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Networked business models on a nascent market for sustainable innovation

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Abstract

Purpose – The purpose of this paper is to explore networked business models on a nascent market for a sustainable innovation.

Design/methodology/approach – The study takes a qualitative approach through a comparative case study of three solar photovoltaic (PV) parks in Sweden. Data was collected from 14 interviews with multiple supply chain and network actors as well as secondary data. Industrial marketing and purchasing is applied for theoretical framing.

Findings – The study demonstrates transactional, relational, environmental and social drivers for participating in the network. The study reveals the duplicity of the nascent market, which encourages supply chain actors to develop their individual business models to take a larger market share or become future competitors to current collaborators. On the nascent market with few developed regulations, the network enables actors to influence regulations on local and regional levels.

Research limitations/implications – The study is limited to the nascent solar PV industry in Sweden, which is characterized by institutional turbulence, market uncertainties and few established supply networks.

Practical implications – Practitioners need to consider multifarious drivers for participating in networked business models, where the economic driver may be the least motivating.

Originality/value – This study provides several multiactor business models and classifies them into specific applications and general applications. The study provides unique insight into the complexity of interactions among supply chain actors in networked business models on a nascent market for sustainable innovation. Due to the scarcity of available partners on the nascent market, actors need to look beyond their on-going relationships and their network horizon, or actors' roles evolve to include activities that was not part of their individual business models.

Keywords Collaboration, Sustainability, Business strategy, Case studies, Regulations, Relationship value

Paper type Research paper

1. Introduction

In recent years, both researchers and practitioners have stressed the importance of multiactor collaboration to increase the diffusion of sustainable innovations through new business models (Melander and Lind, 2022; Pedersen *et al.*, 2021; United Nations Department of Economic and Social Affairs (DESA), 2023). Scholars have emphasized the importance of extending supply chain management to include management of business models (Trkman *et al.*, 2015; Trkman *et al.*, 2007). While supply chain actors are vital for enabling focal firms' business models, additional actors are also needed for implementing business models with a particular focus, such as with a focus on sustainability (Beh *et al.*, 2016; Svensson *et al.*, 2018). This implies that business actors need to collaborate beyond their vertical supply chains and include actors such as competitors, governmental agencies and academic institutions in their networks (Melander and Pazirandeh, 2019; Solaimani and van der Veen, 2021). In these networks, actors must coordinate their activities and contribute with different resources, which tend to be complex and involve a variety of collaborative behaviors, activities

and interactions (Agndal *et al.*, 2023; Huang *et al.*, 2020). This has led scholars to emphasize the need for understanding business models from a network perspective (Bankvall *et al.*, 2017; Jocevski *et al.*, 2020; Klimanov and Tretyak, 2019).

A recent review stresses the importance of taking a network-oriented view of business models as business relationships and interconnectedness between actors become more important (Jocevski *et al.*, 2020). When no single actor is able to govern all resources and activities needed to provide the offering of a business model, the business logic resides in a network of interdependent actors (Palo and Tähtinen, 2011). As such, it becomes important to understand how actors interact to create value for the whole supply chain network, not just for a focal

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firm and its customers (Bankvall *et al.*, 2017). There are multiple definitions of what constitutes a networked business model (Jocevski *et al.*, 2020). In this paper, we rely on the definition by Palo and Tähinen (2013, p 775), where a “networked business model guides how a net of companies will create customer and network value by developing collective understanding of the business opportunities and shaping the actions to exploit them”.

The industrial marketing and purchasing (IMP) literature emphasizes the significance of fostering close and long-term collaborations among supply chain actors for commercial prosperity (Håkansson *et al.*, 2009; Håkansson and Snehota, 1995). Sustainable innovations, however, typically first gain traction on nascent markets (Geels, 2002) where actors must create new supply networks (Möller and Svahn, 2009). This creates challenges for developing networked business models for sustainable innovations, since actors cannot fully rely on their existing partnerships. Nascent market are also characterized by blurred market boundaries, shifting market players and uncertain business models (Eisenhardt and Martin, 2000), which may deter potential new partners from participating in the network. To increase the diffusion of sustainable innovations, understanding why actors join networked business models in nascent markets becomes essential.

Networked business models remain relatively underexplored in research (Jocevski *et al.*, 2020), particularly in the context of nascent markets for sustainable innovations. Understanding networked business models in this context is crucial for policymakers aiming to accelerate the diffusion of sustainable innovations and for managers seeking to commercialize them, as it can clarify the prerequisites for developing and managing such models. Against this background, this paper aims to explore networked business models on a nascent market for sustainable innovation.

The study takes a qualitative approach through a comparative case study of three recently constructed solar photovoltaic (PV) parks in Sweden with similar networked business models. Although the global market for solar PV has grown exponentially over the past decade, it has only recently become economically viable for actors to develop, construct and operate large-scale centralized solar PV parks in Sweden (Lindahl *et al.*, 2022). As a result, networked business models for solar PV parks have emerged on the Swedish market, making it a suitable context for this study.

Findings reveal that a diverse set of private and public actors interact to build relationships in networked business models and that actors have multifarious incentives for participating, including transactional, relational, environmental and social drivers. The study shows how regulatory voids on multiple levels on the nascent market are challenging. Actors face such regulatory voids through adaptability in the network business models, allowing for network reconfiguration. We find that actors' participation in networked business models either reinforce, expand or focus their individual business models. Hence, our study reveals the dynamics and developments of the networked business model, and shows the duplicity of the nascent market, which encourages supply chain actors to develop their individual business models to take a larger market share or become future competitors to current collaborators. This study

provides several different multiactor business models and classifies them into specific and general applications.

The paper is outlined as follows. First, networked business models are introduced and discussed (Section 2). Then our methodology is presented in Section 3, followed by the case findings in Section 4. Thereafter, a discussion including proposition is provided (Section 5). Finally, conclusions, implications, limitations and future research are presented in Section 6.

2. Theoretical background

2.1 Multiactor business models

A business model describes the business logic of a firm, which is often conceptualized as how the firm creates, delivers and captures value (Teece, 2010). This includes the firm's offer and target customer(s), the organization of its resources, activities and partnerships, as well as the structure of its revenues and costs (Richardson, 2008). Much of business model literature centers around one actor and examines the network through that actor. However, scholars have argued that this firm-centric view of a business model is inadequate for describing and studying situations where the business logic resides in a network of actors rather than a single firm, since it does not account for the resources and activities of all involved actors (Bankvall *et al.*, 2017; Jocevski *et al.*, 2020).

Several literature streams deal with multiactor collaborations within the business model context, such as networked business models, digital platform business models, ecosystem business models, industrial symbiosis business models and open business models. These rely on different theoretical foundations, definitions and concepts and have been studied in multiple contexts. Table 1 presents a selection of how these different multiactor business models are described in the literature, including basic underpinnings of these models.

The IMP and network perspective is part of supply chain management literature, where early studies focused on multiple buyer-supplier relationships that formed a network of actors (Gadde and Håkansson, 2001). In recent years, IMP studies have focused on business models, the importance of supply chain actors and not focusing solely on one actor. A networked business model relies on network level value processes rather than taking a focal firm perspective (Bankvall *et al.*, 2017). In digital platform business models, firms rely on digital technology to connect actors, creating platforms that are “organizations of organizations” (Ketschmer *et al.*, 2022). Hence, a web of actors are connected and need to be coordinated. In the ecosystem business models (Lindgren, 2016), the value chain includes many supply chain functions, such as inbound logistics, operation, outbound logistics, marketing and sales and procurement. Industrial symbiosis business models are characterized by the exchange of waste that is produced by one actor, which becomes input to another actors (Fraccascia *et al.*, 2019). Here, waste in the form of e.g. materials, energy and water becomes input and connects supply chain actors, such as buyers, suppliers and waste treatment actors. In industrial symbiosis business models the supply chain is extended as firms form collaborations with supply chain actors that are not part of their main business focus (Herczeg *et al.*, 2018). The final example of multiactor

Table 1 Comparing multiactor business models

	Networked business models	Digital platform business models	Ecosystem business models	Industrial symbiosis business models	Open business models
Theoretical foundation	IMP theory	Sharing economy	Ecosystem	Industrial symbiosis	Open innovation
Definition	“... the network-embedded type of business model encompasses a set or network of firms involved in business exchanges that can only be understood and described at the network level” (Bankvall <i>et al.</i> , 2017, p 199)	“... conceptualize platforms as meta-organizations, or ‘organizations of organizations’ that are less formal and less hierarchical structures than firms, and yet more closely coupled than traditional markets” (Kretschmer <i>et al.</i> , 2022, p 405)	“... is proposed analogically as a ‘community of living BM’s’ where different businesses offer their ‘AS ISBM’ and develop their ‘TO BE BM’ in conjunction with the BMES environment (things like technologies, HR, organizational structure and culture)” (Lindgren, 2016, p 70)	“... involves complex and multiple relationships among firms producing and using wastes (forming the so-called IS network)” (Fraccascia <i>et al.</i> , 2019, p 114)	“Open models can also enable greater value capture, by using a key asset, resources or position not only in the company’s own business but also in other companies’ businesses” (Chesbrough, 2006, p 2)
Selection of core concepts	Actors, resources, activities, interactions, business relationships, network, interdependency	Configuration, coordination, connecting actors, sharing, digitalization, platform	Value proposition, value formulation, user and customer, networks, value chain (internal), competences	Symbiotic relationship, inter-dependencies, coordination, control, sustainability, waste	External knowledge, open, closed, innovation process, strategy
Empirical contexts (examples)	Industrial manufacturing, technology-based services, textile, transport	E-commerce, finance, hospitality, transport	Retail, energy industry, consumer products	Agriculture, chemical, mining, metal and textile	Chemical industry, consumer products, electronics, software and engineering
Categorization of resource applications	General applications	Specific application: sharing resources	General applications	Specific application: waste as a resource	Specific application: external knowledge as a resource

Source: Authors' own work

business model is the open business model, where firms capture value by combining other firms' key assets, resources and position with their own (Chesbrough, 2006).

While the multiactor business models in Table 1 are defined somewhat differently and rely on different theoretical foundations, they have much in common. The core concepts share many similarities, such as actors, networks, relationships and coordination. The multiactor business models can be categorized into specific applications and general applications. Specific applications relate to waste as a resource in the industrial symbiosis business model, to external knowledge as a resource in open business models and to sharing of resources in digital platform business models. Meanwhile, networked business models and ecosystem business models are not limited to a specific type of resource. The ecosystem business model has a focus on values while the network business model has a focus on business relationships and interactions. In this paper, we rely on the networked business model using the IMP lens to analyze our findings.

2.2 Networked business models through the industrial marketing and purchasing lens

The conceptualization of a networked business model primarily draws on the IMP literature based on the assumption that business actors are interdependent (Bankvall *et al.*, 2017). As

such, actors tend to form long-term relationships in which they make adaptations and investments (Gadde and Håkansson, 1993; Lind and Melander, 2019). These long-term business relationships form network-like structures, often called business networks. Such networks are not static but change as actors enter or exit them.

Nascent markets are typically characterized by high levels of uncertainty and dynamism in terms of market boundaries, market players and what business models will be successful (Eisenhardt and Martin, 2000). Actors that wish to operate on such a market may, therefore, struggle to form and manage the network needed to realize a particular business model. In nascent markets, actors often search for roles and it may be difficult to identify and motivate actors with key resources to participate in the network (Leminen *et al.*, 2015). Westerlund *et al.* (2014) highlight that actors may join the network based on individual drivers, but that shared drivers are essential for the long-term survival of a networked business model. Research on business networks also suggests that actors choose to participate in a network to access resources, markets, technologies, new knowledge and for economic incentives (Håkansson and Snehota, 2017; Snehota and Håkansson, 1995). For sustainable innovations, actors join networks for e.g. marketing, resource and legitimization purposes (Melander and Arvidsson, 2022; Vanpoucke *et al.*, 2016).

Networked business models are associated with added complexity and dynamism since networks involve multiple actors and evolve over time (Palo and Tähtinen, 2013). As such, actors may face additional challenges when becoming involved in a networked business model. Actors may struggle with having less control of the networked business model compared to their individual business model since they must rely on other actors to a greater extent (Bankvall *et al.*, 2017). Individual business models and incentives may also be in conflict (Jocevski *et al.*, 2020). To address this, Palo and Tähtinen (2013) emphasize the importance of having a focal actor that guides the development of the network and shapes a collective understanding among the actors. Klimanov and Tretyak (2019) also point out that it is critical to build interaction among actors to jointly create value as well as to avoid potential conflicts in networked business models. However, in highly regulated markets that involve public-private partnerships, some interactions (e.g. long-term collaborations often seen in the private sector) are hindered by regulations (Runfola *et al.*, 2021; Waluszewski and Wagrell, 2013).

The dynamic character of networked business models implies that actors and their roles may change as the network evolves, which can be challenging for the involved actors to manage (Palo and Tähtinen, 2011). Interaction is considered key for understanding networked business models (Bankvall *et al.*, 2017; Håkansson and Waluszewski, 2013). This is because interactions influence the business model design by shaping the relationships of the involved actors and the roles that they take in the network, and vice versa (Palo and Tähtinen, 2013). The roles of actors may also change over time as the network develops, e.g. an actor's role may differ between the development- and implementation phase (Lindkvist *et al.*, 2022). A recent study of the Swedish solar industry reveals how the business relationships between solar firms and electric utilities changed over time (Altunay and Bergek, 2023). The initial collaborative approach resulted in conflict as the importance of resources changed over time, the solar firms strengthened their network position and previously mutual drivers became misaligned. Supply chain management research shows how relationship changes can be linked to opportunism and knowledge spillover (e.g. Patrucco *et al.*, 2022; Yan and Kull, 2015; Zeng *et al.*, 2017).

Previous research points to challenges in managing networked business models due to the increased complexity of multiactor collaboration. Notably, actors may struggle to handle the reduced control over the networked business model (Bankvall *et al.*, 2017) and the increased dynamism, both in the environment and within the network itself (Palo and Tähtinen, 2013). Business actors involved in network business models also have their own individual business models and incentives that can be in conflict (Jocevski *et al.*, 2020). However, there is limited empirical evidence on the types of drivers and challenges that actors face when participating in a networked business model and what implications they have. In particular, there is little knowledge of interaction between actors in nascent markets (Eisenhardt and Martin, 2000; Leminen *et al.*, 2015). Three questions arise in relation to networked business models on a nascent market:

RQ1. What are the drivers for participating in networked business models?

RQ2. What challenges do actors face in networked business models?

RQ3. How do actors interact in networked business models?

3. Method

3.1 Study design and case selection

This study uses a qualitative case study design (Yin, 1994) based on a comparative analysis of three solar PV parks in Sweden. The case study approach is suitable for understanding the “rich, real-world context in which the phenomena occur” (Eisenhardt and Graebner, 2007, p. 25) by studying a small number of entities using multiple sources of data (Easton, 2010). It is also prominently used in industrial networks research since it “resonates well with interactions and relationships as basic units of analysis” (Dubois and Araujo, 2004, p. 210).

The selection criteria included centralized solar PV parks that were currently being built or finalized in the year 2020. To identify relevant cases, we reached out to the Swedish solar PV market expert representing the International Energy Agency's Photovoltaic Power System Programme (IEA PVPS) for suggestions. After receiving five suggestions, we screened newspaper articles and firms' websites to understand at what stage of development the solar PV parks were and what actors were involved in the projects. Three cases were selected based on (1) having similar business models involving multiple actors, and (2) being at a later stage of development compared to the alternatives, and, thus, having formalized networks. The selected solar PV parks were put into operation in 2020 (Case A) and 2023 (Cases B and C).

3.2 Data collection and analysis

Primary data was collected (December 2022–May 2023) through 14 semi-structured interviews [1] with representatives from multiple actors involved with developing, constructing and operating the selected solar PV parks (Table 2). Initial contact with the project owners of each solar PV park was provided by the Swedish representative of IEA PVPS, which was followed by snowball sampling of interviewees to ensure selecting representatives that had been involved with the projects. To get an understanding of the relationships in the networks, representatives from all involved actors were approached for an interview, but not all representatives were willing to participate in the study. The interview questions comprised general questions about the focus of the organization, drivers for engaging in the solar PV park, the roles of different actors involved and how actors interacted. Interviews lasted about 45 min each. All interviews were recorded and transcribed. We also triangulated the interview data with secondary data from press releases, newspaper articles and IEA PVPS market reports 2020–2022 (National Survey Reports Archive – IEA-PVPS) to get a better understanding of the solar PV market and how the solar PV parks had been marketed.

To allow for patterns to emerge, the data was analyzed with a bottom-up approach in accordance with the method developed by Gioia *et al.* (2013). This involved aggregating text segments from the interview transcripts and secondary data sources into first-order concepts, second-order themes and aggregated dimensions (Table 3).

Table 2 Interviewees

Case	Actor	Interviewee position
A	Solar firm 1*	Head of sales and marketing
A	Bank	Head of group sustainability
A	Energy utility 1	Head of strategy, business development and venture projects
A	Energy utility 1	Business unit manager
A	Asset management firm	Investment and sustainability manager
B	Solar firm 2*	CEO
B	Solar firm 3	Founder
B	Municipality	Municipal commissioner
B	Municipality	Senior advisor
B	Consulting firm	Project manager
B	Energy utility 2	Senior business developer
B	Real estate firm	Project development manager
C	Energy utility 4	Head of financial trading
C	Solar firm 4*	Utility business developer

Note: *Project owner

Source: Authors' own work

In line with [Eisenhardt \(1989\)](#), data was first coded for each case separately followed by a cross-case analysis in which patterns from all three cases were compared. The first-order concepts were empirically derived (e.g. describing the exiting actors in the network, describing new actors in the network and how actors contributed to the network). First-order concepts were then clustered into Second-order themes which were based on theoretical concepts from the IMP literature (e.g. dynamic roles as the network evolves). We have three higher level aggregated dimensions. During the analysis, data was revisited, and new concepts emerged to better explain the data. The coding was carried out by one author while the other author checked it for consistency, after which both authors discussed the coding until consensus was reached.

4. Case description

All three cases have a networked business model that is based on a power purchase agreement (PPA) in which an offtaker (i.e. electricity buyer) agrees to purchase the produced electricity from a third party that owns and operates the solar PV park (i.e. energy producer) [\[2\]](#). The networked business models involved multiple actors ([Figure 1](#)), each with their own individual business models and prior networks. Some of the actors' individual business models were closely linked to the networked business model (e.g. focusing on solar PV or energy production), whereas others were more distant (e.g. banking, or municipal development). The actors took on different roles in the network by contributing with key resources and performing necessary activities. These roles included landowner, grid owner, park owner, offtaker, electricity retailer, developer and contractor [\[3\]](#). [Table 4](#) compares the actors' roles, individual business models and the link between the networked and individual business model.

4.1 Drivers

In all three cases, actors were motivated to join the networked business models to increase their economic gains, to promote

sustainability and to strengthen new or existing relationships (see [Table 3](#)). The offtakers, such as the Bank in Case A or the Real Estate Firm in Case B, highlighted ambitious sustainability targets and the ability to secure their long-term electricity costs as main drivers. Landowners were instead motivated by the ability to promote local renewable energy production or to utilize their land for economic gains. "After all, we get paid better for the land from the park than what we did before" (business unit manager, Energy Utility 1). Interestingly, actors that did not emphasize transactional benefits focused on social incentives and the ability to promote their image as an innovative or sustainable firm. "It is important for us to show that we are a modern municipality that looks to the future. For that reason, we thought it was interesting, but also because it was a local business" (municipal commissioner, Municipality).

Other actors (e.g. park owners) emphasized relational incentives for joining the network. For instance, when Energy Utility 1 became interested in co-ownership of the solar PV park in Case A, the Asset management firm was particularly keen on joining as well. "We want to invest as much as possible in Nordic infrastructure, and we think that doing it together with municipal counterparts, such as municipal energy utilities, is only beneficial. It strengthens the partnership angle so that we can do other things together" (investment and sustainability manager, Asset Management Firm).

Actors in all three cases were motivated to join the networked business models when they aligned with their goals and strategies, especially actors with ambitious sustainability targets. Solar PV parks were seldom actors' main business, but most actors still saw synergies between the networked business model and their individual business model that motivated them to join. For instance, the Real Estate Firm in Case B took the role of park owner because it aligned with their individual business model (see [Table 4](#)). "We own properties – that is our core business – so we can easily do this type of investment in terms of financing" (Project development manager, Real Estate firm). Learnings from the network also enabled some actors in Case A and B to develop their individual business models. "We have established our own solar business based on the experience that we acquired here" (head of strategy, business development and new venture projects, Energy Utility 1).

4.2 Challenges

All cases faced challenges related to regulations in terms of the time-consuming permit process, rules limiting or requiring certain actors' network participation and underdeveloped regulations due to the nascent character of the market. Regulatory uncertainties made Energy Utility 4 in Case C reluctant to join and invite their customer to the network until such risks had been mitigated. "We have made it clear that if we look at any projects, all decisions must be approved by the county administrative board, the electricity grid agreement must be in place, and the land lease must be signed so that there are no problems later. It is easier for a developer to say: 'this did not work out', but we must go back to a client with whom we have had a relationship for the past 10 years and say that it will not happen. Then we are the ones who get the negative publicity" (head of financial trading, Energy Utility 4).

Table 3 Coding structure

First order concept	Second order theme	Aggregated dimension
<ul style="list-style-type: none"> - The networked business model was seen to secure electricity costs and increase financial returns on investments. <i>Case A, B, C</i> - Actors joined the network to increase economic gains from existing resources (e.g. land or knowledge). <i>Case A, B, C</i> - Actors joined the network to form new relationships or strengthen existing relationships enabling future partnerships with the involved actors. <i>Case A, B, C</i> - Actors were motivated to join the networked business model to promote their sustainability image, branding and get positive public recognition. <i>Case A, B, C</i> - Actors used the solar PV park as a part of their sustainability commitment toward other stakeholders (customers, citizens and board members). <i>Case A, B</i> - Actors wanted to be part of the transition to sustainable energy production. <i>Case A, B, C</i> - Actors wanted to be seen as innovative organizations. <i>Case A, B</i> - Timing influenced incentives, where at one point there was limited customer interest in solar PV parks, then interest in becoming green grew and electricity prices increased. <i>Case A, B</i> - Actors that did not see economic benefits instead focused on social benefits and image of being a leader in innovation and sustainability investments. <i>Case A, B, C</i> - Local actors had limited knowledge due to there being few solar PV parks in Sweden. <i>Case A, B</i> - Actors joined the network to acquire new knowledge (e.g. how to develop, construct and operate solar PV parks themselves). <i>Case A, B</i> - Actors were motivated to join the networked business model when it aligned with their goals and strategies (e.g. contributing to a renewable energy transition or supporting local business growth). <i>Case A, B, C</i> - Knowledge was shared within the networks to teach new members and to ensure high quality throughout the projects. <i>Case A, B</i> - Sustainability initiatives have developed and become part of some actors' core businesses, where solar PV parks was a suitable fit. <i>Case A, B, C</i> - Actors whose individual business models were core to the networked business model (e.g. by installing, investing in or providing services connected to solar PV) were motivated to engage in the network. <i>Case A, B, C</i> - Actors' main business was often in another area, e.g. building small-scale solar PV systems or other types of energy projects. <i>Case A, B, C</i> - Participation in the network resulted in some actors adapting their individual business models to include different activities, e.g. development of solar PV parks. <i>Case A, B</i> - Actors acquired knowledge through the network and were able to establish their own solar energy competence within their organization. <i>Case A, B</i> - Some actors needed to follow certain regulations (e.g. public procurement regulations), limiting their options as network participants. <i>Case B</i> - Regulations require certain actors (e.g. grid owners) to be part of the network, but with limited incentives, these actors were reluctant to engage in the network beyond what was required of them. <i>Case B, C</i> - Time consuming to get permits since the permit process included three levels: municipality, county council and county board. <i>Case A, B, C</i> - The permit process frustrated some actors that were not used to such regulatory obstacles which made them want to exit the network or wait to join the network until permits were secured. <i>Case B, C</i> - New market and industry, where regulations are not yet fully developed, which results in uncertainties and a need for risk mitigation. <i>Case A, B, C</i> - Different expectations regarding e.g. recognition, project progress, objectives and communication between actors resulted in disagreements. <i>Case A, B</i> - Some actors with key resources did not prioritize the project. <i>Case B, C</i> - Limited information and engagement from grid owners to establish grid connection. <i>Case B, C</i> - Difficulties in finding a suitable location for the solar PV, making it difficult to involve local actors at early stages. <i>Case A, B, C</i> - Difficulties in identifying offtakers with suitable energy needs since energy production fluctuates. <i>Case A, B, C</i> 	<ul style="list-style-type: none"> Multifarious incentives: transactional, relational, environmental and social 	Drivers
	<ul style="list-style-type: none"> Goal alignment and knowledge acquisition 	
	<ul style="list-style-type: none"> Business model synergies and business model evolution 	
	<ul style="list-style-type: none"> Regulatory impacts on the network 	Challenges
	<ul style="list-style-type: none"> Network reconfiguration to mitigate challenges 	

(continued)

Table 3

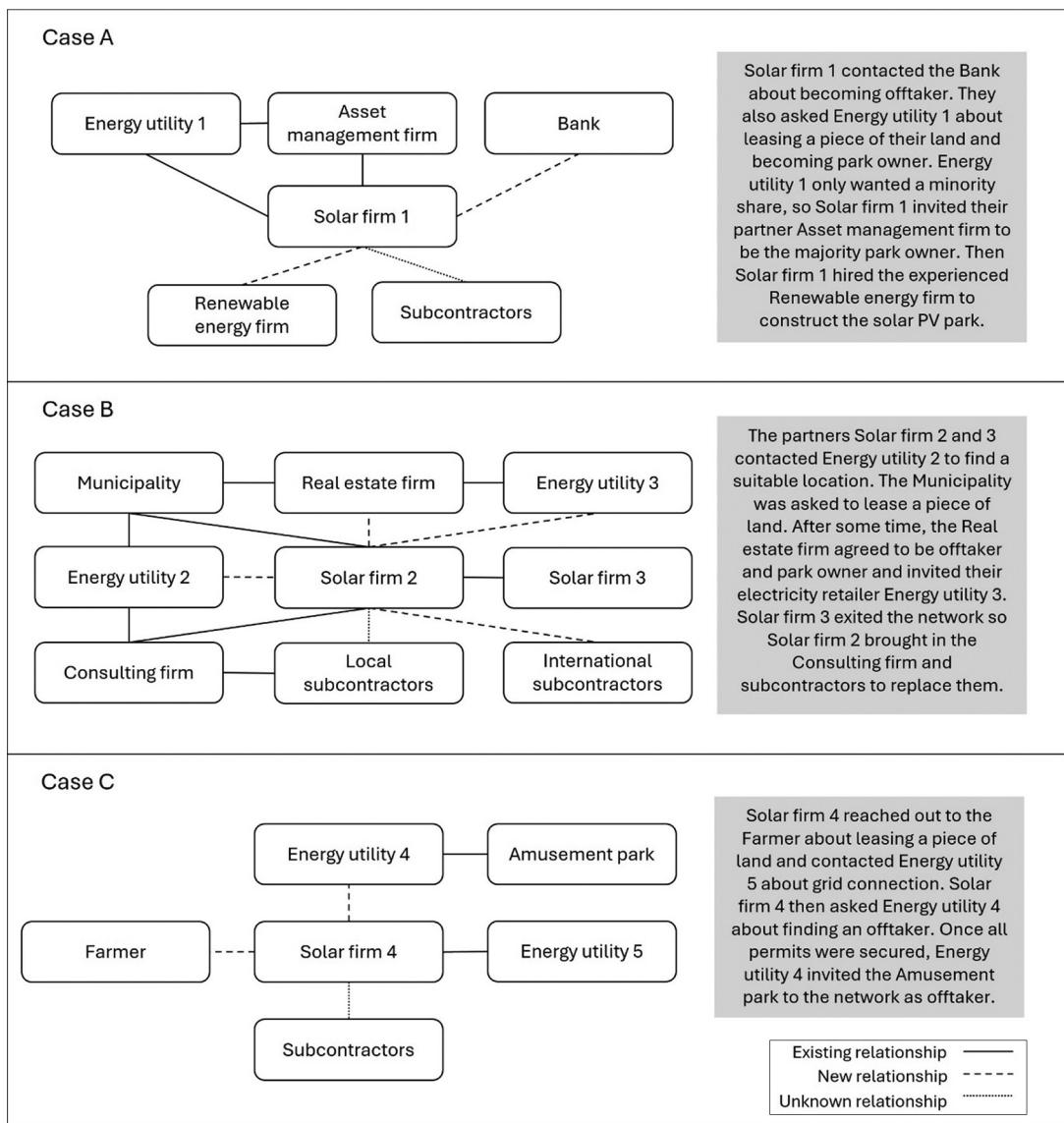
First order concept	Second order theme	Aggregated dimension
<ul style="list-style-type: none"> - Developers had to spend considerable efforts trying to convince potential key actors of the benefits of joining the network. <i>Case A, B</i> - Uncertainties about future electricity prices resulted in hesitation from some actors as to whether they should continue or exit the network. <i>Case A, B</i> - Need to bring in new actors to see the project through. <i>Case B</i> - Actors were reluctant to join networks where potential competitors participated, fearing knowledge leakage and strengthening competitors' brands. <i>Case B</i> - Actors left the network after changing their individual business models, creating a need to recruit new actors to replace them in the network. <i>Case B</i> - Actors in the network expanded their individual business models as they saw opportunities in taking a larger role in solar PV park development, making them competitors with other network actors. <i>Case A, B</i> - Reliance on established supply chains with proven subsuppliers. <i>Case A, B, C</i> - New actors were approached to join the networks because they possessed necessary resources (e.g. construction knowledge on solar PV parks). <i>Case A, B, C</i> - Actors acquired knowledge from previous projects and collaborations. <i>Case A, B, C</i> - Actors involved several different competences within their own organizations to solve different issues that occurred. <i>Case A, B, C</i> - The network evolved over time, as the project progressed. <i>Case A, B, C</i> - Different phases of the project had different participation by actors. <i>Case A, B, C</i> - New actors entered the network as actors exited the network. <i>Case B</i> - The nascent market resulted in actors searching for their role in the network (roles were not clearly defined from the start but evolved as the project progressed). <i>Case A, B</i> - Actors whose individual business models were closely connected to the networked business model (e.g. solar PV developers) were more engaged in establishing and managing the network (e.g. initiating, recruiting and coordinating interaction between actors). <i>Case A, B, C</i> - Some actors with key resources (e.g. land, grid connection) were not particularly engaged in the networked beyond their resource contribution. <i>Case B, C</i> - Dialogue between actors was used to improve participation and attract actors' attention to the project. <i>Case A, B, C</i> - Actors' network engagement varied over time. <i>Case A, B, C</i> - Formal contracts were primarily used to specify responsibilities, both between actors in the network and internally between different departments within an organization. <i>Case A, B, C</i> - Formal contracts were used specifically with offtakers and landowners. <i>Case A, B, C</i> - The nascent market with limited prior experience resulted in contracts that avoided locking in actors and were flexible in nature, to facilitate adaptation to changes and uncertainties. <i>Case A, B</i> - Established relationships with supply chain actors that joined the network applied limited use of contracts and instead relied on relational ties. <i>Case A, B</i> - Prior relationships resulted in easy communication and limited need for formal agreements. <i>Case A, B</i> - Personal relationships between individuals from prior collaborations facilitated communication and governance. <i>Case A, B, C</i> - The need for control of the project resulted in combining transactional and relational control measures (contracts, reports, informal meetings and trust). <i>Case A, B, C</i> 	<ul style="list-style-type: none"> Business model dynamics and developments Dynamic roles as the network evolves Variations in actors' network engagement Combining transactional and relational governance 	Interactions

Source: Authors' own work

Regulatory voids related to solar PPAs were also highlighted in Case A and B as a risk that threatened the setup of the networked business models. "There is no procedure for how to register this financial instrument with the regulators, and the regulators do not know how to handle it themselves. In theory, we could end up in a situation where we are breaking the law. At the same time, the market cannot wait. So, we are more likely looking at a situation where we must adjust as the regulations are put in place, rather than holding off altogether" (investment and sustainability manager, Asset Management firm). Thus, by moving forward with a PPA-setup for the solar

PV parks, actors also put pressure on regulators and influenced the design of such regulations.

Actors also experienced network configuration challenges related to identifying, engaging and replacing essential actors in the network and managing disagreements due to different expectations regarding e.g. recognition, project progress, communication and objectives. Finding suitable offtakers proved to be particularly challenging in all cases. "It is not easy for developers to find the ones who buy these agreements because they have no relationships with those clients. But that is where we come in. We have very good relationships and

Figure 1 Case networks

Source: Author's own work

established collaborations, which means that the developers turn to us" (head of financial trading, Energy Utility 4). In addition, when Solar firm 3 exited the network after focusing their individual business model on pure solar wholesales, Solar firm 2 had to recruit new actors and learn new skills to fill their role. The exit damaged the close and long-term relationship between Solar Firm 2 and Solar Firm 3 to the point where they stopped doing business with each other.

4.3 Interactions

In all networked business models, actors relied on their established supply chains to reduce uncertainties and enable smooth interactions. "We had a relationship from before, so communication and how to follow up the project was already in place" (project manager, Consulting Firm). However, actors also had to involve new actors to access necessary resources and acquire new knowledge. "I am happy that we brought in a full-

time project manager to do this project. That is how we learn" (CEO, Solar Firm 2). Notably, networks where solar firms had limited knowledge of solar PV parks (e.g. Case B) consisted of more actors compared to cases where solar firms had previous experience (e.g. Case C).

The networks in all cases evolved over time, where new actors entered as the projects progressed since different project phases required different actor participation. Actors' engagement in the networks also varied, where actors whose individual business models were closely connected to the networked business models (e.g. solar firms) were more engaged in establishing and managing the network. "We tried to follow all the streams and project manage them even if they were not our own resources" (head of sales and marketing, Solar Firm 1). Other actors (e.g. landowners) were more passive. Grid owners in Case B and C showed limited interest in contributing to the network but were legally obliged to

Table 4 Actors' roles, individual business models and links to the networked business models

Actor	Network role(s)	Individual business model	Link between the networked- and individual business model
Case A			
Solar firm 1	- Developer - Contractor (O&M)	<i>Solar PPA provision</i> : sell solar electricity through PPA setups by developing, building and operating large solar PV systems	<i>Reinforce</i> : PPA-based solar PV parks was at the core of the firm's business model
Energy utility 1	- Landowner - Park owner - Grid owner - Electricity retailer	<i>Municipal energy utility</i> : develop, build and operate large, centralized power plants to generate and deliver energy to end consumers	<i>Expand</i> : the networked business model enabled adding solar electricity to the portfolio
Asset management firm	- Park owner	<i>Infrastructure investment</i> : manage pooled client funds by providing financing to build, purchase or upgrade infrastructure assets	<i>Reinforce</i> : PPA-based solar PV parks represented an attractive infrastructure investment
Bank	- Offtaker	<i>Banking</i> : provide financial services to businesses and private consumers	<i>Reinforce</i> : securing solar electricity was seen to build credibility as a sustainable bank
Renewable energy firm	- Contractor (EPC)	<i>Renewable energy construction</i> : build and operate large, centralized power plants based on renewables	<i>Expand</i> : the firm started to develop solar PV parks and offer PPA setups after participating in the network
Case B			
Solar firm 2	- Developer - Contractor	<i>Solar turnkey provision</i> : develop and build turnkey solar PV systems	<i>Expand</i> : the networked business model enabled them to start developing and building solar PV parks in-house
Solar firm 3	- Developer (park design)	<i>Service-based solar wholesales</i> : sell solar PV components and installation services to retailers and developers	<i>Focus</i> : the firm exited the network after changing to a pure solar wholesales business model
Municipality	- Landowner	<i>Municipal development</i> : promote economic and social development of the local community	<i>Reinforce</i> : participating in the network was a way to support local business and municipal development
Consulting firm	- Contractor (project management)	<i>Energy consultancy</i> : provide professional customers with expertise and services relating to the energy industry	<i>Reinforce</i> : the networked business model led to a closer collaboration with their existing customer Solar firm 2
Real estate firm	- Park owner - Offtaker	<i>Real estate</i> : Develop and own rental residential and social infrastructure properties	<i>Reinforce</i> : owning a solar PV park was a way to secure sustainable electricity in a familiar way (owning properties)
Energy utility 2	- Grid owner	<i>Municipal energy utility</i> : develop, build and operate large, centralized power plants to generate and deliver energy to end consumers	<i>Reinforce</i> : as the area grid owner, the firm was obliged to assist with connecting the solar PV park
Energy utility 3	- Electricity retailer	<i>Municipal energy utility</i> : develop, build and operate large, centralized power plants to generate and deliver energy to end consumers	<i>Reinforce</i> : joining the network enabled them to keep the real estate firm as a customer
Case C			
Solar firm 4	- Developer - Contractor - Park owner	<i>Diversified solar PV provision</i> : develop and build both small and large turnkey solar PV systems. Also operate large solar PV systems	<i>Reinforce</i> : PPA-based solar PV parks represented one branch of the firm's individual business model
Amusement park	- Offtaker	<i>Park amusement</i> : offer stationary recreational attractions for visitors	<i>Reinforce</i> : solar electricity supported their business and sustainability profile
Energy utility 4	- Electricity retailer	<i>Municipal energy utility</i> : develop, build and operate large, centralized power plants to generate and deliver energy to end consumers	<i>Reinforce</i> : joining the network enabled them to keep the amusement park as a customer
Energy utility 5	- Grid owner	<i>Multinational energy utility</i> : develop, build and operate large, centralized power plants to generate and deliver energy to end consumers	<i>Reinforce</i> : as the area grid owner, the firm was obliged to assist with connecting the solar PV park
Farmer	- Landowner	<i>Agriculture</i> : produce crops and livestock	<i>Reinforce</i> : the networked business model represented a way to utilize existing resources and contribute to sustainability

Source: Authors' own work

participate as the sole grid provider. "They will only look at the type of information that we are asking about. If we ask about finding some kind of optimum, we must work very hard with the grid owner to get that answer" (utility business developer,

Solar Firm 4). However, this was not an issue in Case A where Energy Utility 1 had additional roles and incentives to engage in the network. Finally, actors in all three cases combined transactional and relational governance in the networks, where

formal contracts were used primarily to specify responsibilities, both between actors and within the same organization.

5. Discussion

Our key concepts are presented in [Figure 2](#) in the form of a framework that reveals how networked business model drivers, challenges and interactions are influenced by the nascent market for sustainable innovation and actors' individual business models.

5.1 Nascent market influence on networked business models

Actors displayed multifarious incentives for participating in the networked business model, including transactional, relational, environmental and social drivers. Hence, our study confirms previous studies demonstrating actors' motivations for participating in sustainability-based networks varies ([Vanpoucke et al., 2016](#)). Actors do not join networked business models based on one motive, instead, actors seem to be influenced by cumulative benefits. Due to the nascent market, actors were uncertain about outcomes from the project, limiting the transactional drivers as economic gains were uncertain, which pushed actors to explore relational, environmental and social drivers. Thus, we propose:

P1. The context of a nascent market for sustainable innovation increases transactional uncertainty, thereby increasing relational, environmental and social drivers for participating in networked business models.

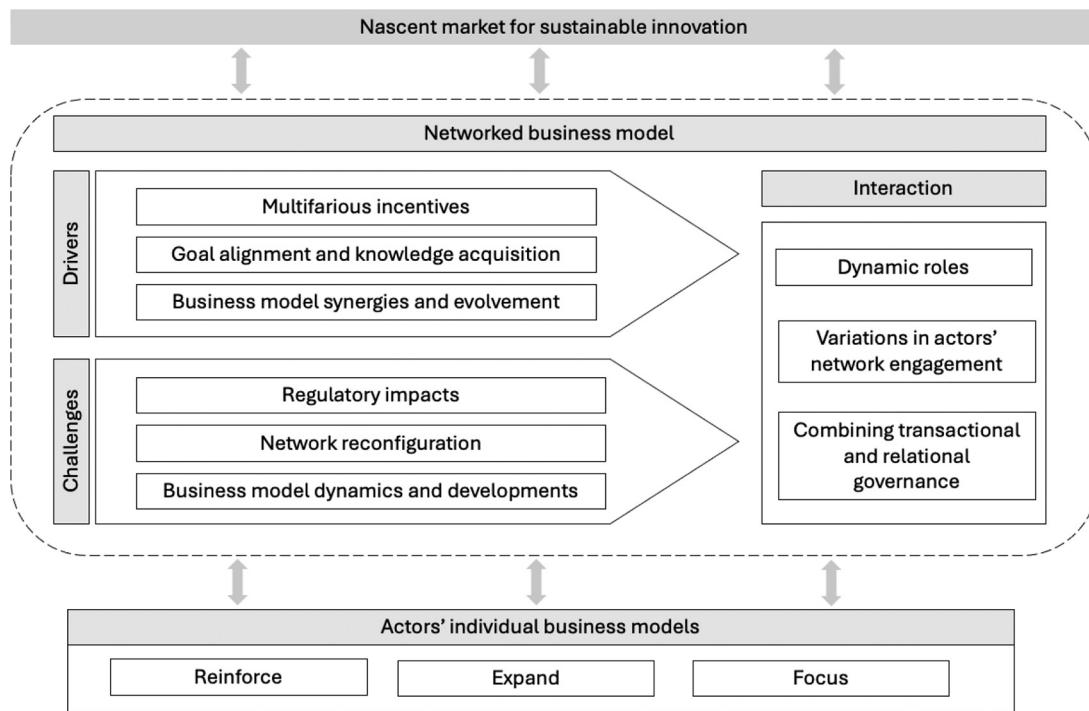
Due to the nature of being a nascent market, regulations were not yet fully developed which created uncertainties regarding actors' roles and their network position. Actors tried to overcome these uncertainties by increasing interaction and building relationships ([Ford et al., 2011](#)). However, our study provides additional examples of how interactions in public-

private partnerships may be hindered due to regulations ([Runfola et al., 2021](#); [Waluszewski and Wagrell, 2013](#)), in an empirically new context, the highly regulated nascent market for sustainable innovation. Additional complexity resulted from the need to follow regulations on three different public levels, which between them had limited interactions. Due to the complexity in regulations and the uncertainty of the nascent market, supply chain actors needed to learn alongside regulatory bodies. Through a broad collaboration between actors, the network was able to spread risk between actors and influence the development of regulations on the nascent market. We propose:

P2. Networked business models enable actors to mitigate the increased risk associated with underdeveloped regulations that characterize a nascent market for sustainable innovation.

The nature of the nascent market and limited prior knowledge motivated actors to share and create knowledge in the network. Our findings extend previous research on how network actors learn from each other ([Altunay and Bergek, 2023](#)), demonstrating the dynamics of the networked business model as well as actors' individual business models on a nascent market. The growth of the nascent market encourages actors to join networked business models to acquire knowledge that enable them to expand their individual business models and take a larger market share. While this behavior contributes to increased diffusion of the sustainable innovation by enabling commercialization among more actors, it may also make actors reluctant to join the network in the first place, due to fear of knowledge spillover to potential competitors. Actors can avoid knowledge spillover by limiting interactions and preventing suppliers from forming supplier-supplier relationships ([Patrucco et al., 2022](#)). However, in a nascent market where individual actors have limited knowledge and resources,

Figure 2 Framework of networked business models on a nascent market for sustainable innovation



Source: Author's own work

interactions are necessary to ensure the success of the networked business model. Hence, actors need to address the possibility of opportunistic behaviors and current partners becoming future competitors. It is, therefore, important to maintain a balance between interaction and knowledge sharing in the network, e.g. by varying the closeness between different types of actors (Huang *et al.*, 2020). Our findings show how actors limited their network interaction to preserve existing partnerships, but also how network actors became competitors after expanding their individual business models due to knowledge gained in the network. Hence, business relationships evolved as network positions changed (Altunay and Bergek, 2023). We propose:

P3. The context of a nascent market for sustainable innovation is characterized by knowledge gaps, which increases the need for knowledge sharing in networked business models, which in turn enable actors to expand their individual business models, thereby becoming competitors to network partners.

The context of the nascent market, limited knowledge and multiactor networks with both public and private actors required coordination, knowledge sharing, motivation to engage actors in the network and ensure execution of the project. Actors' engagement in the network varies (McGrath and O'Toole, 2021), as actors search and find their role in the network. In line with e.g. Palo and Tähtinen (2011), our findings illustrate the dynamic character of networked business models where actors and their roles change as the network evolves over time. While networks constantly evolve as actors exit and enter the network (Håkansson and Snehota, 2017), the emergent nature of the market in our study and a scarcity of potential actors to join the network made actors inclined to expand their individual business models to take on additional roles beyond their business strategy. We propose:

P4. On a nascent market for sustainable innovation where few potential actors are available to join the network, actors increasingly take on roles beyond their business strategy, thereby expanding their individual business model.

Our findings point to the importance of a focal actor to coordinate and engage actors, supporting previous studies (Palo and Tähtinen, 2013). While the nascent market made actors seek out familiar and local supply chain actors to facilitate interaction and reduce uncertainty, new actors were needed to complement the network with resources and knowledge. The scarcity of potential network actors and uncertainty of the nascent market increased the need for resource control and adaptability to changes. As such, governance proved to be important and complex, combining transactional and relational mechanisms to govern the network. Having a key resource did not necessitate a close relationship or much interaction if that resource could be controlled through a formal contract. Hence, our study supports other supply chain studies on the duality and complexity of governance issues (Agndal *et al.*, 2023). We propose:

P5. When key resources can be controlled through contracts, the need for interaction decreases, thereby creating arm's length relationships in networked business models on a nascent market for sustainable innovation.

P6. The context of a nascent market for sustainable innovation is characterized by high levels of uncertainty and few potential actors, which increases the need for adapting to changes and controlling critical resources, thereby resulting in the need for combining transactional and relational governance in networked business models.

5.2 Individual business model influence on networked business models

Our study shows that actors focused, reinforced or expanded their individual business activities in relation to the networked

business model. In line with Jocevski *et al.* (2020), conflicts arose when a change in focus of an individual business model made it misaligned with the networked business model, resulting in the actor exiting the network and thereby damaging their long-term relationship with an established supply chain partner. In this case, network reconfiguration was used to resolve conflicts, thus, nuancing the assumption of long-term supply chain collaborations (Håkansson *et al.*, 2009; Håkansson and Snehota, 1995) and supporting the need for supply chain actors to reach beyond on-going relationships and established networks (Solaimani and van der Veen, 2021). Our study shows that the exit of actors can have a positive effect, forcing actors to expand their network and take on new roles that may result in becoming more competitive on the nascent market. We propose:

P7. Actors that focus their individual business models outside the scope of the networked business models on a nascent market for sustainable innovation are more likely to exit the network, which increases the risk of damaging their long-term relationships with network partners.

The networked business models aligned with some actors' own goals, making participation in a side business reinforce the actors' core business. Our study supports previous studies on the importance of goal alignment in the supply chain (Khan *et al.*, 2012; Pero *et al.*, 2010) and emphasize business model synergies as a principal driver for participating in networked business models on a nascent market for sustainable innovation. Actors that joined networked business models without a clear connection to their core business, instead focused on the ability to acquire knowledge and expand the activities of their individual business models. Actors focused on establishing and strengthening relationships in the network with key actors to acquire knowledge, as suggested by IMP scholars (Håkansson and Snehota, 2017; Snehota and Håkansson, 1995). Notably, actors wanting to expand their individual business models were also more engaged and took on more roles in the network. As such, our findings emphasize the importance of networked business models for building competence on nascent markets for sustainable innovations, where the networked business model provides a space for modifying the individual business model. Hence, we propose:

P8. Actors that join networked business models on a nascent market for sustainable innovation to reinforce their individual business models are more likely driven by goal alignment and business model synergies.

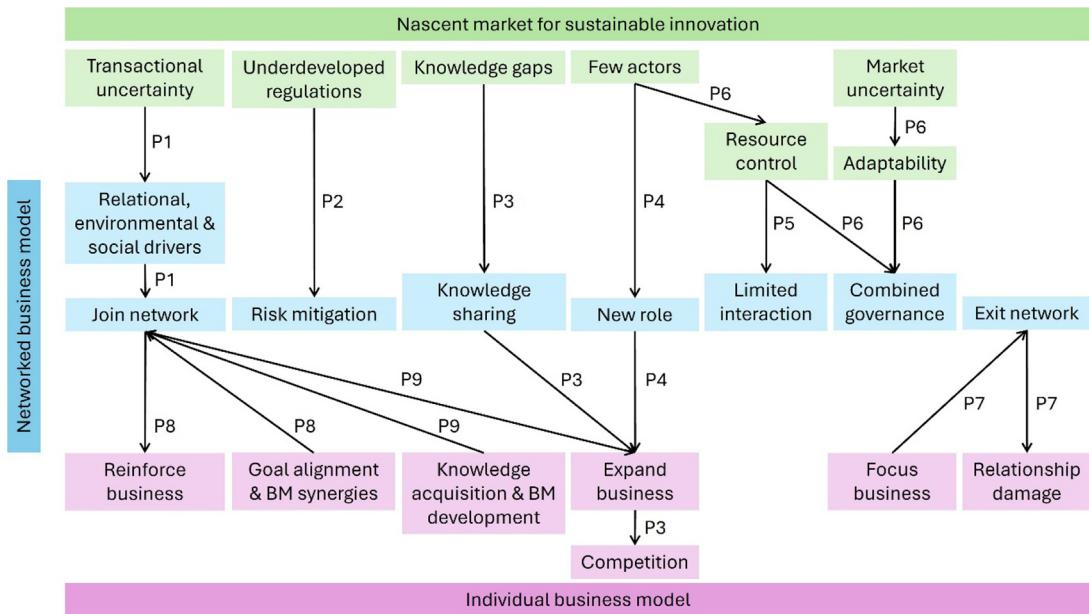
P9. Actors that join networked business models on a nascent market for sustainable innovation to expand their individual business models are more likely driven by knowledge acquisition and business model development.

Figure 3 illustrates the propositions and the relationships between key concepts. P1, P8–P9 focus on drivers, P2–P3, P7 relate to challenges while P4–P6 deals with interaction.

6. Conclusions

The study provides evidence from multiple actors in networks, offering unique insight into the complexity of interactions in networked business models on a nascent market for sustainable innovation, which is characterized by unclear roles and regulatory uncertainties. The study provides implications for supply chain management theory and practice by exploring networked business models on a nascent market. In addition, the paper contributes to IMP literature on networked business

Figure 3 Visualization of propositions: networked and individual business models on a nascent market for sustainable innovation



Source: Author's own work

models (Bankvall *et al.*, 2017; Lind and Melander, 2021) by analyzing the implications of actors joining a networked business model in relation to their individual business models.

6.1 Theoretical contributions

This paper provides several different multiactor business models and classifies them into specific- and general applications. Networked business models (Bankvall *et al.*, 2017) and ecosystem business models (Lindgren, 2016) can be applied to a wide range of applications and is not limited to a specific resource or innovation strategy. In contrast, industrial symbiosis business model (Fraccascia *et al.*, 2019) applies waste as a resource, digital platform business models (Kretschmer *et al.*, 2022) is applied to sharing of resources while open business models (Chesbrough, 2006) apply external knowledge as a resource.

The study reveals multifarious incentives, including transactional, relational, environmental and social drivers, for participating in a networked business model on a nascent market. Due to transactional uncertainty, actors increasingly rely on relational, environmental and social drivers for participating in networked business models. This study contributes to previous supply chain collaboration studies, highlighting the complexity of actors and their drivers for collaborating in these networks (Huang *et al.*, 2020; Oyedijo *et al.*, 2022; Vanpoucke *et al.*, 2016). The nascent market with underdeveloped regulations in combination with regulated public-private interaction resulted in complexities and uncertainties for the networked business model. However, actors were able to mitigate regulatory risk by sharing it within the network. The constellation of the network enabled actors to influence the development of regulations (Melander and Lind, 2022) for the sustainable innovation on a local and regional level. Our study shows that on a nascent market for sustainable innovation, which is characterized by few actors and high levels

of uncertainty, there is an increased need to control critical resources while also being able to adapt to changes. Hence, actors combine transactional and relational governance in networked business models. In contrast, our results show that when key resources can be controlled through contracts, actors limit their interactions and create arm's length relationships.

While our study investigates the dynamics and developments of the networked business model, it also shows the duplicity of the nascent market for sustainable innovation. On one hand, on a nascent market for sustainable innovation where few potential actors are available to join the network, actors increasingly take on roles beyond their business strategy, thereby expanding their individual business model. On the other hand, as actors interact and share knowledge in the network, an environment for opportunism emerges where actors expand their individual business models and become competitors with network partners. To mitigate such risks, supply chain actors limit knowledge spillover by avoiding direct interaction and being cautious with their choice of suppliers. While there are many studies on buyer-supplier knowledge spillover and opportunism (Patrucco *et al.*, 2022; Yan and Kull, 2015; Zeng *et al.*, 2017), our study contributes to the research on interorganizational knowledge spillover from a network perspective (Ried *et al.*, 2021), where there is less research. Our study shows that actors who join networked business models to reinforce their individual business models are driven by goal alignment and business model synergies. Actors who wish to focus their individual business model may end up exiting the network business model. Our study shows that such exit risks damaging long-term partnerships with actors in the network.

6.2 Managerial and policy implications

The paper contributes to practice by presenting drivers and challenges for supply chain actors to participate in networked

business models on nascent markets. Managers should consider multifarious drivers for participating, where the economic driver may be least motivating, as relational, environmental and social drivers are more motivating. Managers need to understand the dynamic nature of these networked business models, which implies that actor collaborations may change as the market matures and actors build competence. The nature of the nascent market may hinder supply chain collaboration, where division of roles and responsibilities become unclear due to regulatory uncertainties. Supply chain managers need to consider the dynamics and evolution of the network, as well as managing the tension of sharing sufficient knowledge for development while avoiding knowledge spillover to potential future competitors. As the nascent market grows, supply chain collaborators may develop their own business models and become competitors. Thus, managers need to handle the contrasting governance mechanisms of contracts and interaction, combining the two to create a dynamic networked business model.

The paper contributes to policymakers by showing that rapid systemic change toward more sustainable energy systems through large-scale solar PV deployment involves local public actors as well as local private actors that are new to the industry. Policymakers can make it easier for such actors to collaborate in networked business models by clarifying regulations at local, regional, national and EU levels.

6.3 Limitations and future research

This study has some limitations. While empirical cases include several actors in the network, we were not able to interview all the different actors. Case C is limited to interviewing two actors, due to the other actors declining to participate in our study. However, we have aimed to collect additional data in the form of reports and news articles to gain a better understanding of the network. Future studies could take a longitudinal approach to follow the development over time of actors' roles in the networked business model and actors' modification of individual business models. It would also be interesting to study how the market for solar PV parks develops as additional resources such as battery storages connected to the parks grows in importance, and the request from the public for renewable energy grows.

Notes

- 1 All interviews with one exception were carried out digitally.
- 2 When different departments of the same organization enters into such agreement it is called an internal PPA.
- 3 The contractor role was sometimes divided based on engineering, procurement and construction (EPC) and operations and maintenance (O&M) of the solar PV park.

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