual trust, appreciation, and support are built on. They form the foundation that needs to be there, because if there is lack of trust, you can see it when people don’t dare to disagree.”* The firms' organizational structures often reflected their cultures. Many of the case firms were organized loosely. In these firms, the hierarchy of decision-making was low, employees were integrated into decision-making processes, and the business operations were not siloed in separate sections.

Interviewees perceived their companies' liberal organizational culture and open communication climate to have a straightforward link to innovativeness. Innovations were an all-encompassing theme that formed the core of the companies. The interviewees highlighted the need for continuous learning as a building block of innovativeness. Any employee could be an innovator, and innovations could be born anywhere and at any time, as pointed out by I5: *“Someone suffering from a hangover on Sunday thinks about something being done differently. Or a client calls and asks if this could be done that way. And someone reads about something; it can come from anywhere.”* Innovativeness was related to the strong work engagement of the employees, and some interviewees felt that detaching from work in one's free time was at times difficult. Innovations were also promoted through various incentives and routines, such as meetings, idea emails, feedback

channels, and innovation days. However, innovativeness and agility can come with disadvantages, and some interviewees discussed these aspects in terms of the *blue ocean* of opportunities: “*I think renewal can also be a risk for a small company, if there’s too much of it. For the big companies, it is a risk if there’s too little of it. We cannot go innovating all the way, because then we remain stuck at square one*” (I6).

4.2 Alignment of firm capabilities with the business environment: Strategic niche management perspective

Analyzing the interview data through the SNM framework offered a means to understand how the case companies orient themselves in their operational environments. Unpacking the challenges the SMEs are facing with the conceptual tools of SNM can offer insights that the dynamic capabilities perspective cannot. Successful niche development, as described in Section 2, requires the articulation of *expectations and visions* (14 mentions), *scaling up* (18 mentions), and the *building of broad and deep networks* (32 mentions). Furthermore, niche actors also need to *engage in learning processes* with the regime (altogether 82 mentions of the subtopics). These processes are described in more detail in Subsections 4.2.1, 4.2.2 and 4.2.3. Section 4.2.4 analyzes the case companies’ relationships with the regime.

4.2.1 Articulation of expectations and visions and scaling up

The case companies all held similar *expectations and visions* regarding the future. The value base of the case companies was manifested in their disposition toward the cascading principle, which was essentially how they addressed their sustainability promise. By utilizing wood as a raw material source instead of as an energy source, these companies perceived themselves to be contributing to the improved total sustainability of society, as manifested in the outspoken mission of I4: “*Our mission is to change things, make this a better planet, if we only can.*” In terms of building an economically viable business, the case companies’ visions and expectations regarding the future were strongly linked to growth and *scaling up*, as stated by I2: “*Our vision is to be the primary supplier of these products.*” The possibilities for growth were perceived to be high, and the firms were keen to exploit growth opportunities. Many had intentions related to internationalization, and some wanted to pass the business on to larger companies after growing to a certain point. The growth strategy extended to the outspoken intention expressed by some interviewees of reforming the traditional forest industry as a whole. However, when talking about market creation, many interviewees pointed out that the markets do not yet exist, or when they do exist, they are based on raw materials other than wood. This situation was aptly described by I7: “*In many fields, you are working in markets that do not exist yet. In other words, you are creating new paths. Or then the market, which has a huge demand, is used to different materials and processes, and your task is to make your clients use their time and money in order to adopt new ways of doing things, new materials, and new processes.*”

4.2.2 Building networks

Successful niche development requires *building broad and deep networks*. However, the attitude of the interviewees toward this topic was ambivalent. Cooperation was discussed widely in the interviews, and in principle, the interviewees saw its value and importance. Yet their manner of speaking was somewhat conditional: “*We know that in Finland, there is a lot of know-how in this field. Of course, we are hoping to find a partner who would take these things forward with us*” (I2).

Most of the interest in networking, business ecosystems, partnerships, and cooperation was steered toward the same value chain in which the firms were already participating, which meant that they were more oriented to vertical rather than horizontal cooperation. This sentiment was expressed by I7: “*We are aiming at finding partnerships with the paying customers, but also at finding strong influencers from the value chain, with whom we can create a more functional relationship.*” The approach that many companies held toward partnerships was having essentially fewer partners but deeper cooperation with the chosen ones.

Technological innovations that allowed the processing of wood fibers from side streams were at the heart of the business models of the case companies. All the case companies were driven by their specific technologies: the businesses rise and fall with their technologies, and if their idea leaks to their rivals, the business case may be lost altogether. As a result of this orientation, the case companies were understandably protective of their own technological solutions, as stated by I2: “*When it comes to partnerships with suppliers, obviously there’s a line in what we want to disclose to them of what’s going on in here.*” I10 expressed a similar sentiment: “*We have our own technology. We are doing things for the first time, so no one else is capable of doing these things.*” This orientation was reflected in the nature of the innovation activities. The innovations were perceived to be happening mostly within the companies (i.e., by their employees), and if outsiders were involved, they were universities or research institutes. On a broader scale, Finnish society was depicted as “*a huge innovation factory*” (I4), but for most of the interviewees, the innovations were related mostly to in-house product development. Patents were considered an important means of protecting the intellectual property of the case companies against their peers, as well as against the giants in the field. I3 described this sentiment as follows: “*We have a small black box that we will never open. That’s the only way to go. The big firms have their exhausters.*”

4.2.3 Learning through regime–niche interactions

Finally, successful niche development requires *learning* about topics such as regulatory frameworks, culture, technology, consumer demand, production-related factors, and the sustainability effects of new technologies: the ways in which the contemporary regime works. The findings concerning learning about and with the regime revealed some of the barriers that the case companies are facing in their quest to scale up their production.

Challenges related to *production* were evident, especially in the utilization of recycled materials over virgin materials. Some of the case firms were able to utilize homogeneous side streams, while others needed to use a certain amount of virgin materials to achieve the desired product quality. However, for some case firms, using recycled materials was an impossibility, as described by I8: “*It is extremely difficult to introduce the recycled materials to our production. It just does not work on this scale.*” Many of the case firms were struggling with maintaining the stable quality of the raw materials. When customers are used to the homogeneous quality that can be achieved with virgin materials, the irregularity of recycled materials poses challenges for the production, as stated by I3: “*The commercial recipes need to be fixed to some extent so that it’s always the same quality. At least within a certain window. Then having variation of plus or minus 60% does not really fit this situation.*” Even though *consumer preferences* were anticipated to change in favor of recycled materials, there was still a prevailing demand for homogeneous quality.

To improve the *environmental performance* of their production systems, some of the case companies were considering a take-back system for their products to realize their extended producer responsibility. However, implementing such systems means high costs, and it is not profitable due to the relatively low prices of the raw materials. However, some interviewees saw a possibility of utilizing more recycled materials in their processes in the future. Many of the products are suit-

able for recycling in terms of their design, but some interviewees highlighted the responsibility of the end user to take care of recycling. Others pointed out that the structures needed for wide-scale circulation of the materials are not yet available. Due to the massive variety of contexts that come into play if companies are aiming at international markets, organizing the recycling activities is a demanding task.

The *institutional framework*, disseminated not only through legislation but also through other industry conventions, such as guidelines and standards, is another important factor in the niche actors' room to maneuver. The interviewees generally felt that while the legislation was moving in the right direction, it was by no means ready yet. At worst, the legislative environment was perceived as inconsistent and even contradictory, particularly concerning the approach of legislation to the cascading principle and the use of wood-based materials as energy. For example, I5 indicated the following: "*Energy utilization is not very high in the material hierarchy, and still regulations in many cases favor it and do not guide the streams to higher value utilization.*" However, it was also acknowledged that regulation has benefited their businesses, and "*even though the legislation could be more supportive, there is a lot going on already*" (I10). Some interviewees felt that the new products do not always fit the old standards, as expressed by I3: "*When you bring a new material to the markets, you will always be compared to the old standards; the old written rules will come across your path at some point, no matter what.*" For the regulator, innovative wood-based materials are new as well, and some interviewees have found it difficult to define the category to which their materials belong.

4.2.4 *The case companies' relationships with the regime*

As a whole, the relationships of the case companies with the regime could be described in terms of two distinct approaches: the first approach essentially relies on the regime and its incumbent actors, while the second aims for a more radical transformation of the regime. The *regime follow-ups* are more likely to operate according to the same rules as the incumbent regime actors. These companies felt the business ecosystems already existed, albeit possibly with some minor parts missing: "*We have the ecosystems already; in this sense, developing them is not necessary because they are there*" (I1). For these firms, winning the confidence of the regime actors is essential. The existence of these niche actors can mean a win-win from the incumbents' point of view: their side streams are utilized, and their sustainability performance is improved, but the risks are borne by someone else. This win-win deal was described by I5: "*Side streams are a challenge for many companies, as they incur costs. It's a major item of expenditure for them. If you then have a streamlined concept to utilize these streams that is also cost-efficient, then it's an opportunity for them.*" Breaking ground in the direction of the incumbent actors was, however, perceived as difficult. The culture within the dominant regime was described as rigid and traditional. Small companies found it hard to get in touch with the right people within large organizations, and if they were able to cooperate, the fear of losing one's own voice was apparent. They were even anxious that ideas might be stolen from small actors that do not have resources to protect their innovations.

For the regime challengers, the outlook is different. The business models of the regime challengers may not be a good match with those of the incumbent regime actors, or they may be perceived as potential rivals. Many interviewees expressed their aim as reform of the whole traditional forest industry. For these actors, the main task is to win the confidence of end users and customers and, in this quest, scale the production aggressively. However, the companies are unlikely to be able to do this by themselves. They would need to join forces with other actors operating at the edges of the forest-based regime. This was not a task that the case companies seemed committed to, as they appeared to lack interest in developing horizontal networks.

5 Discussion

When the case companies are viewed through the lens of dynamic capabilities, they seem to have all the prerequisites for success. However, the big picture at the national level regarding the cascading principle in the use of wood-based side streams remains unchanged. Energy use continues to prevail, indicating that there are notable difficulties in scaling-up activities that entail alternative uses for wood-based side streams. While the dynamic capabilities approach explains why the firms *should* succeed, alternative explanations are required to understand why they *do not* do so. To this end, strategic niche management provides an alternative storyline. The interpretations of the interview data through this lens revealed, on the one hand, that the forest-based regime effectively resists the efforts to scale up new niche-level innovations and, on the other hand, that the firms operating on the outskirts of the regime do not form a uniform technological or market niche. Indeed, they do not even aim at developing such horizontal networks that would essentially aid them in their quest to change the forest-based regime. This reluctance is largely explained by the firms' strong orientation toward their own technological innovations.

From the viewpoint of dynamic organizational capabilities, the key enablers for the success of these firms were the firms and their human resources. The organizational cultures of the studied firms can be described as agile, low hierarchy, innovative, growth oriented, and built on the shared value base and commitment of their personnel. As confirmed by many other studies, these are all features that can promote the dynamic reshaping of companies' business models (Näyhä and Pesonen 2014; Hansen 2016; Korhonen et al. 2017; Reim et al. 2017; Brunnhofer et al. 2020; Näyhä 2020). They are also the features that essentially differentiate start-ups and smaller firms from large, mature companies. Notably, from the dynamic capabilities and transition perspectives, promoting innovations holistically has been identified in numerous studies as a particular challenge for mature industries (Näyhä and Pesonen 2014; Hetemäki and Hurmekoski 2016; Hurmekoski et al. 2018; Krätzig et al. 2019). At the same time, we also found that maintaining an agile and flexible culture and a low hierarchy was considered a challenge when the firm grows. Growth was pursued, as it gives more credibility to the companies, while a lack of credibility was considered a challenge from the customer point of view. Some interviewees felt that during maturation and growth, the reactive nature of the company would move aside and give way to a more determined business strategy, thereby guiding the companies toward specific paths within the ocean of opportunities. In accordance with this, Eisenhardt et al. (2010) argue that the competitive advantage related to microfoundations is essentially related to balancing between efficiency and flexibility in favor of flexibility. Thus, the growth of the firms – once achieved – is ultimately likely to diminish the very competence that creates the core competitive advantages of these firms.

While a strong organizational culture was clearly a strength and a positive driver for the case companies, the focus of the case companies on their own novel technologies and their own value chains meant that the broad, horizontal networks that could allow niches to grow and challenge the existing regime did not develop. Such *collective system building* (Planko et al. 2017) could enable the establishment of a favorable environment for new, innovative technologies promoting sustainability and CBE. Even though the vision of transforming the business and contributing to a more sustainable society was the backbone of the case companies, the companies did not seem very interested in joining forces with others, apart from their own value chains. The traditional forest-based regime culture does not often favor open networks, and challenges related to firm-level collaboration in the context of forest-based industries and the circular economy are well identified in the literature (D'Amato et al. 2020; Kuckertz et al. 2020; Patala et al. 2020). The *openness dilemma* is related to the importance of firm-specific technological solutions and makes companies hesitant to share information due to reasons of confidentiality (Patala et al. 2020).

The importance of horizontal collaboration becomes even more important when we consider that the case companies face various kinds of resistance at the regime level. Some of this resistance is related to the incompatibility of the case companies' business models with the implicit and explicit rules and regulations at the regime level, while some is more active resistance from the regime incumbents. For example, the regulative framework was not considered ready for the business models of the case companies. Challenges related to bioeconomy regulation have also been recognized by other studies, and bioeconomy policy has been described as a complex and contested area (Scordato et al. 2017). For example, Kelleher et al. (2019) highlight that politicians should be aware of how policy coherence and design can promote or prevent the bioeconomy transition. Moreover, the inconsistencies of policies between different bioeconomy subsectors cause conflicts, the solving of which could enable bioeconomy objectives to become mainstreamed (Gould et al. 2023). In addition, customers might not be ready for the novel wood-based products: in the end, customers' and consumers' acceptance and adoption of these products are central to the success of these companies.

Regime blocking (Antal 2019), wherein strongly positioned regime actors constitute a barrier to new actors entering the market (Kuckertz et al. 2020), seems to be an issue in the FBS. This was reflected in the difficulties some case companies were experiencing in their attempts to break in partnerships with the incumbent actors on one hand, and in the attempts of the others to sideline the incumbent actors altogether and build their business ecosystems *from the scratch*. Regime blocking does not, however, solely explain the barriers that the new, innovative SMEs working toward CBE are facing. Developing and commercializing sustainable innovations are loaded with various tensions (Oskam et al. 2021), and particularly for those innovations that are not a good match with the dominant regime, this implies fighting an *uphill battle* (Bakker and Budde 2012). The positioning of the new entrants in relation to rivalry vs. cooperation with the regime actors can be conceptualized as the disruptor's dilemma, which elicits divergent strategies from the entrants (Ansari et al. 2015; Kangas et al. 2021). The concept of *coopetition* has been defined as "simultaneous competition and cooperation among firms with value creation intent" (Gnyawali and Ryan Charleton 2018: p. 2513). Among other aspects, the firms' orientation in relation to markets and the resource base affects the forms of coopetition between the firms within the niche and the regime (Kangas et al. 2021).

In summary, our results suggest that understanding the success of firms in transition contexts requires complementing frameworks focusing on organizational aspects, such as the dynamic capabilities perspective, with approaches that account for the relationships of the organizations with their broader operational environments. The concepts of niches and regimes, as discussed in sociotechnical transition theory, offer useful tools for further understanding the nature of this environment. The conceptual framework we presented in Fig. 1 offers one possibility for the alignment of the transition and strategic management perspectives.

The framework we have adopted highlights the importance of inter-organizational networks, and surrounding supportive ecosystems are a necessity for companies to innovate and commercialize their novel technologies and create markets for them (Möller and Svahn 2009; Aarikka-Stenroos et al. 2014; Sandberg and Aarikka-Stenroos 2014; Planko et al. 2017). Thus, to scale up their CBE solutions, diverse FBS niche firms should consider the potential of collaborations with their peers in activities that they can jointly contribute to, thereby increasing pressure at the regime without sharing their technologies. Niche companies should explore the business ecosystems around their innovations and evaluate which actors and factors in these networks are already shared or could be shared in the future and which could be potentially affected or developed in collaboration with other niche actors. For example, are there any common customer or user groups? Are there suppliers or investors that could be approached collectively to attain shared benefits? In other words,

firms should look for potential collaborations with their peers that are not based on similar types of technologies or novel products and for which technological details do not need to be shared.

As our results only concern the niche actors – which is also its main limitation as regards understanding the niche-regime-interactions, further research should engage with regime actors to understand how transition processes are perceived by them. Further research in the fields of environmental psychology (e.g., the theory of values, beliefs, and norms by Stern 2000) and marketing (e.g., the diffusion of innovation theory by Rogers 2003) will be important in outlining the drivers and barriers on the customer–consumer side in relation to these new wood-based products. More research is also needed explicitly asking how niche actors can collaborate and take advantage of these joint efforts. Exploring these issues will benefit from the combined efforts of management and transition studies (Loorbach and Wijsman 2013). For example, Oskan et al. (2021) propose a framework for different actors in innovation ecosystems to develop sustainable business models together in a way that satisfies all the actors involved. This is clearly a step in the right direction toward a more systemic and holistic approach in management studies. In addition, the role of innovations for sustainability (Bocken et al. 2019) as drivers for sustainability transitions has been widely studied from a management perspective, but between management and transition studies, there remains a vast unexplored ground. Our analysis indicates that the niche firms are facing various tensions in their internal development orientation as well as in working with other niche actors and incumbents. This challenge suggests that integrating the approaches from transition research and the analysis of paradoxes within management research (Hahn et al. 2015) could yield important insights.

6 Conclusions

The FBS is a central part of Finnish society. However, to achieve the goals of a sustainable CBE, there is a widely recognized need to upgrade the way in which wood materials are currently utilized in mass-oriented, relatively low value-added production and energy use. Such a shift could increase the FBS's income streams without increasing the harvesting intensity. For this shift, wood-based side streams are of special interest. Despite the numerous policy goals and strategy documents that have been prepared, these side streams are still increasingly being used in energy production, and the promises related to the upgrading of wood-based materials seem to be largely unfulfilled.

In our study of SMEs utilizing wood-based side streams, we argue that they have the potential to act as catalysts toward a CBE transition. The case companies follow the cascading principle, and they are innovative and strongly oriented toward technology and growth. They aim to respond to the changing demands of the business environment through their well-developed dynamic capabilities and overall tendency toward global competitiveness. Success requires constant learning and acquisition of knowledge of regulatory frameworks, consumer demands, production-related factors, and the sustainability effects of the new technologies, many of which concern the requirements set by the dominant regime. However, variation in the end products and markets, as well firms' protectiveness of their technologies, leads to a lack of collaboration between diverse niche actors. As a result, strong niches that could effectively transform the existing regime do not develop. If the SMEs are to realize their future goals and business models for CBE, the quest of simply scaling up their own business might not be enough, but needs to be accompanied by transformations taking place at the regime level. Following this transformation, niche companies could – and should – put more focus on the collaboration with other niche actors in horizontal networks. They could collaborate on issues that do not require sharing details regarding their technologies or novel products, instead promoting mechanisms for creating supportive ecosystems around novel businesses.

Supplementary files

S1.pdf; Interview questionnaire for the managers of SMEs utilizing forest-based side streams, available at <https://doi.org/10.14214/sf.23080>.

Data availability

The interview data are not publicly available due to interviewee confidentiality.

Acknowledgments

We would like to thank all the managers of the case companies who participated in the interviews as well as the editors and reviewers for their constructive comments that have helped us develop this manuscript.

Funding

The data for this research were acquired in the Puusta Pidemmäle project, which was co-funded by Sitra. Annukka Näyhä also acknowledges funding from the Academy of Finland (BuSuT project 340756). Irene Kuhmonen acknowledges funding from Strategic Research Council at the Academy of Finland (Project ‘Biodiversity Respectful Leadership BIODIFUL’, grant number 345884). The funding agencies were in no way involved in the analysis or interpretation of the data or in the preparation of this manuscript.

Author contributions

Irene Kuhmonen: conceptualization, methodology, analysis, writing – original draft, writing – review & editing; visualisation; Annukka Näyhä: conceptualization, methodology, writing – original draft, writing – review & editing, supervision; Miisa Solaranta: conceptualization; methodology, analysis, investigation, writing – original draft; Janne Keränen: conceptualization, writing – original draft, writing – review & editing, supervision, project administration, funding acquisition.

References

- Aarikka-Stenroos L, Sandberg B, Lehtimäki T (2014) Networks for the commercialization of innovations: a review of how divergent network actors contribute. *Ind Market Manag* 43: 365–381. <https://doi.org/10.1016/j.indmarman.2013.12.005>.
- Amit R, Schoemaker PJ (1993) Strategic assets and organizational rent. *Strat Manag J* 13: 33–46. <https://doi.org/10.1002/smj.4250140105>.
- Ansari S, Garud R, Kumaraswamy A (2015) The disruptor’s dilemma: TiVo and the U.S. television ecosystem. *Strat Manag J* 37: 1829–1853. <https://doi.org/10.1002/smj.2442>.
- Antal M (2019) How the regime hampered a transition to renewable electricity in Hungary. *Environ Innov Soc Transit* 33: 162–182. <https://doi.org/10.1016/j.eist.2019.04.004>.

- Antikainen R, Dalhammar C, Hildén M, Judl J, Jääskeläinen T, Kautto P, Koskela S, Kuisma M, Lazarevic D, Mäenpää I, Ovaska J, Peck P, Rodhe H, Temmes A, Thidell Å (2017) Renewal of forest based manufacturing towards a sustainable circular bioeconomy. Reports of the Finnish Environment Institute 13/2017. Finnish Environment Institute, Helsinki. <http://hdl.handle.net/10138/186080>.
- Avelino F (2017) Power in sustainability transitions: analysing power and (dis)empowerment in transformative change towards sustainability. *Environ Policy Gov* 27: 505–520. <https://doi.org/10.1002/eet.1777>.
- Bakker S, Budde B (2012) Technological hype and disappointment: lessons from the hydrogen and fuel cell case. *Technol Anal Strateg Manag* 24: 549–563. <https://doi.org/10.1080/09537325.2012.693662>.
- Bansal P, Song H (2017) Similar but not the same: differentiating corporate sustainability from corporate responsibility. *Acad Manag Ann* 11: 105–149. <https://doi.org/10.5465/annals.2015.0095>.
- Barney JB (2001) Resource-based theories of competitive advantage: a ten-year retrospective on the resource-based view. *J Manag* 27: 643–650. <https://doi.org/10.1177/014920630102700602>.
- Bishop P, Hines A (eds) (2007) Thinking about the future: guidelines for strategic foresight. Social Technologies, Houston.
- Bocken N, Ritala P, Albareda L, Verburg R (2019) Introduction: innovation for sustainability. In: Bocken N, Ritala P, Albareda L, Verburg R (eds) Innovation for sustainability. Palgrave Macmillan, Cham, pp 1–16. https://doi.org/10.1007/978-3-319-97385-2_1.
- Borup M, Brown N, Konrad K, Van Lente H (2006) The sociology of expectations in science and technology. *Technol Anal Strateg Manag* 18: 285–298. <https://doi.org/10.1080/09537320600777002>.
- Braun V, Clarke V (2006) Using thematic analysis in psychology. *Qual Res Psychol*. 3: 77–101. <https://doi.org/10.1191/1478088706qp063oa>.
- Brunnhöfer M, Gabriella N, Schögl J, Stern T, Posch A (2020) The biorefinery transition in the European pulp and paper industry – a three-phase Delphi study including a SWOT-AHP analysis. *For Policy Econ* 110, article id 101882. <https://doi.org/10.1016/j.forpol.2019.02.006>.
- Collins DJ, Montgomery CA (1995) Competing on resources: strategy in the 1990's. *Harvard Bus Rev*, July-August 1995.
- D'Amato D, Veijonaho S, Toppinen A (2020) Towards sustainability: forest-based circular bioeconomy business models in Finnish SMEs. *For Policy Econ* 110, article id 101848. <https://doi.org/10.1016/j.forpol.2018.12.004>.
- de Haan J, Rotmans J (2011) Patterns in transitions: understanding complex chains of change. *Technol Forecast Soc Change* 78: 90–102. <https://doi.org/10.1016/j.techfore.2010.10.008>.
- Dessbesell L, Paleologou M, Leitch M, Pulkki R, Xu C (2020) Global lignin supply overview and kraft lignin potential as an alternative for petroleum-based polymers. *Renew Sustain Energy Rev* 123, article id 109768. <https://doi.org/10.1016/j.rser.2020.109768>.
- Donner-Amnell J (2020) Metsäalasta tarvitaan nyt rehellinen tilannearvio. [An honest assessment of the forestry sector is needed now]. *Maaseudun tulevaisuus* 7.9.2020.
- Eisenhardt KM, Martin JA (2000) Dynamic capabilities: what are they? *Strat Manag J* 21: 1105–1121. [https://doi.org/10.1002/1097-0266\(200010/11\)21:10<11%3C1105::AID-SMJ133%3E3.0.CO;2-E](https://doi.org/10.1002/1097-0266(200010/11)21:10<11%3C1105::AID-SMJ133%3E3.0.CO;2-E).
- Eisenhardt KM, Furr NR, Bingham CB (2010) Microfoundations of performance: balancing efficiency and flexibility in dynamic environments. *Organ Sci* 21: 1263–1273. <https://doi.org/10.1287/orsc.1100.0564>.
- Eriksson P, Kovalainen A (2008) Qualitative methods in business research. Sage Publications, London. <https://doi.org/10.4135/9780857028044>.
- European Commission (2018) A sustainable bioeconomy for Europe: strengthening the connec-

- tion between economy, society and the environment. Updated bioeconomy strategy. <https://op.europa.eu/en/publication-detail/-/publication/edace3e3-e189-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-277514025>.
- Finnish Bioeconomy Strategy. Sustainably towards higher value added (2022) Finnish Government. <http://urn.fi/URN:ISBN:978-952-383-547-4>.
- Finnish Forest Industries (2020) Green and vibrant economy. The climate roadmap for the forest industry 2035. <https://www.metsateollisuus.fi/newsroom/finnish-forest-industry-climate-roadmap>. Accessed October 2023.
- Fuenfschilling L, Truffer B (2014) The structuration of socio-technical regimes – conceptual foundations from institutional theory. *Res Policy* 43: 772–791. <https://doi.org/10.1016/j.respol.2013.10.010>.
- Geels FW, Raven R (2006) Non-linearity and expectations in niche-development trajectories: ups and downs in Dutch biogas development (1973–2003). *Technol Anal Strateg Manag* 18: 375–392. <https://doi.org/10.1080/09537320600777143>.
- Geels FW, Schot J (2010). The dynamics of transition: a socio-technical perspective. In: Grin J, Rotmans J, Schot J (eds) *Transitions to sustainable development. New directions in the study of long term transformative change*. Routledge: New York, pp 11–101.
- Gnyawali DR, Ryan Charleton T (2018) Nuances in the interplay of competition and cooperation: towards a theory of coepetition. *J Manage* 44: 2511–2534. <https://doi.org/10.1177/0149206318788945>.
- Gould H, Kelleher L, O’Neill E (2023) Trends and policy in bioeconomy literature: a bibliometric review. *EFB Bioeconomy* J 3, article id 100047. <https://doi.org/10.1016/j.bioeco.2023.100047>.
- Grant R (2010) *Contemporary strategy analysis*, 7th edition. Blackwell Publishing, Oxford.
- Guerras-Martín LA, Madhok A, Montoro-Sánchez Á (2014) The evolution of strategic management research: recent trends and current directions. *Bus Res Q* 17: 69–76. <https://doi.org/10.1016/j.brq.2014.03.001>.
- Hahn T, Pinkse J, Preuss L, Figge F (2015) Tensions in corporate sustainability: towards an integrative framework. *J Bus Ethics* 127: 297–316. <https://doi.org/10.1007/s10551-014-2047-5>.
- Hair Jr J, Page M (2015) *The essentials of business research methods*, 3rd edition. Routledge, New York. <https://doi.org/10.4324/9781315716862>.
- Hansen E (2016) Responding to the bioeconomy: business model innovation in the forest sector. In: Kutnar A, Muthu S (eds) *Environmental impacts of traditional and innovative forest-based bioproducts*. Springer, Singapore. https://doi.org/10.1007/978-981-10-0655-5_7.
- Hassan MK, Villa A, Kuittinen S, Jänis J, Pappinen A (2019) An assessment of side-stream generation from Finnish forest industry. *J Mater Cycles Waste Manag* 21: 265–280. <https://doi.org/10.1007/s10163-018-0787-5>.
- Helfat E, Peteraf MA (2003) The dynamic resource-based view: capability lifecycles. *Strat Manag J* 24: 997–1010. <https://doi.org/10.1002/smj.332>.
- Hetemäki L, Hurmekoski E (2016) Forest products markets under change: review and research implications. *Curr For Rep* 2: 177–188. <https://doi.org/10.1007/s40725-016-0042-z>.
- Hetemäki L, Hanewinkel M, Muys B, Ollikainen M, Palahí M, Trasobares A (2017) Leading the way to a European circular bioeconomy strategy. *From Science to Policy* 5. European Forest Institute. http://www.efi.int/files/attachments/publications/efi_fstp_5_2017.pdf.
- Hietala J, Huovari J (2017) Economic impacts and outlook of the Finnish wood-based bioeconomy. PTT Working Papers 184, Pellervo Economic Research PTT, Helsinki.
- Hsieh H, Shannon SE (2005) Three approaches to qualitative content analysis. *Qual Health Res* 15: 1277–1288. <https://doi.org/10.1177/1049732305276687>.
- Hurmekoski E, Jonsson R, Korhonen J, Jänis J, Mäkinen M, Leskinen P, Hetemäki L (2018)

- Diversification of the forest industries: role of new wood-based products. *Can J For Res* 48: 1417–1432. <https://doi.org/10.1139/cjfr-2018-0116>.
- Huttunen S (2014) Stakeholder frames in the making of forest bioenergy legislation in Finland. *Geoforum* 53: 63–73. <https://doi.org/10.1016/j.geoforum.2014.02.006>.
- Johnson G, Scholes K, Whittington R (2008) Exploring corporate strategy, 8th edition. Pearson Education Limited, Harlow, Essex.
- Kangas H, Ruggiero S, Annala S, Ohrling T (2021) Would turkeys vote for Christmas? New entrant strategies and cooperative tensions in the emerging demand response industry. *Energy Res Soc Sci* 76, article id 102051. <https://doi.org/10.1016/j.erss.2021.102051>.
- Kanger L (2021) Rethinking the multi-level perspective for energy transitions: from regime life-cycle to explanatory typology of transition pathways. *Energy Res Soc Sci* 71, article id 101829. <https://doi.org/10.1016/j.erss.2020.101829>.
- Kasanen M, Heikkinen HI (2012) Power relations in the decision-making processes of forest owners in Northern Finland. *Nordia Geogr Publ* 41: 83–93.
- Kelleher L, Henchion M, O'Neill E (2019) Policy coherence and the transition to a bioeconomy: the case of Ireland. *Sustainability* 11: article id 7247. <https://doi.org/10.3390/su11247247>.
- Kemp R, Schot J, Hoogma R (1998) Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management. *Technol Anal Strateg Manag* 10: 175–198. <https://doi.org/10.1080/09537329808524310>.
- Keränen JT, Immonen K, Lehmonen J, Venetjoki P, Roine S, Fontell P, Raudaskoski A (2019) Puusta pidemmälle: määrystä arvoon. [Circular economy business from wood project]. VTT Technical Research Centre of Finland. ISBN 978-951-38-8711-7.
- Köhler J, Geels FW, Kern F, Markard J, Wieczorek A, Alkemade F, Avelino F, Bergek A, Boons F, Fünfschilling L, Hess D, Holtz G, Hyysalo S, Jenkins K, Kivimaa P, Martiskainen M, McMeekin A, Mühlemeier MS, Nykvist B, Onsongo E, Pel B, Raven R, Rohrer H, Sandén B, Schot J, Sovacool B, Turnheim B, Welch D, Wells P (2019) An agenda for sustainability transitions research: state of the art and future directions. *Environ Innov Soc Transit* 31: 1–32. <https://doi.org/10.1016/j.eist.2019.01.004>.
- Korhonen J, Hurmekoski E, Hansen E, Toppinen A (2017) Firm-level competitiveness in the forest industries: review and research implications in the context of bioeconomy strategies. *Can J For Res* 48: 141–152. <https://doi.org/10.1139/cjfr-2017-0219>.
- Korhonen J, Giurca A, Brockhaus M, Toppinen A (2018) Actors and politics in Finland's forest-based bioeconomy network. *Sustainability* 10, article id 3785. <https://doi.org/10.3390/su10103785>.
- Korstjens I, Moser A (2017) Series: practical guidance to qualitative research. Part 2: Context, research questions and designs. *Eur J Gen Pract* 23: 274–279. <https://doi.org/10.1080/13814788.2017.1375090>.
- Kotilainen J, Rytteri T (2011) Transformation of forest policy regimes in Finland since the 19th century. *J Hist Geogr* 37: 429–439. <https://doi.org/10.1016/j.jhg.2011.04.003>.
- Krätzig O, Franzkowiak V, Sick N (2019) Multi-level perspective to facilitate sustainable transitions – a pathway for German OEMs towards electric vehicles. *Int J Innov Manag* 23, article id 1940006. <https://doi.org/10.1142/S1363919619400061>.
- Kuckertz A, Berger ESC, Brändle L (2020) Entrepreneurship and the sustainable bioeconomy transformation. *Environ Innov Soc Transit* 37: 332–344. <https://doi.org/10.1016/j.eist.2020.101829>.
- Kunttu J, Hurmekoski E, Heräjärvi H, Hujala T, Leskinen P (2020) Preferable utilisation patterns of wood product industries' by-products in Finland. *For Policy Econ* 110, article id 101946. <https://doi.org/10.1016/j.forpol.2019.101946>.
- Kvale S, Brinkmann S (2009) Interview: learning the craft of qualitative research interviewing.

- Thousand Oaks, Sage Publications, CA, US.
- Linnenluecke MK, Griffiths A (2013) Firms and sustainability: mapping the intellectual origins and structure of the corporate sustainability field. *Glob Environ Change* 21: 382–391. <https://doi.org/10.1016/j.gloenvcha.2012.07.007>.
- Lintunen J, Kohl J, Buchert J, Asikainen A, Jyske T, Maunula J, Lehto J (2023) Suomi elää metsästä myös 2035 – keskustelunavaus metsäsektorin arvonlisän kaksinkertaistamiseen. [Finland will still live off the forest in 2035 – a discussion starter on doubling the added value of the forestry sector]. *Research on natural resources and bioeconomy* 14/2023, Natural Resources Institute Finland, Helsinki. <http://urn.fi/URN:ISBN:978-952-380-620-7>.
- Loorbach D, Wijsman K (2013) Business transition management: exploring a new role for business in sustainability transitions. *J Clean Prod* 45: 20–28. <https://doi.org/10.1016/j.jclepro.2012.11.002>.
- Loorbach D, Frantzeskaki N, Avelino F (2017) Sustainability transitions research: transforming science and practice for societal change. *Annu Rev Environ Resour* 42: 599–626. <https://doi.org/10.1146/annurev-environ-102014-021340>.
- Luhas J, Mikkilä M, Uusitalo V, Linnanen L (2019) Product diversification in sustainability transition: the forest-based bioeconomy in Finland. *Sustainability* 11, article id 3293. <https://doi.org/10.3390/su11123293>.
- Majava A, Vadén T, Toivanen T, Järvensivu P, Lähde V, Eronen JT (2022) Sectoral low-carbon roadmaps and the role of forest biomass in Finland’s carbon neutrality 2035 target. *Energy Strateg Rev* 41, article id 100836. <https://doi.org/10.1016/j.esr.2022.100836>.
- Mattila O, Hämäläinen K, Häyrinen L, Berghäll S, Lähtinen K, Toppinen A (2016) Strategic business networks in the Finnish wood products industry: a case of two small and medium-sized enterprises. *Silva Fenn* 50, article id 1544. <https://doi.org/10.14214/sf.1544>.
- Ministry of Agriculture and Forestry of Finland (2008) Finnish National Forest Programme 2015. *Maa- ja metsätalousministeriön julkaisuja* 3/2008.
- Ministry of Agriculture and Forestry of Finland (2019) Finnish National Forest Strategy 2025-update. *Maa- ja metsätalousministeriön julkaisuja* 7/2019.
- Ministry of Economic Affairs and Employment of Finland (2017) Wood-based bioeconomy solving global challenges. *MEAE guidelines and other publications* 2/2017.
- Möller K, Svahn S (2009) How to influence the birth of new business fields – network perspective. *Ind Market Manag* 38: 450–458. <https://doi.org/10.1016/j.indmarman.2008.02.009>.
- Natural Resources Institute Finland (2020) Puun energiakäyttö 2019. https://stat.luke.fi/puun-energiak%C3%A4ytt%C3%B6-2019_fi.
- Näyhä A (2019) Transition in the Finnish forest-based sector: company perspectives on the bioeconomy, circular economy and sustainability. *J Clean Prod* 209: 1294–1306. <https://doi.org/10.1016/j.jclepro.2018.10.260>.
- Näyhä A (2020) Finnish forest-based companies in transition to the circular bioeconomy: drivers, organizational resources and innovations. *For Policy Econ* 110, article id 101936. <https://doi.org/10.1016/j.forpol.2019.05.022>.
- Näyhä A, Pesonen H (2014) Strategic change in the forest industry towards the biorefining business. *Technol Forecast Soc Change* 81: 259–271. <https://doi.org/10.1016/j.techfore.2013.04.014>.
- Oskam I, Bossink B, de Man A (2021) Valuing value in innovation ecosystems: how cross-sector actors overcome tensions in collaborative business model development. *Bus Soc* 60: 1059–1091. <https://doi.org/10.1177/0007650320907145>.
- Österberg M, Karjalainen M, Lintunen J, Tammelin T, Asikainen A, Vakkilainen E, Toivonen R, Virta P, Henn A, Nuutinen E, Kohl J, Hassinen J (2024) Lankusta lääkkeisiin. Tuoteportfolion arvonnoususta uutta arvonlisää metsäsektorille. [From planks to medicines. New added value

- for the forestry sector through the rise in the product portfolio's value]. *Metsäbiotalouden tiedepaneelin raportti 1/2024*. The Finnish Forest Bioeconomy Science Panel, Helsinki.
- Patala S, Salmi A, Bocken N (2020) Intermediation dilemmas in facilitated industrial symbiosis. *J Clean Prod* 261, article id 121093. <https://doi.org/10.1016/j.jclepro.2020.121093>.
- Peltola A, Ihalainen A, Mäki-Simola E, Sauvula-Seppälä T, Torvelainen J, Uotila E, Vaahtera E, Ylitalo E (eds) (2019) *Finnish forest statistics*. Natural Resources Institute Finland, Helsinki. <http://urn.fi/URN:ISBN:978-952-326-856-2>.
- Peltola T (2007) Business on the margin: local practices and the politics of forests in Finland. *Ethics Place Environ* 10: 29–47. <https://doi.org/10.1080/13668790601156328>.
- Planko J, Chappin M, Cramer J, Hekkert M (2017) Managing strategic system-building networks in emerging business fields: a case study of the Dutch smart grid sector. *Ind Mark Manag* 67: 37–51. <https://doi.org/10.1016/j.indmarman.2017.06.010>.
- Raven R, Bosch SV, Weterings R (2010) Transitions and strategic niche management: towards a competence kit for practitioners. *Int J Technol Manag* 51: 57–74. <https://doi.org/10.1504/IJTM.2010.033128>.
- Reim W, Sjödin D, Parida V, Rova U, Christakopoulos P (2017) Bio-economy based business models for the forest sector – a systematic literature review. *Proceedings of the 8th International Scientific Conference Rural Development*. <http://doi.org/10.15544/RD.2017.109>.
- Rip A, Kemp R (1998) Technological change. In: Rayner S, Malone EL (eds) *Human Choice and Climate Change 2*. Battelle Press, Columbus, Ohio, pp 327–99.
- Rogers E (2003) *Diffusion of innovations*, 5th edition. Free Press, New York.
- Sandberg B, Aarikka-Stenroos L (2014) What makes it so difficult? A systematic review on barriers to radical innovation. *Ind Mark Manag* 43: 1293–1305. <https://doi.org/10.1016/j.indmarman.2014.08.003>.
- Schot J, Geels FW (2008) Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. *Technol Anal Strateg Manag* 20: 537–554. <https://doi.org/10.1080/09537320802292651>.
- Scordato L, Bugge MM, Fevolden AM (2017) Directionality across diversity: governing contending policy rationales in the transition towards the bioeconomy. *Sustainability* 9, article id 206. <https://doi.org/10.3390/su9020206>.
- Smith A (2007) Translating sustainabilities between green niches and socio-technical regimes. *Technol Anal Strateg Manag* 19: 427–450. <https://doi.org/10.1080/09537320701403334>.
- Stegmann P, Londo M, Junginer M (2020) The circular bioeconomy: its elements and role in European bioeconomy clusters. *Resour Conserv Recycl X* 6, article id 100029. <https://doi.org/10.1016/j.rcrx.2019.100029>.
- Stenzel T, Frenzel A (2008) Regulating technological change – the strategic reactions of utility companies towards subsidy policies in the German, Spanish and UK electricity markets. *Energ Policy* 36: 2645–2657. <https://doi.org/10.1016/j.enpol.2008.03.007>.
- Stern PC (2000) Toward a coherent theory of environmentally significant behavior. *J Soc Issues* 56: 407–424. <https://doi.org/10.1111/0022-4537.00175>.
- Teece DJ (2007) Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strat Manag J* 28: 1319–1350. <https://doi.org/10.1002/smj.640>.
- Teece DJ (2023) The evolution of the dynamic capabilities framework. In: Adams R, Grichnik D, Pundziene A, Volkmann C (eds) *Artificiality and sustainability in entrepreneurship*. FGF Studies in Small Business and Entrepreneurship. Springer, Cham, pp 113–129. https://doi.org/10.1007/978-3-031-11371-0_6.
- Teece DJ, Pisano G, Shuen A (1997) Dynamic capabilities and strategic management. *Strat Manag J* 18: 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7%3C509::AID-](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7%3C509::AID-)

SMJ882%3E3.0.CO;2-Z.

Toppinen A, D'Amato D, Stern T (2020) Forest-based circular bioeconomy: matching sustainability challenges and novel business opportunities? For Policy Econ 110, article id 102041. <https://doi.org/10.1016/j.forpol.2019.102041>.

Vecchiato R, Roveda C (2010) Strategic foresight in corporate organizations: handling the effect and response uncertainty of technology and social drivers of change. Technol Forecast Soc Change 77: 1527–1539. <https://doi.org/10.1016/j.techfore.2009.12.003>.

Wei LQ, Lau CM (2010) High performance work systems and performance: the role of adaptive capability. Hum Relat 63: 1487–1511. <https://doi.org/10.1177/0018726709359720>.

Total of 97 references.