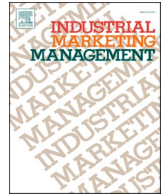


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Research paper

Adapting to sustainability: Reorchestrating collective eco-innovation in project-based shipbuilding networks[☆]

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ABSTRACT

Adapting a business network to mitigate climate change builds on the collective creation of eco-innovations. This qualitative case study explores the reorchestration of an established supplier network toward an eco-innovation net in the project-based shipbuilding industry. Focusing on the network's orchestration adaptation needs and challenges, we identify reorchestration mechanisms and their respective orientation dimensions, and unveil the multifaceted challenges confronted by a network actor attempting to reorchestrate its surrounding network for collective eco-innovation. This study contributes to the literature on network orchestration by revealing the complexity of steering an existing project-based business network to collectively advance its environmental sustainability. It also offers empirical insights into the generation of strategic nets for collective innovation. Moreover, it identifies avenues for future research on reorchestrating eco-innovation in project-based industry networks and offers managerial recommendations for actors attempting to adapt their interactions and others' for sustainability advancement.

1. Introduction

The meteoric rise in public debate on climate change, resource depletion, and biodiversity loss has made it imperative for organizations to collectively transition toward sustainability. This implies various changes in business-to-business markets, ranging from changes in the business environment, such as regulatory frameworks and customer demand, to strategizing in terms of business models, branding and procurement (Sharma, 2020; Voola et al., 2022). These changes require various adaptations from businesses and their networks. Mutual adaptations are at the core of business network interactions (Håkansson & Snehota, 1995), as are adaptations to the dynamic environment (Joshi & Campbell, 2003). Understanding the processes by which business networks adapt to growing environmental pressures and collaborate to attain sustainability in their strategies and operations are of growing interest given the rapidity of the expected change as well as the multitude of challenges its implementation entails (Sharma, 2020; Voola et al., 2022). Much of this rests with the challenges of integrating

environmental sustainability into product and process innovation (Bossle et al., 2016), a process resulting in eco-innovation.¹

Innovation is generated from interfirm interactions and collaborative processes within business networks (Aarikka-Stenroos et al., 2017; Dhanasai & Parkhe, 2006; Hakansson, 1987; Hurmelinna-Laukkanen & Nätti, 2018; Reypens et al., 2016). Several recent studies have highlighted the growing importance and impact of eco-innovation on business-to-business relationships (Pattinson et al., 2023). Eco-innovation networks are interorganizational collaborations of multiple actors with the objective of developing eco-innovations and improving their environmental performance (Melander & Arvidsson, 2022). However, financial resource constraints, skills deficits, and incompatibilities with existing processes undermine interorganizational engagement in cocreating complex eco-innovations (Del Río et al., 2010). Temporal, task-oriented project settings distinct from permanent organizational forms present further challenges for some networks (Brady & Davies, 2014; Hobday, 2000; Lundin & Soderholm, 1995).

Network orchestration is key to overcoming such collaboration

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¹ Eco-innovation has been used interchangeably with other terms, including "green," "environmental," and even generally "sustainable", to describe innovations that have a reduced negative impact on the environment (cf. Díaz-García et al., 2015; He et al., 2018; Hojnik & Ruzzier, 2016; Pattinson et al., 2023; Pichlak & Szromek, 2021; Schiederig et al., 2012).

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challenges in innovation networks (Hurmelinna-Laukkanen et al., 2022). The processes by which individual actors attempt to orchestrate their networks have gained increasing research interest (Hurmelinna-Laukkanen et al., 2022; Hurmelinna-Laukkanen & Nätti, 2018; Möller & Halinen, 2017; Schilling & Phelps, 2007). Prior research suggests that network orchestration can take place via different mechanisms for goal development, collaboration enhancement, resource exchange, and identity building (Schepis et al., 2021). However, research on how orchestration processes are adapted to changes in the business environment remains scarce (Guercini et al., 2024; Hurmelinna-Laukkanen et al., 2022). In particular, it remains largely unknown how individual actors attempt to orchestrate their established, multifaceted supplier networks to deliver eco-innovations (Crespin-Mazet et al., 2019). Such reorchestration implies changing orchestration mechanisms to initiate the transformation of a traditional business network toward an innovation network.

Shipbuilding is an interesting, traditional industry delivering highly complex products through broad supplier network contributions. In recent years, a number of European policy developments, such as the European Green Deal (Claeys et al., 2019) and the Corporate Sustainability Reporting Directive (Hummel & Jobst, 2022), have placed European shipbuilding networks under increased pressure to adapt their operations, products, and services to become more sustainable. Moreover, global competition has pushed cruise shipbuilders and their supplier networks to enhance their cost-efficiencies, and respond to cruise passengers' demand for increasingly unique yet sustainably created experiences. Meeting these demands collectively is challenging in the project-based industry context.

This study explores the complexity of initiating the reorchestration of a traditional business network toward eco-innovation in the project-based shipbuilding industry. We seek to answer two research questions: First, how does an actor need to adapt its network orchestration mechanisms to generate collective eco-innovation in a project-based business network? Second, how is the adaptation challenging for this orchestrator? Adopting a qualitative case study approach, we examine a long-established European shipbuilding network wherein its hub company—the shipyard—decided to adapt to growing green demands by starting the development of a climate-neutral cruise ship concept, requiring the network-wide generation of eco-innovative solutions. Although an individual firm has no managerial influence over the actions of others in a business network, we hereafter term this company the network orchestrator owing to its continuous attempts to orchestrate the network to develop its offerings and expertise for eco-innovation.

This exploratory study advances the network orchestration literature by introducing the concept of network reorchestration—an actor adapting its orchestration mechanisms to steer the transformation of an established network toward a strategic net with a new development goal. It identifies the respective adaptation needs in the network orchestration mechanisms, highlights the orientation dimensions of these adaptations, and unveils the challenges experienced by the network orchestrator at the start of reorchestration. We propose that generating eco-innovation in a traditional project-based supplier network requires reorchestration through elaborating, enabling, engaging, and exploring activities, whereby the orchestration mechanisms are adapted to the collective sustainability objective in terms of value orientation, process orientation, and temporal orientation. This study contributes to the industrial marketing and purchasing (IMP) literature by offering empirical insights into the complex emergence of strategic nets and by showing how an individual company attempts to steer conventional supplier network interactions toward collective eco-innovation.

The remainder of this paper proceeds as follows: Section 2 presents a synopsis of the literature, leading to our analytical framework. Section 3 outlines our methodology, followed by the case findings in Section 4. In Section 5, we discuss the findings in the context of the extant literature. In Section 6, we synthesize the study with concluding remarks and

implications for managers and researchers.

2. Literature review

2.1. Eco-innovation in project-based business networks

2.1.1. Eco-innovation

Traditionally, environmental preservation and economic growth have been viewed as contradictory strategies (Porter & Linde, 1995). Likewise, business growth and innovation have been associated with a negative environmental impact (Bossle et al., 2016). However, today, business performance is increasingly dependent on whether a firm can develop environmentally friendly products (De Medeiros et al., 2014). Given the increasing consumer and regulatory pressures, firms are pushed to reduce their negative environmental impact (He et al., 2018; Hojnik & Ruzzier, 2016) by generating environmentally sustainable innovations, eco-innovations, which improve their environmental performance (Carrillo-Hermosilla et al., 2010). Eco-innovations refer to the development of products or services that have less negative environmental impacts than their current alternatives (Kemp & Pearson, 2007). Eco-innovations are deemed critical for the transition toward a more sustainable future (Del Río et al., 2015) and tend to result in a positive impact on firm performance, competitive advantage, and corporate image (Chistov et al., 2021; Díaz-García et al., 2015). However, developing eco-innovations can be considered more problematic than general, market-driven innovations; the latter are geared toward market success, whereas eco-innovations target market success together with reduced environmental impact (Bossle et al., 2016; Pattinson et al., 2023), solving possibly contradictory demands arising from market pull, regulatory push, and technology pull (Rennings, 2000).

Prior research has examined the drivers (Bossle et al., 2016; Díaz-García et al., 2015; Hojnik & Ruzzier, 2016) and determinants (De Medeiros et al., 2014; Del Río et al., 2016) of eco-innovation in firms. The macro-level drivers concern regional and policy factors and the micro-level drivers concern firm-specific strategies, resources, and capabilities, whereas the meso-level research has focused solely on industry characteristics and networks as a source of information and knowledge (Díaz-García et al., 2015). The extant research points to the importance of knowledge sharing and innovation across network actors as the most efficient way for firms to develop eco-innovations (Chistov et al., 2021; Ghisetti et al., 2015). Eco-innovation builds on sharing knowledge and developing new knowledge across interorganizational collaborations, although merging the requirements of many stakeholders increases the complexity of such processes (Pichlak & Szromek, 2021).

2.1.2. Collective innovation in networks

Critical knowledge is often sourced from an organization's external relationships (Björk & Magnusson, 2009). It has been firmly established in the IMP literature that business networks play a fundamental role in fostering organizational innovation (Håkansson et al., 2009). Complex interactions among actors, resources, and relationships in networks have advanced the technological innovations of industries (Håkansson, 1987; Roy et al., 2004). The cross-fertilization of complementary knowledge among multiple actors brings about an interdependence-driven adaptation as resources are adjusted, investments are made into relationships, activities are shared, and risk is diversified among parties (Hallén et al., 1991). However, firms engaging in collective innovation may struggle with the tension between strategically planned knowledge exchange and the sufficient protection of knowledge to avoid disclosure.

The industry dynamics, strategic orientation, and objectives of the innovation network shape how the network is designed and managed (Adner, 2017). IMP scholars (Möller et al., 2005; Möller & Halinen, 2018; Möller & Svahn, 2003) depart from the concept of macro industrial networks (Håkansson & Ford, 2002) by suggesting that some networks take the form of a “strategic net” that can be intentionally

developed for specific purposes, such as innovation (Möller et al., 2005; Möller & Halinen, 2017; Möller & Svahn, 2003; Möller & Svahn, 2006; Rubach et al., 2017). Strategic nets are developed by a group of network actors pursuing mutual goals with agreed roles and responsibilities (Möller & Halinen, 2017). Nets can be temporary for specific projects and led by a hub firm that uses its resources in the attempt to orchestrate the members' interactions to support and shape the project's collective objective (Möller et al., 2005). A key purpose is enabling strategically oriented resource sharing between actors, and because the actors' competitiveness is based upon their access to these resources, their participation in the net is about relinquishing part of their autonomy to achieve goals beyond their own resources (Möller & Halinen, 2017).

2.1.3. Innovation in project business

Networks in project-based business are characterized by loose couplings among members, allowing for fast, economical, and substantial local adaptations in individual firms without affecting the whole system. They also provide firms with greater independence, identity, and freedom (Dubois & Gadde, 2002). However, innovation outputs arising from projects are short-lived for the purposes of the project goals, and due to weak couplings, they rarely extend to wider industry implications (Bygballe & Ingemansson, 2014; Dubois & Gadde, 2002). Conversely, projects provide unique arenas for inventing new solutions and act as platforms for fostering an environment conducive to innovation and change (Brady & Davies, 2014; Hobday, 2000). The performance of eco-innovative projects, however, depends on the integration of suppliers and customers in the eco-innovation activities (Moreno-Mondéjar et al., 2020). As systemic changes require collective adaptations instead of local ones, driving and coordinating their emergence is challenging in loosely coupled settings with limited actor engagement (Dubois & Gadde, 2002).

In complex and unique projects with broad network involvement (Gurca et al., 2021), organizations in hub positions may play a key role in orchestrating the network toward a common goal (Roehrich et al., 2023). An actor may use orchestration mechanisms in an attempt to change temporary interfirm interactions to overcome knowledge-sharing and system-integration challenges. This leads us to a detailed discussion of network orchestration.

2.2. Orchestrating innovation networks

2.2.1. Network orchestration

Network orchestration refers to the process of driving an interorganizational network to achieve a collective goal (Paquin & Howard-Grenville, 2013). However, no firm can fully manage or control the development of the surrounding business network (Håkansson & Ford, 2002; Nordin et al., 2018). Thus, orchestration comprises activities such as coordination, mobilization, and motivation for the attempted influencing of other actors' actions. Following Hurmelinna-Laukkanen et al. (2022, p. 171), we define orchestration as purposeful actions undertaken by an actor to steer the construction of and collaboration in an innovation network. In line with the IMP view, we acknowledge that the leverage and impact of such orchestration activities is limited due to the interdependencies and evolving positions of network actors. Thus, a network orchestrator refers to an actor that employs orchestration mechanisms in an attempt to influence the other network members' actions through its interactions with them.

While the orchestration concept has been used in the context of strategic nets, scholars have recently adopted it in the examination of more organically emergent and borderless networks, also labeled ecosystems, sectors, and business fields (Aarikka-Stenroos et al., 2017; Aarikka-Stenroos & Ritala, 2017; Autio & Thomas, 2014; Hurmelinna-Laukkanen et al., 2022; Hurmelinna-Laukkanen & Nätti, 2018; Möller & Halinen, 2017; Müller-Seitz, 2012; Reypens et al., 2021). Thus, the polarization of views on whether networks can be managed or not is getting more varied through the identification of various ways of

influencing in networks; and in their variety, these influencing processes result in emerging network developments. In consolidating the streams and elements of network management research, Möller and Halinen (2017) outlined three configurations: influencing embryonic networks, orchestrating extensive networks, and managing strategic networks. While real configurations are not that distinct but constitute mixed profiles, orchestration in the middle is a flexible concept to describe the variety of governance activities employed in a dynamic business network. Instead of hierarchical management, orchestration is about influencing the interactions of network actors (Hurmelinna-Laukkanen et al., 2022), including legitimizing the network activities within peripheral actors (Aarikka-Stenroos et al., 2017). A single actor cannot control the surrounding emergent network (Håkansson & Ford, 2002) but orchestration activities can lead to individual and collective gains among specific network members, particularly in the long run (Paquin & Howard-Grenville, 2013).

The orchestration of innovation networks has gained increasing scholarly attention in recent years (Hara et al., 2015; Hurmelinna-Laukkanen et al., 2022; Hurmelinna-Laukkanen & Nätti, 2018; Möller & Halinen, 2017; Reypens et al., 2021; Schepis et al., 2021). Prior studies have explored different kinds of innovation orchestrators (Hurmelinna-Laukkanen & Nätti, 2018; Mitrega et al., 2012; Sabatier et al., 2010), orchestration in different types of innovation networks (Aarikka-Stenroos et al., 2017; Hurmelinna-Laukkanen et al., 2022), and different orchestration mechanisms (Nambisan & Sawhney, 2011; Reypens et al., 2016; Reypens et al., 2021; Schepis et al., 2021). We build on the recent work by Schepis et al. (2021), in which innovation orchestration mechanisms can be divided into four categories: The first, developing goals, includes mechanisms such as alignment, envisioning, agenda-setting framing, and agenda construction. The second, which focuses on connecting and collaborating, comprises co-development, coordination, mobilization, engagement, and activation. The third, involving and exchanging resources, includes mechanisms such as resource management, knowledge mobility management, resource framing, and resourcing. Finally, building actor identity and legitimization can be orchestrated through enthusing and empowering, compromising, and strengthening cocreation, for example. Network orchestrators implement these mechanisms to facilitate value creation and evaluate the outcomes to fine-tune the mechanisms to correspond with changing value demands (Schepis et al., 2021).

2.2.2. Adapting network orchestration

Orchestrators can be classified as profit- and competitiveness-driven player-orchestrators; noncompetitive facilitator-orchestrators pursuing collective goals; and sponsor-orchestrators, a mixture of the previous two (Hurmelinna-Laukkanen & Nätti, 2018). Orchestrators also have different profiles—a translative orchestration profile, transformative orchestration profile, and transcending orchestration profile—depending on the innovation network (Hurmelinna-Laukkanen et al., 2022). Orchestrators may also employ different roles based on the activities conducted by the orchestrator in its position (Hurmelinna-Laukkanen & Nätti, 2018) and build on a dominating or consensus-based mode of orchestration (Reypens et al., 2021).

These characteristics are not stable, but orchestrators may adapt them in the face of sudden disruptions or notable opportunities as networks evolve (Paquin & Howard-Grenville, 2013). The orchestrator's ability to make such changes depends on its role-switching and role-augmentation capabilities (Hurmelinna-Laukkanen & Nätti, 2018). Role switching refers to the orchestrator's ability to detect signs of developments that require changes in the orchestration, and to the ability to switch between roles or even create new ones accordingly, whereby the employed orchestration activities change. Role augmentation, in turn, concerns the orchestrator's ability to respond to more disruptive events. In such cases, the orchestrator faces a need to change not only the role but possibly also its type, including alterations in its own characteristics, position, or goals. Such changes in orchestration can be

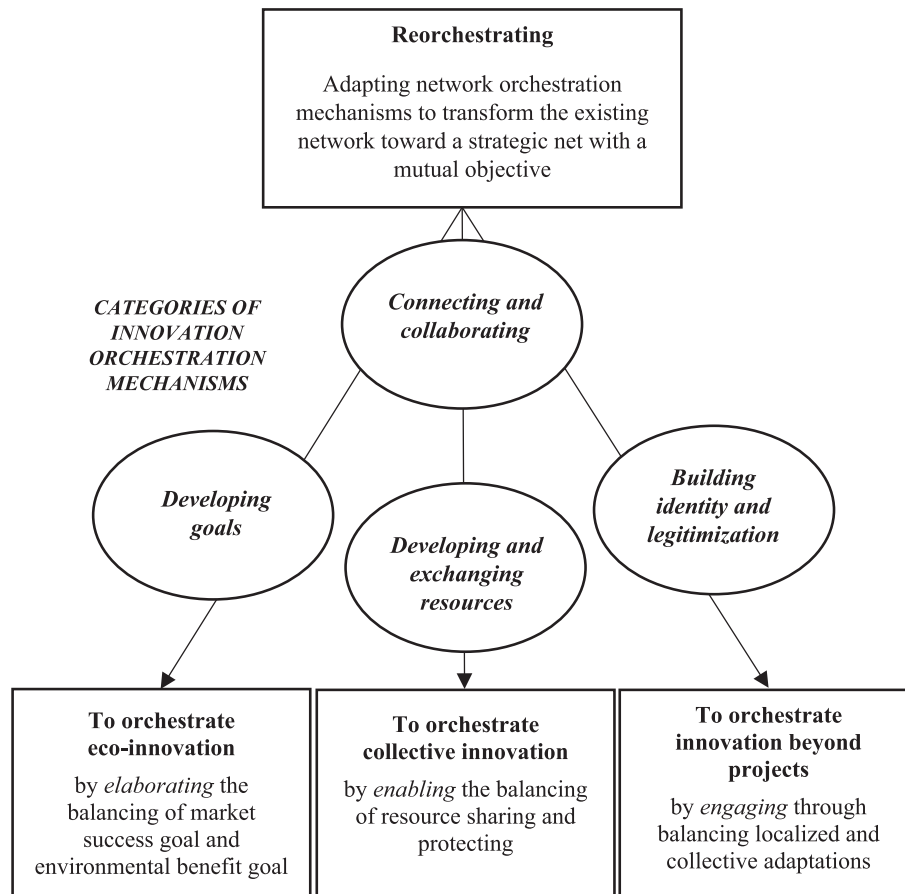


Fig. 1. Analytical framework.

risky yet also fruitful.

However, amid the transformative, systemic change for sustainability, we propose that turning an existing project-based network into a strategic net for collective eco-innovation requires reorchestration, whereby not only the orchestrator but also the whole network reconfigures itself to the new objective with suitable process changes and leaves behind unsuitable practices. Such adaptation is not about fine-tuning but about transforming an established network of business actors and interactions into a collective with mutual interests and goals. To understand what such reorchestration might entail in the context of sustainability advancement, we synthesize the above-discussed perspectives in Fig. 1, building on the four categories of innovation orchestration mechanisms developed by Schepis et al. (2021).

For an actor attempting to reorchestrate its network for collective eco-innovation in a project-based business, the adoption of all four categories of orchestration mechanisms is relevant. The first category is the connection and collaboration mechanisms, which sets the foundation for the employment of the rest; connection and collaboration are the prerequisites for the emergence of the other collective activities. The second category, goal development mechanisms, is highly relevant to orchestrating the creation of eco-innovation. This entails elaborating the practical meaning of the objective by balancing the existing market success goal and the emerging environmental benefit goal. The third category, resource development and exchange mechanisms, is key to orchestrating collective innovation. Here, the orchestration centers on enabling adequate data flows with balanced information-sharing and protecting for the joint generation of ideas, leading to the sharing of other resources. The employment of the fourth category, identity and legitimization-building mechanisms, is of particular relevance to orchestrating innovation beyond projects; through these mechanisms,

the orchestrator may support the long-term engagement of the other members as the network keeps evolving due to its project-based nature. This synthesis shows that reorchestrating network interactions for collective eco-innovation in a project-based business implies various adaptations in the orchestration mechanisms, which we explore next empirically.

3. Methodology

3.1. Case study research design

A qualitative case study approach is recommended for investigating dynamic business network settings with contextual and process elements (Gliga & Evers, 2023; Halinen & Törnroos, 2005) when prior insight into a phenomenon is modest (Ghuri & Grønhaug, 2005). We employ the case study approach to examine a phenomenon in its naturalistic context and examine theory in the empirical world (Piekkari et al., 2009). This case studies a network orchestrator, the shipyard, which is attempting to orchestrate eco-innovation in its existing supplier network to meet an ambitious objective—to develop a climate-neutral cruise ship concept. The authors gained access to this network through an R&D project in which the authors' university and the shipyard were partners; hence, the case selection was based on the availability of a unique and real-time case development. Three particular aspects differentiate the focal case from those studied in the prior literature on orchestrating innovation networks: (1) the network is not new but was established decades ago on the basis of supply and generally innovative contributions from partners, (2) the industry context is project-based and transient in membership without a specific motivational and contractual remit plan for co-innovation, and (3) innovation

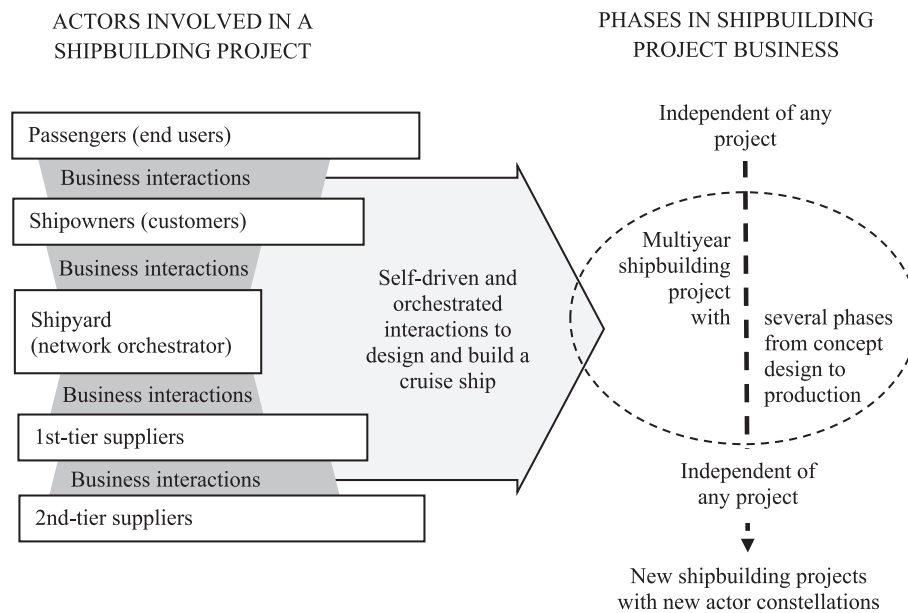


Fig. 2. Actors and their interactions in the project-based shipbuilding industry.

focuses specifically on eco-innovations (Dangelico & Pujari, 2010).

We conduct an embedded case study focusing on several subunits within a single case, and the units represent orchestration regarding the acceleration of eco-innovation at different levels: (1) the orchestration of eco-innovation at the network level and (2) the reactions to this at the managerial level (with the perspectives of key individuals within the orchestrator firm and the network firms as subcases). This allows us to understand the perceptions regarding the ongoing network orchestration at the managerial level and the overall developments regarding how the orchestration supports systemic sustainability advancement at the network level.

3.2. Data generation and analysis

The primary data generation took place in two steps: individual interviews (Appendix A) followed by a focus group interview (Appendix B). In total, 25 interviews were conducted between November 2021 and November 2022—12 within the shipyard and 13 within the supplier network. Hence, the study began around the same time that the shipyard publicly announced its objective of delivering the concept of a climate-neutral cruise ship within a 3-year timeframe, allowing us to see how the orchestration took place in the first year of the new agenda. To generate as comprehensive an understanding of the network orchestration developments as possible, the interviewees within the shipyard represent different sections of shipbuilding operations. Similarly, the supplier-side interviewees represent different kinds of suppliers currently involved in the shipyard's shipbuilding projects, varying in terms of product, size, age, and nationality. We approached potential interviewees directly, and the interviews were conducted in person or via Zoom and recorded with each interviewee's permission. To allow the managers to express their views openly, the interviews were conducted based on a semi-structured interview guide, focusing on the informants' experiences and current views of how interfirm interaction in the shipbuilding network functions in terms of innovation cocreation and how this is developed and should be in the future. The interviews were transcribed verbatim. Some secondary data, including news articles and author observations from virtual network meetings, were also used to follow the network developments and to take those into account during the interviews.

The data analysis began in May 2022 and ran concurrently with remaining interviews. Once all the interviews were completed in

November, the first round of data analysis was conducted to identify the emerging central themes. The focus group interview followed, conducted as a workshop for shipyard managers and allowing them to hear, reflect on, and react to the interview findings regarding sustainability advancement and its orchestration in the network. All the shipyard interviewees, and other relevant shipyard managers without whom the interviews would not have been possible, were invited to the workshop. Because the interviews were confidential, the participants were unaware of who had been interviewed in advance. The workshop session began with one author presenting the findings from the interview data and facilitating a detailed discussion comprising three parts: (1) understanding the challenges of advancing sustainability in this shipbuilding network, (2) brainstorming solutions to the identified challenges, and (3) discussing who should take responsibility for implementing the defined solutions—the orchestrator company itself, the suppliers in the network, or external actors. This 3.5-h face-to-face discussion was recorded with the consent of all participants and transcribed verbatim.

The data were organized using NVivo following the analytical framework (Fig. 1). The data were first coded under themes relevant to orchestration: (1) eco-innovation, (2) co-innovation and (3) innovation beyond projects, and (4) reorchestration challenges. Regarding the first research question, we coded the data chunks in the first three categories in more detail, allowing us to identify the orchestration mechanisms in use and their adaptation needs (Appendix C). While employing an exploratory research approach, we allowed these subcodes to emerge from the data (Miles & Huberman, 1994). For the second research question, we conducted a more detailed coding round for the data under the fourth coding theme: reorchestration challenges. This allowed us to identify the challenges of starting reorchestration at different levels: network orchestrator, supplier network, and business environment (Appendix D). Our interpretations of these challenges and the network orchestrator's perspective were member-checked (Creswell & Miller, 2000) and further elaborated during the focus group interview, which, in addition to the involvement of multiple researchers in the study, enhanced the validity of the research. In the focus group interview, the shipyard representatives were informed about the challenges and wishes identified in the individual interviews, and they were guided to jointly elaborate these and create solutions to adapt the orchestration mechanisms accordingly. We coded this rich discussion data similarly to the interviews; this provided us with detailed views on the roots of reorchestration challenges and allowed us to hear how the orchestrator

representatives themselves would like to see them solved, hence supporting the development of justified managerial recommendations.

4. Findings

4.1. Case study context

The case study examines a long-established European network of companies operating in the shipbuilding industry that specializes in the design and manufacturing of the world's largest luxury cruise shipping vessels. The hub of the network is a large shipyard, whose suppliers comprise marine equipment manufacturers, turnkey suppliers in interior outfitting, design offices, and various system and material suppliers. These total hundreds of supplier firms at different tiers, including some 30 turnkey suppliers.

The shipbuilding industry is project based, meaning that the suppliers involved vary through tendering ship by ship. For each ship project, the shipyard subcontracts about 80 % of the work to the supplier network. The shipyard designs the new-build concepts with its customers; initiates the bidding process within the network for each ship project; coordinates the manufacturing, assembly, and budgetary processes; and is accountable for the quality of the final ship product and costs. Fig. 2 presents a simplified depiction of the position of the shipyard as the network orchestrator between the customers and suppliers across consecutive shipbuilding projects.

The majority of suppliers are small and medium-sized enterprises that compete for new projects. Their resources for innovation activities outside of individual shipbuilding projects are often limited. However, it is in the interest of the shipyard that the whole network enhances its expertise and engages in product development independent of any project so that the network can deliver increasingly competitive offerings in the future. However, competing shipyards may purchase products and services from the same suppliers, and the suppliers vary to some extent from project to project, making it highly challenging to steer innovation in such a dynamic network. Typically, the expertise and product development is gradual and rests on learning and ideas accumulated from completed shipbuilding projects. R&D activities are also sometimes conducted by the suppliers individually or in collaboration with the shipyard to solve specific challenges.

In 2022, the shipyard announced a new objective for itself and its supplier network—the development of a climate-neutral cruise ship concept within a 3-year timeframe. Despite not having a predefined customer for it, accomplishing this initiative would strengthen the network's global-forerunner image and generate a state-of-the-art product for future business. The shipyard also received a significant amount of public funding through a specific R&D program to support the related innovation activities within the supplier network and research institutions. We sought to explore the complexity of starting the reorchestration of this network during the first year of this new initiative. Drawing upon our analytical framework (Fig. 1), we present our key findings below.

4.2. Elaborating: orchestrating eco-innovation through goal development

The findings indicate that the shipyard struggled with goal setting both from the economic and environmental perspective. The supplier interviewees reported that to engage in such development activities, there should be a foreseeable business opportunity, or at least a business advantage. For many equipment suppliers, increasingly efficient solutions generate clear customer value by measurable energy savings or waste reduction, but for interior suppliers, the situation was more challenging—materials developed for purely ecological performance tend to come with higher costs than their current alternatives but do not generate direct market value to the customers. Therefore, shipowners were not willing to pay extra for such alternatives. However, with scarce resources, suppliers looked for a perspective on how the R&D efforts

would pay off, particularly amid increasing global competition and inflation.

Regarding the environmental side, the interviews among the suppliers and at the shipyard showed the versatility of views regarding what sustainability is, varying from overall product carbon footprint reduction to enhanced durability, recyclability, material transportation optimization, and waste reduction. Although all interviewees were aware of the shipyard's new climate-neutral ship initiative, views were highly heterogeneous as to what that entails and how they would implement this in practice. Without any specification about what the climate-neutral ship would be like, many suppliers saw a high risk of investing in innovating something that did not eventually fit the complex product, future customer needs, or regulatory demands. Supplier representatives expected to receive some guidelines from the shipyard to this seemingly specific yet practically ambiguous development objective and felt that such steering was missing.

Shipyard managers also had varying views of what sustainability means. This challenged the shipyard's potential and largely presumed role as the orchestrator of collective eco-innovation. Some shipyard interviewees expressed that the focus should be on energy because the majority of the cruise vessel carbon footprint results from energy and fuel consumption. Others desired a more comprehensive sustainability plan to strengthen the shipyard's aim to brand itself as a leader in green vessel production. Some interviewees referred to the Corporate Sustainability Reporting Directive on the carbon footprint of the wider supply chain and further emphasized that the sustainability of the interior turnkey suppliers should be advanced. However, the interviewees said that even under this regulation, how carbon measurement should take place and how other aspects of ecological sustainability should be incorporated remained ambiguous and undefined. Even with the objective of a climate-neutral cruise ship concept, it remained unclear what kind of eco-innovations should be generated. Moreover, some shipyard managers focused only on their everyday operations, whereas others found room to consider future-oriented development objectives. Interviewees stated that while cruise shipbuilding is about generating continuous improvements in lifecycle investment efficiency and passenger entertainment experiences, adding environmental consideration as the third priority element only increases complexity and contradictions in their work.

Hence, if clarification and incentivization were required within the shipyard, it is understandable that the same needs emerged in the supplier network. The specification of the targeted eco-innovation was not coordinated but was left to the network members themselves, whereby the specific-sounding objective seemed obscure to individual firms and challenging for them to monetize given the difficulty of turning it into customer value. Thus, the supplier network called for reorchestration in terms of how to extend its orientation from market value-based innovation toward environmental value innovation.

4.3. Enabling: orchestrating co-innovation by enabling resource exchange

A significant factor impeding the start of collective eco-innovation was the lack of information-sharing. This led to information asymmetries and limited idea-sharing between the shipyard and the supplier network. The sharing of information related to feedback from executed new-build projects, and ideas for innovations were largely based on sporadic one-on-one discussions and personal relationships. Although official documentation on project communication protocols already existed, it was ineffective for this kind of broader initiative. All interviewees saw that formalized information-sharing processes would serve all in improving products and production for the future and generating customer value. Although a few shipyard interviewees thought they already knew well enough what the suppliers could offer, most of them and most of the suppliers felt that communication channels were inadequate.

The shipyard organized regular info-seminars for the network, but

suppliers felt that the virtually organized events were mostly information “downloads” regarding ongoing projects instead of platforms for information and resource sharing. To support the new initiative, the shipyard also introduced weekly R&D-related virtual meetings for idea sharing. However, while some found these informative, supplier involvement was often limited to specific representatives interested in taking part in these development sessions. Accordingly, the large R&D initiative offered innovation funding for the network members, but mainly only the pioneers experienced in such public project work were able to and interested in benefiting from it. The suppliers also saw that the ship project tendering processes did not support future-oriented vertical or horizontal sharing of knowledge or resources.

Most shipyard interviewees welcomed suppliers to present ideas more actively so that they would be better informed about what is under development and what kind of resource needs there are in the network. At times they were not well aware of the sustainability developments taking place even in their own organization. For instance, some were involved in sustainable material development, while others did not consider such activities worthwhile. The shipyard interviewees voiced that the process of pursuing new ideas in a multinational organization was sometimes slow and winding, occasionally undermining the shipyard’s ability to pursue its self-defined goals.

Overall, these findings show that orchestrating an established network toward an innovation net entails adaptations in the orchestrator’s internal operations and in its use of external orchestration mechanisms. Thereby the focus of process development can be reoriented from product functioning and production to wider ship lifecycle optimization, building upon increased sharing of information and other resources.

4.4. *Engaging: orchestrating beyond projects by building identity and legitimization*

The collective objective of developing a climate-neutral cruise ship concept had been communicated to the interviewed suppliers at different association seminars and turnkey interior supplier meetings, but the concrete steps and frameworks for reaching the ambitious objective together remained ambiguous to them during the first year of the new initiative. For instance, the related sustainability R&D program with funding for eco-innovation was not considered easily accessible to all, and the suppliers sometimes found it challenging to identify and reach the right counterparts at the shipyard to present and discuss their development ideas. In contrast to the intended objective, this program did not generate a sense of belongingness or empower all network actors to join the innovation efforts. Moreover, increasing the sheer availability of financial resources for co-innovation did not provide strong support for the network actors’ consideration of a common identity or engagement in pursuing a legitimate, shared goal. All the interviewed suppliers called for further leadership from the shipyard, such as showing examples of how to put active effort into sustainability development in collaborative R&D projects outside current shipbuilding projects. The suppliers expected indications of specific development directions regarding sustainability and signals of how these development efforts would be rewarded. Such expectations emerging in the supplier and shipyard interviews included setting the minimum environmental requirements for applicable suppliers or ranking suppliers based on certain environmental performance criteria, indicating that there were concerns of possible disqualification from the network in the future. The suppliers would have appreciated targeted, cocreative discussions on such measurements and joint innovation projects yet acknowledged that the shipyard might find it troublesome to define these issues independently, as this should be done in collaboration with its paying customers.

The shipyard representatives, in turn, felt that they should have control over the customer relationship with the shipowner customers and did not want suppliers to develop close, direct relationships with them. However, engine and system suppliers were quite active in

communicating directly with shipowners, as their products constitute a central part of the ship’s concept design. Turnkey interior suppliers would also have preferred to showcase their innovative ideas to the customer for feedback, but this was not encouraged by the shipyard owing to future tendering processes. However, in the absence of clear, common incentives, there were still active innovators among both equipment and interior outfitting suppliers. They felt that their pioneering efforts would one day provide them with a competitive advantage and possibly even a new business area. Others remained passive, waiting for instructions from the shipyard. Simultaneously, the shipyard was situated between the shipowners’ varying demands and budgets to materialize them. Most interviewees at the shipyard saw that the suppliers, as experts in their own areas, should themselves take the initiative, develop their products outside current projects, and present their ideas to the shipyard proactively. However, many shipyard representatives acknowledged that it was challenging for the suppliers to do so without a clear customer-driven signal and foreseeable business benefit. Hence, some shipyard interviewees reported that it would be important to increase the internal resources in the shipyard’s sustainability advancement to share the workload related to the ambitious climate-neutral cruise ship initiative, thus serving both the increased communication of R&D plans with the suppliers and internal idea generation.

Overall, calls for collective action and deeper mutual engagement for sustainability development emerged from all network members, including both the shipyard and its suppliers, indicating that the orchestration for shared identity and legitimization was rather low, particularly due to the project-based industry context. The communication with the network firms continued to focus on the ongoing project deadlines, and there were only a few attempts to engage the existing network members and potential future suppliers into future-oriented, long-term innovation collaboration. This indicates that orchestrating co-innovation beyond projects in a coordinated and far-sighted manner also entails temporal adaptations in the employed orchestration mechanisms.

5. Discussion

5.1. *The need for network reorchestration*

To address our first research question, we identify adaptation needs in the orchestration mechanisms employed by an actor attempting to reorchestrate the existing industry network toward a strategic net for collective eco-innovation. Regarding *the goal development mechanisms* category (cf. Schepis et al., 2021), the use of envisioning and agenda setting (Aarikka-Stenroos et al., 2017; Möller, 2010) was recognized in this case. However, there was no detailed collective agenda-setting framing or construction with the supplier network members. The general objective of developing a climate-neutral ship concept within three years was ambitious yet ambiguous, because there was neither further specification nor a roadmap toward its development. Of equal importance was the question of costs, concerning whether the developed solutions would be eventually paid for or otherwise incentivized through supplier ranking or criteria. Thus, the agenda had been set, but it became too vague to function as a means of orchestration. This provides a vivid example of the complexity of combining environmental and conventional product attributes in a feasible way (Bossle et al., 2016; Dangelico & Pujari, 2010). In orchestrating eco-innovation, there was a need for mechanisms to *elaborate* the expected market value of innovation, the expected environmental benefit of innovation and its measurement and evaluation method, and the collective goal with detailed innovation interfaces.

Regarding the mechanism category *developing resource exchange*, there was wide use of coordinating, mobilizing, and activating mechanisms to accomplish the current shipbuilding projects, but mechanisms to support wider resource management and knowledge mobility (Dhanasai & Parkhe, 2006; Nambisan & Sawhney, 2011) were absent.

Table 1
Orientation dimensions of network reorchestration for environmental sustainability in the shipbuilding industry context.

	Network orchestration for business as usual	Network orchestration for collective eco-innovation
Value orientation	Customer value through passenger-pleasing product with maximum durability and cost-efficiency	Customer value combined with ecological value
Process orientation	Optimizing efficiency in shipbuilding and ship operations	Optimizing the ship’s overall emission reduction throughout its lifecycle
Temporal orientation	Generating solutions to meet the agreed-upon shipbuilding project deadlines	Generating solutions beyond projects to allow continuous sustainability development for the future

There was information-sharing related to the ongoing shipbuilding projects and bidding for new ones but no systematic forum for network members to share their ideas for innovation. The shipyard had not demanded or notably encouraged such information-sharing with or between network members, as it deemed it an initiative for the suppliers. The existing means of ensuring knowledge mobility did not reflect what it takes to develop eco-innovations. Impactful orchestrating of co-innovation would involve mechanisms to *enable* bilateral communication channels between members and orchestrators, collective communication channels among members, and communication channels between the network and its end customers.

Regarding the *building identity and legitimization* category, the shipyard attempted to enthruse the collective sense of cocreation among the network members with the publicly announced development goal and the related R&D scheme. However, the employed mechanisms did not yet result in a change to the existing balance of localized and collective adaptations toward more collective working practices or a sense of unity due to the project-based industry character. The problems seem to concern mechanisms such as network mobilization (Dhanasai & Parkhe,

2006; Paquin & Howard-Grenville, 2013) and network stabilization (Aarikka-Stenroos et al., 2017; Dhanasai & Parkhe, 2006; Nordin et al., 2018). All suppliers were welcome to apply for funding from the R&D program for eco-innovation, but this required initiative and often some prior experience from the firms. The shipyard expected the suppliers to deliver ideas for development with this funding without actively feeding their emergence. Hence, new mobilization instruments had been established, but the communication of these to the wider network remained modest, and the initiative was expected from the suppliers. When it comes to network stabilization, in turn, many of the extant suppliers benefited from long-term business relationships with the shipyard and shared a sense of belongingness to this network, but due to the project-based industry nature and the invitation of new suppliers to bid for every project to control costs, uncertainty arose concerning the extent to which the suppliers dared to share their ideas within the network. The network had been relatively stable during past projects, involving largely the same suppliers, yet it was not permanent in that the firms currently involved knew that they would also deliver future ship projects and could thereby openly share their innovative ideas for the generation of the climate-neutral cruise ship. To orchestrate innovation beyond projects, there was a need to *engage* the network members in collaboration through localized, firm-specific motivation, a localized and collective objective, and collective guidance.

Besides adapting the choice of various orchestration mechanisms, our analysis further suggests that the network orchestrator needs to adapt the orientation of its orchestration mechanisms along three dimensions that characterize the reorchestration of a traditional supplier network in a project-based industry for eco-innovation cocreation—in other words, how the strategic orientation inherent in the orchestration mechanisms should be adapted to transform the existing loosely coupled and traditionally operating network toward a strategic net for eco-innovation. These orientation dimensions emerge from the empirical findings regarding elaborating, enabling and engaging in reorchestration. To start with the goal elaboration, given that the interviewees’ confusion in innovation goal setting stems largely from the feasibility

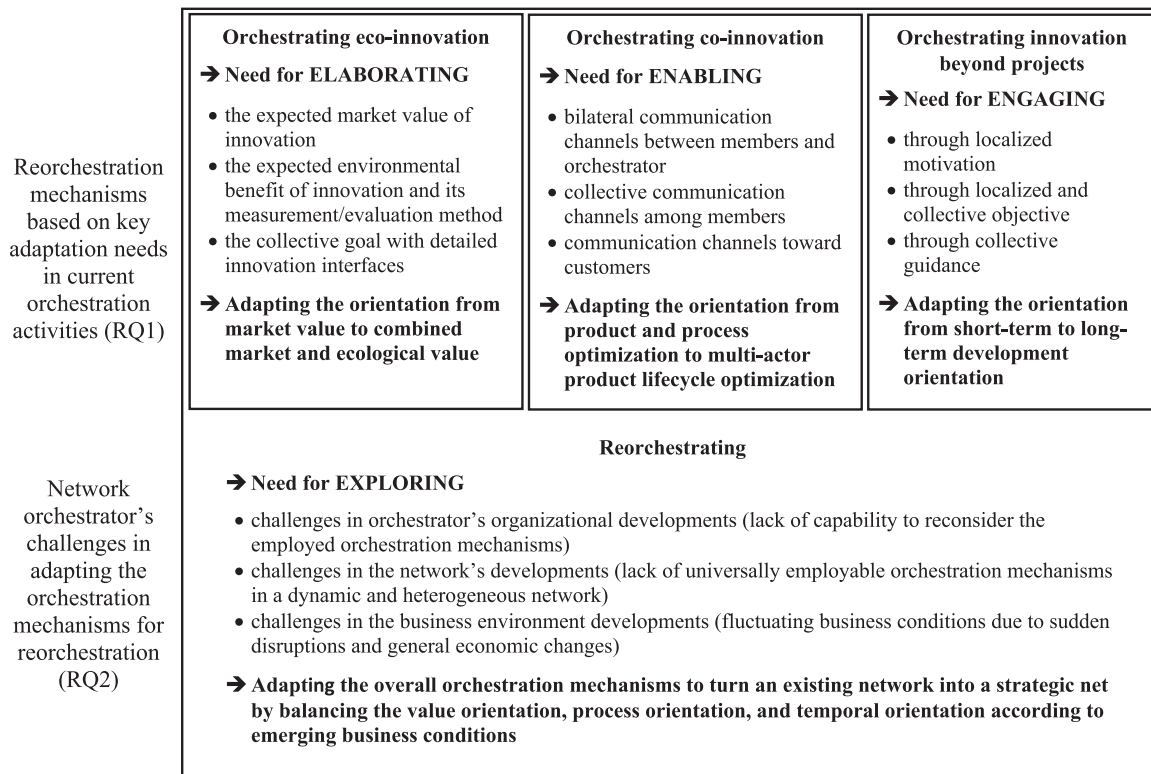


Fig. 3. Reorchestration mechanisms and challenges.

questions, the reorchestration for eco-innovation concerns changing the value-generation orientation from purely economic-benefit based thinking of customer value toward the inclusion of environmental benefit. Regarding resource enabling, the generation of environmentally impactful innovations concerns widening the process development orientation from optimizing the current operations to reducing the ship's negative environmental impact throughout its whole lifecycle. To overcome the challenges of engagement, the reorchestration concerns designing orchestration mechanisms that shift the temporal orientation from a short-term project completion toward long-term sustainability advancement in the network's interactions. These three discovered orientation dimensions of reorchestration are compiled in Table 1.

Network reorchestration for collective eco-innovation entails adapting these orchestration orientations by innovatively employing and developing relevant network orchestration mechanisms. We summarize these reorchestration needs in Fig. 3 and continue discussing the related challenges.

5.2. Challenges of network reorchestration

For the second research question, the findings show that during the first year of the new initiative, the shipyard experienced problems in reorchestrating the network toward sustainability advancement. The data point to challenges emerging at different levels (Appendix D). First, issues internal to the orchestrator hindered the reorchestration. The shipyard's lack of knowledge of future customer preferences and regulations, combined with coping with managerial and business environment challenges, did not provide optimal grounds for defining the goal internally. The orchestrator actor comprising employees in different departments was neither able to predict the level of changes needed in its orchestration mechanisms nor able to act accordingly. Second, the wide, diverse, and dynamic supplier network was challenging to orchestrate. It was difficult for the shipyard to develop orchestration mechanisms that would guide the supplier network into forming a strategic net for co-innovation and expertise development. Third, the project-based nature of the industry with its contextual developments complicated the use of orchestration mechanisms. Given the broader economic challenges combined with the network firms' confusion regarding the future regulatory frameworks for sustainability, the orchestrator was hesitant to attempt strong, orchestration activities without a detailed vision. Therefore, the network firms were left to enact the broad innovation objective rather independently. Such initiative from the orchestrator gave the suppliers a push to become interested in sustainability issues but did not guide them further in forming a strategic net to overcome the respective challenges collectively.

Overall, during the examination period, the orchestrator lacked the capabilities to explore these challenges in detail and adapt the orchestration mechanisms to the needs it had itself generated by setting the network-level goal for sustainability advancement. These challenges are synthesized with the above-discussed orchestration adaptation needs in Fig. 3.

We argue that this inadequate adaptation of orchestration did not concern changing the orchestrator's role as the prior literature views it—there was no need to shift from player–orchestrator to facilitator–orchestrator (Hurmelinna-Laukkanen & Nätti, 2018), or to turn from dominating orchestration to consensus-based orchestration (Reypens et al., 2021), or to change from a transcending orchestration profile to a translative one (Hurmelinna-Laukkanen et al., 2022). We also argue that it did not concern role augmentation (Hurmelinna-Laukkanen & Nätti, 2018), because the case was not about changing orchestration in response to external events, but it was self-driven. Instead, in the case of reorchestrating an existing network for sustainability, the change concerns turning an existing project-based network into a strategic net for eco-innovation, where the focus is not on the role or position of an individual actor attempting to drive the change but on the mechanisms that it may employ in trying to pursue this

transformation in the network interactions. The respective adaptations in the employed orchestration mechanisms comprise the selection and development of mechanisms and the extending of the orientations of the orchestration, which would support the transformation of the network interactions for the environmental sustainability goal.

Our study indicates that reorchestrating a business network for sustainability entails elaborating, enabling, and engaging mechanisms to drive the transformation of the network into a more strategically driven net. These activities are interlinked—the joint elaboration of the targeted value supports the enabling of co-innovation and engagement beyond projects. Enabling information and resource sharing for co-innovation feeds joint value elaboration and long-term engagement among actors. The long-term engagement, in turn, supports the joint value elaboration and co-innovation enabling. However, the reorchestration may be inhibited by factors internal to the orchestrator firm, the characteristics of the network, and industry-specific matters. To overcome these issues, the network orchestrator may continuously explore the applicability of current and alternative mechanisms.

6. Conclusion

6.1. Theoretical contributions

This study contributes to the literature on orchestrating innovation networks in three ways. First, it introduces the concept of reorchestration for sustainability—that is, an actor attempting to drive the transformation of an established business network into a strategic net for eco-innovation by changing its orchestration mechanisms. Second, it identifies such reorchestration mechanisms comprising elaborating, enabling, and engaging activities for delivering the sustainability objective across the network. A final mechanism, exploration, is suggested to maintain the continuous reflection and generation of contextually applicable orchestration mechanisms. Third, it exposes the orientation dimensions of network reorchestration for sustainability, which entail adapting the network's business as usual in terms of its value orientation, process orientation, and temporal orientation to ecological value-oriented, lifecycle-oriented, and future-oriented business interactions, respectively. Thus, we propose that reorchestrating collective eco-innovation in a project-based network concerns adapting the orchestration mechanisms, as well as the orientation of these mechanisms, to the orchestrator's intended new objective and vision for the network.

Generally, the study highlights the complexity of an existing yet dynamic network transforming toward a large, strategic net for eco-innovation. We build upon the IMP literature by suggesting how strategic nets (Möller et al., 2005) may emerge in conventional and relatively loose business networks for sustainability advancement, which demands unforeseen strategic collaboration. Besides the limited influence that an individual actor, even in a hub position, has in the development of a business network, this study sheds light on the organization, network, and business environment level challenges in adapting network orchestration mechanisms for sustainability accordingly.

Overall, the study responds to recent calls to advance the understanding of innovation network orchestration (Hurmelinna-Laukkanen et al., 2022; Hurmelinna-Laukkanen & Nätti, 2018; Möller & Halinen, 2017; Schilling & Phelps, 2007). It extends the views of orchestration change beyond role shifting and augmentation to the mechanisms, orientation dimensions, and challenges of reorchestrating the transformation of a wide, traditional business network into an eco-innovation net. While the development of business network relationships builds on mutual adaptations (Brennan & Turnbull, 1999; Håkansson & Snehota, 1995), reorchestration emerges as a core issue in the quest for new ways to support mutual adaptations for sustainability advancement. It entails adaptations, first, in the orchestrator actor's own interactions within its network, and thereby, in the other actors' interactions with one another in the network.

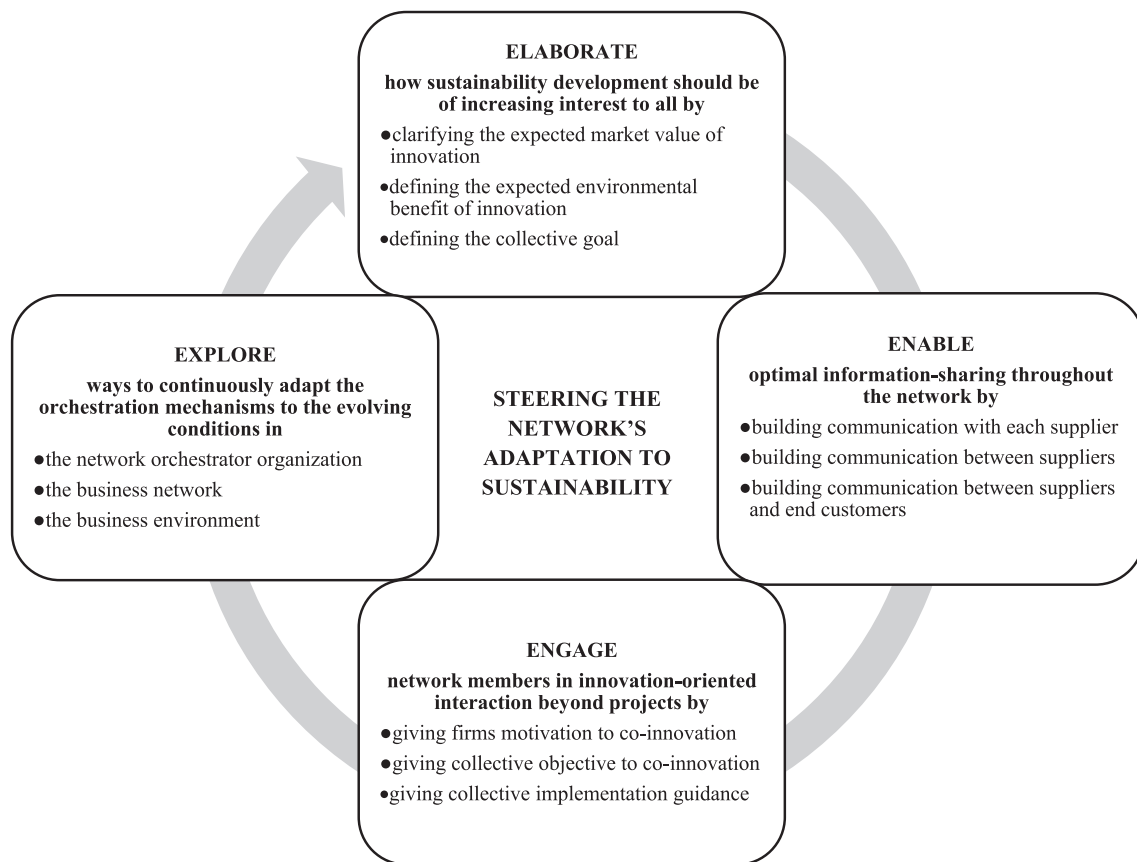


Fig. 4. Sustainability steering wheel for reorchestrating a traditional supplier network toward a collective eco-innovation net.

6.2. Managerial recommendations

While this empirical case study focuses on the shipbuilding industry, the findings may provide valuable ideas for steering collective eco-innovation in other project-based industry contexts with similar needs for changes in network interactions. An actor may employ the activities combined in Fig. 4 to reorchestrate its existing network toward collective sustainability advancement.

Despite actors intentionally employing orchestration mechanisms to influence their networks, all firms are encouraged to analyze their current and potential role in driving eco-innovation, at least as participants in these activities and supporters for collaboration. Eventually, despite any orchestration attempts, no actor can control the actions of others, and the generation of eco-innovations builds on the systemic activity and initiative of all network members.

6.3. Limitations and avenues for further research

Being based on a unique business network case in shipbuilding industry, the findings of this study may not be directly applicable to other contexts, such as industries with more rapid product lifecycles or easier end-customer value demonstration of eco-innovations. Further research should examine eco-innovation processes in other industry network settings, looking also further into the connections between the identified reorchestration mechanisms. In addition, the data for the focal study build solely on the perspectives of orchestrator-firm and supplier-firm representatives, whereas the views of other actors, such as regulators

and customers, might be valuable in understanding industry adaptation to increasing environmental pressures. We also call for studies examining network reorchestration in sustainability enhancement processes other than eco-innovation, and in response to other grand challenges, for instance through resilience enhancement. Conducting systemic changes in an increasingly turbulent business environment requires growing, collective adaptation skills from firms in all positions and industries.

CRediT authorship contribution statement

Eini Haaja: Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Data curation, Conceptualization.
Natasha Evers: Writing – review & editing, Writing – original draft, Conceptualization.

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Appendix A. List of interviews

SHIPYARD INTERVIEWS				
Code	Management area	Date	Length	Means
Y1	Research and development	16 March 2022	70 min	video call
Y2	Product development	22 March 2022	65 min	video call
Y3	Naval architecture	25 March 2022	60 min	video call
Y4	Naval architecture	25 March 2022	45 min	video call
Y5	Sales	5 April 2022	60 min	video call
Y6	Ship project management	13 April 2022	55 min	video call
Y7	Procurement	6 May 2022	65 min	video call
Y8	Quality management	11 May 2022	65 min	video call
Y9	Production development	19 May 2022	60 min	video call
Y10	Hotel design	24 May 2022	65 min	video call
Y11	Sales	8 October 2022	65 min	video call
Y12	Product development	19 October 2022	60 min	video call

SUPPLIER INTERVIEWS				
Code	Expertise area	Date	Length	Means
S1	Interior outfitting	2 November 2021	105 min	in person
S2	Interior outfitting	19 January 2022	55 min	in person
S3	Interior outfitting	5 May 2022	60 min	video call
S4	Equipment	16 May 2022	75 min	video call
S5	Interior outfitting	25 August 2022	50 min	video call
S6	Interior outfitting	12 October 2022	50 min	video call
S7	Materials	1 November 2022	65 min	video call
S8	Equipment	22 September 2022	55 min	video call
S9	Equipment	28 September 2022	45 min	video call
S10	Materials	13 September 2022	65 min	video call
S11	Interior outfitting	2 November 2022	60 min	video call
S12	Interior outfitting	26 October 2022	40 min	video call
S13	Interior outfitting	14 October 2022	60 min	video call

Appendix B. List of focus group interview participants

SHIPYARD FOCUS GROUP INTERVIEWEES ON 12 DECEMBER 2022		
Code	Expertise area	Pre-interviewed
Y3	Naval architecture	yes
Y8	Quality management	yes
Y9	Production development	yes
Y10	Hotel design	yes
Y12	Product development	yes
Y13	Product development	no
Y14	Production development	no
Y15	Procurement	no
Y16	Research and development	no
Y17	Research and development	no
Y18	Research and development	no
Y19	Ship project management	no

Appendix C. Examples of data quotations regarding orchestration mechanisms and adaptation needs

1st level group theme code	2nd level sub-code	3rd level sub-code	Coded data excerpt (translated)	Interviewee
Orchestrating eco-innovation	Orchestration mechanisms in use	Developing a collective goal	“I was involved in planning this (climate-neutral cruise ship) initiative, so it is hard for me to say how it shows. But the things that have been defined there, those we will do internally and together with our ecosystem, and aim to build a larger ecosystem from the sustainable development perspective and future perspective, that is the goal of the initiative.”	Y11
		Agenda setting framing	“If it (sustainability) becomes a part of sales considerations besides sheer price, it would require some minimum criteria or giving preference in competition, that is, supplier selection. The price difference also needs to be large enough, so that one can make it in competition while being involved in sustainability development. That’s the way I see it. As long as price is the only decisive thing, in addition to other basic attributes like supplier trustworthiness, so that one dares to buy something from them... But given	S6

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1st level group theme code	2nd level sub-code	3rd level sub-code	Coded data excerpt (translated)	Inter-viewee	
Orchestrating co-innovation	Adaptation needs in orchestration	Defining the expected market value	the suppliers that are known to be able to do the job, if there is no other decisive factor than price, it (sustainability development) is much more difficult.” ”I guess we are on the right path. It (sustainability advancement) is not a common practice yet, but hopefully it will soon start to materialize. But I guess an individual turnkey supplier is only a listener in that situation, I mean it should dribble down from the shipowner, the directions that all start to follow. Because we are shouting into a forest in a way, we can do much and try much, but the customer should provide some requirements.”	S10	
		Defining the expected ecological value	”At least from our perspective, the shipowner has not specified what sustainability means or what they want. It (sustainability) means so many different things and in some cases also exclusive things. What they (shipowners) want to emphasize... If we think about these materials, do they want the material to be recyclable as such, or made of recyclable materials, or is it about the shortest possible transportation distance to our factory? All concern sustainability from different perspectives, and how to measure it, there are no concrete details about that.”	S5	
		Developing a collective ecological objective	”If you (shipyard) say that you want something more sustainable... that it is your competitive advantage, I can’t immediately say specifically what it refers to, besides trying to use less material and do things faster. To use less energy in production. I can’t say specifically what it might be. But maybe it will come from the network, we cannot invent anything only on our own.” ”I’m extremely excited (about the new R&D funding program) and I try to build an ecosystem around it. And there is one thing related to this, I see that in order to get some progress to emerge, one must create a psychologically safe atmosphere. That we should learn a working model where it is always ‘yes and’ and never ‘no but’. That when someone is presenting an idea, we never comment that there you have a mistake. It needs to be brought to so that the person in question can continue life afterwards empowered, like ‘hey, this guy advised me, now I can move forward better when I get this additional information here’. [...] I’ve tried to bring it to all this remote work, like you saw there. ”We’ll see how this [R&D program] develops, hoping for shipyard’s involvement, that they would take a better hold of it [...] But they are not active themselves. If we talk about innovations, the interaction is pretty much missing. So I can’t identify... I run the R&D department at [supplier firm name], but I honestly cannot identify who at the shipyard is my match, with whom I could discuss. So the contact surface in the early phase (of new ship concept design), it doesn’t exist.”	S1	
	Orchestration mechanisms in use	Framing resources; Activating	”They (the shipyard) must be the compiling force there. We can of course suggest them that ‘hey, this kind of thing, could we look into this’, but it requires them to take the lead and bring the crowds around them, they have the power to get the people involved. So they must sometimes use it so that we actually get the people to come around it. And they can also create the framing conditions regarding what is coming and underway, like where... Otherwise the development work gets too abstract if there is nothing to build it on.” ”In practice (we would need to know) like what size of ships are coming in the future and so on, like frame a little for the project and like what type we are looking for. Because they see the side which we can’t see at all, what they are going to want at the customer side in the future regarding the size of ships and structures and so on.”	Y1	
		Developing communication between the suppliers and the shipyard	We, in fact, have every week these two [virtual events]. One is for the network and the other is our internal [virtual event] where we discuss these (sustainability) things. So every week yes... [...] I think it is a well working concept, this [virtual events], which takes place on afternoons. There have been lots of good discussions on these topics.” ”I can’t say if they (shipowners) are ready to pay (for sustainability), but of course they have the same aim to proceed to increasingly responsible direction. It might actually be a competitive advantage for the shipowner toward their customers if they were able to sell services that have been produced as responsibly as possible. But I can’t say how much they would be willing to pay for it. I mean we know that, at least in the beginning, new solutions come with a certain price tag.”	S4	
	Adaptation needs in orchestration	Developing communication between suppliers	”If they (shipyard) knew that those (environmentally friendly solutions) are needed, maybe we could also put more effort in such product development, innovation. But first we should know that we are not doing unnecessary work. As such we could certainly do more, but where does it lead and does it make any difference, that is the key issue.”	S8	
		Developing communication between suppliers and end-customers	”They (shipyard) must manage this ensemble and this sustainable development thing. We pursue it from our perspective, that is, where we see that we can benefit from it. But if the objective is to make it a common industry-wide practice, then it is the shipyard who drives it.” ...”If somebody wants a target for the carbon footprint, or a target for recyclability, or whatever, it has to come from somewhere above us. And the whole network	S8	
	Orchestrating innovation beyond projects	Orchestration mechanisms in use	Enthusing; Strengthening the sense of cocreation		Y12
			Giving localized motivation		Y7
		Adaptation needs in orchestration	Giving specific collective objective		S5
Giving collective guidance			S1		

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1st level group theme code	2nd level sub-code	3rd level sub-code	Coded data excerpt (translated)	Interviewee
			has to be involved in such thing. Whether it's the state, or some association, or a shipyard, or a shipowner... but it is not us!"	

Appendix D. Example of data quotations regarding challenges of network re-orchestration

1st level group theme code	2nd level sub-code	Coded data excerpt (translated)	Interviewee
Orchestrator organization developments	Lack of personnel for collective eco-innovation	"This (sustainability advancement) is only starting and I think it's in the shipyard's strategy, yes, mentioned, but I guess for now the situation is that... Once we got rid of Covid, everybody just focuses now on completing the ships on time and proceeding with routine activities, everybody just focuses on getting their job done. Even though we have employees, the staff resources are quite limited sometimes."	Y10
	Changes in personnel	"The problem is that the people (at shipyard) change all the time. People are leaving, and new people are coming, who don't know anything about things again, like what has been agreed and how... It hasn't been like this always. Before it used to be the same people but now that they have taken these new people in... And now they even circulate them there and, that's what it is. Of course one needs to understand that they don't know everything, these new people." "I'm thinking how slow things are proceeding. Particularly the hierarchy which relates to the multinational corporation structure, therefore things are not, in a way, proceeding. Somehow I'm not used to this slow pace. I don't know. It is a little slow in my opinion. We could pay more attention to speeding things up. Because otherwise they may be forgotten. I don't know if they are forgotten to somebody's table, they just stop somewhere and things don't move on. And perhaps, it is challenging when there are new people, I don't always know who is handling what. I would like to push things forward right away, but of course it does not work that way, one needs to follow specific steps and hierarchy."	S2
	Bureaucracy in a large company	"We must be at least climate-neutral or even emission-free by year 'x', which is no longer somewhere in the horizon but right there. But what everybody does about it, that's what we are thinking about all the time. But these practical steps that me and the people here are struggling with... For example, we are calculating the (carbon) footprints, and when the ship comprises like million components, how to handle that. If only there were a system where each component had some certified footprint and then we would just add them together, and that's it! Then it would be easier for us to make choices (between suppliers)."	Y12
Network developments	High number of suppliers	"We have some (eco-innovation) collaboration with others, but the case is that those who are truly interested (in sustainability advancement) are already involved in this R&D project of ours. Beyond those, of course the network is wide, and not all are up to the current developments, but I can't see complete ignorance (of environmental considerations) anymore, so at least they are aware. If nothing more, at least they talk about it."	Y2
	More and less active suppliers	"This culminates into the issue that no one (shipowners) has money to meet us halfway (in sustainability development), which would take things forward and would be ultimately cheapest to all. Now we are fighting about very small issues. But this thought was still on the background in the normal situation, whereas there emerged a big extra burden due to the pandemic, and this war situation (in Europe) has now blown it all."	S6
Business environment developments	Lack of financial resources due to Covid-19 pandemic and Russia's invasion in Ukraine	"I think that the situation is that we now try to find the cheapest possible accepted supplier in order to overcome this Covid misery and the bad years it brought along. In that sense, we should now... And the shipowners have probably suffered from this the most. They have had their ships there running idle, and cash funds must be in the red. Perhaps we must wait a little until the financial situation stabilizes, so to say, before we can fully push this (sustainability advancement) forward."	Y6
	Shipowners struggling with recovering cruise tourism		Y10

Data availability

The data that has been used is confidential.

References

Aarikka-Stenroos, L., Jaakkola, E., Harrison, D., & Mäkitalo-Keinonen, T. (2017). How to manage innovation processes in extensive networks: A longitudinal study. *Industrial Marketing Management*, 67, 88–105.

Aarikka-Stenroos, L., & Ritälä, P. (2017). Network management in the era of ecosystems: Systematic review and management framework. *Industrial Marketing Management*, 67, 23–36.

Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. *Journal of Management*, 43(1), 39–58.

Autio, E., & Thomas, L. D. (2014). Innovation ecosystems. In M. Dodgson, D. M. Gann, & N. Phillips (Eds.), *The Oxford handbook of innovation management* (pp. 204–228). Oxford University Press.

Björk, J., & Magnusson, M. (2009). Where do good innovation ideas come from? Exploring the influence of network connectivity on innovation idea quality. *Journal of Product Innovation Management*, 26(6), 662–670.

Bossle, M. B., de Barcellos, M. D., Vieira, L. M., & Sauvée, L. (2016). The drivers for adoption of eco-innovation. *Journal of Cleaner Production*, 113, 861–872.

Brady, T., & Davies, A. (2014). Managing structural and dynamic complexity: A tale of two projects. *Project Management Journal*, 45(4), 21–38.

Brennan, R., & Turnbull, P. W. (1999). Adaptive behaviour in buyer-supplier relationships. *Industrial Marketing Management*, 28, 481–495.

Bygballe, L. E., & Ingemansson, M. (2014). The logic of innovation in construction. *Industrial Marketing Management*, 43(3), 512–524.

Carrillo-Hermosilla, J., Del Río, P., & Könnölä, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*, 18(10–11), 1073–1083.

- Chistov, V., Aramburu, N., & Carrillo-Hermosilla, J. (2021). Open eco-innovation: A bibliometric review of emerging research. *Journal of Cleaner Production*, 311, 127627.
- Claeys, G., Tagliapietra, S., & Zachmann, G. (2019). *How to make the European Green Deal work*. Brussels, Belgium: Bruegel.
- Crespin-Mazet, F., Romestant, F., & Salle, R. (2019). The co-development of innovative projects in CoPS activities. *Industrial Marketing Management*, 79, 71–83.
- Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory Into Practice*, 39(3), 131–156.
- Dangelico, R. M., & Pujari, D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics*, 95(3), 471–486.
- De Medeiros, J. F., Ribeiro, J. L. D., & Cortimiglia, M. N. (2014). Success factors for environmentally sustainable product innovation: A systematic literature review. *Journal of Cleaner Production*, 65, 76–86.
- Del Río, P., Carrillo-Hermosilla, J., & Könnölä, T. (2010). Policy strategies to promote eco-innovation: An integrated framework. *Journal of Industrial Ecology*, 14(4), 541–557.
- Del Río, P., Carrillo-Hermosilla, J., Könnölä, T., & Bleda, M. (2015). Resources, capabilities and competences for eco-innovation. *Technological and Economic Development of Economy*, 22(2), 274–292.
- Del Río, P., Carrillo-Hermosilla, J., Könnölä, T., & Bleda, M. (2016). Resources, capabilities and competences for eco-innovation. *Technological and Economic Development of Economy*, 22(2), 274–292.
- Dhanasai, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review*, 31(3), 659–669.
- Díaz-García, C., González-Moreno, Á., & Sáez-Martínez, F. J. (2015). Eco-innovation: Insights from a literature review. *Innovation*, 17(1), 6–23.
- Dubois, A., & Gadde, L.-E. (2002). The construction industry as a loosely coupled system: Implications for productivity and innovation. *Construction Management and Economics*, 20(7), 621–631.
- Ghauri, P. N., & Grønhaug, K. (2005). *Research Methods in Business Studies: A Practical Guide*. Harlow: Financial Times Prentice Hall.
- Ghisetti, C., Marzucchi, A., & Montresor, S. (2015). The open eco-innovation mode. An empirical investigation of eleven European countries. *Research Policy*, 44(5), 1080–1093.
- Gliga, G., & Evers, N. (2023). Marketing capability development through networking: An entrepreneurial marketing perspective. *Journal of Business Research*, 156, Article 113472.
- Guercini, S., Rocca, A. L., & Perna, A. (2024). The IMP research on business networks: A systematic literature review and research agenda. *Italian Journal of Marketing*, 149–175.
- Gurca, A., Bagherzadeh, M., Markovic, S., & Kaporcic, N. (2021). Managing the challenges of business-to-business open innovation in complex projects: A multi-stage process model. *Industrial Marketing Management*, 94, 202–215.
- Håkansson, H. (1987). *Technological development: a network approach*. New York: Croom Helm.
- Håkansson, H., & Ford, D. (2002). How should companies interact in business networks? *Journal of Business Research*, 55, 133–139.
- Håkansson, H., Ford, D., Gadde, L.-E., Snehota, I., & Waluszewski, A. (2009). *Business in Networks*. Chichester, West Sussex, UK: John Wiley & Sons.
- Håkansson, H., & Snehota, I. (1995). *Developing relationships in business networks*. London: Routledge.
- Halinen, A., & Törnroos, J.-Å. (2005). Using case methods in the study of contemporary business networks. *Journal of Business Research*, 58(9), 1285–1297.
- Hallén, L., Johanson, J., & Seyed-Mohamed, N. (1991). Interfirm adaptation in business relationships. *Journal of Marketing*, 55(2), 29–37.
- Hara, Y., Endo, T., & Kobayashi, H. (2015). The hidden abode of network orchestration: The case of de-legitimated diesel cars in Japan. *Industrial Marketing Management*, 49, 5–21.
- He, F., Miao, X., Wong, C. W., & Lee, S. (2018). Contemporary corporate eco-innovation research: A systematic review. *Journal of Cleaner Production*, 174, 502–526.
- Hobday, M. (2000). The project-based organisation: An ideal form for managing complex products and systems? *Research Policy*, 29, 871–893.
- Hojnik, J., & Ruzzier, M. (2016). What drives eco-innovation? A review of an emerging literature. *Environmental Innovation and Societal Transitions*, 19, 31–41.
- Hummel, K., & Jobst, D. (2022). *The current state of corporate sustainability reporting regulation in the European Union*. Available at SSRN 3978478.
- Hurmelinna-Laukkanen, P., Möller, K., & Nätti, S. (2022). Orchestrating innovation networks: Alignment and orchestration profile approach. *Journal of Business Research*, 140, 170–188.
- Hurmelinna-Laukkanen, P., & Nätti, S. (2018). Orchestrator types, roles and capabilities—a framework for innovation networks. *Industrial Marketing Management*, 74, 65–78.
- Joshi, A. W., & Campbell, A. J. (2003). Effect of environmental dynamism on relational governance in manufacturer-supplier relationships: A contingency framework and an empirical test. *Journal of the Academy of Marketing Science*, 31(2), 176–188.
- Kemp, R., & Pearson, P. (2007). Final report MEI project about measuring eco-innovation. *UM Merit Maastricht*, 10(2), 1–120.
- Lundin, R. A., & Soderholm, A. (1995). A theory of the temporary organization. *Scandinavian Journal of Management*, 11, 437–455.
- Melander, L., & Arvidsson, A. (2022). Green innovation networks: A research agenda. *Journal of Cleaner Production*, 357, Article 131926.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.
- Mitrega, M., Forkmann, S., Ramos, C., & Henneberg, S. C. (2012). Networking capability in business relationships—Concept and scale development. *Industrial Marketing Management*, 41(5), 739–751.
- Möller, K. (2010). Sense-making and agenda construction in emerging business networks—How to direct radical innovation. *Industrial Marketing Management*, 39(3), 361–371.
- Möller, K., & Halinen, A. (2017). Managing business and innovation networks—From strategic nets to business fields and ecosystems. *Industrial Marketing Management*, 67, 5–22.
- Möller, K., & Halinen, A. (2018). IMP thinking and IMM: Co-creating value for business marketing. *Industrial Marketing Management*, 69, 18–31.
- Möller, K., Rajala, A., & Svahn, S. (2005). Strategic business nets—Their type and management. *Journal of Business Research*, 58(9), 1274–1284.
- Möller, K., & Svahn, S. (2003). Managing strategic nets: A capability perspective. *Marketing Theory*, 3(2), 209–234.
- Möller, K., & Svahn, S. (2006). Role of knowledge in value creation in business nets. *Journal of Management Studies*, 43(5), 985–1007.
- Moreno-Mondéjar, L., Cano, A., & Sáez-Martínez, F. (2020). Successful eco-innovators: Exploring the association between open inbound knowledge strategies and the performance of eco-innovative firms. *Business Strategy and the Environment*, 29, 939–953.
- Müller-Seitz, G. (2012). Leadership in interorganizational networks: A literature review and suggestions for future research. *International Journal of Management Reviews*, 14, 428–443.
- Nambisan, S., & Sawhney, M. (2011). Orchestration processes in network-centric innovation: Evidence from the field. *Academy of Management Perspectives*, 25(3), 40–57.
- Nordin, F., Ravald, A., Möller, K., & Mohr, J. J. (2018). Network management in emergent high-tech business contexts: Critical capabilities and activities. *Industrial Marketing Management*, 74, 89–101.
- Paquin, R. L., & Howard-Grenville, J. (2013). Blind dates and arranged marriages: Longitudinal processes of network orchestration. *Organization Studies*, 34(11), 1623–1653.
- Pattinson, S., Damij, N., El Maalouf, N., Bazi, S., Elsahn, Z., Hilliard, R., & Cunningham, J. A. (2023). Building green innovation networks for people, planet, and profit: A multi-level, multi-value approach. *Industrial Marketing Management*, 115, 408–420.
- Pichlak, M., & Szromek, A. R. (2021). Eco-innovation, sustainability and business model innovation by open innovation dynamics. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2), 149.
- Piekkari, R., Welch, C., & Paavilainen, E. (2009). The case study as disciplinary convention: Evidence from international business journals. *Organizational Research Methods*, 12(3), 567–589.
- Porter, M. E., & Linde, C. V. D. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97–118.
- Renning, K. (2000). Redefining innovation—Eco-innovation research and the contribution from ecological economics. *Ecological Economics*, 32(2), 319–332.
- Reypps, C., Lievens, A., & Blazevic, V. (2016). Leveraging value in multi-stakeholder innovation networks: A process framework for value co-creation and capture. *Industrial Marketing Management*, 56, 40–50.
- Reypps, C., Lievens, A., & Blazevic, V. (2021). Hybrid orchestration in multi-stakeholder innovation networks: Practices of mobilizing multiple, diverse stakeholders across organizational boundaries. *Organization Studies*, 42(1), 61–83.
- Roehrich, J. K., Kalra, J., Squire, B., & Davies, A. (2023). Network orchestration in a large inter-organizational project. *Journal of Operations Management*, 69(7), 1078–1099.
- Roy, S., Sivakumar, K., & Wilkinson, I. F. (2004). Innovation generation in supply chain relationships: A conceptual model and research propositions. *Journal of the Academy of Marketing Science*, 32(1), 61–79.
- Rubach, S., Hoholm, T., & Håkansson, H. (2017). Innovation networks or innovation within networks. *IMP Journal*, 11(2), 178–206.
- Sabatier, V., Mangematin, V., & Rousselle, T. (2010). Orchestrating networks in the biopharmaceutical industry: Small hub firms can do it. *Production Planning and Control*, 21(2), 218–228.
- Schepis, D., Purchase, S., & Butler, B. (2021). Facilitating open innovation processes through network orchestration mechanisms. *Industrial Marketing Management*, 93, 270–280.
- Schiederig, T., Tietze, F., & Herstatt, C. (2012). Green innovation in technology and innovation management—an exploratory literature review. *R&D Management*, 42(2), 180–192.
- Schilling, M. A., & Phelps, C. C. (2007). Interfirm collaboration networks: The impact of large-scale network structure on firm innovation. *Management Science*, 53(7), 1113–1126.
- Sharma, A. (2020). Sustainability research in business-to-business markets: An agenda for inquiry. *Industrial Marketing Management*, 88, 323–329.
- Voola, R., Bandyopadhyay, C., Voola, A., Ray, S., & Carlson, J. (2022). B2B marketing scholarship and the UN sustainable development goals (SDGs): A systematic literature review. *Industrial Marketing Management*, 101, 12–32.