



Orchestrating for lead user involvement in innovation networks

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ABSTRACT

To respond to the notable changes in the field of healthcare, innovation networks bringing together industry and public sector actors are needed. Subsequently, the orchestration of such networks has attracted increasing attention. However, most research on network orchestration takes the point of view of the orchestrator and/or the innovation producers. It lacks explicit discussion on the users, especially lead users, in the network orchestration context. On the other hand, while the user-innovation literature tells how lead users can be involved in innovation processes, it focuses on those managerial actions that are meant to specifically influence lead users and misses the network-wide orchestration-related dynamics. Furthermore, a lead user discussion with a focus on customers viewing market trends does not necessarily fully acknowledge healthcare professionals or end users of public sector services. This study starts to bridge these discussions as it introduces findings from a theoretical examination and an illustrative case study. It provides a context-sensitive approach to innovation network orchestration in a situation where active involvement of lead users is crucial for the functioning of the innovation network. Acknowledging the interaction between the innovation network orchestrator, innovating companies, and lead users adds to existing knowledge on how to orchestrate innovation networks.

1. Introduction

In recent years, generating innovations has become notably networked (de Man, 2004; den Hertog et al., 2010; Powell and Grodal, 2006; Powell et al., 2010; Valkokari et al., 2012). While this kind of operations model can be highly beneficial, managerial challenges emerge from the related complexity and the need to acknowledge varying motivations of the involved parties (Bocquet and Mothe, 2010; Clarke and Crane, 2018; Lee, 2009; Paasi et al., 2010; Porter, 2010; Swan and Scarbrough, 2005; Teece, 2000). Network orchestration has been considered to be a viable response to these challenges.

Network orchestration can be defined as the discreet and dynamic coordination of the network formation and collaboration, which involves a number of dimensions such as knowledge mobility, network stability, and innovation appropriability promoting value capturing among the participants (Dhanaraj and Parkhe, 2006; Hurmelinna-Laukkanen and Nätti, 2018). A network *orchestrator* is an actor conducting this activity. An orchestrator can be an individual actor or group of actors (e.g., organized under a single organization) who actively steers, guides, and facilitates the network participants in the innovation

process (Hurmelinna-Laukkanen and Nätti, 2018). For example, in the healthcare context, new medical devices can be developed and tested in collaboration among hospitals, universities, research institutes, technology firms, service providers, and patients, but this requires a party – an orchestrator – to facilitate the activities (Parston et al., 2015; Srivastava and Shainesh, 2015). A single firm can often take the lead in developing technology and services and involving others, but there are also other alternatives, such as research institutes (see, e.g., Roijakkens et al., 2013) or individual persons acting as orchestrators (see, e.g., Gausdal and Nilsen, 2011). It also has been acknowledged that the orchestrator can change as the innovation process proceeds from one stage to the next, and that orchestration tasks can be shared between multiple orchestrators (Hurmelinna-Laukkanen and Nätti, 2018).

Having focused on the features of orchestrators and orchestration activities, earlier orchestration studies tend to take the point of view of the focal actor, the orchestrator. Likewise, they tend to focus on the actors responsible for producing and offering the innovations—typically focusing on technology or service companies being orchestrated or acting as orchestrators (see, e.g., Hurmelinna-Laukkanen and Nätti, 2018; Möller and Halinen 2017; Nambisan and Sawhney, 2011).

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However, innovation inherently also includes end users, that is, such individuals and organizations that use the innovation according to its core purpose and function (Bogers and West, 2012). Therefore, a shortcoming in the innovation network orchestration literature is that it has not sufficiently addressed the end-user perspective (see Chesbrough et al., 2006; Fichter, 2009; von Hippel, 2007; Howells, 2006; Mäkinen et al., 2019). In particular, although users are acknowledged in the existing literature as sources of valuable knowledge and relevant actors in innovation networks—and as subjects to orchestration in that sense—it is hardly considered what kind of specific dynamics might be related to attempting to orchestrate innovation networks that involve end-users as important actors.

We suggest that turning to research on user innovation provides the needed insight to increase understanding of network orchestration and the related network dynamics in this respect. A notable amount of literature discusses *lead users*—innovative and influential actors who ‘face future needs before most others do and benefit significantly from innovative solutions to their needs’ (Lehnen et al., 2016, p. 212; see also von Hippel, 1986; Hiennerth and Lettl, 2017; Enkel et al., 2005; Hiennerth and Poetz, 2005; Kaulio, 1998; Kristensson et al., 2004; Lüthje, 2004; Coyne, 2000; Dehne, 2003; Intrachooto, 2004). The studies in this field cover customer/user involvement in innovation and product development extensively, touching upon its various facets from motivation to practical organizing. In earlier studies, similar elements are present as in the innovation network orchestration discussion. For example, issues of user identification (Lüthje and Herstatt, 2004)—including its automated forms and social media (see, e.g., Bilgram et al., 2008; Pajo et al., 2017), acknowledging tensions related to ownership and intellectual property issues (Tietze et al., 2015), and motivation to participate (Heiskanen et al., 2010) share the basic logics with the dimensions of orchestration that capture ensuring knowledge mobility, network formation and structuring, and fair value capture and appropriation (see Dhanaraj and Parkhe, 2006).

However, originating first from business-to-business context and emphasizing later the idea of ‘customers’ having a view on ‘market trends’ (Schuurman et al., 2011), these studies tend to highlight the importance of lead users in developing products and services of an individual organization, and in improving market diffusion (Edvardsson et al., 2012; Heiskanen et al., 2010; Jeppesen and Laursen, 2009; Marzouki and Belkahl, 2020; Globocnik and Faullant, in press). This focus obscures the role of the wider network, potential distinction between private and public sectors, and possible challenges of orchestrating cross-sectional networks that benefit from lead user involvement. For example, earlier research indicates that a threshold level of trust between the user (customer) and the producer is a prerequisite for effective interaction (Laage-Hellman et al., 2014), but it is not clear if and how this is reached in networks.

Summarizing the above notions, not much is known about the mechanisms of orchestrating networks with lead users, the lead users’ perceptions, experiences and reactions to network orchestration meant to influence them, or the related dynamics (see Makkonen and Johnston, 2014; Béji-bécheur and Gollety, 2007). We consider these questions as we take the following research question as our guideline: *How can lead user involvement be facilitated by means of innovation network orchestration?*

In our study, we maintain the orchestrator perspective and focus on the orchestration dimensions, but extend earlier knowledge by combining to this the principles of lead user involvement. We aim to understand the premises of orchestrating innovation networks where lead users are relevant contributors—and to narrow the gap found in the intersection of networked innovation management theory and lead user theory—with the help of a case study placed in the *healthcare context*. Observing a healthcare process development is a relevant starting point for a network orchestration study (see e.g., Yang and Hsiao, 2009; Laere and Aggestam 2016; Kanstrup et al., 2015; Oftedal et al., 2019; Iakovleva et al., 2019): Health-related innovations are systemic by nature, and

this complex professional environment involves lead users in a high-end professional setting. In this context, lead users can come from notably different groups (e.g. varied health professionals, patients) and have differing approaches to innovation, which may be relevant to how their knowledge can be harnessed (Srivastava and Shainesh, 2015). This kind of research setting enables understanding further, how the strong role of individual professionals and professional networks surrounding them may challenge network orchestration in unique ways. There can be questions as to how medical doctors can be motivated to participate in networked activities with other actors, like small and medium-sized companies (SMEs) with commercial goals, without becoming ‘protectionist’ in sharing their ideas in the process. What if they would like to commercialize their own ideas themselves? Likewise, it can be asked how patients that are giving away their development ideas for free (see DeMonaco et al., 2018; von Hippel, 2017) can be involved in orchestration activities where profiting is the key for some actors and may therefore eventually lead to costly services for the patients.

Our empirical research work comprises a longitudinal case study covering a one-year period. The materials derive from a project conducted at a public university hospital. The project aimed to co-develop innovative technology solutions for a future children’s hospital, focusing on the paediatric surgical journey of children and their parents. This paediatric patient journey covers the steps from home, through primary care to secondary care and its processes, and to releasing the children back to home. Depicting deliberate orchestration of an innovation network and having varying users in central role, this setting provides important insight into the topic of interest.

The remainder of this paper is structured as follows. First, we look at existing literature on innovation network orchestration and lead users, focusing on those elements where points of connection can be found between these two areas of research. We organize our discussion around orchestration dimensions as elements that are generally present in all innovation networks but have varying contents depending on the qualities of the network, including the participants. We then explicate the methodological aspects of the study and introduce our empirical case that illustrates the special tone and details of orchestration in networks with lead user participants. The findings from the empirical examination are presented before drawing conclusions on the theoretical and managerial implications, and concluding the paper with suggestions for future research.

2. Theoretical BACKGROUND—ORCHESTRATION and lead users in networked innovation

There are numerous studies that cover a variety of innovation environments and management activities within them (e.g., Möller and Rajala, 2007; Nordin et al., 2018; Perks et al., 2017; Planko et al., 2017) and that specifically discuss the orchestration of innovation networks (e.g., Dhanaraj and Parkhe, 2006; Dollet and Matalobos, 2010; Nambisan and Sawhney, 2011; Aarikka-Stenroos et al., 2017; Möller and Halinen 2017; Reypens et al., 2019; Roijakkers et al., 2013). These studies typically concentrate on structural issues, such as what kinds of actors are included in the networks and how they are positioned compared to each other, as well as on the aims set for the networks. As a central issue in this paper, varying orchestration activities, categorized under key orchestration dimensions required to build the networks and achieve the aims, are also addressed in many of these studies. (Hurmelinna-Laukkanen and Nätti, 2018; Möller and Halinen, 2017).

At the same time, there is little discussion about how to involve lead users by means of orchestration, for example, how this involvement shows in the orchestration dimensions. In the innovation management literature, the role of users—especially lead users—has been recognized and examined for a long time (e.g., von Hippel, 1986; Kaulio, 1998; Kristensson et al., 2004; Lüthje, 2004; Enkel et al., 2005; Hiennerth and Poetz, 2005; Schuurman et al., 2011; Schuhmacher and Kuester, 2012; Hiennerth et al., 2014; Hyysalo et al., 2015; Hiennerth and Lettl, 2017;

Lettl, 2020). For example, Laage-Hellman et al. (2014) discuss the practical means of involving customers in product development, Bosch-Sijtsema and Bosch (2015) explicate utilizing customer feedback in product development, and Lüthje and Herstatt (2004) cover the identification of lead users and facilitating their involvement in the innovation projects as they introduce the Lead User method. Lehnen et al. (2016) describe agile project management in lead user projects, Roy (2018) addresses lead users' role in the emergence of disruptive innovation, and Hyysalo et al. (2016) analyse user-driven innovation modes. The element of networking has also emerged in this literature. For example, Heiskanen et al. (2010) scrutinize user-focused innovation communities, and Lynch et al. (2016) study involving network of customers and related measurements. However, the research mostly covers connections between the users within individual supply chains rather than wider networks with multiple producers and other stakeholders. Network orchestration as a starting point for involving lead users in collaborative innovation process is still missing. In particular, the perspectives and reactions of the lead users on the orchestration activities that are targeted to them specifically, and the rest of the network, are not recorded comprehensively. Nevertheless, earlier research provides some direction on how the lead user traits and orchestration might be aligned. These issues are discussed shortly in the following sections.

2.1. Who are the lead users?

The accumulated scholarly knowledge provides information on numerous facets of lead user involvement that, taken together, provide an overview of the basic premises of the who, why, and how of the phenomenon.

Determining who the lead users are and what kind of characteristics they have is an important issue, and a topic that has been widely examined (e.g., Lilien et al., 2002; Urban and Hippel, 1988; Franke and Von Hippel, 2003; Franke et al., 2006; Schuurman et al., 2011; Schuhmacher and Kuester, 2012). Although other categorizations also exist that build on the observed differences between users (see, e.g., Schuurman et al., 2011), we adopt a classification in a recent study by Hiennerth and Lettl (2017) to ground combining the insights on lead users to network orchestration. Hiennerth and Lettl (2017) divide user types into the categories of regular users, user innovators, expert users, and lead users. Regular users are standard users who are rather passive with respect to innovative activities. They simply utilize the offerings. User innovators are dissatisfied with the current standard and may invest in innovating solutions themselves to answer their own needs. However, the value of these solutions does not necessarily expand more widely; the solutions are specific and therefore of limited wider applicability. Expert users have distinct knowledge in a certain domain, but they do not derive any true benefit from innovative solutions and are therefore not likely to engage in innovation activities, at least not actively (Hiennerth and Lettl, 2017). *Lead users* are distinct from these groups in that they voluntarily engage in innovation and expect high personal benefits from it, not necessarily in terms of monetary reward, but in their profession, for example (see e.g., Lüthje and Herstatt, 2004). Their views or expertise are ahead of existing trends and thus attractive to others also (Bilgram et al., 2008).

This turns attention to the 'why'—not for the lead users only, but also regarding motivations of innovating organizations to engage lead users in innovation. Among the types of users, lead users hold the most potential for assisting organizations in gaining leading positions, cost-efficiency, and other benefits through their voluntary participation and input (Hiennerth and Lettl, 2017; Lüthje, 2004; Pisano and Verganti, 2008; Di Gangi and Wasko, 2009; Lynch et al., 2016; Bosch-Sijtsema and Bosch, 2015). For instance, according to the literature, companies rely on lead users because they help them to fit their solutions to the market and because this allows their customers to adopt and integrate innovations faster and more intensively into their existing processes and practices (Scheier and Prügl, 2008; Schweisfurth and Dharmawan,

2019). Earlier research has mentioned long-distance hauling firms as relevant lead users for Volvo Trucks (Laage-Hellman et al., 2014), hobbyists (e.g., free divers) as lead users for Suunto, a sports equipment manufacturer, and diabetes professionals (medical researchers and practitioners) as lead users for a small software company trying to create an Internet-based medical archive (Heiskanen et al., 2010). These cases show how the involvement of a lead user can improve the features of the offering and its speed to market, and also help find other relevant users. In our empirical setting, medical experts—doctors and nurses who benefit from innovative tools developed for the paediatric surgery process—are the ones in the position to give their input to the innovation process, together with the child patients' families who experience the medical care service and benefit from the introduced improvements in it.

However, it has also been acknowledged that involving lead users is not a straightforward activity and that the 'how' often comes with complications. Identifying the lead users has been found to be a challenging task, especially ex-ante (Laage-Hellman et al., 2014; Schuurman et al., 2011), and even after getting past this problem, other challenges await. The voluntary nature of the users' contribution is only one point to consider, as issues with willingness of users to participate can be accompanied with issues with the ability to do so. Users may not be able to communicate their knowledge, and producers may lack the capabilities to seize the opportunities (see, e.g., Heiskanen et al., 2010; Katila et al., 2017). It also is possible that producers capture wrong user insights, leading them to unfeasible trajectories. Existing research therefore indicates that a variety of methods need to be employed both to identify relevant users and to harness their knowledge (Bilgram et al., 2008; Fichter, 2009; Lettl and Gemunden, 2005; van Laere and Aggestam, 2016; Laage-Hellman et al., 2014). We adopt this insight and develop it further, as we suggest that in innovation network contexts, the ability of lead users to contribute to innovation depends not only on themselves or individual companies, but also on the ability of orchestrators to involve lead users, facilitate interaction, and respond to lead users' initiatives.

2.2. Central dimensions of innovation network orchestration—Premises for identifying relevant activities to involve lead users

For an individual organization, integrating end-user needs into the solution being developed is at the core of innovation activity (e.g., Bosch-Sijtsema and Bosch, 2015; Hiennerth and Lettl, 2017; Lynch et al., 2016). Therefore, organizations frequently aim to steer the innovation process in a way that avoids integration-related problems and ensures that the organization and end users work together, each contributing their expertise to the process (Parmentier and Mangematin, 2013).

Similar aspects emerge in complex, even vague, innovation networks, where orchestrators pursue to promote integration of the capabilities of different actors and to facilitate a common platform to support participants in creating solutions (Fichter, 2009; Hurmelinna-Laukkanen and Nätti, 2018; Nambisan and Sawhney, 2011). Innovation network orchestrators conduct many orchestration activities as an innovation process proceeds (Dhanaraj and Parkhe, 2006; Russo-Spena and Mele, 2012; Möller and Halinen, 2017; Aarikka-Stenroos et al., 2017). For example, in the early phases of the innovation process, orchestrators tend to focus on facilitating sense-making among collaborators, clarifying the goal of cooperation, and mapping out the needed capabilities. Orchestrators also put effort into attracting contributors to join the network (Möller and Rajala, 2007). Later, when commercialization of an innovation nears, orchestration turns towards a more determined set of activities, resembling more traditional forms of management compared to 'discreetly influencing' innovators (Hurmelinna-Laukkanen and Nätti, 2018). This resembles the phase model for involving users in innovation activities (see Bosch-Sijtsema and Bosch, 2015) but is distinctive and more complex due to the pluralistic setting.

Notably, individual orchestration activities fall under specific

orchestration dimensions—agenda setting, mobilization, network stabilization, knowledge creation and transfer, securing innovation appropriation and coordination—that need to be addressed to foster innovation-targeting collaboration and reach adequate structure without hampering the flexibility needed for the system to be innovative (see, e.g., Capaldo, 2007; Dhanaraj and Parkhe, 2006; Dyer and Nobeoka, 2000; Leonard-Barton, 2007; Kenis and Provan, 2006; Luo, 2008; McGuire, 2002; Möller, 2010; Möller and Halinen, 2017). Examination of the inherent dimensions enables understanding of the premises of involving lead users in innovation networks. Therefore, we also use these dimensions to form a framework for our empirical analysis.

Agenda setting is about providing (initial) direction for the innovation process. Agenda setting activities allow orchestrators to influence the creation and communication of a development agenda for the network, thus making it understandable to the varying actors, including lead users. For example, Möller (2010, p. 361) suggests that developing an agenda for cooperation is a “key cognitive process.” As lead users ‘already live in the future’ (Mahr and Lievens, 2012), agenda-setting should benefit strongly from gaining insights from lead users (see Bosch-Sijtsema and Bosch, 2015). At the same time, agenda setting that has this kind of focus potentially increases lead users’ interest toward the network activity.

Like agenda setting, *mobilization* is emphasized especially during the early phases of the innovation process, where the main orchestration challenge is often to select and attract potential and capable actors—including knowledgeable users—to join the innovation process (Möller and Halinen, 2017). Motivating different actors to join and contribute by demonstrating the future benefits of cooperation forms the core of mobilization (e.g., Mouzas and Naudé, 2007). If the orchestrator shares common values and aims with relevant actors to be mobilized, the task can be notably easier (Ritvala and Salmi, 2010). Therefore, the incentives of lead users need to be integrated into the orchestration at this stage, next to the incentives of other valued participants.

This leads us to the next orchestration dimension: *network stabilization*. Ensuring stability is about strengthening the common identity, shared values, and beliefs (Dhanaraj and Parkhe, 2006; Zhao et al., 2015; Goduscheit, 2014). It is about constructing a common culture for involvement in continuous value co-creation. Lead users may be interested in participation, but without proper incentives and a common language, they may be lost (Chandra and Leenders, 2012; Parmentier and Mangematin, 2014). In innovation networks, some participant turnover is to be expected (and also welcomed; see, e.g., Laage-Hellman et al., 2014), but it is worth noticing that stability might require special attention, especially regarding lead users whose involvement builds on voluntariness rather than business connections and interdependencies (see Jeppesen and Laursen, 2009).

According to the established knowledge on innovation network orchestration, network stability is relevant for *knowledge creation and transfer* (Dhanaraj and Parkhe, 2006). This orchestration dimension involves activities that enable the network members share and combine their specialized knowledge and co-create new knowledge (Andersson et al., 2007). Knowledge mobility ensures that beneficial knowledge from not only within, but also from outside the network can be utilized (e.g., Czakon and Klimas, 2014; Zahra and George, 2002), which in the case of user involvement extends the network to lead users’ social networks and user communities (Hienerth and Lettl, 2017; Katila et al., 2017). As facilitating knowledge processes in networks is crucial, those activities are relatively well understood for interaction between producers (e.g., Corsaro et al., 2012; Hurmelinna-Laukkanen and Nätti, 2018; Marzouki and Belkahl, 2020). However, networks with lead user participants might need a different approach. At the same time, the literature on user innovation has a good understanding on how to promote knowledge mobility between individual organizations and their customers (e.g., Mäkinen et al., 2019; Stewart and Hyysalo, 2008), but that is different from orchestrating for knowledge mobility within the

networked context where different parties with different motivations to access knowledge are present.

Lead users in the search for benefits for themselves are likely to be quite open about the knowledge they possess (Hau and Kang, 2016) and can hold a boundary spanner role, too (Jeppesen and Laursen, 2009). This brings both opportunities and threats in inter-organizational networks. Indeed, in innovation networks, a certain amount of security and conviction of value appropriation possibilities is needed for knowledge to flow (Dhanaraj and Parkhe, 2006). When innovations emerge, there is a need to generate and maintain principles for fairly distributing the accruing benefits. This is where *securing innovation appropriation* comes into play. This refers to the orchestration activities aiming at ensuring value capture and profit for those involved (Hurmelinna-Laukkanen and Nätti, 2018). Appropriability may not be an issue for lead users who do not have immediate concerns for profiting from an innovation (see DeMonaco et al., 2018; von Hippel, 2017), but there are also exceptions to this; some lead users wish to gain monetary benefit from proprietary uses (see Tietze et al., 2015). On the other hand, knowledge protection or intellectual property rights may also be problematic for lead users who wish to see the solutions adopted widely (see Oftedal et al., 2019). Lead users are to be reckoned in appropriability-related activities to ensure that misappropriation does not disrupt the network and to avoid over-protective approaches.

Finally, *coordination* as a dimension of orchestration covers the activities of project management: defining tasks, roles, goals, milestones, and a schedule for the innovation process. Likewise, it is about monitoring the performance along the process. Nambisan and Sawhney (2011, p. 42) suggest that “managing innovation coherence” is about internal network activities that facilitate the “coordination and alignment of processes and outputs” and external network activities that align the network’s goals with the external market and technological environment. For involving the voluntary lead users, the premises may be quite different from those of companies that produce the innovations, and this needs to be considered when planning coordination activities. For example, the orchestrator may have to consider differently, when and how users are available for joint activities.

While it has been recognized in earlier studies that orchestration activities under the above dimensions vary between different network contexts and situations (e.g., Kirkels and Duysters, 2010; Möller and Svahn, 2003), it has not yet been established how lead users can be and are involved as a part of this setting. There is no comprehensive understanding of whether the different network orchestration activities—when aimed to influence lead users or other actors in the network—have diverging effects on user engagement. Therefore, we proceed to study the interaction between the orchestrator(s), lead users, and innovating organizations with the help of a tentative theoretical framework building on the above discussion and depicted in Fig. 1 below.

2.3. Embracing lead user involvement as a part of innovation network orchestration

Studies based on the industrial network approach emphasize the emergent and evolutionary nature of network entities (e.g., Håkansson and Snehota, 1995; Håkansson and Ford, 2002), and suggest that networks can be intentionally and purposefully formed and coordinated—that is, orchestrated by a dedicated orchestrator—rather than strictly managed by some authority (e.g., Batterink et al., 2010; Dyer and Nobeoka, 2000; Möller and Rajala, 2007). Therefore, orchestration view fits quite well with the idea of lead user involvement: There is no reason to expect that lead users would be responsive to strict, perhaps even coercive, top-down management, which may, on the other hand, emerge in organizational settings when companies’ only alternative to survive is to comply with the expectations of more powerful actors (see Jeppesen and Laursen, 2009). More discreet coordination matches the voluntary participation. Yet, the question of how the principles of lead

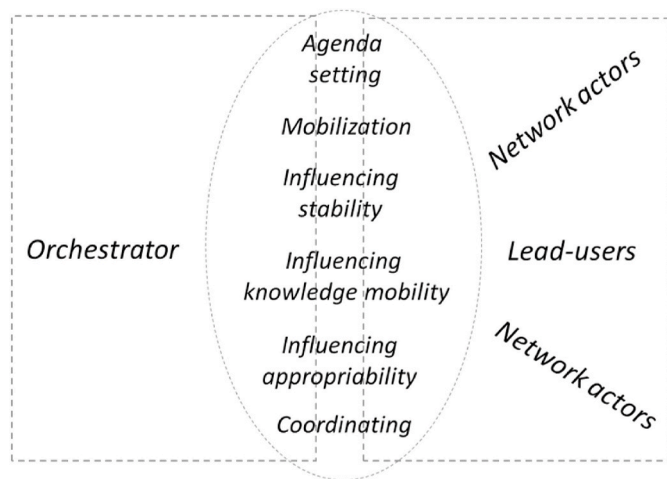


Fig. 1. A tentative theoretical framework for the study—Dimensions of orchestration for lead user involvement.

user involvement and network orchestration can be aligned calls for closer consideration from both sides of existing literature.

Previous studies on orchestration have suggested that every network entity is different in various regards, for example, in terms of its level of determinacy, its goals, the nature of the knowledge shared, and the variety and number of network actors and their relative power positions (e.g., Hurmelinna-Laukkanen and Nätti, 2018; Möller and Halinen, 2017). Relatedly, networks and orchestration can be organized in different ways: having a lead organization, participant-governed, or network administrative organization models (Provan and Kenis, 2008). Such underlying flexibility helps determine what kind of orchestration is most suitable in specific situations (Hurmelinna-Laukkanen and Nätti, 2018; Aarikka-Stenroos et al., 2017), including the involvement of lead users to gain insight into the upcoming trends, to conduct joint testing and experiments, or promote innovation diffusion, among other things (e.g., Bosch-Sijtsema and Bosch, 2015; Hienert and Lettl, 2017; Heiskanen et al., 2010).

At the same time, the lead user literature provides starting points for finding orchestration activities suitable for lead users. The inherent characteristics of lead users provide clues on what kind of orchestration activities orchestrators may initiate to promote their involvement and motivation. As a relevant example, the incentives for lead users to contribute to the new product development of a firm can be manifold, and it may be that the network context provides wider opportunities to respond to these than what would be the case in an individual organization. In many instances, lead users wish to influence the development trajectories or the possibilities to use the end results meeting a need for a specific feature, product, or service (Heiskanen et al., 2010; Hienert and Lettl, 2017; Korreck, 2018; Leenders and Dolfma, 2016; Urban and Hippel, 1988), in which case a network may be more efficient than a single firm. Lead users have also been noticed to have entrepreneurial goals (Shah and Tripsas, 2007), which can be accommodated in orchestration activities relevant in the commercialization phase. In other situations, lead users might be looking for professional gains (Heiskanen et al., 2010) or recognition with respect to some important trend (Marchi et al., 2011). One example of trend leaders mentioned by Lettl et al. (2008) is the work of neurosurgeons, who typically want to be top-level experts in their specific focus area and who therefore might also have an interest in continuous skill improvement and gaining new knowledge of the technology opportunities neighbouring or directly related to their own specific focus area. Building on the variety in incentives can be an important starting point for continuous facilitation of lead user participation also at the network level.

However, in the network context, involving lead users might be more complicated compared to them being incorporated into the internal,

strategy-guided activity of individual organizations (see Urban and Hippel, 1988; van Laere and Aggestam, 2016; Parmentier, and Mangematin 2014). While identification of lead users is not in the hands of one actor only and can therefore be potentially enhanced in orchestrated network setting, organizations may be reluctant to reveal their important users or render to freeriding, which deters identification. Stickiness of information poses potentially a more pronounced challenge with an increasing number of actors with different capabilities. Furthermore, innovation with users requires the organizations to be willing to open up the development process and give up some of the control over the innovation process (Parmentier and Mangematin, 2013). In a network, this may open a new, relatively uncontrollable channel for knowledge flows between varying actors. Lead users seem to be particularly prone to share knowledge (Hau and Kang, 2016), and they may unintentionally (or intentionally) pass important information even to competitors. Therefore, the orchestrator needs to execute particular attentiveness to these issues.

In addition to pointing towards the problematics for the innovating organizations, lead user research indicates that the network context may introduce some specific issues in terms of incorporating lead users' motivations and the voluntary nature of their work (see, e.g., Chandra and Leenders, 2012, on complexities related to combining virtual and second lives, and Mahr and Lievens, 2012, on difficulties in virtual communities). Having multiple companies and public sector actors involved simultaneously may prove to be particularly challenging: What if a lead user is willing to work with one organization but is adversely positioned against another actor in the network? What if the type of the orchestrator (e.g., a company, university, association; see e.g., Roijakkers et al., 2013; Hurmelinna-Laukkanen and Nätti, 2018), is not preferred by the lead user, or if the orchestrator lacks the capability to understand lead users (see Czakon and Klimas, 2014; Goduscheit, 2014; Hinterhuber, 2002; Mitrega et al., 2012)? What if a lead user starts to shy away from the network because of increasing expectations, contacts from multiple actors, and requests for participation from multiple parties? It may be that the demands and circumstances are no longer favourable from the point of view of lead users when the activity spreads beyond boundaries of a specific organization into the wider network (see Tietze et al., 2015). Knowledge of these kinds of possible challenges and their solutions on either side is still relatively thin, which gives a start to the need for empirical evidence.

3. Dynamics of lead user ORCHESTRATION—FINDINGS from a healthcare case

Huang et al. (2020) note that in the field of healthcare, the quality of services provided to meet patient needs is determined by knowledge sharing among a plurality of stakeholders such as physicians, decision makers and payers. This indicates that the healthcare context is increasingly relevant for examining innovation network orchestration and lead user involvement.

3.1. Case: networked innovation project in a university hospital

Our empirical examination was conducted via an illustrative case study where we could understand the complex topic of interest by scrutinizing the phenomenon based on multiple data sources (e.g., Yin, 2014; see the data sources, number of interviews and interview questions in Appendices 1–3). This approach is appropriate because determining lead users in the health context can be challenging, and the boundaries between the phenomenon and the context are not always clear (see Yin, 2014). Examining the single case allowed detailed, context-sensitive observation of the emerging orchestration challenges and activities.

Specifically, the context of our study is an innovation network (see Fig. 2) that was initially launched by the management of a public university hospital in Finland. The network was originally set up to support

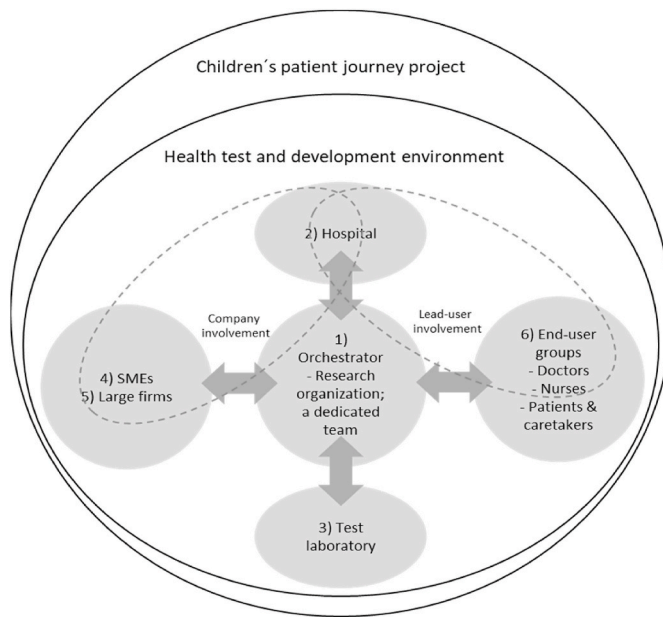


Fig. 2. The networked innovation participants in the university hospital—Innovation organized under a project utilizing the physical premises of a test and development environment.

the hospital's own innovation work related to the development of a next-generation digitalized children's hospital. To make this effort more concrete, the university hospital established a test laboratory that imitated the actual hospital environment. The hospital management considered that the test lab could offer a place where future hospital devices and applications developed by companies could be evaluated in accurate and authentic simulations. Researchers from a public research institute were invited to help coordinate the innovation process. Building on these premises, a specific research project was initiated with a focus on the development of new digital solutions for the children's patient journey from home to hospital and back home. The aim was to reach developments for service chains that would benefit patients and healthcare professionals. For example, reducing waiting times, improving data logging, and ensuring converging information systems were pursued results.

At the time of our study, the project included (1) the orchestrator; a dedicated team from the research organization, (2) the hospital (represented by its management team), (3) the university hospital's integrated health testing and development laboratory, (4) six large companies intending to build a healthcare ecosystem to support their solution development, (5) ten SMEs wanting to promote their offering as part of the ecosystem, and (6) three user groups: healthcare professionals: doctors and nurses, child patients, and caretakers of the child patients (see Fig. 2 and Appendices). Although the firms also have their user networks, these were not specifically observed, but they were represented in the firm's participation indirectly. Eventually many users that took part in the project met the definition of lead users, having clear benefit and far-reaching insights (especially doctors and nurses) based on their expertise and experiences. However, in some instances, also expert users could be identified; eventually those professionals who preferred earlier ways of work were not included in the closer examination.

For multiple reasons, this specific project was an excellent setting for our study. First, there were a variety of actors involved. As a notably important issue, the role of the participating lead users was remarkable, and we were able to observe both those users who were to utilize the generated technical solutions (doctors and nurses) and those users who were to benefit from the services utilizing those solutions (child patients via their parents)—next to various private and public actors. The special

needs of children as users formed the starting point for the innovation project. In line with widely established norms, minor surgery is generally implemented in health centres under local anaesthesia, but children under 18 years old must be anaesthetized and treated as paediatric surgery patients in specialized care. The paediatric surgery process is structured along pre-, intra-, and post-surgical phases and a home-care phase. Most surgeries in the studied hospital were pre-scheduled day surgeries, and 40% were acute emergency operations. The provision of day surgeries is increasing, and therefore resource management and comprehensive process development are required. Thus, in addition to enhancing the patient experience, one important goal was to reduce the redundant time that doctors and nurses had during the paediatric surgical patient process, for example, time lost due to waiting or double data logging. This means that digital solutions likely bring value, but involvement of lead users and connecting their input to that of solution provider firms is essential.

Second, the innovation project genuinely represents the leading edge in healthcare innovation. The explicit future-orientation of the project and the fact that innovation development in and around the specific project is highly comprehensive—from the improvement of processes to restructuring of the hospital organization and reconstruction of buildings—provide a unique setting for examining innovation networks.

Third, in this project, the orchestrator is a neutral actor (see Hurmelinna-Laukkanen and Nätti, 2018) rather than an individual company, which allows examining lead user involvement in the innovation network orchestration without fear of actually observing “regular” user-innovation involvement already examined in lead user research. Relatedly, Finland provides a good examination context in the sense that it is considered as one of the innovative countries, there is high compliance to regulation, and the public sector plays a notable role in providing healthcare. The small market has also been considered as creating a test-environment type of context for innovation. Finally, we had wide and longitudinal access to multiple sources of data in an environment that is often inaccessible for these kinds of studies (see Yin, 2003). Close interaction with the project actors allowed for gaining holistic insight from a variety of viewpoints.

Prior to the data collection, the ethics approval was applied from the central governance of the organization responsible for regional healthcare. Its ethical committee concluded that the approval is not needed, as the study did not extend to customer healthcare itself and as only parents were involved in data collection, not child patients. Interview data came from altogether 17 different paediatric specialists at the university hospital. In addition, meeting observations and informal talks added to empirical materials from the hospital. Data was also collected from parents whose child had either gone through the surgical journey or was currently in hospital care. Online discussions were organized in a closed virtual workspace, and parents were asked to tell stories of their child's surgical patient process and share ideas about what kind of solutions might have tackled the related challenges. In these online discussions, parents could also comment on the others' experiences and ideas. Data from involved companies came mainly from interviews. These were conducted among the 16 participating companies. At the end of the project, the companies had the opportunity to introduce their solutions and collect feedback in a demo event. Data collection was also done at this event to gain insight into the project and the related processes. Altogether 22 companies joined the event, which involved approximately 150 participants.

All the interviews, workshops, online discussions and observation data (see Appendices) were analysed thematically utilizing a content analysis approach (Weber, 1990) to build an in-depth understanding of lead user orchestration in the project. Earlier literature on lead users and innovation network orchestration provided the starting point, and the findings below are organized accordingly.

3.2. Empirical observations on orchestration activities—The dynamics of involving lead users

We started our analysis by looking at the data from two directions simultaneously. Using abductive logic, we started coding the materials, paying attention to the lead user point of view, and then, instructed by existing theorizing, mapped the emerging themes along the orchestration dimensions. Fig. 3 illustrates the activities as they took place as the project progressed, organized under orchestration dimensions, and Table 1 shows excerpts from the raw data, demonstrating such issues that emerged as relevant to lead users.

3.3. Agenda-setting

In the children's patient journey development project, the agenda-setting process started with individual discussions between the orchestrator and hospital management and with the chief doctors and nurses in

the paediatric surgery unit. Those included at this stage had the required knowledge to identify key personnel and the power to enable the involvement of the lead users (doctors and nurses) from the hospital's varying departments.

In the initial discussions, common targets related to the expected innovations in the paediatric children's surgical journey were collected and codified by the orchestrator. The aim was not to set up too tightly defined goals, but rather to empower lead users in the innovation process. It was considered that having a clear view of the existing situation was necessary for drafting a feasible agenda. Likewise, it was important to align the identified goals to support other ongoing hospital development projects, especially considering the simultaneous renewal of the children's and women's hospital (see Fig. 2 above), and the user-centric approach. This alignment was an important motivator for the lead users, who were asked to divide their time with many parallel innovation activities.

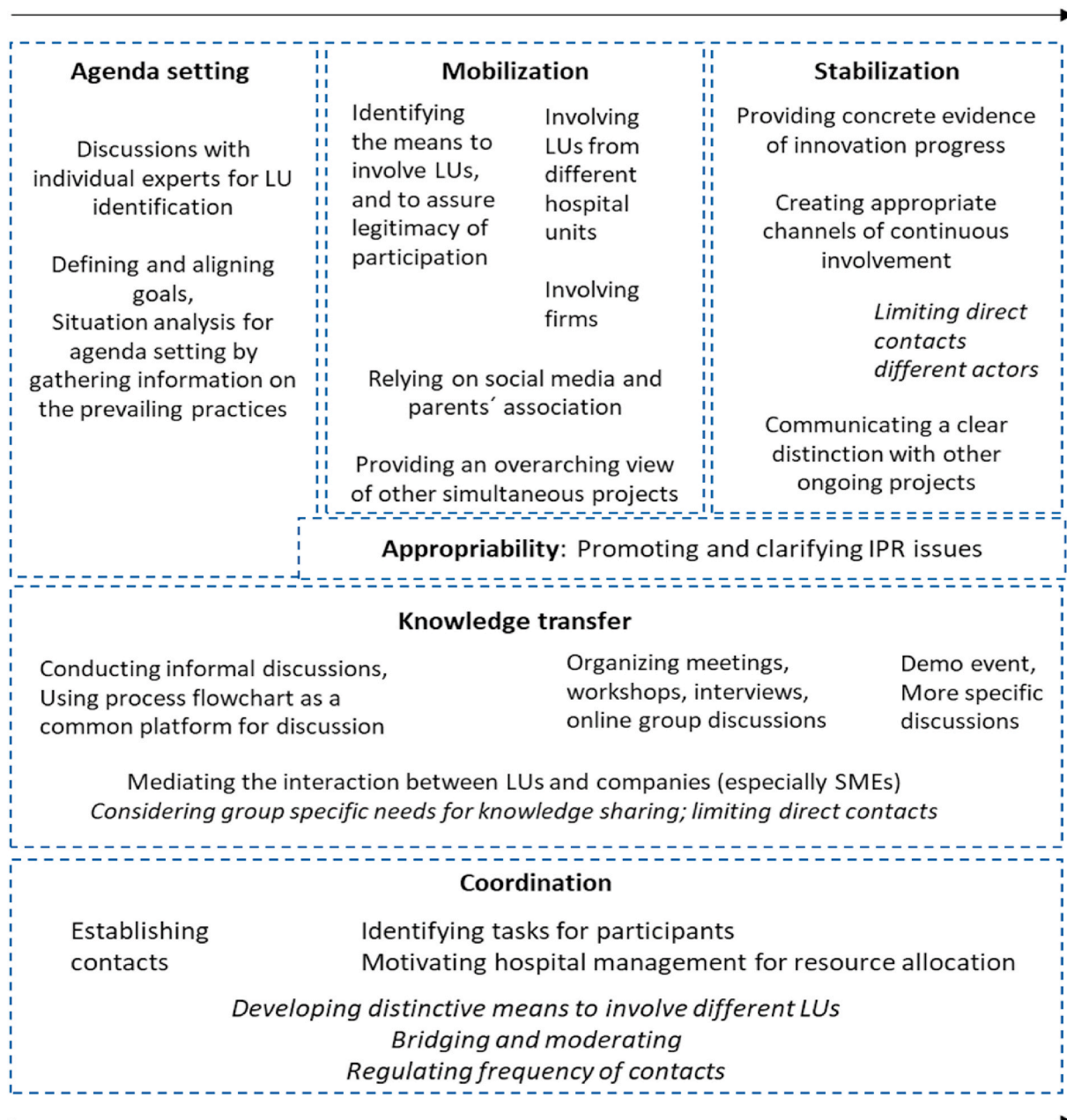


Fig. 3. Orchestration for lead user involvement in the paediatric journey innovation project.

Table 1
Illustrations of lead user's insight to involvement by orchestration dimensions.

Orchestration dimension	Quotes	Critical issues to be addressed
Agenda-setting	"It is important that everyone knows the overall care journey of the patient. We have made so many care process descriptions, but most often those descriptions capture only the insight of the clinic. Even if patients are visiting a different special care area, professionals in that department are not necessarily interested in telling us what kind of patient care process they have planned." (Hospital)	Goals accommodating lead user involvement
	"We have many parallel things going on related to the future hospital, e.g., how to save money and what we need to do to improve efficiency." (Hospital)	Alignment of goals
	"Satisfying patient needs and design of improved, patient-centred care processes currently fuels the healthcare transformation agenda in our future digital hospitals". (Doctors)	Common ground in goal-setting
Mobilization	"When the nurses are coming together from different departments, we suddenly can see the improvement needs differently". (Nurses)	Communication between relevant actors
	"If the management does not give the green light for the idea, it will not be accepted in any of the departments". (Doctors)	Legitimacy
	"Both parties have to find a common time slot. This innovation work is really binding our resources". (Doctors)	Acknowledging boundary issues
	"When we have a workshop, we have an agreed time for the innovation activity ... otherwise we should do the work after normal work hours". (Nurses)	
	"This Future Hospital project demands that we participate in so many projects at the moment that we do not have enough resources for all this". (Doctors)	
	"40 patient-side representatives were recruited via the existing patient panel of the hospital, online group and face-to-face interaction ... from these, face-to-face recruitment proved to be the most efficient". (Orchestrator*)	Means of communication
Network stabilization	"The three most significant reasons for the patient side representatives to participate in these co-creation activities were identified as follows: 1) person's genuine desire to improve things, i.e. make the world better, 2) person's sincere interest in the innovation, and 3) feeling of being heard and taken seriously." (Orchestrator*)	Acknowledging incentives
	"The Future Hospital project expects us to join in everywhere—it is difficult to find resources to support SMEs". (Doctors)	Limited participation possibilities
	"Ideas can emerge at any time, for example when I walk in the corridor, suddenly I realize that a task could be accomplished differently" ... "It would be great if	Easing involvement (by systematizing participation)

Table 1 (continued)

Orchestration dimension	Quotes	Critical issues to be addressed
Knowledge mobility	we had some concrete place to add new ideas" ... (Nurses)	Concrete evidence of progress as an incentive for continuous involvement
	"Doctors are more used to participating in the innovation process in the testing phase when there is something concrete to show them". (Chief doctor)	
	"In one case, we realized that there was no feedback on the solution from doctors before the solution was in use. Suddenly when the solution was in actual use, there were a million things to be improved". (Doctor)	Ensuring the potential to make an impact
	"We always need to think about the benefit that this solution will bring to the end users. In many cases, the benefits appear later, not immediately when the solution is in use". (Chief nurse)	
	"It would be great if we had some concrete place to add new ideas" ...	Common repository of knowledge
	"Then someone else could group the ideas and decide when to implement the solutions for them." (Nurses)	
Appropriability	"We are not communicating much inside the hospital or between hospitals. For instance, [a company] has developers in many hospitals and hospital units, but we do not know what is said or done in the other two hospitals". (Hospital management)	Platform for knowledge exchange
	"An interactive demo event was organized to give companies the possibility to present their solutions to end users (practitioners and patient-group representatives). Altogether 22 companies joined DemoDate with approximately 150 event participants. Based on the collected feedback from company and end-user participants, several 'lessons learnt' issues could be identified that ought to be taken into account when planning and organizing a similar kind of event in the future in order to genuinely provide value to participants." (Orchestrator*)	
	"We should continuously collect feedback, not only in those cases when we have an unhappy customer." (Hospital)	Systematic feedback collection
	"Three of the participating companies were at a too early stage to get the full benefits of the provided user information. On the other hand, three companies that were at a more mature state were able to use the needed information to develop a service prototype that could be shown and ideated further with the health professionals." (Orchestrator)	Evaluation of maturity of ideas for knowledge exchange
	"Healthcare professionals were pleased with the mode of operation in which professionals' expectations and needs were the main focus and considered first [...] rather than focusing too much on a technology point of view". (Orchestrator)	Collecting information on user needs—user orientation

(continued on next page)

Table 1 (continued)

Orchestration dimension	Quotes	Critical issues to be addressed
Coordination	"It is unclear which actual needs or technological innovation ideas can be openly mentioned to the SMEs". (Doctors)	Uncertainty with legal aspects and confidential information
	"We do not know what we are allowed to tell the companies and what we cannot." (Doctors)	
	"The unclear legal aspects may hinder communication". (Hospital management)	Coopetitive setting
	"The university hospital itself is making services that could be sold in international markets, and on the other hand, there are many companies that are competitors with each other". (Hospital management)	
Coordination	"We should have resources allocated for the innovation work—for instance 10% [of working time]. The co-creation should be on the strategic agenda of the hospital, and the management should give a clear message that this is respected work that also has a resource allocation". (Doctors)	Resource allocation
	"If we buy an innovative solution to our problem that costs one million euros, we also need to test it." (Nurses)	Importance of testing possibilities
	"There cannot be wild markets in which all the companies are just selling and testing their solutions in different hospital units. We need a structured approach to how we carry out innovation work." (Doctors)	Systematic approach to innovation; clear process
	"Sometimes we would like to have the solution in the departments, but the attitude towards the new innovation idea is clammy in our management". (Doctors)	

Note: For confidentiality reasons, we do not show here direct quotes from the patients/caretakers. Their views are described in the text and through orchestrator's notes, which build on statements of the patient/caretakers. [See quotes marked with an asterisk (*)].

3.4. Mobilization

Wider mobilization (i.e., a selection of relevant actors for the innovation network and motivating them) was built on the discussions between the orchestrator and the chief doctors and nurses who helped identify the lead users in their own groups. One fundamental challenge revealed in the discussions was the communication gaps between the departments of the university hospital, even if they were involved in the same care path. In the discussions, it was quickly understood that an important prerequisite for comprehending the whole process was to involve lead users from the different departments and generate chances for them to interact. However, it was also noticed quite early in the mobilization phase that the ways of including the lead users—both practitioners and representatives of the patient-group—needed to be planned carefully and tailored. It was considered important that the orchestrator talked with the hospital management to assure the legitimacy of the activity. Likewise, the orchestrator needed to actively promote agreement on the ways to involve these different lead users and to act as an intermediary in these discussions.

After the initial discussions and some trial and error, specific approaches were identified: Doctors often work individually with the support of nurses to conduct very specific medical actions. Therefore, it

was important to listen to their ideas individually to gain their initial commitment. On the other hand, for mobilizing nurses, being able to talk in groups among peers from different departments turned out to be most efficient. This also met the hospital management's hope of crossing departmental boundaries. Permission to use working time for innovation activities and the nurses' superiors' specific recommendation to participate in the project were identified as prerequisites for their participation. That is, while willingness to contribute existed, practical obstacles and barriers related to the hierarchical organization needed to be removed. The orchestrator's initiative was critical in this.

When involving the child patients and their parents as lead users, initial mobilization was carried out through patient associations and social media (a Facebook group was established for disseminating information and invitations). Increasing the awareness of the possibilities to have an influence was an important orchestration practice. Patient associations offer peer support and organize meetings for parents to help them manage their experiences. They were active in helping to share information about the workshops that targeted better services in the children's hospital. The invitations in the innovation workshops reached hundreds of people, but only a limited group of parents was connected to the project. These participants had relevant knowledge and a high motivation to participate, and they represented the ideas of their children also. In the end, employing carefully selected means of mobilizing different actors allowed some key lead users among the health professionals and parents to be reached, which enabled a holistic view to be gained regarding the children's patient journey, its challenges, and improvement ideas. At this stage, companies were also included in the network. In practice, they were connected to the wider hospital development endeavour. In fact, having an overarching view of the ongoing simultaneous projects in the hospital turned out to be important for mobilization. It was easier for the orchestrator to promote mobilization of lead users when there was clarity of how this particular project related to the other ongoing endeavours and what was expected from the lead users in each of these, e.g., by the relevant firm partners.

3.5. Network stabilization

In our study, the main challenges in network stabilization related to the parallel hospital projects that continuously invited the same lead users to participate in various activities. Consequently, clearly communicating the distinctions between different projects and their expectations was a central orchestration activity in keeping the lead users as active participants in the innovation work—not unlike their initial mobilization. One suggested solution to the competition over lead user time and resources was to have a tool for systematic collection and prioritization of innovation ideas.

Stability was also an issue present among lead user parents. They found difficulties in finding suitable times for face-to-face meetings to be continuously involved. The parents hoped that the participation could happen as a combination of online discussions and face-to-face meetings at appropriate intervals. It was noted that the best way to promote continuing involvement of lead user patients was through the hospital feedback system. In sum, finding appropriate platforms and points of connection for continuous involvement seems to be one important stabilization task.

Finally, in addition to user-type-specific actions, providing concrete evidence of innovation progress seemed to be one important way to maintain their attention and motivation. For lead users, it was most motivating to make a valuable impact on advancing the development of solutions that could potentially ease and bring value to their work and by gaining better patient experiences. The orchestrator was able to promote this by introducing chances for the company and lead user participants to meet specifically for these purposes.

3.6. Knowledge mobility

Knowledge exchange with the lead users was established through the following mechanisms: First, planning meetings with practitioner lead users provided the needed information on the key phases of the patient journey. Second, information about the needs and technological opportunities was acquired from the lead users via paediatric nurse workshops and specialist interviews and documented by the orchestrator. Thereafter, the orchestrator collected more detailed knowledge of the identified steps of the paediatric surgery process and the related needs and challenges for each step. Accordingly, innovation ideas driven by technological solutions were mapped to fit the process. The resulting flowchart of the paediatric surgery process was used as a framework for collecting feedback on proposed technology improvements among the network participants. Third, information concerning patient experiences was shared in a workshop, in online group discussions (a closed environment), and at a demo event initiated by the orchestrator. The participating patient-group lead users provided in-depth knowledge about needs and expectations for future care experiences. The improvement needs involved, for example, the transparency of the care journey, meaning fast, real-time and extensive information mediation and support before, during and after surgery, as well as a channel for ongoing feedback. Fourth, the information that the orchestrator collected and documented was analysed and transferred to the companies in workshops and individual meetings. Depending on how the knowledge exchange was organized, the orchestrators mediated the interaction of lead users and the producer companies, or observed the development of direct connections between firms and lead users. It was notable that the environment required the different groups to be separated, which can be considered an exception to the usually recommended free flow of knowledge. Among lead users, nurses indicated that it was easier to describe the hospital-level improvement ideas without companies or doctors being present (as their ideas would dominate the discussion in the traditionally hierarchical environment). Likewise, the patient-group and firms were not connected directly. In this setting, the orchestrator needed to be alert regarding knowledge mobility. For example, the demo event showed that the most successful innovation outcomes were achieved by a company who had had direct discussions with nurses.

3.7. Innovation appropriability

Securing innovation appropriability was important in our case context, as communication challenges emerged between lead users and firms. Uncertainty regarding legal issues burdened the communication, and it was considered easier to get information and ideas from lead users in the discussions between the orchestrator and lead users than when the companies were present. However, this approach was not expected by the companies that wanted to talk directly to the healthcare practitioners about the specific development needs related to their solutions. The lead users felt like the companies did not understand their point of view.

The importance of the orchestrator being the party to promote intellectual property right (IPR) issues and clarifying them became evident in the course of the project. The orchestrator needed to understand the potential competition and disclosure issues in the network and related tensions. There was a need for guidelines that clearly explained what could and could not be shared with companies in different situations, taking into account the hospital IPR issues, the interests of the involved lead users (e.g., doctors with their own enterprises or expectations of becoming partners) and data protection law (especially with patient information). As the health care environment is highly regulated, making sure that all parties gain an appropriate share of the output from the development work was found challenging, but achievable with careful orchestration through negotiations, guidelines and agreements, which were all supervised by the orchestrator throughout the process.

3.8. Coordination

Besides concretely contacting the participants, finding information on and for them, and providing platforms and support for creating suitable practices, the orchestrator aimed to coordinate activities by suggesting what network members could do. This included opening the discussion in the hospital regarding the support needed from the hospital management and working time allocated for practitioners to participate in the innovation activity. Although some of the doctors clearly considered themselves to be lead users with high expertise in their domains and a high potential benefit accruing from the development work, participation seemed to be impossible for them without a certain time and resource allocation. A related practical issue for coordination was that it was challenging to initiate pilots and testing of innovations in the hospital. Typically, there were limited resources or willingness on the hospital management side to purchase pilots. While the orchestrator could not make decisions on these kinds of issues, they could convey the messages from lead users to the appropriate actors.

In addition to bringing relevant topics to the table, the orchestrator could coordinate innovation activities with lead users by using distinctive means of involving the users. In our data, it was mainly the company representatives who brought up the need to contact users as directly as possible. However, this was considered problematic due to the complex hierarchy of the hospital. Some SMEs involved in the project contacted doctors and nurses from the university hospital 'too directly'. Furthermore, multiple parallel projects increased the confusion for lead users. Bridging and moderating were therefore essential activities to facilitate the cooperation between lead users and companies to ensure that the lead users did not feel overly burdened. Among patients and caretakers as lead users, such issues did not emerge—most likely because the tradition of keeping patient information confidential is widely accepted and respected, and well-understood by all parties in the network.

In sum, while lead users had the personal interest and expertise to participate in the networked innovation work, the orchestrator was needed to influence the allocation of resources for this purpose. In fact, after the examined innovation project, the university hospital set up a virtual innovation unit for which money and resources were specially reserved to support the actions of the innovation network.

4. Discussion

Involving lead users in networked innovation activities is not without challenges, which can be seen quite clearly in contexts such as professional and hierarchical healthcare. The voluntary nature of lead user participation, multiple different user groups, demanding work tasks of health professionals, dispersion of end-users, privacy and regulation issues, potentially competitive and even conflicting relationships among network actors, fear of knowledge leaks, and constant time pressure perceived by lead users are examples of issues that argue for the importance of diligent network orchestration.

While scholarly knowledge on orchestration dimensions from earlier research (see e.g., Dhanaraj and Parkhe, 2006; Möller and Halinen, 2017; Aarikka-Stenroos et al., 2017) helped us in defining relevant facets of lead user involvement in the examined case in a structured manner, empirical observation showed issues that differ from what is usually considered relevant for orchestration. Examining these anomalies against the earlier discussion on user innovation to find explanation provided us with a better understanding of orchestration of innovation networks involving lead users. The overall findings suggest not only that individual orchestration dimensions hold specific activities when lead users are essential participants of innovation networks, but they also point toward the need to add another dimension: shielding (see Fig. 4). These issues have both theoretical and managerial relevance as discussed next.

The literature on innovation network orchestration considers *formation of the network* to be a relevant part of successful orchestration

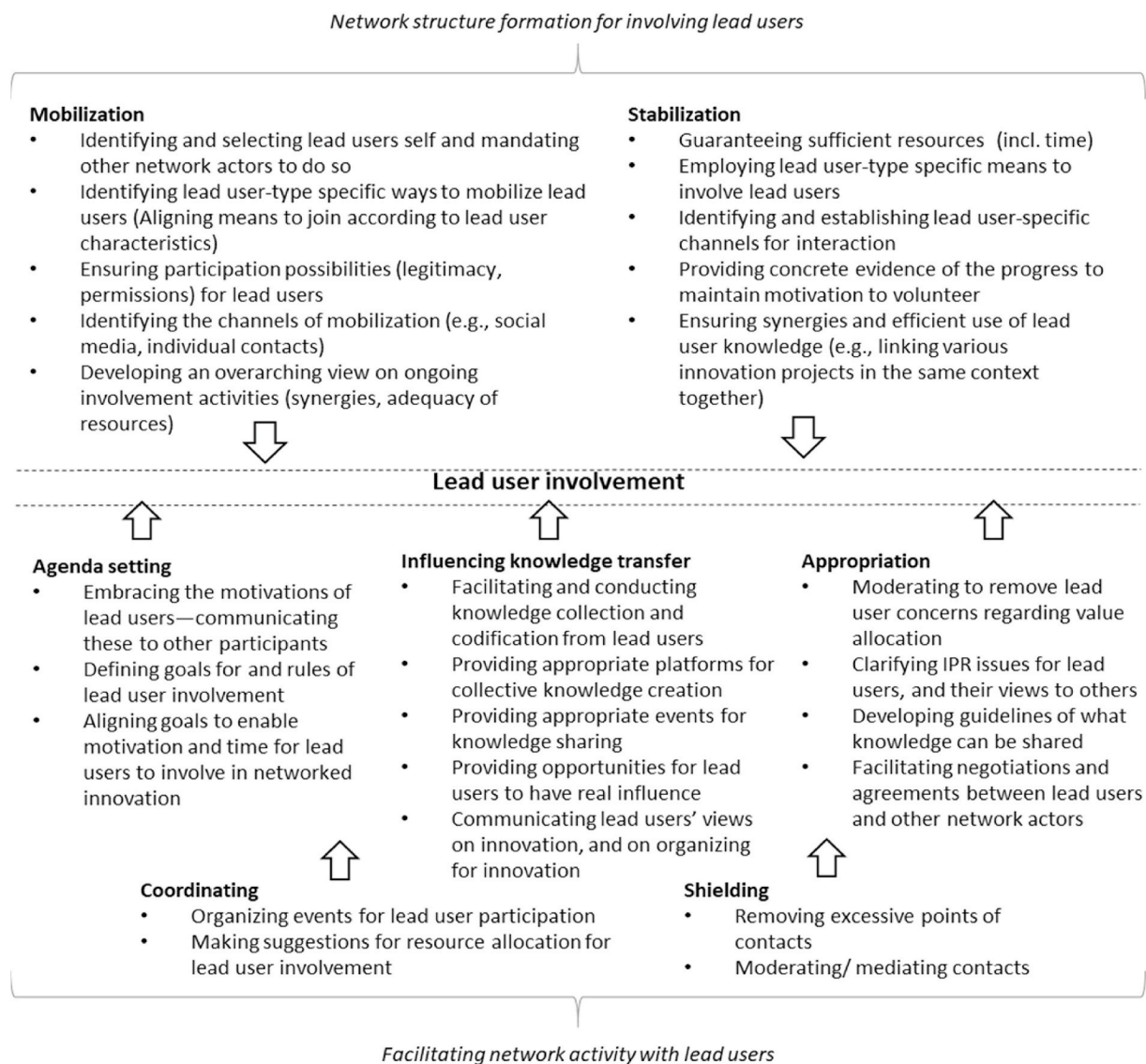


Fig. 4. Lead user involvement through orchestration activities.

(Batterink et al., 2010). This connects to earlier studies stating that one of the challenges in lead user involvement is to identify, recruit, and motivate lead users for the innovation project (e.g., Brem et al., 2018; van Laere and Aggestam, 2016; Lüthje and Herstatt, 2004). Heiskanen et al. (2010, p. 498) advocate that “users may be interested in innovating, but not exactly what, when and where producers desire them to innovate”. Besides, already finding the lead users can be an exhausting task, even with the help of automation (Pajo et al., 2017) or social media or associations and communities. The orchestration literature on *mobilization* of relevant actors provides insight into how to proceed in engaging lead users in such wider entities (see Möller and Halinen, 2017), and our empirical findings add to these views. A good strategy for identifying lead users seems to be to rely on communities with highly experienced users (e.g., doctors or nurses) and taking a look at their relevant networks (e.g., subordinates of chief practitioners, or patient associations), which confines and targets the search (see also Hiennerth and Lettl, 2017; Lüthje and Herstatt, 2004; Mäkinen et al., 2019; Scheier and Prügl 2008; Stewart and Hyysalo, 2008, who point to the relevance of communities and overlapping roles of users in and outside their reference organizations). This suggests that the orchestrator, while taking the overall responsibility, can invite and mandate other actors in the network to do some of the lead user mobilization.

Another distinctive issue is that in our research context, the traditionally hierarchical hospital culture seemed to highlight the importance of the legitimacy of collaborating as a relevant issue from the orchestration point of view. Notably, different orchestration activities are required to involve different lead users; what is suitable for nurses does not necessarily help the orchestrators to involve doctors, or patient representatives. The discreet internal dynamics within and between professional groups are influential, which resonates with the general knowledge on user communities (see Hiennerth and Lettl, 2017). Furthermore, it is important for orchestrators to understand who can decide how resources are used. For example, while patients may be quite free to contribute depending on their situations, how nurses can use their time is not for them to decide, but their involvement may necessitate permission to participate from supervisors in the hierarchical organization.

For the *network stabilization* aspect, earlier orchestration studies and our empirical evidence point to continuous interaction being highly relevant (Dhanaraj and Parkhe, 2006), preferably coupled with giving concrete evidence of the fruits of collaboration for participating lead users. For voluntary lead users, the internal motivation is essential. They need to have genuine possibility to benefit by reaching better services and work practices to be continuously motivated to take part in

networked activity that may sometimes cause frustration and confusion (see Lüthje and Herstatt, 2004; Parmentier and Mangematin, 2014; Globocnik and Faullant, in press).

The issues with network formation and maintenance also resonate with the *facilitation of the collaborative innovation activity*. Connecting to the motivational aspects in lead user discourse (see Leenders and Dolfsma, 2016; Lettl et al., 2008; Urban and Hippel, 1988), *agenda-setting* as a relevant network orchestration dimension calls for a careful approach (Hurmelinna-Laukkanen and Nätti, 2018). Our empirical findings indicate that the presence of various public and private actors with individual motivations and goals (see Clarke and Crane, 2018; Porter, 2010) affects the involvement of lead users (see Chandra and Leenders, 2012; Mahr and Lievens, 2012). An important issue to consider in coordination of networked innovation with lead users is dealing with contradictory expectations of the parties in the innovation process (Hienerth and Lettl, 2017; Hurmelinna-Laukkanen and Nätti, 2018; Katila et al., 2017; Lehnert et al., 2016; Nambisan and Sawhney, 2011) and especially removing concerns of lead users. For example, from the company perspective, direct relationships with lead users would be the most convenient route to successful development and an issue that might remove some of the stickiness of information (following the established lead-user processes; see Lüthje and Herstatt, 2004). However, in the networked—especially cross-sectional—setting, the information on lead users may not be easily available or it may be held by specific actors, or the lead users might not always be willing to discuss the issues with all network members (e.g., if they do not share the same values with specific actors). To formulate an agenda that embraces the lead users' motivations, different orchestration activities are needed compared to situations where only firm or research institute representatives and other innovation producers are involved.

At a practical level, the activities used for ensuring *knowledge mobility* can vary, as seen in our case and suggested in earlier research (see e.g., Dhanaraj and Parkhe, 2006; Hurmelinna-Laukkanen and Nätti, 2018 for orchestration research, and, e.g., Bosch-Sijtsema and Bosch, 2015; Cui and Wu, 2016; Di Gangi and Wasko, 2009; Lüthje, 2004; Lynch et al., 2016; Stewart and Hyysalo, 2008; Mäkinen et al., 2019 for user innovation literature). For transferring lead user knowledge, various means from online alternatives to individual discussions or demo events and other interactive events were utilized. More specifically, our empirical evidence suggests that different channels of communication may be needed for different lead users. Importantly, the orchestrator may need to take different roles; either mediating and monitoring the communication between lead users and other network actors, or gathering knowledge from lead users and then taking it to the innovating companies. Diverging from accustomed views to orchestration, orchestrators in lead user involving networks need to monitor the frequency and extensiveness of communication, and may have to limit it (see, e.g., Jeppesen and Laursen, 2009).

In addition to content related communication, networks with lead users may comprise educational and informative communication in relation to activities promoting *innovation appropriability* (see Dhanaraj and Parkhe, 2006; Nambisan and Sawhney, 2011). In our case, the participating actors (including lead users) had potentially competing positions regarding the new developments, and the related ambiguity and unfamiliarity were identified as challenges. Lead users (especially doctors) had their reason to feel suspicious of how their ideas would be used by companies (see Hienerth and Lettl, 2017; Lettl et al., 2008; Lüthje and Herstatt, 2004; Marchi et al., 2011); many of them had participated in innovation processes before and felt that they had not gotten recognition for their contribution while the companies picked the fruits of their collaboration. Many doctors might also have own business interests, firms, and collaborations (see Katila et al., 2017). Indeed, important for the orchestrator is to make sure that all the participants: (a) know their role in the process, (b) understand the principles of how the outcomes are shared are defined, and (c) have clear idea about those principles.

Coordination dimension of networks with lead users could be considered to follow similar logics to any other innovation network (see Hurmelinna-Laukkanen and Nätti, 2018; Möller and Halinen, 2017). The most distinctive elements related to the orchestrator having a role in helping those lead users that entered the network from the professional setting; they needed support in securing time and legitimacy for their participation from their home organization, not least because regulatory issues could limit also outside-work volunteering.

Finally, our empirical study suggests, that the orchestrator needs to ensure that the lead users' involvement does not interfere with their regular activities too much. That is, a dimension that we call as "*shielding*" emerged. This is an aspect that extant network orchestration discussion overlooks and that is only implicitly present in user-innovation discussions through the notion of voluntariness (see Hienerth and Lettl, 2017). While activities of shielding resemble coordination, quite specific issues emerged that were not limited to the coordination dimension only. For example, instead of seeing "ensuring knowledge mobility" simply in terms of increasing knowledge exchange between the network members, our study indicates that also *limiting* knowledge exchange was needed when lead users were considered. Likewise, continuing lead user involvement was dependent on the orchestrator operating as a "buffer" between lead users and innovating organizations. Compared to companies and other actors that generate the developed solutions, lead users need not, and should not, be pushed to move beyond their existing modes of operation too much. In fact, this thought is also supported by earlier research that surgeons might, when put to decision-maker roles, hurt rather than enhance innovation (Katila et al., 2017). The ability and willingness of lead users to participate in a purposeful manner needs to be secured by filtering the flow of communication in their direction, regulating the connection points, and by considering carefully the roles in which lead-users are put.

This aspect was intensified in the hospital environment, where the doctors and nurses rather joined more concrete development endeavours than general future-oriented discussions, and where patients' privacy needed to be considered.

5. Conclusions

In our study, we combine views from two streams of literature—innovation network orchestration and lead user innovation—and an empirical examination in the context of health innovation with the aim to find out how lead user involvement can be facilitated by means of innovation network orchestration. Answering this question contributes to both of these streams of literature and brings forth practical implications for innovation network orchestration.

5.1. Implications to theory and practice

Orchestration of innovation networks can still be considered to be an emerging area where research related to end user involvement has been limited (see Klerkx and Aarts, 2013; Möller and Halinen, 2017). Understanding the role of users has the potential to shed light on the underlying dynamics of interaction in innovation processes, and identifying the relevant success factors (van Laere and Aggestam, 2016; Heiskanen et al., 2010; Mäkinen et al., 2019).

Our study indicates, first, that when lead user involvement is considered, orchestration and its dimensions have different content compared to the involvement of actors that develop and offer the innovation for others to use (see Möller and Halinen, 2017; Hurmelinna-Laukkanen and Nätti, 2018). Fig. 4 summarizes identified lead-user specific activities. Adding activities such as "ensuring participation possibilities (legitimacy, permissions) for lead users"—referring to the orchestrator searching for permission to participate on (potential) network actors' behalf to the earlier identified sets of orchestration activities extends prior orchestration discussions (see Dhanaraj and Parkhe, 2006; Nambisan and Sawhney, 2011; Möller and Halinen,

2017). Furthermore, observing how orchestration activities may be adjusted to improve collaboration experiences for lead users adds to knowledge on network orchestration at individual level (Gausdal and Nilsen, 2011; Kempainen et al., 2019).

Second, when lead users join innovation networks, an additional dimension of orchestration—shielding—seems to become relevant that actually may collide with other orchestration dimensions: Instead of pushing for increased knowledge exchange or taking stability as constant contribution and building of intricate ties between network actors, based on our findings, the orchestrator seems to be asked to become “a buffer” that adjusts and regulates the involvement of lead users to purposeful levels. The purpose of the activities in this orchestration dimension is to allow the lead users to continue focusing on their core work while at the same time contributing to innovation development in a manner that enables producers to develop meaningful solutions more efficiently. In practice, shielding as a dimension of orchestration may mean isolating the lead users from some network activities—or even actors, limiting communication, putting appropriability of innovation producers in the background, and allowing lead users to come and go according to their own interests instead of the coordination activities introduced by the orchestrator. In other words, these activities may go to some extent against the common wisdom on orchestration (see Batterink et al., 2010; Dhanaraj and Parkhe, 2006; Nambisan and Sawhney, 2011).

Third, an important issue is that the orchestrator needs to design the orchestration of the overall network in a way that does not come across as intimidating (e.g., too time-consuming, or risky regarding confidentiality or IPR issues) for lead users. This view is still largely missing in the existing research and is therefore all the more important issue to acknowledge, especially when large-scale societal challenges (such as the need to produce healthcare services) are taken into the networked innovation context (Kempainen et al., 2019; McGahan et al., 2020; Yaghmaie and Vanhaverbeke, 2019).

With our findings, we can also add to lead-user research where the discussion has mostly addressed the means of individual organizations to harness users' knowledge (Bosch-Sijtsema and Bosch, 2015; Cui and Wu, 2016; Di Gangi and Wasko, 2009; Hienerth and Lettl, 2017; Lettl, 2020; Lüthje, 2004; Marzouki and Belkahl, 2020; von Hippel, 1986; Hyysalo et al., 2016). As suggested above, those means may not be completely applicable to situations where lead users are engaged to networked activity with varied actors with their distinctive, sometimes even opposing goals. Our findings from theory and practice indicate that a neutral orchestrator could, by mediating and bridging the network members' interaction, promote the contribution of companies and lead users (see Hurmelinna-Laukkanen and Nätti, 2018). While this kind of boundary-spanning activity is also present in the user-innovation literature, it has been noted that lead users, rather than orchestrators, conduct these tasks (see, e.g., Jeppesen and Laursen, 2009). In the networked context, the user communities of lead users (Hienerth and Lettl, 2017) are highly valuable, but it seems that they also need to be shielded from an overflow of points of contact. This may be even more visible in contexts such as healthcare, where the network comprises private and public actors, and where the goals of the network do not dwell solely around commercial solutions (e.g., Laere and Aggestam 2016; Thune and Mina, 2016; Tietze et al., 2015) but also have wider societal importance.

Drawing from and summarizing the above considerations, we conclude that combining the principles from the orchestration and lead-user literature introduces an extension to understanding networked innovation activity. To put it simply, lead users can be involved in networked innovation by extending the focus of orchestration to the user side, by taking into account lead user characteristics, and by adjusting activities within orchestration dimensions so that lead users are acknowledged in all orchestration practices—and by doing these things in a way that all network actors understand the reasoning behind

adjustments.

Regarding the practical implications, the findings of this study are useful for orchestrators. Our findings provide advice on viable principles and practices in lead user involvement, and perhaps more importantly, show the limits of employing conventional means of engaging companies or public organization representatives to involve lead users. The orchestrators should not focus only on changing the contents of orchestration when working with lead users either; they should also change how they communicate with representatives of participating organizations so that they too understand the principles of lead user involvement. That is, orchestrators are advised to take a holistic view on the employed orchestration activities. Furthermore, the findings instruct company managers to be alert to the complexity of the setting where lead users may come from different parts of the network. Establishing good channels of communication with the orchestrator and the official representatives of the participating organizations may also provide them with good access to lead user knowledge. Finally, our findings indicate that support and resource allocation from those organizations through which lead users come into contact with the innovation network bears notable importance. Connecting an organization's lead users to a wider innovation network is an investment that needs to be followed through to be able to gain the pursued results and enable reaching the benefits that motivates the lead users. In the end, investing in lead user involvement may come back to the organization in the form of improved customer or employer satisfaction and higher efficiency.

5.2. Limitations and future research

In this study, we examined orchestration in the context of the development project of a paediatric surgical journey in a university hospital. Various sources of information were used to ensure an adequate scope and validity of the conducted case study. However, confidentiality issues limited our study as we cannot be completely transparent with our data analysis. Besides, although the results of the study provide insights into the complex phenomenon, specific practices required to involve end users call for additional examination in different contexts outside of what we have captured here. For example, the use of social media may be much more pronounced in other contexts where privacy and confidentiality are not as highlighted, and the findings might look different in studies conducted in private rather than public sector hospitals. Therefore, we encourage diverse data samples and multiple case studies. Future research could also approach these questions quantitatively, for example by surveying lead user views on innovation network participation and orchestration, and comparing the results across different lead users.

In our study, we chose to use the innovation network orchestration discussion as the starting point and maintain the orchestrator perspective on the relevant activities. Future studies could adopt lead user view as the starting point, or could go deeper by making comparisons between the types and roles of the orchestrators (e.g., Goduscheit, 2014; Klerkx and Aarts, 2013; Rese et al., 2013; van Laere and Aggestam, 2016). That is, our study gives just one point of departure to examine the points of connection between the network orchestration and lead user discussions. On a wider scale, our combination of the user innovation literature and the network orchestration literature could be extended to study applicability of the ideas introduced in the Actor Network Theory to improve understanding of the relevant phenomena. We hope that our study inspires future research exploring these directions.

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Appendix 1. A summary of organized activities by types of participants

Activity type	Participants	Hospital district/company type
1st workshop with paediatric nurses	2 nurses	University hospital
2nd workshop with paediatric nurses	3 nurses	University hospital
3rd workshop with paediatric nurses	4 nurses	University hospital
Online discussion with child patients' parents	6 parents	Nationwide
Workshop with child patients' parents	6 parents	University hospital
Interviews with paediatrics specialists	8 professionals	University hospital
Interviews with companies	16 companies	10 SMEs, 6 large corporations
Demo event	150 participants + 22 company exhibitors	University hospital

Appendix 2. Interviews with healthcare professionals at the hospital

Interview number	Speciality	Viewpoints
1	Doctor, Paediatric surgery	Administration, teaching, hospital development, technologies and innovations
2a	Doctor, Anaesthesiology	Anaesthetics, the new hospital project
2b	Anaesthesia nurse	The new hospital project, hospital ICT
3	Doctor, General Practice	Secondary-primary healthcare, care process design
4	Doctor, Paediatric surgery	Urology, surgery, administration
5	Doctor, Paediatric surgery	General surgery
6	Doctor, Paediatric surgery (specializing)	Specializing, conducting their own research
7	Paediatric surgery	Gastrology

Appendix 3. Interview Guideline

- Introduction, roles and tasks
1. What is your role and what are your tasks? In which process phase(s) are you acting?
 2. What are the main improvement needs for your tasks?
 3. What aspects of your work need the most technological assistance or change?
- Pre-operation
1. What essential information or patient data is needed before surgery? How it is transferred?
 2. Are there any upcoming process changes (e.g., gradual arrival in the surgery in the morning)?
 3. Are there any unexpected or exceptional situations that can occur just before surgery that require cancelling or postponing the surgery, or that complicate the course of events in patient care?
 4. What features should be visible in intelligent decision-support systems (DSSs)? How should an ideal DSS work?
 5. If you had ideal possibilities for real-time data transfer and advanced technology in use, how would you communicate with other health professionals? How should ideal communication be implemented among health care organizations?
 6. Could patients provide self-monitoring data or information independently before surgery in order to facilitate preparation work at the hospital?
 7. How do you communicate with the patients? How do you inform patients? What are your visions of how this will change in the future?
- The surgical operation
1. What essential information or patient data is needed during the surgery? How is it transferred?
 2. What kinds of communication tools or solutions facilitate surgery? Is communication or consultations needed during the surgery?
 3. Would wireless solutions facilitate the operation?
- Post-operation
1. What essential information or patient data is needed after the surgery in the ward and home care? How is it transferred?
 2. How is the patient's status archived?
 3. When and how are the child's parents able to follow the recovery process of the patient?
 4. Is customer feedback collected from the patient and parents regarding the hospital visit? How do you collect the feedback?
- Home care
1. Could technology usage assist in providing home care instructions and certificates for patients and family?
 2. What patient data and information would be useful for specialists, monitored by the patient at home?
 3. What alternative methods could be used in patient consultations, control visits, or other follow-up situations (e.g., video chat consultations for rural citizens)?
 4. Are the parents or the patient responsible for performing any medical procedures independently at home?
 5. If the patient is transferred to another health care organization, how do you transfer the patient data and records?
- The professional's motivation and future innovation projects
1. How do you see your job 10–15 years from now?
 2. What kind of quality meters and value metrics of the process are in place? What should be monitored more, and how is it currently being followed?
 3. How could care process transparency be improved for patients and their family throughout the process?

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4. How are development ideas reported and analysed in the hospital? How often are development ideas considered?
5. What would be the best way to pilot new products and services in hospital use? How should hospital co-creation and communication be implemented with companies?
6. What would motivate and engage professionals in research, development and innovation (R&D&I) projects in the future?
7. Are you interested in goal-oriented R&D&I projects implemented in collaboration with the OUH TestLab, companies and patient associations?

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