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# Network management in emergent high-tech business contexts: Critical capabilities and activities

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ABSTRACT

Due to their inherent uncertainty, emerging high-tech business fields require a unique set of network management capabilities. Drawing from the dynamic capabilities literature and the networking capability literature, we develop a framework for network management in such environments. The framework consists of three interrelated capabilities – context handling, network construction, and network position consolidation. A longitudinal case study of a start-up company in the smart energy sector validates and provides an illustrative understanding of the three capabilities. The findings identify how they are enacted through a portfolio of activities, providing a microfoundational insight into how a focal actor in an entrepreneurial and explorative manner navigates and manages a business field in the making. Our research contributes a novel conceptualization of network management capabilities with an explicit focus on attracting, establishing and managing relationships in the complex and uncertain environment of emerging high-tech fields. In addition, our research offers guidance to managers with respect to the capabilities they need to galvanize and coalesce actors in an emerging business network.

## 1. Introduction

Increasingly, success in high-tech industries is a function not just of how well one actor develops, manages and deploys its own resources for strategic advantage, but also how well the actor constructs and coordinates a network of partners and resources (e.g., Rampersad, Quester, & Troshani, 2010). The complexity of high-tech contexts implies that the resources and infrastructure are not controlled by any one company, but rather they are widely dispersed among various actors within the industry (Aarikka-Stenroos, Sandberg, & Lehtimäki, 2014; Möller & Svahn, 2009) as well as actors that are new to the industry. The development and commercialization of new and disruptive solutions thus require the co-creation of innovation and business development agendas in cooperation with a variety of actors (Möller & Svahn, 2009), and accordingly presume capabilities for network management both for gaining support and access to appropriate resources.

Of special interest in this article are the network management capabilities companies require when new technological and scientific inventions are to be transformed into new business fields (cf. Geels, 2005). Such emerging business fields are characterized by a lack of clear market structures and by high uncertainty concerning both the technological solutions and the potential key actors, their resources and contributions (Knight, Pfeiffer, & Scott, 2015; Möller, 2010). However, very little research exists that examines directly the network management capabilities involved in the emergence of new-high-tech business fields (Partanen & Möller, 2012).

An emerging body of research on various aspects of network management related to strategic networks and innovation networks exists, including: (1) conditions under which different types of purposefully created networks can be managed (e.g., Möller & Rajala, 2007; Möller & Svahn, 2003; Ritter, Wilkinson, & Johnston, 2004), (2) the roles of various actors in networked innovation (Aarikka-Stenroos et al., 2014), (3) the process through which such networks unfold (Medlin & Törnroos, 2014), (4) the capabilities involved when shifting from dyadic collaboration to networked radical innovation (Aarikka-Stenroos & Lehtimäki, 2014; Möller & Svahn, 2009), and (5) the role of managerial cognition and sensemaking for network management (Mouzas, Henneberg, & Naudé, 2008; Öberg, Henneberg, & Mouzas, 2012). Relevant articles also address networking capabilities in nascent technological business fields (e.g., Möller, 2010; Möller & Svahn, 2009) but they are of a conceptual character, and would benefit from an articulation of the activities by which network management capabilities

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are enacted. Indeed, Thornton, Henneberg, and Naudé (2013) emphasize that in order to better understand technology-driven business emergence, scholars need more insight into how the characteristics of high-tech and innovation contexts – e.g. complexity, dynamism, and uncertainty (Mohr, Slater, & Sengupta, 2006; Yadav, Swami, & Pal, 2006) – relate to networking behaviors. Considering the critical role of networked efforts in these environments, more research is needed on the capabilities and the specific activities through which companies construct and manage strategic networks in embryonic and elusive high-tech contexts. Consequently, the purpose of this paper is to outline a framework for network management capabilities and their deployment through constituent activities in emerging high-tech business fields.

The specific focus of this article is on those network management capabilities required when an entrant firm introduces a disruptive solution into an existing industry, which implies the emergence of a new business field. Given the volatility of high-tech contexts, ventures like these are characterized by complexity and turbulence, thus calling for specific capabilities. Furthermore, in accordance with an emerging view in the broader literature on the microfoundations of capabilities (Felin, Foss, & Ployhart, 2015; Helfat & Peteraf, 2015; Teece, 2012) and network management (Palo & Tähtinen, 2013), our view is that the individual leader's abilities have great influence and thus the company's capabilities are reflected by the leader's abilities.

We follow the abductive research approach (Dubois & Gadde, 2002) and pursue our aim through analysis of the extant literature and through a seven-year case study of “Techo”, a start-up company (pseudonyms have been used in this paper to protect the anonymity of the companies and the involved participants). Techo developed an energy management system, based on intelligent technology that enables the implementation of smart grids (e.g., Farhangi, 2010), implying a disruption of business models of incumbent firms. The commercialization of this solution required intense collaboration with various actors, both for technological and market development. The abductive approach works well for our research goals where rather generic prior knowledge about the network capabilities exists but more specific knowledge of relevant capabilities and their constituent activities is lacking. The paper progresses as follows: First, we present our theoretical background and delineate a tentative framework. This is followed by a description of our methodology and the case. Thereafter follows the case analysis, which illustrates and expands on the tentative framework. The paper concludes with implications for theory and practice, as well as suggestions for further research.

## 2. A tentative framework for network management in emerging high-tech business fields

Based on the extant literature, we develop a tentative framework for network management in emerging high-technology business fields. To this end, we examine the research addressing the characteristics of high-tech business contexts and management in turbulent environments (e.g.,Mohr & Shooshtari, 2003; Moriarty & Kosnik, 1989) and emerging business fields (e.g., Aarikka-Stenroos & Lehtimäki, 2014; Möller, 2010; Möller & Svahn, 2009; Partanen & Möller, 2012). In addition, we examine the literature on network management capabilities in strategic and/or innovation networks in emerging business fields (e.g., Aarikka-Stenroos & Lehtimäki, 2014; Möller, 2010; Möller & Svahn, 2009; Partanen & Möller, 2012).

### 2.1. Characteristics of emerging high-tech business fields

High-tech business fields have traditionally been framed in terms of market uncertainty, technological uncertainty, and competitive volatility (Mohr & Shooshtari, 2003; Moriarty & Kosnik, 1989). Actors in high-tech markets have to handle a high degree of market uncertainty, defined as the level of ambiguity about the behavior of actors and customers in the market (Moriarty & Kosnik, 1989). Technological uncertainty addresses the difficulty of ascertaining whether a new technology or the company providing it will be able to deliver on its promise to meet specific needs; e.g., if the product will work and be compatible with other products and services (Moriarty & Kosnik, 1989). Competitive volatility exists in high-tech markets, including rapid and unpredictable changes regarding other actors and their possible strategies. Hence, participants in high-tech industries must make decisions with insufficient information, heightening perceived risk in both the supply and demand sides of the business field (D'aveni & Ravenschaft, 1994).

The consequences of high-tech related uncertainties are amplified when new technologies are still in their embryonic form and when their commercialization will require a new supportive infrastructure (Yadav et al., 2006). Particularly when new high-technology business fields emerge, actors face a business landscape lacking structure and clearly specified end customers or intermediaries; moreover, they have to invest in and rely on embryonic and competing technologies (Knight et al., 2015; Möller, 2010). These characteristics imply that the future is essentially unknowable and that there is an “unpredictable uncertainty” associated with possible macro-level disruptions (Ramírez & Selsky, 2014). Dynamic properties can accordingly arise not only from the transactional environment but also “from the field itself”; the “ground” is in motion (Emery & Trist, 1965). This clearly implies a need to think and strategize in terms of whole systems or networks (Selsky & McCann, 2008).

For emerging high-technology contexts, the ability to prepare for various possible futures, and to actively shape the network (Thornton et al., 2013), and consequently the potential future, is essential. Utilizing different conceptual vocabularies, this process has also been called the social construction of markets and technology (Peñaloza & Venkatesh, 2006), market shaping (Knight et al., 2015), and market scripting (Storbacka & Nenonen, 2011).

With respect to the nascent technology environment, the actors co-constructing the new field must make decisions and investments despite competing technologies and lack of clarity of dominant designs (Möller & Svahn, 2009). The path to commercial development is uncertain and the expected returns are very much based on ‘guestimates’. In such emergent and non-transparent business fields, network management is likely to be experiential in nature (Normann, 2001; Ramírez & Selsky, 2014; Selsky & McCann, 2008), calling for an entrepreneurial orientation (Möller & Svahn, 2009; Schilke, 2014; Teece, 2012).

Hence, the characteristics of emerging high-tech business fields accordingly pose significantly greater challenges for network management than more established high-tech contexts. Both can be complex but they differ in terms of the uncertainty managers encounter.

### 2.2. Perspectives on network management

The general topic of network management is of increasing interest and scope (Dhanaraj & Parkhe, 2006; Hibbert, Huxham, Ring, & Peter, 2008; Järvensivu & Möller, 2009). Two basic perspectives can be delineated concerning network management. First, the *industrial network approach* tends to emphasize the historical, evolutionary and embedded character of business networks (Håkansson & Snehota, 1995). This perspective views networks as borderless, self-organizing systems that emerge in a bottom-up fashion from local interactions, a view that is consistent with research on open and complex systems (e.g., Stacey, 1995). Second, *the strategic management perspective* based on the resource and capability-based view (RBV) suggests that ‘strategic networks’ or ‘value nets’ are intentionally constructed and that a specific set of organizations perform agreed-upon roles (Dhanaraj & Parkhe, 2006; Möller, Rajala, & Svahn, 2005; Möller & Svahn, 2003).

Consistent with Ritter et al. (2004), we consider both of these views to be relevant for network management in emerging high-tech markets

in that these markets progress from a more emergent state towards more stable market structures. At the same time, even in emergent markets, focal actors must attempt to configure a network to accomplish particular strategic aims (Corsaro, Ramos, Henneberg, & Naudé, 2012). Hence, for our purposes, we define network management as *a set of activities undertaken by a focal firm, to define and realize the development of a network to support the emergence of a new business field and the focal firm's future position within it.* This definition includes a longitudinal orientation in that we are interested in the capabilities involved from early technological development through commercialization, and ultimately to establishing the focal firm's position in the new business field.

### 2.3. Capabilities for network management

From an organizational perspective, a capability can be understood as "the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result" (Helfat & Peteraf, 2003, p. 999). Lessons from the literature on dynamic capabilities (Eisenhardt & Martin, 2000; Teece, 2007; Teece, Pisano, & Shuen, 1997) provide a general understanding of the role of certain types of capabilities for firm performance. Eisenhardt and Martin (2000) describe dynamic capabilities as the "organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die" (p. 1107), and Teece et al. (1997, p. 516) emphasize their crucial role in "rapidly changing environments". Teece (2007) develops a general framework for the nature of dynamic capabilities and their microfoundations, highlighting the sensing, the seizing, and the reconfiguring capabilities as the three most critical generic capabilities for sustainable "evolutionary and entrepreneurial fitness of the business enterprise" (p.1322).

Helfat and Peteraf (2015) argue that the cognitive capabilities of managers underpin the dynamic capability to sense, seize and reconfigure; including perception, attention, problem-solving and reasoning, language, communication and social cognition. These microfoundational aspects of dynamic managerial capabilities are pertinent for our purposes, considering a focal actor needs the sense-making and sense-giving abilities to understand and influence networked actors, and finally construct entire strategic networks. However, this research stream does not extend the discussion of the microfoundations of the capabilities across the borders of the organization.

Closely related to the aforementioned research is the scholarly work dealing with networking or network *capabilities* (Hagedoorn, Roijakkers, & Kranenburg, 2006; Mitrega, Forkmann, Ramos, & Henneberg, 2012; Mu, Thomas, Peng, & Di Benedetto, 2016; Thornton, Henneberg, & Naudé, 2014). Mu et al. (2016) define networking capability "as the competency of a firm to purposefully search and find network partners, manage and leverage network relationships for value creation" (p. 3); they argue that the networking capability allows firms "to develop networks and gain access to resources that are important for product innovation" (p. 4). This research stream, however, generally has a rather narrow orientation with a focus on capabilities to manage existing relationships (Mitrega et al., 2012) or portfolios of relationships (Hagedoorn et al., 2006; Mu et al., 2016), often between two parties, rather than capabilities required to catalyze and manage the wider network. Furthermore, even though these studies explicitly emphasize the need to exploit and leverage external assets or resources, highlighting partnering and relationship activities, they seldom offer any empirically-based descriptions of how qualified partners can be attracted or how network relationships be leveraged for intended purposes and in specific contexts.

Möller and Svahn (2003) are some of the first to explicitly address capabilities needed for network management in emerging business fields; capabilities related to network visioning, network orchestration, and network mobilization and management are of crucial importance in these contexts. Möller and Svahn (2009) and Möller (2010) develop this framework further, dividing emergence into three different phases, each represented by a set of capabilities and related activities. They explicitly recognize the need for a learning capability in conjunction with the framing/visioning capability. In addition, the ability to construct and communicate an agenda to attract and influence relevant actors and resources – and thereby configure an effective network for the commercialization of the innovation – also arise.

We build on these research streams in the next section to more specifically explicate the capabilities required for network management in emerging high-tech business fields.

### 2.4. A tentative framework for network management in emerging high-tech business fields

The characteristics of nascent high-technology markets pose a number of challenges for companies and their networking capabilities (Möller & Rajala, 2007). By synthesizing the lessons from the research streams above, we develop a preliminary framework for the network management capabilities required in emerging high-tech business fields.

Firstly, we contend that the ability to sense (Teece, 2012) the environment – and to make sense of it for oneself and others (i.e., to recognize business opportunities to come) – is crucial in these settings. The ability to sense the business opportunities of a future as it is still emerging is based on cognition and perceptions of actors/managers (Abrahamsen, Henneberg, Huemer, & Naudé, 2016; Helfat & Peteraf, 2015; Möller, 2010). Traditional market research is of little value here; rather, it is essential to learn with the emerging market (Storbacka & Nenonen, 2015). Because the new technology can disrupt previous network connections and business models, it is necessary to construct an attractive agenda that shapes how actors perceive the potential future in the emerging business field, thus reframing the mental models of incumbent actors (Möller (2010). Firms tend to have a narrow outlook of their business, preventing them from seeing emerging business opportunities caused by radical innovations (Gavetti, 2012; Leonard-Barton, 1992). Accordingly, we propose that the focal actor's capability to "handle" the emerging context, i.e. to comprehend, grasp, and influence it – both present and future – is crucial for network management in emerging high-tech business fields. We label this ability to make sense of and give sense to emerging business opportunities a *context handling capability*.

Secondly, and consistent with research on dynamic capabilities (Eisenhardt & Martin, 2000; Teece, 2007; Teece et al., 1997) and networking capabilities (Hagedoorn et al., 2006; Mitrega et al., 2012; Mu et al., 2016), the ability of a focal actor to identify and attract other actors with relevant resources is critical to establish support for its agenda. We thus argue that a *network construction capability* is required in such contexts. These other actors, including their resources, also need to be mobilized by providing a compelling interpretation, to guide innovation to further develop the field. Emerging business contexts are particularly messy, constantly changing, and lacking feasible infrastructure (Yadav et al., 2006). The uncertainties of such contexts (Mohr & Shooshtari, 2003; Moriarty & Kosnik, 1989) often imply resistance among the established players, making it particularly difficult to construct new networks required for the emerging technology.

Thirdly, firms introducing disruptive solutions must act so that their role in the network is recognized to be at the forefront of technological and market developments. This requires on-going learning and flexible integration of knowledge from internal and external actors (Grant, 1996). While the emergent and uncertain nature of the environment requires flexible and open-minded behavior, it is also important that the focal actor secures its own position in the network and not loses the knowledge advantage which is required to influence both the network and the industry (e.g., Partanen & Möller, 2012). The volatility and uncertainty must somehow be "navigated" by focal actors; network management (Möller & Svahn, 2009) can stabilize the development by aligning the energies of various actors' initiatives and securing a good

position in the emerging business field. Hence, we propose that a *network position consolidation capability* is also required in these contexts; it refers to the capability of the focal actor to continuously leverage its knowledge in order to consolidate its own position in the network.

In sum, we suggest that network management in emergent high-tech contexts is constituted by three broad interrelated capabilities: context handling capability, network construction capability, and network position consolidation capability: making sense of the emerging business field and influencing its development; continuously assessing opportunities and threats, envisioning potential alternative futures, recruiting actors in the network, and solidifying the ways in which all actors work in concert together in order to deliver a viable solution to customers in the emerging business field. An essential feature of all these capabilities is their entrepreneurial and explorative character (Helfat & Peteraf, 2015; McCann & Selsky, 1984; Möller & Svahn, 2009; Normann, 2001; Ramírez & Selsky, 2014; Schilke, 2014; Teece, 2007, 2012).

## 3. Methodology

The literature analysis indicated a need for more detailed and context-specific, empirically grounded knowledge on network management capabilities and activities in emerging high-tech business fields. Therefore, we adopted an abductive research approach, characterized by a nonlinear and iterative process of systematic confrontations of theory with reality (Dubois & Gadde, 2002), to first propose and then illustrate, evaluate and add more detail to our tentative framework through a case study. This approach is particularly well suited for the refinement (Echtelt et al., 2008) or specification (Keating, 1995) of emerging theories.

Using our tentative framework for network management as a starting point, we sought to generate a fine-grained understanding of how an entrant firm in an emerging high-technology context envisions, configures, and manages a network. Accordingly, we employed a case study methodology, which allows the analysis of “how” and “why” questions (Yin, 1994), and more importantly, to understand a dynamic phenomenon, in depth and in a real-life context (Eisenhardt, 1989; Halinen & Törnroos, 2005). Further, to unfold how the network evolved over time, including the specific nature of the capabilities involved and their related activities, a longitudinal case study (Perks & Roberts, 2013; Pettigrew, 1990) was considered appropriate. Pettigrew (1990, p. 268) suggests that longitudinal research can be understood as “catching reality in flight […] studying long-term process in their context”. By inquiring about network management capabilities and activities of a case company at multiple occasions in real-time, as well as retrospectively, we were able to analyze the sequence of activities directed towards the development of the network and draw conclusions about the critical capabilities and their effects. Further, this case allowed us to evaluate and illustrate our capability framework and specify its underlying activities.

The next section further elaborates on the selection of our case, the collection of the data and the data analysis.

### 3.1. Selection of the case

In line with Patton (2014, p. 279), we sought an “intensity sample”, “an information-rich case that manifests the phenomenon of interest intensely”. Hence, we adopted the following criteria for the case selection; the case company should be: 1. operating in an emerging high-technology business field characterized by uncertainty and volatility, 2. developing and offering a disruptive solution, 3. taking an active role in influencing the emergence of the business field, 4. actively engaging in various network-related activities for the purpose of co-creating the value offering with other actors and capitalizing on the emerging business opportunities.

For seven years, one of the co-authors had been cooperating with “Techo”, a Finnish start-up founded in 2009, as it developed a solution for smart home energy management, bringing smart information technology to various heating and cooling systems. The company's solution had implications not only for end users, but, more importantly, also for the main utilities of the energy industry (i.e., actors generating, selling, distributing and transmitting electricity). Techo's solution thus provided a disruptive business model for industry players who faced the opportunity to revise their business models to provide more value for their customers and to reduce customer turnover.

The commercialization of this solution required intense collaboration with various actors, both for technological and market development. As such, the Techo case matched the contextual requirements of our focus. It provided an opportunity to assess the capabilities required for network management in an emerging high-technology business field.

Techo had been used as a teaching case in a master's course focused on strategic marketing management in turbulent contexts and the reconfiguration of value systems and market structures. The CEO of Techo, one of its founders, had visited the course every year from 2009 to 2015 as a guest lecturer. He presented Techo's development trajectory with an explicit focus on the specific circumstances and challenges during each period. The CEO elaborated on projects on Techo's agenda and the current partnerships with various actors, strategies, activities, and achievements for the relevant time period. A narrative case for each year was developed during this seven year period. The longitudinal insights arising from following Techo since its foundation suggested that Techo met our criteria and offered the potential for revelatory insights (Yin, 1994).

### 3.2. Data collection and analysis

A trustworthy case study and analysis requires rich data. The sources of data used in this research, their role in the research process and in the development of our evolving framework are described in Table 1. The primary sources of data in our study derive from two in-depth interviews with the chairman of the board (also a founder and former CEO), seven years of case narratives described previously, corroborated by student case reports and validation from miscellaneous secondary data. The case narratives and the individual student case reports together constitute important real-time data. Accordingly, we had access to both real-time and retrospective longitudinal data, giving us the opportunity to explore process, content and context including their interrelatedness (Pettigrew, 1990).

In small firms, the role of the owner for the strategic development of the business is fundamental (Bjerke & Hultman, 2004). As our case was a start-up, there were few other, if any, suitable informants who would have been able to provide valuable insights into how decisions were made and how different strategies were enacted. Our informant had the most extensive and detailed knowledge of Techo's activities. He was the only person constantly in charge of the business development of the company, leading a management team of between two to three people between 2009 and 2013, after which he became chairman of the board. Rosenbloom (2000) and Adner and Helfat (2003) also note that a firm's entrepreneurial capabilities and activities are often concentrated in the senior leaders. While the use of a single informant can be criticized, Sharfman (1998) emphasizes the essential importance to “talk to informants who are knowledgeable about the issues under investigation” (Sharfman, 1998, p. 375). Moreover, these knowledgeable informant's perceptions may be more accurate and closer to the elusive “truth” (Sharfman, 1998, p. 385) than answers and descriptions from other members of the organization.

The following questions guided our collection and analysis of the data: How has Techo managed and influenced technology and market development in the emerging business field? What type of actors in the immediate and the wider network has Techo collaborated with and why? What type of networking related activities has Techo engaged in and why?

**Table 1**
Description of the sources of data and their role in the research process.

| Source of data | Nature and focus | Role in research process |
|---|---|---|
| Seven case narratives, 2009–2015 | *Real-time longitudinal data*<br>Focus on the yearly status of the emerging business field including challenges, strategies, activities, and achievements as described by the CEO/founder of Techo.<br>Each case narrative consisted of e-mail conversations, guest lecturer's power-point material, and detailed notes from the oral presentations. | Confirmed the appropriateness of Techo as case.<br>Provided a first understanding of the development of Techo as an entrant firm and the emerging business field.<br>Showed how Techo related to its context and managed the commercialization process of the developed solution, including strategies, agendas and prioritized partners and projects. |
| Interview with chairman of the board (founder and formerly CEO) in August 2015 1,5 h | *Retrospective longitudinal as well as current data*<br>Focus on Techo's role in the emergence of the new business field, the nature and purpose of different network cooperations, as well as Techo's strategies for network management related activities. | Provided information about key partners and strategic nets in the immediate environment and their role for the commercialization of the developed solution and the emergence of the new business field.<br>Added depth to the tentative framework and a first fine-grained understanding of how the context handling and network construction capabilities were manifested. |
| Interview with chairman of the board (founder and formerly CEO) in April 2016 1 h | *Retrospective longitudinal and current data*<br>Deepened focus on the management of the wider network, the long-term strategies and plans for the future. | Validation of preliminary conclusions<br>Added new content to the framework through a deeper understanding of the strategic and sequential agenda for proceeding along the emerging path of the business field.<br>Provided a deeper understanding of network dynamics and challenges of later stages of emergence, and the associated network position consolidation capability. |
| Miscellaneous secondary data | *Retrospective longitudinal as well as current data*<br>Techo's web page incl. blog posts, annual reports, press releases, trade publications, Twitter feeds, LinkedIn updates, and YouTube videos from energy summits. Case reports written by 25–30 students each year between 2012 and 2015 from Techo's presentations where current circumstances, challenges, strategies, activities and achievements were presented.<br>Focus on events and milestones for the development of the emergence of the new business field, including specific decisions and activities related to environmental uncertainties and turbulence. | Provided a comprehensive picture of the development of the energy sector in Finland and Europe and the various network constellations Techo engaged in over time.<br>Provided complementary understanding to the evolving framework regarding both the context handling and the network construction capabilities.<br>Partly used as a triangulation tool to double check information derived from secondary data, and partly to add complementary details to the evolving framework regarding all capabilities. |

We started the case analysis by going through the seven annual case narratives complemented with the case reports written by the students. These gave us insights into the nature and structure of the energy sector, the emerging business field and Techo's role and strategy as an entrant firm trying to disrupt an existing industry. We formed a preliminary understanding of how Techo navigated the complex context and managed the commercialization process of the new technology solution, i.e., its strategies, agendas and prioritized partners and projects. With this basis, we conducted an in-depth, open-ended interview with one of Techo's founders to obtain a detailed and authentic account of how Techo managed its network in the emerging business field. We sought supporting details on the development of the company and the emerging business field. In addition, we discussed the challenges and the strategies and various activities undertaken to catalyze support for its disruptive solution.

In accordance with Pandit's (1996) suggestions for the creation of theory, we employed the preliminary data to create a chronological overview of Techo's various networking activities. The secondary data collected from the Internet, annual reports, etc., added more details to the chronological overview and new insights regarding both the context handling and the network construction capabilities. Both the chronological overview and the evolving framework were thus corroborated with secondary data, to enhance construct validity and reliability (cf. Yin, 1994, p. 33). The chronological overview was then used as a research tool when we again met the informant for a follow-up interview. We wanted to ascertain that the information derived from the various data sources had been interpreted correctly. Such member checking (Merriam, 1998) is often suggested as a way to increase descriptive validity (Maxwell, 1992). In this interview, we also collected additional complementary data. We focused in more detail on the strategies behind the various network engagements that Techo had been involved in, the management of the wider network, and long-term strategies and plans for the future. This interview focused as well on the specific issues of operating in an emerging high-tech business field and the challenges for a small entrant firm. In addition, the new challenges encountered during the later phases of emergence were discussed.

Hence, our research evolved in an iterative process (Orton, 1997), with the tentative framework developed on the basis of extant literature as a “rough working frame” (Miles, 1979, p. 591) or a “vague starting point for looking at empirical evidence” (Ragin, 1992, p. 218). Following the tenets of an abductive approach (Dubois & Gadde, 2002, 2014), the research process was reflexive and iterative, based on several constructivist cycles of data reduction and coding (Charmaz, 2014). Throughout the whole process, we employed the procedure described by Dubois and Gadde (2002), by “going back and forth between framework, data sources and analysis” (p. 556). We repeatedly returned to the tentative model, and also to the literature during both data collection and analysis, which enabled the framework to evolve and the underlying activities to be specified in line with the case findings. We wanted neither extant research nor the tentative framework to become a strait-jacket. In fact, in the first version of the framework, the third capability was labeled “network maintenance capability”. However, the interface with the case material showed that “network position consolidation capability” better matched he context of the emerging high-tech business field.

The activities related to the capabilities were identified through this kind of iteration. First, a few core activities underlying each capability surfaced through the analysis of Techo's ambitions and actions, and through learning how the company overcame the challenges it encountered. As the case unfolded, the events and engagements Techo identified as critical to developing the business field both confirmed the initial activities and surfaced a few more additional activities. All activities were then validated by the key informant. The research process included several occasions during which the co-authors discussed and scrutinized preliminary findings and conclusions in order to achieve a common understanding and avoid biased conclusions. These discussions continued until all co-authors agreed on the conceptual meaning of the findings and that our conceptualization had done the case

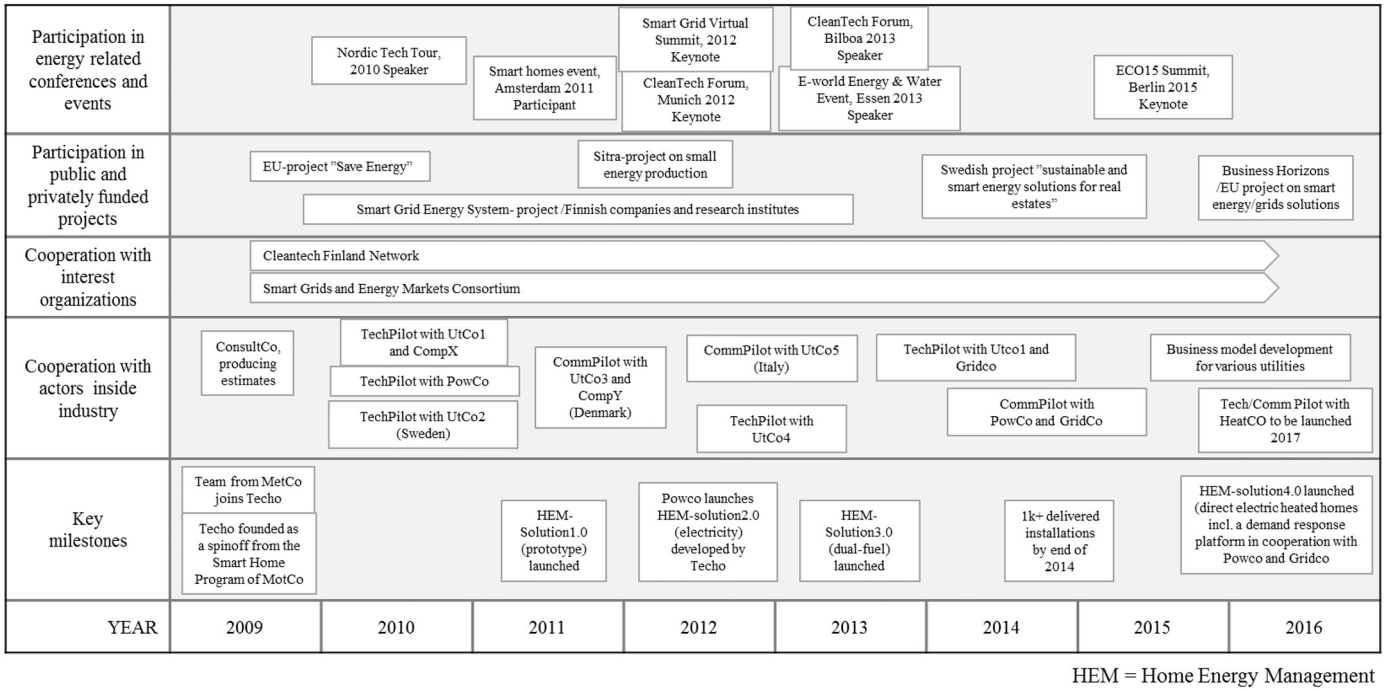


**Fig. 1.** Chronological overview of Techo's selected network activities and key milestones.

material justice. Such procedures, with systematic and conscious attempts to question tentative conclusions, and to test the plausibility of alternative models and explanations, are advocated by Patton (2014).

Next, we provide a fine-grained understanding of these capabilities and demonstrate how these capabilities are manifested as a set of activities grounded specifically in the features of an emerging high-technology business field.

## 4. Network management in an emerging high-tech business field – an overview of the Techo case

This section provides a comprehensive understanding of the case and the emerging business field that we studied. It describes the circumstances, events, and activities that significantly affected the development of the industry and of Techo's business. Organized around the three capabilities identified in the preliminary framework, this overview offers background for the subsequent detailed empirical analysis of capabilities and activities in Section 5. Fig. 1 provides a chronological overview with key milestones.

### 4.1. Context handling

Techo was founded in 2009, as the founders of Techo anticipated a business opportunity in the future energy landscape initiated by the technological shift from mechanical solutions to intelligent internet-based services. They realized that the future development of intelligent/smart technologies (i.e., the emergence of the "internet of things"), coupled with the deregulation of the energy market, had the potential to disrupt the energy business. At this point in time, the implications of intelligent technologies for energy distribution and sales were not obvious to many actors in the energy industry.

In order to build a viable business, it was important that Techo could both make sense and give sense to the future energy landscape they envisioned. In a way, they acted as pathfinders, role models, instructors, and coaches. Techo personnel actively engaged in different energy-related and publicly-funded projects, stakeholder collaborations, and they participated in several conferences as keynote speakers. The change in mental models that this new smart technology required called not only for a plausible vision of the future business field, but also for concrete evidence of the benefits of adopting this vision. Due to its complexity and because the technology was new and untested, Techo considered it necessary to validate the benefits of their solution for energy management in a systematic and stepwise process. Towards this end, Techo developed estimates of the savings their solution would bring to the end user, later verifying these estimates through technical pilots. Techo also established a separate business project in the end-user market to show utilities how the business model could be developed.

Techo's efforts to build support for the emergence of a business field for energy management using intelligent technologies were most intensive from 2009 to 2014. Looking back, Techo concluded that, even though the business opportunity developed as they had anticipated, it took much longer than expected. Financially, it was a stressful period and maintaining focus required tradeoffs in terms of terminating some partnerships and discarding business opportunities that would have deviated from their strategic intent for the emerging business field.

### 4.2. Network construction

As an entrepreneurial company aiming at a reconfiguration of the energy sector, Techo needed to link both with big actors that could play an important role in the future scenario, such as national or multinational utilities companies including public authorities, and with smaller players such as suppliers of hardware, service installations, etc. As shown in Fig. 2, illustrating the expanding nature of Techo's business network, during different periods of time, Techo engaged with different constellations of partners for different purposes. For instance, during the early pilots mentioned previously, Techo cooperated with several national and international actors, mostly utilities but also public authorities, universities, various suppliers of hardware, installation engineers, etc., to promote the development of the new business field.

Getting support from strong industry players with the requisite resources, i.e. a widespread customer base, an established market position, a strong financial position, and thus the power to get things in motion, was important. Early on, Techo identified "Powco" as one of the most important actors they wanted to attract as a partner to the emerging business field for smart energy management. Powco turned

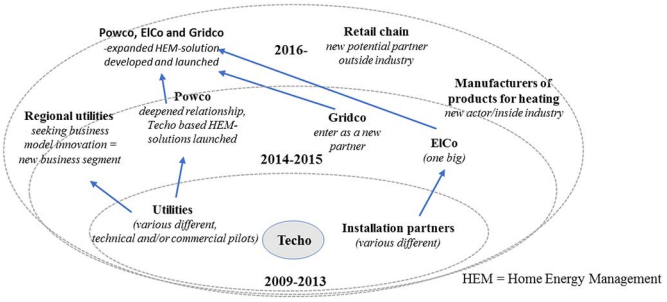


**Fig. 2.** Longitudinal illustration of the development of Techo's business network – simplified version.

out to be "a real dragon to tame" due to the multiple levels and many individuals to convince. During 2010 and 2011, Techo devoted significant time and energy to this end, creating an interface with Powco that was both wide and deep, getting involved with people throughout the organization.

The fact that Techo was a start-up, without an established role and position in the industry to build from, made the mobilization of the requisite partners, especially the incumbents, challenging. Even though many of the actors Techo approached saw a change coming, they were prepared to neither invest nor change, due to uncertainties related to new business models. Moreover, the different actors had their own strategic agendas and challenges to deal with. Techo's ability to get people to change their modes of thinking and their business models rested on three legs. First, it required a thorough understanding of the present energy market structure and the motives and challenges of present actors. Second, it required concrete evidence of savings or value for all stakeholders. And third, above all, it required the ability to interact with and learn about how key persons at different levels in different companies were thinking.

### 4.3. Network position consolidation

Techo realized from the beginning that as soon as the emerging market for smart home energy solutions reached a sufficient level of attractiveness and viability, their position would be vulnerable. Techo needed to manage the implications for when the big actors in the

**Table 2**
Context handling capability: Underlying activities and illustrative quotes.

| Underlying activities | Illustrative quotes |
|---|---|
| *Visioning*: Crafting a compelling vision of the opportunity the emerging business field provides | "The most critical part is to get all pieces together; end customer value and motives, technology, the realization of embedded value for all stakeholders, selling strategies, pricing – the whole business model. You need to have the big and complete picture – technology is not enough, nor the algorithms or even customer value. If you don't have the distribution channels, for instance, customer value will take you nowhere – you are not able to get it out…. it is a lot of things to juggle and manage."<br>"You need to be able to show that it really works – first. Then it will become an option to go for. That's why we set up two small scale solutions for the market, to show what we were talking about and that it is worth investing in. We put much effort into showing the benefits for the bigger stakeholders, for instance, reducing customer churn that has been an acute problem for utilities lately." |
| *Roadmapping*: Developing a strategic agenda for the milestones and steps needed to bring the vision to life | "As the technology is new and untested, you have to proceed in a stepwise process. The strategic order for how you do things is extremely important: Now we are doing this, then that, but not both in parallel or occasionally things in various order. After having produced the estimates, with calculations that showed that it really worked, we started doing technical pilots. Thereafter we proceeded to commercial pilots testing how to sell the solution to the end customers, pricing strategies, selling strategies, i.e. the business model."<br>"You can say that the business development is a cyclic process. You launch one product, it is run out to the market, it is tested, improved and refined, then you add more services, enter new segments, that you also test and where new actors enter the scene, such as for instance Gridco."<br>"In fact, we made quite radical decisions back then when we started. We realized that in order to go for this, we had to go for it to the full. Accordingly, we discarded business opportunities that could have given easy and safe cash flows. But we had to focus [on our vision], even though it resulted in zero cash flows." |
| *Communicating/Evangelizing*: Diffusing a compelling interpretation of the future business field to possible network partners and the wider industry | "The level of complexity of our solution is high. The number of actors is big, and accordingly there are many, many actors and individuals that need to understand what is happening and what role different actors have. We talk on a higher level, about the emerging change in the electrical industry considering how to sell, packaging, different solutions and how to get more value for the end customer."<br>"You need the capability to take full responsibility for framing and designing the complete picture and being prepared to show in concrete terms how things can be done, by taking on different roles. You cannot say that we do not do this and not that…and not that either. Then it will come to nothing. You will not get the players together. Accordingly, we developed a specific brand and started selling the solution to owners of summer houses just to show what the business model could look like." |
| *Navigating*: Advancing along the emerging path, balancing adaptability with agility | "You need to keep going – the landscape is unpredictable and in constant motion. If you stop monitoring it, you will lose your lead. When you have achieved one milestone, you have to head for the next one."<br>"One of the greatest challenges we have is time. Things never develop as fast as you think. I mean, we have been doing this for six or seven years now, and it is only recently that the volumes are ticking up. The business we are running needs financing. You need the capability of being there for the long haul. It is a long way. It's like running a marathon – staying power rules."<br>"At the same time as we must be prepared for volumes, we must keep a cool head…sort of stepping on the brakes at the same time as you speed up the business. These kinds of ventures tend to have a "catch-up" effect, so when that happens – you need to able to handle that situation as well." |

energy sector started moving into a higher gear. For example, Techo noticed that Powco had become much more future minded and alert than before, and could possibly outmaneuver them.

In order to provide a buffer from such risks, Techo had a continuing focus on developing their knowledge platform as a critical resource that provided real value to and hence, would require other players to rely on them. One of the concrete means employed to capture maximum value out of their network relationships was to control information flows generated by the unique data their intelligent technology solution generated, such as energy use patterns of end customers, savings for involved stakeholders, etc. While Techo previously had educated and consulted other network actors for free, and even accepted disadvantageous cooperation agreements in order continue to move forward, as Techo's position solidified, they could set the terms for cooperation. They further capitalized on their knowledge of business model development in the energy sector acquired over the years by offering consultancy services to utilities that needed a strategic revision of their business models and operations. Finally, to continue to scale up and reinforce their position as a key player in the emerging field for smart home energy solutions, Techo proactively approached actors that were not directly competing in the energy sector. For example, Techo recently invited a retail chain in Finland to discuss the possibility of including of smart energy solutions in their customer loyalty program.

## 5. Specifying the network management capability framework: underlying activities

Next, we use the case findings to critically examine and elaborate on the three proposed network management capabilities (context handling capability, network construction capability, network position management capability) and their underlying activities. Although the three capabilities may be applicable for any business context, we argue that they are executed through activities specifically suited to navigate the uncertainties of a new technological field. Each of the capabilities is discussed in turn and Tables 2–4 provide supporting detail for the constituent activities for each capability as well as quotes offering illustrative support for them.

### 5.1. Context handling capability and its underlying activities

The case provides evidence to support that the context handling capability is especially critical in emerging high-tech business fields; we define this capability as *the capability to make sense of and influence the emerging business field by a future-driven and boundaryless outlook*. More specifically, this capability creates a vision of the emerging business field, exploits the embedded business opportunities, and influences the course and pace of the emerging business field. Making sense of the future business opportunity requires interpreting and merging signals from a wide range of domains into an integrated understanding and is fundamental to this capability.

Our case findings suggest four activities by which this capability is enacted: (1) visioning; (2) roadmapping; (3) communicating and evangelizing; and (4) navigating. Each of these is supported with empirical quotes in Table 2.

*Visioning* refers to the ability of the focal actor to create an early yet credible and attractive vision of the opportunities the emerging business field provides. It encompasses an interpretation of the relevant aspects of the future business field including the evolution of technological solution(s), key players and their potential roles and positions in the future markets. A more developed vision involves identifying the value for engaged stakeholders and alternative business model designs, as well as a more comprehensive understanding of the drivers of both value creation and value capture. By connecting fragmented but relevant pieces of information into a coherent picture, and identifying a path forward, the focal actor is able to engage others to support the emergence of the new business field. For Techo, this visioning was of critical importance to sustain their competitive lead in a volatile environment.

*Roadmapping* can be described as a tangible representation of the vision. By developing a strategic agenda for the milestones and steps

**Table 3**
Network construction capability: Underlying activities and illustrative quotes.

| Underlying activities | Illustrative quotes |
|---|---|
| *Casting*: Identifying actors in hold of appropriate resources and abilities | "When we are talking about as disruptive changes as here, a keystone player is needed. It can be either a completely new actor that takes that role, alternatively one of the old players can take the innovative part. We were looking for a player that could take this role."<br>"You have to figure out who is in possession of appropriate resources and who has the capability to do things. Deep pockets are needed for educating the market, for instance. As we often say, 'who are the players and who will be the players?'. This is something that lives, it is open. You can perhaps see that certain actors have some ability, but there are also players who could enter from the side and put everything upside down."<br>"What partners it is worthwhile to continue cooperating with crystallizes quite soon. It is about involvement, and the attitude towards change in the prevailing culture. Eneco, for instance, is a state-owned company, that would like to be a leader, but when it comes to risk… they are clearly a follower. This has implications of its own in terms of what you do and when." |
| *Jamming*: Interacting with invited actors in a humble and learning driven spirit, creating a platform for future engagements. | "It takes time – it is a learning process together with the other organizations. Is there any interest, what are they investing in, etc.?"<br>"There are many who must believe in it [the vision]. Even if the boss is on board and wants to drive really hard, there is usually someone slowing down. We need to convince people in various positions, at different levels and in different functions in the organizations. And it is about psychology; you need to understand what motivates different actors and individuals – only then you will know how to get them involved". |
| *Framebreaking*: Changing mindsets and beliefs at the individual, relationship, and organizational levels | "We work on those who are standing on the brakes. It is about getting people involved. We invited one of their important, influential – but deeply conservative and negative – employees to talk about Powco's view on the future of the energy sector for our board. And suddenly it's great fun for him, people listen and eventually this become a really interesting area for him."<br>"Even if firms perhaps see a change coming, they are not prepared to invest in an early phase. Concrete evidence of savings or value for all stakeholders is therefore extremely important to have. Their own calculations had not been able to catch the big advantage that can actually be achieved here, but they made big eyes [were astonished] when we showed the results of our pilots. You see, you have to prove that it works before people start to think of it as an option and you need to be completely sure that there is a real piece of money to fish out, and to help others fish out. Otherwise no-one will listen." |

**Table 4**
Network position consolidation capability: Underlying activities and illustrative quotes.

| Underlying activities | Illustrative quotes |
|---|---|
| *Harvesting*: Leveraging information flows for the purpose of sustaining knowledge advantage/lead | "One thing that is partly a handicap, partly an advantage for us, is that this is a very complex solution. …There are so many pieces that need to be in place before you can offer this full scale solution…it is way beyond the software part… This is also the reason why it takes time… this is neither a platform nor an app-business where you can roll out things by downloadable apps. There are so many different components needed. But we have them!"<br>"We need to continue being the one sitting on the database of knowledge. As we are the central actor in this game, delivering a complete solution, we are the spider in the web. We must continue being the one sitting on the database of knowledge. Take, for instance, the recent cooperation with Powco and ElCo, an installation company; they cooperate with each other, but all the relevant flows of information run through us. We must ensure that we have the capability to support them, and that we maintain the specific role that we really want to have." |
| *Upgrading*: Building brand visibility and affecting terms for cooperation based on increased credibility | "So far the role of Techo has been quite invisible…the [technology] solutions behind the Powco launches are Techo's, but few know this …now, when we proceed with them and other new partners, there is no other option than that the name and role of Techo are visible for all, also the end users. We have reached a position where we can claim visibility."<br>"Today we start from a consultancy basis and we charge for it… when various utilities call us and invite us to collaborate, we start from discussing their present business model from a strategic outlook."<br>"Our ambition is to have a slice of the big pie. Any competitor who wants to enter this business needs the infrastructure we have in our cloud. They would have a tough place building up the knowledge platform we have. But we need to run fast. Otherwise we will get trampled down. Being a mouse dancing with elephants, you need extremely nimble feet." |

needed to bring the vision to life, the focal actor develops a blueprint of the emerging business field and of its own role and position. Such a roadmap gives direction and enables the firm to grapple with emerging actors, lack of standards, embryonic technologies, and infrastructure. As the field is emerging, unpredictable and therefore capricious, the lack of a roadmap and strategic focus might easily lead a company astray. For Techo, the roadmap also related to the commercialization process from initial market focus to purposefully progressing into new segments.

The roadmap provides a base for *communicating and evangelizing* the vision of the emerging business field to relevant actors in both the immediate network and in the wider environment. The communicated message must be compelling so that other players buy in to the vision. By first making sense of the wider context, enacted through visioning, the communication and evangelizing activity is then focused on influencing the development of the emerging business field, drawing the attention of a wide audience to the compelling business opportunities and societal benefits. Techo exerted significant effort to make sure they understood the various pieces and to connect them together into a holistic view of value for all stakeholders, which was then articulated clearly.

Finally, *navigating* refers to the activity of advancing along the emerging path. Because the field evolves as a consequence of both predictable and unpredictable events, the focal actor must continue to influence the course and pace of its emerging path, balancing adaptability and agility. Navigating thus encompasses the capability to anticipate but also live and learn with the future, to understand what is about to happen in the broader context, and to influence the trajectory of the emerging field and the company's own business. For Techo, the adoption of their vision did not necessarily imply that the destination was reached, but also required that the vision be regularly updated and communicated to actors in other sectors as challenges arose.

### 5.2. Network construction capability and its underlying activities

Our case data also supported the network construction capability as critical in aligning disparate actors and processes, stitching together a functioning network. Defined as *the capability to establish and develop relationships and constellations of partners for the purpose of configuring a network that catalyzes the emergence of a new high-tech business field, especially the solution of the focal firm*, we want to emphasize the dual character of the network construction capability. In addition to being able to influence and co-create a field-wide network, network construction simultaneously includes mobilizing and managing more limited strategic nets for specific purposes. The illustrative findings suggested three activities constitute this capability: (1) casting, (2) jamming, and (3) framebreaking. Each of these is supported with quotes in Table 3.

*Casting* entails searching for and identifying actors (individuals, organizations, forums, etc.) in both the immediate and the broader network who possess relevant resources, and who can participate in the development of the emerging field. Emerging high-tech fields are fluid and messy in nature and actors in possession of relevant resources may be found inside as well as outside the industry. Hence, casting implies zooming out in order to identify appropriate partners and also knowing what to look for. Techo participated actively in various international events that focused on energy-related issues. These events resulted in several co-operations where Techo got the opportunity to conduct important pilots.

To better get to know the actors invited through casting and, using a jazz analogy, finding the right key, tempo, and groove with these actors, the second activity, *jamming* involves free and open conversations, and building trust and legitimacy at the network, relationship, and individual levels. These interactions and conversations are vital for co-constructing a shared interpretation of the emerging business field and for generating a feeling of togetherness. The success of these jamming sessions rested on the ability to maintain flexibility in these interactions, and to respectfully listen and adjust to the counterpart, instead of being wedded to predefined arrangements and ideas. Techo engaged in many such sessions to get better in touch with influential people and to identify the arguments that appealed to them.

The *framebreaking* activity captures the changing of the mindsets and beliefs of individuals in organizations. Convincing argumentation, customized to each actor, providing evidence for the need to change the existing business models and support the emerging business field, are the keys for successful framebreaking. When dealing with larger organizations, framebreaking needs to be enacted at all levels, from the top management down to the members of the organization involved in daily operations. In Techo's case, the ability to interact and learn about how key persons at different levels in different companies think and act was a prerequisite for framebreaking and to gain support from important partners. According to Techo, there are always, everywhere, people who either step on the gas or put on the brakes. Their strategy was to concentrate on those who were standing on the brakes, and

provide the incentives they needed to change their mindset.

### 5.3. Network position consolidation capability and its underlying activities

The relevance of the network position consolidation capability in an emerging high-tech business field appears clearly in the case findings. We define it as the *capability to consolidate and reinforce the actor's own network position for the long term*. When a working network has been constructed and the new high-tech business field is taking shape, the focal actor's position in the network must be consolidated in order to preserve and leverage its leadership. This capability is vital for managing critical value constellations and maintaining commercialized solutions, and to avoid being reduced to a subcontractor position in the network.

The findings suggest that this capability has two constituent activities: harvesting and upgrading. Table 4 provides supporting detail for the activities and illustrative quotes associated with network position consolidation.

*Harvesting* refers to managing and controlling information flows between actors in the network for the purpose of collecting important customer and other relevant data. The ability to access, create and capture relevant information is crucial to ensure and continuously reinforce one's position and role in the emerging business field. Larger incumbents may try to buy or circumvent the entrant firm; the new entrant also risks being caught by technological copy-cats. For Techo, their comprehensive knowledge platform, always at the leading edge, became more and more crucial as the business field developed. They thus paid constant attention to preserving their knowledge lead with the ambition to secure their position in the consolidating business field for smart energy solutions.

*Upgrading* refers to the focal actor's leveraging the enhanced acknowledgement of, interest in, and their increased credibility in the emerging industry. This increase in perceived credibility gives negotiating power and thus allows the focal actor both to claim brand visibility and to set the terms for cooperation with existing and new partners. It also allows the entrant firm/focal actor to continue to influence the future shape of the emerging business field.

These network position consolidation activities are keenly related to the nature of the dynamic high-tech context. Consolidating and maintaining the competitive advantage resides in the ability to recognize and act on the emerging opportunities. In this sense, upgrading is a purposeful activity for the focal actor; it requires managers to strategically maintain and solidify the company's position as well as its ongoing viability in the constructed network. In Techo's case, this activity was evident in their strategies for business development where they capitalized on their acquired credibility by setting terms for cooperation and by entering new business domains.

## 6. Discussion and conclusions

Despite an increasing academic interest in both the microfoundations of dynamic capabilities in general (Felin et al., 2015), cognitive managerial capabilities (Helfat & Peteraf, 2015), and network management capabilities in particular (Möller, 2010; Möller & Svahn, 2009), empirical research is largely silent about how such capabilities are manifested in practice. Responding to the calls for more research on network management in high-tech and innovation contexts (e.g., Aarikka-Stenroos & Lehtimäki, 2014; Thornton et al., 2013), we aimed to construct a framework for network management capabilities and their deployment in emerging high-tech business fields. Based on the existing literature on capabilities in high-tech and emergent business contexts, we delineated a tentative conceptual framework that was illustrated, evaluated and specified through a longitudinal case study.

Our results suggest that three interrelated capabilities (*context handling capability, network construction capability, and network position consolidation capability*) are critical for network management in an emerging business field. Furthermore, the case study indicates that the focal actor must be capable of mastering all three network capabilities simultaneously to capitalize successfully on an emerging business field. The illustrative case study adds further insight into the constituent activities of these network management capabilities, providing a novel and microfoundational understanding of how an entrant firm can navigate the uncertainties and complexities in an emerging business. These findings offer several major theoretical contributions.

### 6.1. Theoretical contributions

First, we contend that the integration of the three critical capabilities into a holistic framework, clarifying their scope and specific roles in the network management process, provides a significant contribution. Our *network management capability framework*, derived from the integration of the literature review and the case study findings, provides a novel and unique, context-specific perspective. The emerging high-tech business field previously has been addressed only conceptually and in a rather fragmented fashion. In extant literature, origins of the capabilities constituting our framework reside in different research streams, i.e. dynamic capabilities literature (Helfat & Peteraf, 2003; Teece, 2007; Teece et al., 1997) and networking capability literature (Hagedoorn et al., 2006; Mitrega et al., 2012; Mu et al., 2016; Thornton et al., 2014). In comparison to the extant literature on networking capabilities, which mainly addresses the management of existing relationships (Hagedoorn et al., 2006; Mitrega et al., 2012), the capabilities outlined in our study have a more explicit focus on attracting, establishing and managing relationships with new and unknown partners. Given the features of emerging high-tech fields, the ability to mobilize resources in the possession of other actors is a necessity.

Second, the capabilities also add new perspectives and insights to extant knowledge. For instance, the *context handling capability* either is overlooked entirely or addressed only vaguely, alluded to in terms of sensing and seizing (Teece, 2007), network visioning capability (Möller & Svahn, 2009), future-mindedness (Wilkinson, 2008), and network cognition (Möller, 2010). Our research articulates a more comprehensive future-oriented context handling capability and its underlying activities of visioning, roadmapping, communicating/evangelizing, and navigating. These specific activities correspond well to the idiosyncrasies of high-tech markets (Mohr & Shooshtari, 2003; Moriarty & Kosnik, 1989). The unpredictable nature of an emerging high-tech business field implies that no one actor has all the requisite information, technological understanding, nor the necessary resources. Hence, the *network construction capability*, and its associated activities of casting, jamming, and frame breaking, is conceptualized to match the ambiguous nature of developing radical innovations with both known and unknown network partners. Finally, our framework also includes the *network position consolidation capability*, emphasizing the need to maintain (i.e., to harvest) the superior value-creation role of the focal actor *vis à vis* other players (see, e.g., Partanen & Möller, 2012). This aspect is very rarely discussed, especially from the view of a start-up in an emerging high-tech business field (Aarikka-Stenroos & Sandberg, 2012).

Third, our longitudinal case provides insights into the interrelationships among the network capabilities and their sequential nature, another contribution to extant literature. Although the evolving nature of emerging high-tech fields implies that the progress is iterative and consists of several parallel activities rather than a straightforward and simple process, we argue that the sequence of capabilities and their activities is critical. Based on the case study, we propose that the context handling capability can be regarded as a prerequisite for successful network construction. The network position consolidation capability, in turn, rests deeply on capabilities for context handling and network construction. As the process unfolds, it seems logical that the capabilities exist in parallel, supporting each other in a continuous

interactive and iterative flow.

Fourth, the constituent sets of *activities* (perhaps the 'micro capabilities') by which the general capabilities are manifested also provide a theoretical contribution. While we acknowledge the possible idiosyncratic and case-specific character of these activities, we argue that they clarify and deepen our predominantly conceptual extant understanding (e.g., Möller, 2010; Möller & Svahn, 2009) of how a focal actor tries to manage in uncertain and complex environments. Some of these activities have been referred to in previous research, i.e., communication agendas (Möller, 2010), which resemble the roadmapping and communication activities. Our findings, however, indicate that entrant firms in emerging high-tech business fields benefit from a purposeful employment of *a portfolio of strategic activities* in the pursuit of their goals. This opens up a microfoundational and operational understanding of capabilities for network management.

In addition to these theoretical contributions, our study also offers a number of other insights. Extant studies seem to underestimate the complexity and uncertainty of emerging high-tech business fields, although these fields often develop in unpredictable ways and over long time periods, with a series of developments, major breakthroughs and blind alleys (cf. Geels, 2005; McCann & Selsky, 1984; Ramírez & Selsky, 2014). An actor cannot predict fully who the other key players will be, how they will act, and when and how the development of the field proceeds (Möller & Svahn, 2009; Murtha, Lenway, & Hart, 2002). This unpredictability suggests – as illustrated by the Techo case – that a company should be constantly on its toes, keeping abreast of and persistently influencing the development of the field via "context handling" and "network construction", while simultaneously ensuring its value-capturing position through "network position consolidation".

Another insight derived from our study in the high-tech landscape is role of an entrepreneurial orientation in enabling managers to steer the messy and iterative development of the network in the emerging business field. Consistent with other scholars who emphasize the creative and entrepreneurial skills of the leaders (e.g., Adner & Helfat, 2003; Rosenbloom, 2000; Schilke, 2014; Teece, 2012) we underline the entrepreneurial orientation. In the context under examination in this study, it is a critical constituent of the network management process and manifests itself through the three core capabilities and their constituent sets of activities.

In sum, our results make significant theoretical contributions to the understanding of the networked creation of new high-tech business fields and particularly to the network management capabilities required.

### 6.2. Managerial implications

Our research provides significant guidance to managers to navigate emerging high-tech business fields, especially with respect to the capabilities needed to galvanize and coalesce actors in the emerging business network. We encourage managers to use our framework as a guide to plan and analyze their behaviors at various stages of network development. Our study suggests that if managers possess – or can develop – the capabilities we propose, and execute them through the associated activities, their goals can be more easily achieved in these emergent contexts.

The first capability we encourage them to strengthen is *context handling* to make sense of the emerging high-tech environment and create a compelling vision of the future business opportunity. Being open to influences from a variety of places, ideas, and actors, actively interacting with a wide set of actors, attending a variety of forums (research seminars, round tables, conferences) and actively engaging in early pilot projects can help identify where they think the field is going (technological understanding, business understanding, potential customer understanding). Vision alone is not enough, however. Our findings also accentuate the importance of creating a strategic roadmap of milestones and collaborators, and a sequence for them, in order to realize the business vision. Without a roadmap, the company might get lost in countless trial and error moves in the complex and fast changing business field and lose the opportunity to galvanize network partners.

Context handling provides a basis for *network construction*, which according to our findings entails focused efforts to invite and influence a variety of stakeholders through casting, jamming, and framebreaking. This capability requires the ability to attract and mobilize partners with critical resources and to negotiate with them jointly agreed roles, responsibilities, and schedules. These activities are not necessarily intuitive, and many managers may have a propensity to want to dial in and nail down partners and plans prematurely. Hence, in their network construction efforts, we suggest that managers develop a deep understanding of the potential market being constructed, its constituents and mechanisms as well as the motives that drive different actors. Our case study suggests that openness to conversation and learning are key to developing a shared interpretation and to getting other network actors on board. In other words, a firm's capability to break the ingrained modes of existing business definitions and to be open-minded about conversations with possible network partners allows it to surface new insights, leading to market innovation within the network.

With respect to the third capability, network position consolidation, as the business field takes shape and scales up, management would benefit from explicit thought regarding how to consolidate the firm's position in the network so as not to lose ground to other actors. Our study suggests that this capability calls for continuous efforts to maintain the technological or knowledge lead, to solidify their credibility, formalize cooperative strategies, and importantly, to manage the customer interface.

Altogether, our framework highlights the importance of a broad approach to network management. Having a wide interface with the external environment, including many organizations (and many levels in those organizations), as well as a wide and deep knowledge base of technologies, actors, business models, and sources of value are essential to constructing a network that can capitalize on the potential of new business fields. In addition, our case highlights that rather than assuming the focal firm knows what do to and how to do it – and who has the requisite resources – the ability to be humble, to be genuinely interested in the values of attractive target partners is part of successful network management.

Having the courage to make tough choices in favor of one's vision, to live with the consequences of these choices, to be comfortable with not knowing all the answers – these are some of the hidden nuggets buried in the capabilities and activities.

### 6.3. Limitations and suggestions for future research

The network capability framework we propose, based on an integration of extant literature and rich longitudinal data from one company navigating the challenges of an emerging high-tech business field, should be regarded as a first stage in the development of a compelling research avenue. Although we relied on a variety of primary and secondary data sources, the use of a single case with one informant is a limitation – even though individual managers are often regarded as both reflective and able to provide relevant data (Sharfman, 1998). In addition, analyzing other players' perspectives about the focal actor's efforts would provide useful insights.

Future research should build on and validate our framework. The next step includes further empirical validation of the network management capabilities and, in particular, their constituent activities. Accordingly, additional in-depth studies of similar entrepreneurial start-ups, active in emerging high-tech business fields is a logical first step. Our case, an entrepreneurial start-up, demonstrated a clear aptitude for cross-boundary thinking and exploration of distant business opportunities, i.e. context handling. The other two capabilities were equally important and the efforts invested were of comparable magnitude over time. Future studies might examine the approach a more

established, or incumbent firm, would apply for network management in emerging high-tech business fields. What portfolio of activities would such firms employ and prioritize in their network management endeavors?

Studies that address factors such as the industry's characteristics, geographic and cultural contexts would add further depth to our understanding of network management in high-tech business fields. Such insights could be achieved with a careful comparative multi-case design, varying the sizes and orientations of the case companies. Systematically examining the relationships between the level of uncertainty and complexity of the emerging business field and the network capabilities is another compelling research path. Although the moderating effect of technological turbulence has been shown in a variety of managerial domains, research is less clear as to its impact on networking behavior. Validating this effect in the network management arena would add additional insights.

Finally, the framework can be tested with quantitative studies to operationalize the variables and model relationships between them. For example, the capabilities and their constituent activities could be modeled as second-order factors. By understanding their inter-relationships and temporal sequence, managers in emerging high-tech business fields will have more insight into their network management skill development.

In sum, our study advances research to gain a deeper understanding of the capabilities and activities for network creation and management in emerging high-tech business fields.

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