



Department of Applied
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Ecosystem orchestration

How to thrive in the increasingly networked
digital economy

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Abstract

Ecosystems, a concept used to describe external inter-organizational networks of actors, is a concept closely linked to the digital economy. When firms become increasingly networked, organizational boundaries blur, which challenges incumbent firms' notions of being isolated entities. Understanding how to cope with this shift has turned out to be a great challenge. To shed light over these challenges, this research paper develops a framework for ecosystem orchestration, that is managing these inter-organizational network relations, for the digital economy which is the main contribution of this thesis. While previous studies generally take on a platform-centric approach, I have conducted an in-depth qualitative case study of an incumbent firm in the Swedish forest industry to attain in-depth understanding of ecosystem orchestration, complementing existing research with an ecosystem-centric approach. By combining the literature on ecosystems and platforms with the near-lying literature on innovation networks, this research additionally contributes to a unified understanding of these literature streams. This thesis concludes how ecosystem orchestration in the digital economy consists of both non-digital and digital orchestration processes which need to be dually managed by incumbent firms as digitalization sweeps across the ecosystem. In this thesis, I argue that incumbent firms need to integrate ecosystem design processes with digital ecosystem orchestration in leveraging the potential of the digital economy. Additionally, digital orchestration processes are argued to be superior to non-digital as they are scalable to a much greater extent, where non-digital orchestration processes are limited by the number of employees. The findings of this thesis thus additionally reveal the competing concern that unfolds when existing practices of ecosystem orchestration are challenged with digital orchestration processes, constituting a challenge for incumbent firms as existing roles are changing. From a greater perspective, this research contributes to our understanding of how markets as well as labour markets are transformed by digitalization, through providing one piece of puzzle to our understanding of ecosystems.

Keywords ecosystem orchestration, digital economy, digital ecosystem, business ecosystem, platform

Table of contents

INTRODUCTION	5
RELATED WORK	7
ECOSYSTEM CONCEPTS IN BUSINESS LITERATURE	7
ECOSYSTEM CONCEPTS IN INFORMATION SYSTEMS LITERATURE	9
THE SOCIOTECHNICAL UNDERSTANDING OF PLATFORMS AND ECOSYSTEMS	11
THEORETICAL FRAMEWORK	12
ECOSYSTEM ORCHESTRATION	12
<i>Hub firm as orchestrator</i>	13
<i>Ecosystem design</i>	14
<i>Orchestration processes</i>	15
<i>Ecosystem health – the outcome of ecosystem orchestration</i>	16
<i>An integrated framework for ecosystem orchestration</i>	16
METHODOLOGY	17
RESEARCH SETTING	17
RESEARCH DESIGN AND DATA COLLECTION	17
THEORETICAL FRAMEWORK AND ANALYSIS	20
THE SYDVED CASE	22
“FROM STUB TO INDUSTRY”	22
INTRODUCING “THE PERSONAL NETWORK”	25
FIRST WAVE ORCHESTRATION - “THE WINNING TEAM”	27
SECOND WAVE ORCHESTRATION – “THE DIGITAL ECOSYSTEM”	30
DISCUSSION	34
UNDERSTANDING THE SYDVED CASE THROUGH THE LENS OF ECOSYSTEM ORCHESTRATION	34
<i>Sydved as hub firm</i>	34
<i>Ecosystem design in Sydved</i>	36
<i>Orchestration processes in Sydved</i>	38
ECOSYSTEM ORCHESTRATION IN THE DIGITAL ECONOMY	41
IMPLICATIONS FOR PRACTICE OF ECOSYSTEM ORCHESTRATION IN THE DIGITAL ECONOMY	44
REFLECTIONS ON FUTURE RESEARCH	46
ECOSYSTEM EVOLUTION	46
THE ROLE OF TECHNOLOGICAL FRAMING IN LEARNING TO ORCHESTRATE ECOSYSTEMS	46
THE ROLE OF GENDER DISCOURSES IN LEARNING TO ORCHESTRATE ECOSYSTEMS	47
CONCLUSION	48
REFERENCES	49
APPENDIX 1 – OVERVIEW OF DATA SOURCES THROUGH ENGAGED SCHOLARSHIP	56

Introduction

Digitalization creates an increasingly networked society, driven by the progression of information technology. As a consequence, digitalization changes the environment in which firms interact where “ecosystem” has come to be one of the most widely adopted concepts for understanding these new circumstances. The ecosystem concept describes how firms co-exist with other ecosystem actors in their external surrounding network (Adner, 2006; Gawer & Cusumano, 2014; Moore, 1993; Tiwana, 2015; Weill & Woerner, 2015), and though its origin is not directly linked to describing business networks in a digital context, it has gained increased popularity as digitalization sweeps across society. Teece (2012) introduced the concept of the digital economy to understand the implications these new circumstances have for firms. The digital economy challenges the industrial through for example emphasizing the ecosystem over the industry, seeing competition as dynamic rather than static, emphasizing modularity rather than vertical integration and focusing on firm-level capabilities rather than transaction and agency costs (Teece, 2012). The logic of the digital economy builds on the assumption that value creation occurs in value networks (Allee, 2000) rather than understood as a value chain as emphasized in the industrial economy (Porter, 1985). This means that firms need to shift the gaze outwards for value creation, meaning that firms cannot perceive themselves as close entities but see their organizational boundaries as increasingly open (Chesbrough, 2006). For incumbent firms, this shift has turned out to be a great challenge.

Turning to the story of Spotify (Snickars & Fleischer, 2018), a new entrant that disrupted an entire industry with their innovative application of digital technology, one finds an example of the significance of shifting the focus to the ecosystem in an increasingly digital context. The backlashes of piracy and illegal file sharing in the music industry in the early 2000’s had drained the value of music creation from the industry. While Spotify originally sought to create an online system for media distribution where the business model’s core would be to sell ads, they soon realized that the success of their model required content of great quality in order to attract users. It might not come as a surprise that the choice of content fell on music. Re-framing how their digital innovation could address a mutual interest with the incumbent actors in the music industry in providing an alternative to file sharing that had come to shape consumer behaviour, Spotify thus sought out to find a role in the already established network of actors. (Snickars & Fleischer, 2018) From an ecosystem perspective, Spotify realized that their own success was dependent on forming relationship with other actors with whom they had identified a shared goal. To succeed with forming relationships in the existing music ecosystem, legal agreements for music distribution with record labels was a necessity. In one sense they were competitors, but they identified a need to collaborate as well, in order for everyone to capture value from Spotify’s innovation. While Spotify was a new ecosystem entrant, exploring digital innovation for incumbent firms involve certain difficulties, understood as unlocking competing concerns within firms (Svahn et al., 2017) and unleashing paradoxes that need to be managed (Gregory et al., 2015). The objective of this thesis is thus to explore the difficulty of shifting to an ecosystem focus and how this challenge can be met among incumbent firms. In doing so, I adopt the concept of ecosystem orchestration in order to retrieve in-depth understanding of how the digital economy affects how incumbent firms need to interact with their external ecosystem.

Orchestration is a concept used to understand how firms are managing external inter-organizational network relations (Gawer & Cusumano, 2014; Nambisan & Sawhney, 2011; Ritala et al., 2009), which provide a contrast to formal control mechanism emphasized in an industrial logic (Parker et al., 2016a). However, the existing literature on orchestration tend to focus particularly on innovators as external actors (Boudreau & Lakhani, 2009; Dhanarai & Parkhe, 2006; Ritala et al., 2009) rather than ecosystem actors from a more general perspective. In this thesis, I argue that the orchestration concept can be extended to ecosystem orchestration through addressing the call by Gawer (2014) in linking the ecosystems literature with the closely related literature on innovation networks. Apart from the mutual interest in the concept of orchestration, merging these literature streams would be of interest to the innovation literature as well as the innovation literature does not specify what role technology in general or the centrality of digital technology specifically play in innovation networks (Dhanarai & Parkhe, 2006; Nambisan & Sawhney, 2011). On the contrary, the role of digital technology in ecosystem literature has become increasingly central where the platform concept has become popular for understanding the role of technology in ecosystems (Selander et al., 2013), a concept that has also been criticized for being inconsistently used across academic disciplines (de Reuver et al., 2017; Gawer, 2014). De Reuver et al. (2017) notes that the platform concept can either be viewed as purely technological or sociotechnical, a divide that is noticed in use of the ecosystem concept as well. While prior research generally uses the concept of the platform as starting point for research (Gawer & Cusumano, 2008; Leijon et al., 2017; Tan et al., 2015), little research takes on an ecosystem-centric approach. This thesis thus contributes to a unified understanding of ecosystems and innovations networks as well as complements existing research in the ecosystem and platform literature by taking on an ecosystem-centric approach. Additionally, in this thesis I use the platform concept as a sociotechnical construct in order to form understanding of how the digital technology challenges existing ecosystem orchestration practices.

As a consequence, existing research of ecosystem orchestration from a sociotechnical perspective is scarce. To extend our understanding of ecosystem orchestration even further, I turn to the Swedish forest industry and the case of Sydved. When encountering Sydved today, there are interesting examples of how they are forming and managing collaborative relationships across firm boundaries in everyday activities, in many ways constituting an example of an ecosystem. However, while having begun to explore what role digital technology could play in these relationships, orchestration is currently mainly a non-digital process. The Sydved case is therefore interesting in terms of timing, as I through taking on the role as engaged scholar may gain in-depth understanding of concerns that unfold from an early stage in exploring digital technology. Additionally, Sydved's role in the ecosystem is particularly interesting in light of this research purpose as well. As Sydved's core mission involves matchmaking of raw material between forest owners and forest industries, previous studies predict that this role is particularly exposed for digital disruption. This is due to a platform being more powerful, efficient and scalable tools for matchmaking in combination with organizational inertia slowing incumbent firms down in keeping up with new entrants (Evans & Schmalensee, 2016). The purpose of this case study is thus to form understanding of both digital and non-digital ecosystem orchestration processes to understand the challenges unfolding by the advancement of the digital economy.

This research has been guided by the following research question:

How does the digital economy affect how incumbent firms orchestrate ecosystems?

Related work

The ecosystem literature contains a myriad of various concepts across scientific disciplines, where the role and nature of technology is one aspect that is understood differently. In this chapter, related work on ecosystems from business and information systems literature is presented along with the closely related platform concept.

Ecosystem concepts in business literature

A pioneering concept within the ecosystem literature proposed by Moore (1993) is business ecosystems. The concept of business ecosystem positions firms to be interdependent as part of a greater system expanding industry boundaries. Within an ecosystem, firms co-evolve capabilities through an interplay of both cooperative and competitive activity. Business ecosystems are argued to have four stages; birth, expansion, leadership and lastly self-renewal or death. Innovations seed new ecosystem and thus constitute an environmental factor to which firms must respond in order to survive. Leadership, undertaken by firms struggling over the role as dominant ecosystem leader, is essential for driving the entire community to a more prosperous future. (Moore, 1993) For some, the business ecosystem concept has been proposed to simply be an analogy for business networks (Iansiti & Levien, 2004), a perspective that is challenged by other concepts. In this approach, the actor taking on the leading role to govern the health of the entire system is conceptualized as a keystone player, or a hub firm. Iansiti & Levien (2004) argue that keystone players do this through providing platforms, described as assets either in the form of services, tools or technology, that other ecosystem members can use for value creation.

Business and economics theorizing in general have been criticized for the exclusion of information technology as a core component in strategy creation (El Sawy et al., 2010) and for not keeping up with understanding how technology and new practices are transforming the economy (Teece, 2012). The same remark can be made about the early ecosystem literature stemming from this academic discipline. In Moore's (1993) business ecosystem, technology is assumed to be exogenous, as technological innovation are thought to be the core around which ecosystem actors centre. The concept of innovation ecosystems, defined as "*the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution*", are argued to be enabled by information technology (Adner, 2006) due to its reduction of costs of coordination. Rather than technology being exogenous, the innovation ecosystem concept signals the increasingly interconnected view of technology and organization, where the role of technology is described as enabling these interorganizational networks. Teece (2012) is even more specific of the role of technology in ecosystems, arguing that co-evolution of business ecosystems is dependent on the technological leadership of a firm. Once again, the concept of platform is introduced, describing that ecosystems may be anchored by platforms (Teece, 2012). In contrast to Iansiti & Levien's (2004) arguing that platforms may be tools or services too, Teece (2012) mean that a platform exist when the elements of business ecosystem members consist of common standards and interfaces.

Ecosystem concept	Reference	Ecosystem definition
Business ecosystem	Moore (1993)	[Firms are] “part of a business ecosystem that crosses a variety of industries. In a business ecosystem, companies co- evolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations.”
	Iansiti & Levien (2004)	Business ecosystem is an analogy for loose networks of firms where the fate of each member of a business ecosystem is dependent on the health of the network as a whole
	Teece (2012)	“A business ecosystem contains a number of firms and other institutions that work together to create and sustain new markets and new products. The co- evolution of the system is typically reliant on the technological leadership of one or two firms that provide a platform around which other system members, providing inputs and complementary goods, align their investments and strategies.”
Innovation ecosystem	Adner (2006)	[Innovation ecosystems are] “the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution.”
(Innovative) business ecosystem	Gawer and Cusumano (2014)	“We define external (industry) platforms as products, services, or technologies that act as a foundation upon which external innovators, organized as an innovative business ecosystem, can develop their own complementary products, technologies, or services.”

Table 1. Overview of ecosystem concepts in the business literature.

Ecosystem concepts in information systems literature

Turning to literature originating from other scientific disciplines where the ecosystem concept has become popular, more specifically information systems and computer literature, a wide range of technology-centric ecosystem concepts have risen such as digital ecosystem (Briscoe et al., 2011; Selander et al., 2013) and platform-based ecosystem (Tiwana et al., 2010). Differing from ecosystem theorizing in business, the ecosystem literature information systems literature approach is to a greater degree technology-centric in understanding ecosystems and there are various approaches in understanding how such ecosystems relate to firms as individual actors and ecosystems.

With a purely technological perspective of platforms, it has been argued that platforms are software-based systems, providing core functionality to which sub-systems called modules can be added which in turn interoperate with the foundational platform through interfaces. In this view, this collection of platform and modules is what constitutes the ecosystem (Tiwana et al., 2010). Similarly, Briscoe et al. (2011) mean that digital ecosystems are distributed software systems, applying principles through biomimicry to apply properties of biological ecosystems. In contrast to Tiwana et al. (2010), the relation to business ecosystem is defined as the digital ecosystem are thought of as “*a platform for the network based economy of business ecosystems*” (Briscoe et al., 2011).

Similar to the business literature, the concept of the platform has emerged as the popular concept for understanding the role of technology. However, there appear to be differences in how one relates the concept of platform to ecosystem. While Briscoe et al. (2011) sees the entire digital ecosystem as the software-based platform for business ecosystem, Selander et al. (2013) treat the digital ecosystem as the collection of firms but the focal firm as the platform owner. This sheds light on the need for specifying whether one sees the ecosystems as well as platform concept as purely technological or sociotechnical constructs, as pointed out by de Reuver et al. (2017).

The information systems literature is in this sense to be viewed as complementary to the business literature on ecosystems. Where Moore (1993) vaguely speaks of “innovation” as centres for ecosystem actors, Selander et al. (2013) specifies that this innovative core is in fact a digital technology. Additionally, while Adner (2006) speaks of information technology, the information systems literature opens up this black box and dives into the specific characteristics of digital technology (Tiwana, 2010; Li et al., 2012; Briscoe et al., 2013). This implies that there might be more to learn about ecosystems through integrating these two separate research streams.

Ecosystem concept	Reference	Ecosystem definition
Platform-based ecosystem	Tiwana (2010)	“I refer to the collection of the platform and the modules specific to that platform as that platform’s ecosystem”.
Digital ecosystem	Li et al. (2012)	“Mimicking biological ecosystems, digital ecosystems refer to complex and interdependent systems and their underlying infrastructures by which all constituents interact and exhibit as a whole self-organizing, scalable and sustainable behaviours.”
	Selander et al. (2013)	[A digital ecosystem is] “a collective of firms that is interlinked by a common interest in the prosperity of a digital technology for materializing their own product or service innovation.”
	Briscoe et al. (2013)	[Digital ecosystems are] “artificial systems that harness the dynamics that underlie the complex and diverse adaptations of living organisms in biological ecosystems.”

Table 2. Overview of ecosystem concepts in the information systems literature.

The sociotechnical understanding of platforms and ecosystems

The various applications of the ecosystem concept have been noted by for example de Reuver et al. (2017), arguing that they either can be seen as organizational or technical why I will clarify below what conceptualizations are guiding this research. A similar critique has been addressed to the platform concept. Gawer (2014) notes that platforms in economics are generally thought of as markets and platforms in engineering design is thought of as technological architectures. She also notes differences in focuses across disciplines, where the main focus of platforms as markets is coordination of consumers and economies of scope in demand while platforms as technological architectures focuses on coordination of innovators and economies of scope in supply and innovation. In economics, a central concept has been that of doubled sided markets, focusing on generating cross-side network effects i.e. value increases as another network group grows (Eisenmann et al., 2006). Value through same-side network effects are contrastingly generated when one's own network group grows, such as for example a telephone network.

Differing from merely seeing platforms as purely technological architecture or markets, Gawer (2014) proposes that platforms are “*evolving organizations or meta-organizations*”. Furthermore, she specifies the relation to the ecosystem, or the industry ecosystem and their constitutive agents (i.e. platform leaders and complementors providing products or services), as the organizational setting for such agency. Gawer (2014) proposes the following definition of platform: [technological platforms are] “*evolving organizations or meta-organizations that: (1) federate and coordinate constitutive agents who can innovate and compete [these agents can be individuals or firms, and can play a variety of roles, these roles not being restricted a priori to being either always consumers or always collaborative innovators]; (2) create value by generating and harnessing economies of scope in supply or/and in demand; and (3) entail a modular technological architecture composed of a core and a periphery*”. She also clarifies the centrality of the notion of agency, as “without autonomous agents and ecosystem governance, an industry platform is just a technological architecture”. (Gawer, 2014) However, this approach to platforms has in turn been criticized for not conceptualizing technology in relation to either the platform or the ecosystem and thus calls upon a specification whether the platform is used as a technical or sociotechnical concept (de Reuver et al., 2017). In this research paper, I clarify that I see platforms as sociotechnical constructs, serving as nodes in the ecosystem with power to federate and coordinate other agents. In line with the business literature on ecosystem, I see ecosystems as the platform's external inter-organizational network of actors. Applying Gawer's (2014) definition of platform, I emphasize that the technological architecture is in fact a *digital* technological architecture, in line with the information systems literature on ecosystem (Briscoe et al., 2011; Li et al., 2012; Selander et al., 2013). I will now explore how this theoretical lens may enhance our understanding of how firms interact with and manage relationships with ecosystem actors, leading us into ecosystem orchestration.

Theoretical framework

Ecosystem orchestration

With an increasingly ecosystem-centric view, firms are required to shift the gaze outwards and thus need to rethink how external relationships are managed. These processes are contrasted to formal control mechanism emphasized in an industrial logic (Parker et al., 2016a), and thus requires other processes than managerial authority and contractual relationships (Gawer, 2014). Instead, loosely coupled network theory has pointed out that relations need to be managed more delicately, defined as “*subtle leadership*” (Orton & Weick, 1990), an important aspect clearly emphasized in the framework I will introduce below (Dhanarai & Parkhe, 2006). Orchestrating an ecosystem has been compared to state governance, with the goal to create wealth and ensure fair distribution amongst those who engages in value creation.

As the ecosystem literature rests on an assumption of a networked setting for firms, I will seek inspiration from a near-lying theoretical field, namely innovation networks, as proposed by Gawer (2014). Other approaches to orchestration is for example found in the concept of resources orchestration (Baert et al., 2016; Sirmon et al., 2011), rooted in the resource-based view of the firm and using capabilities as explanatory concepts. I mean that this view of orchestration does not capture the centrality of the surrounding network, where the explicitly stated focus on coordination, direction, influence and management of other external network members (Dhanarai & Parkhe, 2006) constitutes a better fit for the purposes of this thesis. An evidence for the similarity of the streams is the recurrent use of the term “loosely coupled organizations” as a description for the inter-organizational relations found in both innovation networks and ecosystems literature (Adner, 2006; Dhanarai & Parkhe, 2006; Moore, 1993). To critically evaluate the interchangeability of the two concepts, I will use the framework by Dhanarai & Parkhe as starting point and contextualize to merge the framework components to the ecosystem literature, staying open minded to that there may be notions of value from both perspectives.

Dhanarai & Parkhe (2006) introduce and define the concept of *network orchestration* as “*the set of deliberate purposeful actions undertaken by the hub firm as it seeks to create value and extract value from the network*”. I firstly introduce the framework below and will thereafter explain the different components of the framework more thoroughly below. In brief, the focal firm in the network performing the orchestration is conceptualized as a hub firm, conducting two categories of activities, namely network design and orchestration processes. The outcome of these activities is conceptualized as the network innovation output. For the purposes of avoiding conceptual confusion and underlain the inclusion of the ecosystem literature in these concepts, I will henceforth apply the word “ecosystem” instead of “network” when relating to the framework in headings to emphasize the widened perspective of the ecosystem concept.

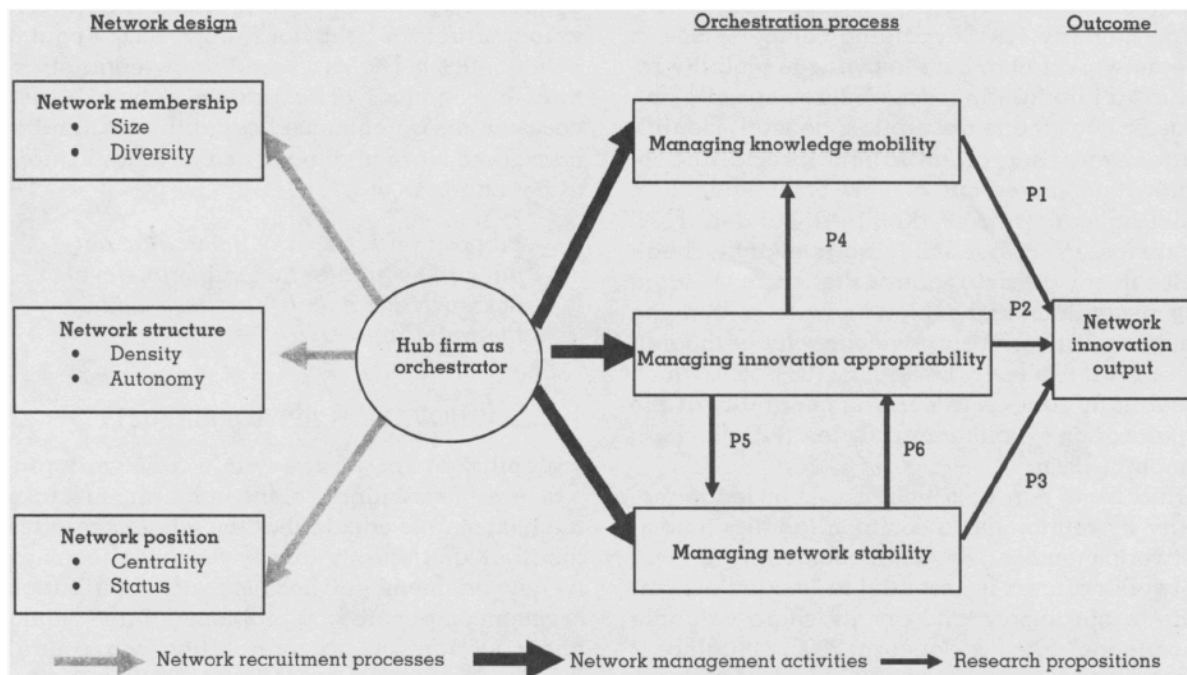


Figure 1. Framework for orchestration in innovation networks (Dhanarai & Parkhe, 2006), serving as starting point for this thesis..

Hub firm as orchestrator

Hub firms are powerful, centrally located actors in the network exhibiting leadership over other network members (Dhanarai & Parkhe, 2006). Similar notions can be found in the ecosystem literature as well. In business ecosystems theorizing, hub firms have been described as keystone actors “regulating ecosystem health”, which is not thought of as altruistic but for strategic reasons (Iansiti & Levien, 2004). Research has shown that becoming a leader in ecosystems is challenging, due to failure in strategies for mastering both the technological and business aspects required for this role (Gawer & Cusumano, 2008). The ecosystem perspective on hub firms thus complements the network view through clarifying the inclusion of both organizational and technological aspects of hub orchestration. Studies have shown that the role of the hub firm is not always clear in evolving ecosystems and requires orchestration in order to emerge (Basole, 2009). This implies that a hub firm does not exist a priori to orchestration processes.

Ecosystem design

Network design are described as engineered, instrumental processes with the intention to form and stimulate growth in a network (Dhanarai & Parkhe, 2006; Doz et al., 2000). Dhanarai and Parkhe (2006) label processes for network design performed by the hub firm as “network recruitment processes”, of which they identify three forms; network membership including size and diversity; network structure including density and autonomy and network position including centrality and status. These processes are described as “networked recruitment processes” (Dhanarai & Parkhe, 2006), and have further been argued to consist in two forms; emergent or engineered. While emergent processes result from environmental interdependence and identifying a similar interest, engineered processes requires a triggering entity, that is active recruitment of network members. (Doz et al., 2000)

Levén et al. (2014) expand on these notions. In network membership, firms may learn about the nature of value creating interactions of network members and ultimately impact size and diversity in order to foster such interactions. As noted above, depending on the perspective of platforms, attracting network members has generally been focusing on consumers or innovators (Gawer, 2014). In terms of innovators, the literature has focused on the notion of incentives in order to attract target network members, emphasizing the need for including intrinsic innovation as complements to extrinsic motivations in increasingly collaborative environments (Boudreau & Lakhani, 2009). While Gawer (2014) highlights the emphasis on pricing as attraction mechanism in economics theorizing, other business theorizing branches seeks information from for example sociology in forming understanding of consumer groups. Looking to consumer marketing, the concept of tribes has been used to metaphorically describe networked groups (Maffesoli, 1995), as part of a cultural perspective on consumers (Arnould & Thompson, 2005). This imply that there may exist subgroups of ecosystem networks which are culturally defined. As the ecosystems literature do not appear to yet have formed a unified theoretical lens for attracting and impacting ecosystem membership, for the purposes of this paper I will not delve deeper than including subgroups into this category, but also highlight that. these may be alternative stepping boards to form deeper understanding.

As for the two subsets of network structure, density relates to the degree of formal and informal relationships between network members and autonomy relates to the degree to which members can take action independently of formal control of the network. From the ecosystem literature, I here introduce the notion of co-opetition (Brandenburger & Nalebuff, 2011; Ritala et al., 2014), encapsulating the dynamism of collaboration and competition in external relationships which may be thought of as another dimension of network structure. As for network position, network centrality and status are mainly reflected in how the other network members perceive the hub as network designer and orchestrator. (Levén et al., 2014) Reoccurring concepts in the ecosystems literature describing network position are the concepts of core and periphery, where the central firm in core is equated to a platform owner (Selander et al., 2013).

Orchestration processes

Orchestration processes relates to the network management activities of a hub firm. Dhanarai & Parkhe (2006) identifies three types of orchestration processes; knowledge mobility, managing innovation appropriability and fostering network stability.

Knowledge mobility is defined as “the ease with which knowledge is shared, acquired, and deployed within the network” (Dhanarai & Parkhe, 2006). This links to the view that value creation does not occur in isolation, but emphasizes open organizational boundaries (Chesbrough, 2006). Levén et al. (2014) points out three forms for improving knowledge mobility; *knowledge absorption*, attained through reinforcing other network members to form new combinations of existing capabilities and thus increase absorption of knowledge; *network identification*, attained through stimulating a common identity to create trust, and lastly *inter-organizational socialization*, attained through for example stimulating creation of social capital through mutual forums and communication channels.

Managing innovation appropriability refers to how a firm “*governs an innovator’s ability to capture the profits generated by an innovation*”, handled through establishing an “appropriability regime” through for example patents, copyright and trademarks (Dhanarai & Parkhe, 2006; Teece, 1986). How value is distributed additionally need to be perceived as equitable by network members, why socially established trust and justice are emphasized (Levén et al., 2014). When the definition of actor is broadened from not only regarding innovators as external actors in ecosystems, the concept of creating an appropriability regime can therefore be expanded to “*an ecosystem actor’s ability to capture the profits generated by one’s business operations*”. This can be found in the ecosystems literature as well, where value capture is argued to be a key capability taking place on firm levels in ecosystems (Leijon et al., 2017; Ritala et al., 2013). Leijon et al. (2017) identifies profit from transactions in network, profit from spill over innovations and profit from new value propositions as tools for value capture in innovation ecosystems, but research is still scarce on tools for establishing an appropriability regime and how value is distributed amongst actors within an ecosystem context.

The last orchestration process is fostering dynamic network stability, described as the aim for a positive growth rate in network while simultaneously allow for entry and exit of network members. Key activities for network stability are enhancing one’s own reputation, lengthening the shadow of the future where network members can link their current actions to future benefits and lastly, stimulating deepened, multiplex relationships through creating additional joint projects. (Dhanarai & Parkhe, 2006). However, platforms as a technological foundation enable expanded opportunities for scaling and managing network effects as pointed out by Dhanarai & Parkhe’s (2006) definition of network stability. Not only does ecosystem design need to account for entry and exit of ecosystem members, it needs to be frictionless (Parker et al., 2016b). The need for frictionless movement also includes side switching between ecosystem groups. The scalability of network effects additionally carries with the need of curation mechanism, meaning avoiding negative network effects. Negative network effects may arise when the quality of interactions decrease as a result of increased difficulty in creating valuable matches within the ecosystem. (Parker et al., 2016b)

Ecosystem health – the outcome of ecosystem orchestration

Extending the notion of the outcome of orchestrating ecosystems requires one to think broadly. Dhanarai & Parkhe (2006) mean that the outcome of network design orchestration processes simply is “innovation output”, but as the wide range of actors in ecosystems engage in a wider range of activity, this notion needs to be expanded too as. The main goal of a hub firm has been argued to be governing the collective health of the actors in the ecosystem, not for altruistic reasons but as the success of the hub firm rests on ecosystem health too (Iansiti & Levien, 2004). There are three factors of ecosystem health pointed out by Iansiti & Levien (2004); *productivity*, in the sense of creating value from technology and/or raw material alike how biological ecosystem convert non-biological input into living outputs such as organisms; *robustness*, in the sense of resisting disruptions for example technological or environmental changes in biological ecosystems; and lastly, *niche creation*, in the sense of fostering diversity in the ecosystem.

An integrated framework for ecosystem orchestration

In figure 2, I present the extended framework from innovation network orchestration to ecosystem orchestration which serves as the theoretical lens for understanding the Sydved case.

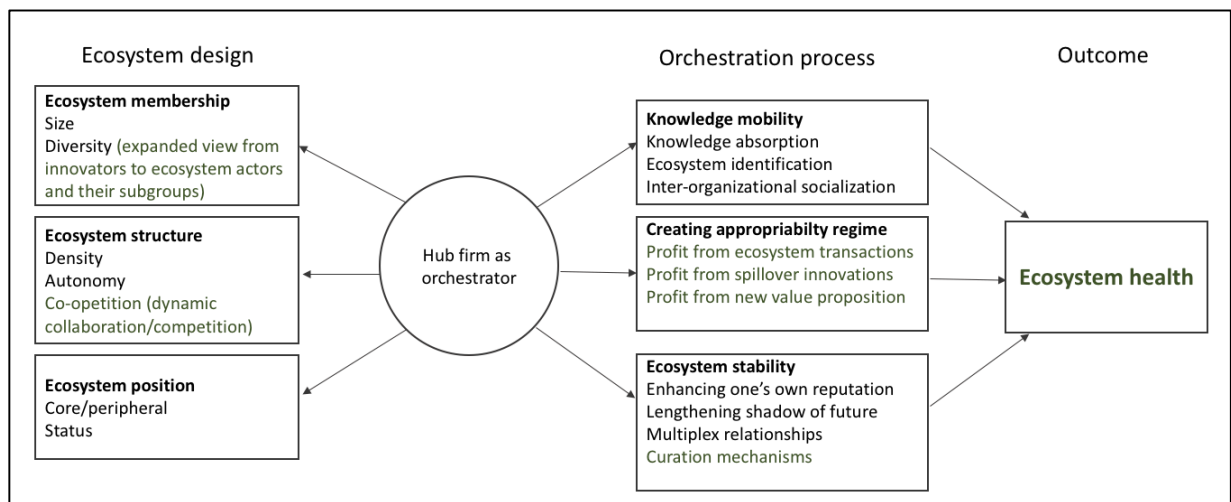


Figure 2. Theoretical framework for ecosystem orchestration.

Methodology

Research setting

The Swedish forest industry is an industry with long-spanning history, significant role in Swedish economy and an aim to contribute to sustainable solutions (Skogsindustrierna, n.a.). The focal firm of this study, Sydved, was founded in 1979 and is owned by two forest industry actors whose main mission is production of wood-fibre based products. Sydved's mission is thus to purchase and supply these industries with raw material. One core activity of Sydved is thus to establish relations with forest owners in the southern parts of Sweden with the purpose to buy forest raw material. 50 % of Swedish forest properties are owned by private individuals, 25 % by privately owned corporations, 14 % by governmentally owned corporations, 6 % by additional private owners, 3 % by the government and 2 % by additional groups (Skogsstyrelsen, 2014). One main target group is thus private individual forest owners. Described in industrial concepts, one can compare this business model to a reversed supply chain. Another main operation of Sydved is logistics, matching the raw material to pulp mills run by their industrial owners and other actors such as saw mills and heating mills owned by external customers with whom they have established barter and trade to optimize logistics flows.

The organization has about 140 employees, of which about 50 % hold the role as forest buyer. The organization is geographically divided into 2 sub-regions with 7 district offices in total where each buyer has been assigned one specific area within this region as one's focal area. Logistics and additional support functions such as finance, marketing, forest business development and IT are located in the head office but specific logistics team members are responsible for certain districts as well. Each district has one district leader. Each region has one leader as well who in turn is part of the Sydved management team. The management team consists of 7 members; the CEO, chief of logistics, chief of human resources, chief of marketing, chief of information technology and two regional chiefs as mentioned previously.

Research design and data collection

The major inspiration for this research has been to apply the notions of engaged scholarship (Walsham, 1995) as an approach to an interpretivist qualitative in-depth case study. The research project is at writing time still on-going and started 1st of January 2018, but some related, significant activities occurred before the official project start which are worth mentioning as well. In August 2016, the current CIO in Sydved participated in a four-day course for CIOs focusing on digitalization, conducted by the university department of ours. The participation awakened the CIO's increased attention to learn more, why three follow up workshops focusing on visualizing the surrounding ecosystem were held. During this process, the idea of a research project was born. The resulting research project is designed in line with the notions of action-based research as an approach to engaged scholarship, where research outcomes are produced in tandem with practical problem-solving (Mathiassen et al., 2012). The identified practical problem for Sydved, the case, broadly defined, was to make sense of digitalization and create a process for digital innovation. As for research outcomes, some theoretical concepts were chosen to guide the

research while still stay open-minded for emerging research opportunities within the scope of the chosen concepts. There are two main documents that serve as; the project proposal document and my research proposal for my PhD-position, bearing this project in mind. Central theoretical concepts in the project proposal are platforms, ecosystems and options theory. A complementary concept found in my research proposal that is not directly linked to the concepts mentioned in the project proposal is gender discourses. This paper mainly addresses the platforms and ecosystems concepts.

Everyday engagement with Sydved has occurred through frequent visits under an extended period of time (Walsham 1995) The research is conducted under the assumption of seeing every experience as a potential source of data. Therefore, notes have carefully been written about my experiences at Sydved in order to document the sessions where audio recording has not been an option, which has been the main priority. This research is thus built on multiple data sources which are presented in an overview in table 3 below. See appendix 1 for data sources related to my participation as engaged scholar in detail. Additionally, I have taken part of documents such as for example Sydved's strategy documents, policies, formal and informal records, process descriptions, power-point presentations and recent editions of Sydved's editorial magazine for forest owners. I have also sought understanding through industry related social media content where I pursue following industry/ecosystem actors of relevance to understanding the case, industry related editorial media content where the CMO have shared relevant articles with me and taking part of industry actors' web pages. I have also had access to the digital applications that Sydved has developed. In order to facilitate my understanding of key events and understanding causal relationships in the history of Sydved, a time line has been created and updated continuously during the research process to systemize this particular data. The data that is presented here concerns the research project as a whole, and as the research question has been narrowed down, this has guided what sources have been analysed in detail.

Overview of data sources	
Research method	Comment
Everyday participation	Quantity: 36 days, 281 hours in total thus far
Focus group	Workshop centring around 4 potential, future scenarios of how Sydved explores digital innovation
Participant observations (meetings)	Quantity: 19
Interviews (mainly unstructured)	Quantity: 39
Mail correspondence	Both my own (used for complementary interview questions, everyday communication, sharing of articles of interest related to our research project) but also taken part of mails sent out by Sydved actors with relevance to our research project
Documents	Particularly interesting documents for the purposes of ecosystem orchestration are for example PowerPoint presentations from mid-2000's decade by the CMO with the education and workshop slides on "the personal network", the guidelines for Sydved's idea reward program, guidelines for changes in how the relationships with the entrepreneurs are managed from 2018, workshop slides from current forest buyer educations, the policy document for the incentive structure for forest buyers and district managers, descriptive slides of Sydved online (the web based interface), various PowerPoint slides on how "digitalization" has been presented to the Sydved board by the CMO from 2016-now, records of the system integrations with the subsidiary company Susab and biofuel sister company, overviewing visualization of system architecture (not recently updated), districts' budgets, records from 1978 on the formation of Sydved, a story about the formation of Sydved from 1981, notes from an informal meeting between the current CMO and former CIO from 2001 regarding ICT-related questions, notes by the forest buyer describing his "personal network" from 2003
Social media pages (Facebook, Instagram, LinkedIn)	Following for example Sydved, SCA, Södra skogsägarna, Ahlström Munksjö, Stora Enso, Virkesbörsen, Metsä Group
Web pages/mobile applications	Visited Sydved, Metsäverkko, Virkesbörsen, Susab (Sydlig Skogsutveckling AB), Stora Enso, Forest business accelerator (incubator initiative by SCA, IBM, Processum and BizMaker), SDC, Kuutio, SCA Skogsvinge, Katam, Viol3 (SDC initiative), Södra skogsägarna, Norra Skogsägarna (application), Skogsstyrelsen, Skogsindustrierna, Skogssverige

Table 3. Overview of data sources.

Applying a qualitative case-study methodology for understanding ecosystems has its limitations. For example, such a methodology would not be appropriate for providing a comprehensive visualization of the relationships of an entire ecosystem but rather takes the perspective of one specific actor. However, as the idea evolved to explore how this case could provide understanding of ecosystem orchestration, where it was identified that current theory was insufficient, the qualitative case study has been argued to suit research areas where theory building is needed due to its proximity to empirical evidence (Eisenhardt, 1989). Being an engaged researcher also require careful reflections on methodological implications and ethical considerations. Being engaged as a researcher allows one to get an inside view but may also result in challenges such as organizational agents being affected by the perception of the researcher's personal stake in engaging in organizational activity (Walsham 1995). In conducting the research, I have pursued to meet this with transparency of the research process, as I experience that such concerns have risen when there is lack of understanding about the research process and how it is conducted. I have therefore met questions and curiosity about the research process with careful explanations of what and why I do when I am present in Sydved as well as when my whereabouts are elsewhere. I also see this closely linked with ethics, as obtaining consent is one guideline for conducting ethical research (Silverman, 2010). Explaining why I am there and what I do has been perceived as crucial in order for the people I met to actively express if they want to consent to participate or not. For this same reason, events or conversations that I experience that clearly concern the private roles of the Sydved agents have been left out of the data records. Another challenge of engaged research is to report on the role that I myself play in the research, which tend to face the dangers of either self-modesty or self-aggrandisement (Walsham 1995). In handling this, I have experienced that while frequent visits are emphasized as important, so is understanding what happens in my absence. I have therefore found complementary interviews focusing on gathering data on what happens during my absence a necessary complement to evaluate my role (or non-role) in the outcomes.

Theoretical framework and analysis

Identifying the theoretical lens has been an iterative process with the aim to find a tight link with our data, argued suitable for qualitative case studies (Eisenhardt, 1989). The concepts included in the project description, for the purposes of this paper platforms and ecosystems, set an initial broad research question with the purpose to set a theoretical lens for our research as well (Eisenhardt, 1989). Sydved's matchmaking role, through being the intermediary between forest owners and the industry, caught our interest early and as I learnt more about Sydved's everyday operations and their history, the data evoked the idea that ecosystems, and more particularly ecosystem orchestration, might in fact be a fit concept to narrow down the research question. I still found our observations of the low digital maturity in Sydved a challenge to understand. When including Gawer's (2014) conceptualization of platforms as sociotechnical constructed, I managed to find a fit with our data and our theoretical background, which guided the subsequent data collection and data analysis without being overwhelmed by the data I had access to (Silverman 2010).

The first coding process was conducted through identifying orchestration processes, working under a vague definition at the time, understanding ecosystem orchestration as a process for

managing and leading other ecosystem actors to whom one has or seeks a relation. When deciding that there may be value to understand these activities more thoroughly as the number of examples grew as more data was collected, a literature search on orchestration opened up for theoretical options. With Gawer's (2014) call in the back of my mind on the potential of uniting the platform literature with the literature on innovation networks, I identified and chose to expand the framework by Dhanarai & Parkhe (2006) for managing innovation networks to ecosystem orchestration. The data was then reread and coded once again, applying a deductive approach in searching for correspondence with our data and the theoretical framework. In combination with this approach to reasoning, I also sought for varieties in our codes of orchestration with the framework, in order to enriching the extension of the framework to ecosystems rather than solely innovation networks. By doing so, I combined deductive and inductive reasoning and, in this sense, applying an iterative process of theory and data (Eisenhardt, 1989).

The Sydved case

The empirical results of this study are presented as a case story including four chapters of significant events in Sydved's history; "from stub to industry"; introducing "the personal network"; first wave orchestration – "the winning team" and lastly, second wave orchestration – "the digital ecosystem".

"From stub to industry"

In 1977, four actors in Swedish forestry formed the idea of creating a mutual "pool" of forest raw material. The idea was driven by the need to rationalize the supply of raw material and to optimize both transportation and distribution of wood, and as the industrial actors had already initiated barter in between one another for these purposes, the idea grew of forming a mutually owned subsidiary company to carry this mission. As the industry actors were mainly interested in different types of woods and assortments, one meant that it was no coincidence that it was precisely those actors who initiated a collaboration. After internal negotiations in the respective firms, three of them decided to go through with the idea and in 1979, Sydved was founded. The core mission carried out still today is to buy raw material from forest owners and sell the product to their industrial owners, of which two still remain. The tradition of collaboration between industrial actors in Swedish forest industry expands the history Sydved and thus served as a source of inspiration in the formation of Sydved.

"There are many reasons that our three company groups will now collaborate in Sydved. Generally, we are all whipped to decrease the costs of managing the raw material if we want to survive on a global market. But that it happens to be us three collaborating is no coincidence, as we are mainly interested in different types of wood and assortments."

Extract from the story of Sydved's foundation written in 1981

As time went by, the idea of barter and trade has been extended in the forest industry network of actors. While Sydved's industrial owners are mainly interested in one specific product assortment, the other assortments resulting from forest felling have opened up for additional business opportunities. Sydved has therefore initiated trading of excess product categories with certain industry actors and buying their own product category in return. These barter agreements have included barter of wood types and assortments, barter of shipments across geographical locations and barter across time where shipments destinations have been determined depending on where the demand has been at a specific point in time. In 1994, Sydved decided to scope its core offering through forming a complementary subsidiary company, focusing on a specific target group of forest owners who demanded a wider package of services. The mission of the company, Susab, is to provide full forest management services to owners with greater properties.

Apart from the various types of wood assortments, a near-lying market was that of bio fuel material, a product where Sydved eventually noted increased demand. Additionally, Sydved reasoned that this was a product that they did not currently capture the value from and thus identified an emerging business opportunity in capturing value from all forms of raw material

assortments from felling. Sydved thus decided to found the subsidiary company Sydved Bio with the mission to ensure a supply of bio fuel material from forest felling to the heat mills. Eventually, this turned out to have create additional value as one later on identified a sustainability value from this form of collaboration. Sydved Bio later on became the sister company of Sydved.

The core business of Sydved is generally spoken of as “from stub to industry”, described as a form of reverse supply chain. In order to fulfil the mission to their owners, a key actor has since Sydved’s origin been the forest buyer. The reorganization in the early 2000s strengthened this role, as the production leader role was removed as the forest workers were turned to business partners. Historically framed as “your Sydved-person”, providing services “from contract to accounting”, the daily activities of a forest buyer involve personal meetings in forest owner’s homes or properties, analysing their specific needs and providing a proposal. Thereafter, the buyer arranges felling, forest work by loggers and transportation to the industries. The forest buyer role thus includes not only forming relationships but coordinating the forest work with the entrepreneurs as well as administration of the entire process. Managing the relationships with the forest owners has evolved into a role with autonomy and responsibility, something Sydved describes as “freedom under responsibility”. Over time, the scope of services involved in the buyers’ coordination has increased to include for example planting, cleaning and thinning to name a few examples. To create and sustain long-term relationships with forest owners has long been the goal. While the district and region managers handle the negotiation of raw material prices with their industrial partners, the forest buyer role has become relatively free in deciding the details for prices in dealing with the forest owner. Apart from prices, the forest buyer needs to bear in mind the various industries’ demand of various product assortments and what type of wood Sydved needs to supply at a specific point in time. For this, an individual plan of industry supply is set up in collaboration with the district manager, providing guidelines for this coordination process.

“I don’t just randomly think “Well, I’ll just give him [the forest owner] 670 SEK per cubic meter”, but I know in the back of my mind the price that Hans [the district manager] sold the pine timber for to the industries. And I know where to send it [when I see the trees in the forest], in this case, The Rink [saw mill owned by competitor]. I had already decided that when I first visited the forest area in question, before the business deal was signed, I knew that “I will send this to The Rink”. Then I look up the price we have negotiated per cubic meter, say we have set 680 SEK here, and offer [the forest owner] the forest owner 670 SEK. That is 10 crowns below our price. We need to make some profit, of course.”

One of the forest buyers

The everyday activity of a forest buyer thus has involved satisfying the needs of more than one partner. The complexity of these transactions can be seen in the performance measurement system, for forest buyers as well as district managers, introduced by the management. This system accounts for four parameters in performance; business results (measured in both volumes of raw material and profit margins), delivery precision in terms of delivery plans made to the industries, production plans in terms of production plans made for felling activities and lastly forest care activities. As the main interest of their industrial owners has been the supply of raw material, there have been examples where forest buyers have created deals with forest owners with zero profit margin in order to ensure the stability of raw material supply and have then

simultaneously affected the individual bonus of his/hers positively. There have also been examples of Sydved providing financial loans when potential forest owners are interested in buying a forest property along with creating a deal of forest felling on the specific property.

Introducing “the personal network”

The turn of the millennium was a significant time in the history of Sydved. Major reorganizations took place in the firm and one major change in this process was giving notice to the forest workers, or the loggers. These workers had traditionally been employed by Sydved, some of them since the early days of Sydved. What this meant in practice was a great reduction of the number of employees, while the need of collaboration in the felling process still remained. One reason used for this was to decrease the accumulation of capital, where human capital through employments and ownership of forest machines were examples of such. Another reason was to explore how such a re-organization would potentially release entrepreneurial forces in these collaborations, driven by a belief in that this could improve performance of forestry operations and increase productivity. Through price negotiations with partners, Sydved thought that this would create a mutual interest in lowering the prices of forest work. Nevertheless, it was of greatest importance to see these collaborations as long-term partnerships.

This forced Sydved to seriously consider how to manage these relationships as the forest workers were now turned into potential external partners instead, running their own businesses. These businesses will henceforth be addressed as “entrepreneurs”, reflecting the language used by Sydved. At first, the direction to the forest buyers working closely with the loggers in everyday operations, was: “We cannot be friends with our partners”. While it is not clear what “friend” meant in this description, Sydved soon discovered that in order to form an effective collaboration with the loggers, one need to rethink how to do so. Treating entrepreneurs as “friends” was thought of as a cost rather than an investment.

“This had to do with how forest industry firms traditionally treated the entrepreneurs [what forest work firms and transport firms are called in everyday communication of Sydved] [...] where one thought that “No, we can’t become friends with the entrepreneurs cause that will only cost us money, and we need to hold our costs and compensations low”.

The CMO of Sydved

In close occurrence with the reorganization, the new CMO embarked the role as chief marketing officer in Sydved. This role’s main focus was mainly focused on editorial activities by his predecessor but the CMO had great ambitions in leveraging communications notions in the firm, both externally and internally. When looking back, an inspirational meeting that proved significant was when encountering the CEO of a regional company spurring technological innovation in the region. Through him, the new CMO learnt about the “spirit of The Lake”. This “spirit” was signified by visualizing value creation in a cluster, which had proven successful in the close by region of The Lake. This notion was packaged as “a personal network”, and applied methodologically through individuals in organizations mapping out their already established relations, spanning the focal industry one is in. This purpose of this visualization was to then use it to identify business opportunities.

Around 2003, the CMO decided to apply the method in Sydved and invited one of the forest buyers to define and visualize his “personal network”. This task, taking place on November 2003, included defining what a network is, identify pros and cons and describe what the notion meant in everyday activities. This forest buyer described his personal network as “*personal relationships*,

people I can trust and can recommend; two-way communication, I convey contacts and receive an equal effort back and; both parts having benefits of a collaboration". He continued through describing his own network as an "inner" and an "outer" network. In the inner network, he positioned his colleagues and the loggers categorized in different production groups. In this description he also included the transporters further down in the description. Clear was that the entrepreneurs were not only expected to take responsibility of the production but also contribute to the buying process and managing customer relations as ambassadors. He described this system as "self-purifying", relating to the mutual interests of Sydved and the entrepreneurs in identifying business opportunities and deliver qualitative services.

"My perception of what a network is; personal relationships, people I can trust and can recommend; two-way communication, I convey contacts and receive an equal effort back and; both parts having benefits of a collaboration. [...] "Everything is based on mutual trust, whoever breaks this is out. [...] The entrepreneurs [what logger and transport firms are called in everyday communication of Sydved] and the employed are all a part of the buying process, managing customer relations, marketing [...] and shall represent Sydved. Practically, this means that entrepreneurs will strive for buying volumes [of raw material] when we work on a property. If there is an interesting neighbour around, the entrepreneur shall follow this person and look at the property. [...] Regarding pricing of raw material, the entrepreneur is responsible for this. We provide guidelines, but the entrepreneur will send me a proposal for each object, and I pay this person in return. The system is self-purifying."

Extract from the forest buyer's description of "the personal network" from 2003

As for the "outer" network, the forest buyer described this as valuable relationships that are some kind of ambassadors for Sydved, requiring reciprocity in order for them to stay of value. In this network, he identified for example specific forest owners, firms providing ground, road and gravel services, architects, artisans such as carpenters, insurance companies, brokers, machine vendors, plant services, the Swedish government agency for forest care, gardeners, saw mill workers and hunting arrangers. According to this buyer, this task simply illustrated the everyday process of his operations in forest buying.

The CMO was intrigued by the result of the task conducted by this buyer of describing the personal networks and thus decided to include the task in the education session for both new and existing forest buyers which the CMO has been part of leading throughout the years. He decided to extend the task and asked the buyers to visualize their "personal network" through positioning oneself in the centre and drawing outwardly directed lines to other actors in their surroundings to whom they have a personal relationship which he exemplified as friends, real estate brokers, hunting partners, carpenters and evidently loggers. Thereafter, he included an element of valuing the different relations in the network based on comparing the perceived versus the actual impact on business results generated through the "personal network" across time, with the intention to educate the buyers on evaluating their input in their personal networks.

First wave orchestration - "The winning team"

With the intention to leverage the potential he saw of value creation in a personal network, the CMO turned to his communications background. At some time after the notion of the personal network consolidated, the CMO introduced the metaphorical slogan "*the winning team*", a message he identified had value in being applied both internally and across organizational borders as well. Generally, the telephone has traditionally been the central technology supporting the cross-firm collaboration processes but this was now complemented with social arrangements. Through arranging meetings with forest buyers, the entrepreneurs including the transporters, the CMO spread the message but also engaged the participants in group discussions to form collective meaning of what "the winning team" means in practice. Such meetings were then extended to a re-occurring process, labelled as "hut meetings", held by forest buyers. The "hut meetings" welcomed local teams in the production where the forest buyer set up an agenda with topics that are of mutual importance to be solved by together. The production teams might thus have consisted of one or several entrepreneur firms. The intention of the "hut meetings" has not been to be perceived as formal meetings, but the forest buyers have rather been encouraged to arrange for example a traditional Swedish "fika" coffee break, barbecue with hot dogs or treat with a traditional sandwich layer cake to create an informal atmosphere.

"The important thing [about the hut-meetings] is to create a process where the forest buyer maybe schedules a lunch or pays a visit with "fika" [Swedish coffee-break] or sandwich layer cake [traditional Swedish food for specific events], and then they say, "let's spend three-four hours on these questions [related to our collaboration]" [...]. It can include anything from "Do we meet the demands of average length on pulpwood?" or "Should we arrange a forest day together?"

The CMO of Sydved

As the notion of "the winning team" notion gained meaning the organization, the leadership skills of the forest buyers have gained increased importance. In order to further stimulate the forest buyer to engage in these processes of managing the entrepreneurs, the yearly district strategy processes have occasionally included workshops on how to lead the production teams and foster collaboration. This has over the years come to include the buying process as well, as forest buyers have been encouraged to leverage how they in turn can encourage their entrepreneurs to scout for business opportunities in their personal networks as well. According to the CMO, taking advantage of the local knowledge and relationships of entrepreneurs has led to examples where the forest buyers does not meet the forest owners but only signs the contract of the deal the entrepreneur has created. In our conversation, he light-headedly estimated that for some of the forest buyers, 30 % of their volumes has been generated through the entrepreneurs in their team. Kristoff, one of the forest buyers, described this effect of the team-work as "a self-playing piano". He used this metaphor to describe the different roles he and the entrepreneurs take on in everyday practices of forest buying. If he focuses on establishing relations with new forest owners, the loggers focus on sustaining the existing relations with forest owners.

”Some entrepreneurs drive purchase of more business and raw material, well not more than the buyers themselves, but maybe provide 30 % of the volume [of raw material] that they buy through their own personal networks. They often have local knowledge and know a lot of people. We sometimes have examples where the entrepreneurs fix the deal but the forest buyer just signs the contract without having even met the forest owner.”

The CMO of Sydved

In order to focus on relationship building activities, the districts are allocated a budget for representational activities. This is not subdivided into individual budgets of forest owners, due to avoiding a conflict with the profit margin performance measurement. It thus varies across districts and individual buyers to what extent and what form of relational activities are arranged, but examples of such activities targeted towards forest owners are inspirational lectures with prominent sportspersons, hunting activities and Christmas dinners. As for entrepreneurs, lunches or spontaneous visits to the forest huts for a cup of coffee are prioritized. One of the forest buyers mean that encouragement of socializing between entrepreneurs and forest owners has been of importance as well, in order to remove himself as “a source of error” in the communication in between all engaged actors. He has encouraged the logger in the forest machine talks directly with the forest owner, to identify specific desires in their services. To further stimulate interaction between various actors, some of the forest buyers have formed Facebook groups, to which they have invited their community. One of them has additionally made one of the entrepreneurs in his team administrator of the page, with the intention to collaborate on creating content in the group. Another forest buyer uses the Facebook group to share news updates and photos, activities conducted by other group members as well. The posts have arisen engagement of other group members as well, through interaction in the comments field and likes.

There are additional examples on how Sydved has demonstrated interest in benefitting from the skills of the entrepreneurs. One prominent entrepreneur has been recruited for their pedagogic skills and has been offered the role as coach for other entrepreneurs, as part of the educational sessions that Sydved has carried out to increase the competencies amongst them. Another example is how Sydved’s reward system for ideas for business development has been designed to include the ideas generated by entrepreneurs as well. In this system, individual proposals are rewarded monetarily if they generate value in terms of savings or is evaluated based on their degree of innovation, utility and effort in creating the proposal. If for any reason the idea cannot be realised, the interest shown in contribute to business development may be rewarded in any case as well.

As time has gone by, the scope of collaborations with external actors has increased from only concerning entrepreneurs. Lately, Sydved has begun to experiment with additional forest services, for example coordinating plants and planting services as re-planting is a requirement if one exploits one’s property in Sweden. This was firstly considered as already included in the original offer to the forest owners, but at some point, the fact that these services were not monetized was questioned. One of the pioneering districts in this form of service now has a cool store for plants in their office and has initiated a close collaboration with a near lying garden centre. An additional service has evolved regarding certifications for forest owners who want to correspond to specific standards in their forestry, as well as entrepreneurs seeking to apply specific standards in their production processes. In this process, the forest buyer has taken on the role as advisor as well as certifier of standards provided by a third-party agency for certifications.

At times, it has also occurred that Sydved has provided financial loans to potential forest owners where this has generated a deal for Sydved to gain access to the raw material on the property when in the possession of this new owner.

According to the CMO, a key ingredient to nurture the relationships surrounding Sydved has been creating a sense of belonging, including the entrepreneurs as well. For the CMO, a priority has been to communicate why the entrepreneurs' engagement is important in the greater system as well as relate how the benefits enabled by team-work helps them support the sometimes five households depending on their business. One of the buyers, mean that this at times has been a worry for him as well, caring more about supplying the entrepreneurs with work than with supplying the industries with raw material. Creating a mutual identity has also been pursued in the field, signalled by the Sydved logotype being applied to entrepreneurs' machines as well. It has been of importance to convey externally that all representatives "in the field" operate under Sydved's brand and the goal has been that all forest machine carry the Sydved logotype. Hans, one of the district managers, described that this close teamwork sometimes creates confusion due to blurred firm boundaries, and that it has happened occasionally that entrepreneurs call and ask for their monthly salary. Although the machines are owned by the entrepreneurs, Sydved is usually engaged in discussions of machine investments in order to ensure its profitability. The reason for this has been if the entrepreneurs' firms are not lucrative, this will harm Sydved as well, and in these instances Sydved has been able to provide information on predictions of future demand of the industries. According to the CMO, the drive for Sydved has thus not simply been altruistic but creating dynamics in the team work which incentivizes participants to contribute to pursuing this mutual goal.

"This is about people and dynamics. There can be someone who just woke up in the morning, who is sitting in this meeting with three pinches of snuff under his lip, his cap pulled down over his face, really dirty, really tired, who says "why am I even here?". And then you see a spark in their eyes as they realize "Am I important?". From that, a great idea can be generated. [...] We want them to stay with us as entrepreneurs because they are part of a team and feel that we help them make their companies profitable. That is the key."

"For an entrepreneur, there are four-five households that need to be supported and depends on your business. For everyone to reach their goals, we need to create win-wins. We can't all just be one organization, we have tried that, but none of us profits from that. We didn't find any dynamics, any progress. But we can't completely separate us either and say "here is your order and here is your money", then we won't get anywhere either. We need to find "the golden cut", so to speak."

The CMO of Sydved

Second wave orchestration – “the digital ecosystem”

Historically, innovation has been an activity that has been close to heart in Sydved. When looking back, Sydved was an advocate for the significance of weeding in forestry in times where this was questioned and was a leading actor in developing new technology for forest weeding during the 1990's. Innovation of weeding processes is therefore still lifted today as evidence of Sydved's spirit of innovation. IT has also historically been significantly valued in Sydved, and there has been pride related to the system portfolio being mainly proprietary as well as how IT contributed to decentralizing the administration processes as a result of the re-organization in the early 2000's. Including the CIO in the management team has been thought of as “natural”, as it has been so since Sydved's early days in the 1980's.

In the early 2000's, IT was increasingly included on managing the external actors in their collaborations, why the first web-based external interfaces targeting forest owners and entrepreneurs were released. Creating a good work environment for entrepreneurs has been central in Sydved's strategy, which came to include IT as well. In 2013, the external interfaces and applications were once again on the agenda. Since then, three mobile applications targeting forest buyers, forest owners and loggers have been developed alongside a web interface for a wider range of stakeholders. The reasoning behind this progression was to tighten the relationships between these actors with Sydved, rationalize the communication flow from Sydved to these actors and thus serve as an added value. The main content of these applications is the map, throughout which one can navigate through GPS. For forest owners, the app is used for accessing the forest management plan one has set up and for entrepreneurs accessing the production files with information on the forest work to be carried out. However, one of the entrepreneurs witnesses about how the process of downloading these files can span up to thirty minutes and thus cannot always be carried out in the forest.

Apart from developing external interfaces, there are a few examples of how Sydved has historically has created system integrations with an external focus. Industry-wise, there is a tradition in the forest industry to find mutual IT-solutions to information flows, where there historically has emerged a third-party association, SDC, for managing information flows from forest production measurements in the industry. As for Sydved, it has been prioritized to architect systems integration to gain access to the data provided by this association which has been essential for their everyday operations. These integrations have been required updates on several occasions, the latest update project initiated in 2015 with a planned time span of five years. In another example, Sydved has engaged in a collaboration with other industry actors, creating a somewhat salient kind of system service for external actors, in this case transporters. A few years back, Sydved noted that transporters started using various applications for optimizing transportation flows through organizing barter of shipments on the roads. As Sydved identified that this raised a threat of a new entrant becoming dominant for such a service, Sydved has thus decided to engage in a project that allowed various applications to communicate with one another, so use of various applications still would be possible.

Apart from SDC, there has been other examples of systems integration with external actors in Sydved's history. Sydved's systems are for example an intermediary for information flows

between SDC and Sydved's daughter company Susab, and another example is how integrations were built with their sister company, Sydved Bio. The reasoning behind this was officially to enable increased rationality in pricing and communication, which was carried out by physically sending documents by mail, but there was also dissatisfaction amongst forest owners and forest buyers on how logistics of bio fuel were carried out and the systems integration also facilitated communication between the two firms. Before the integration, bio-fuel products ended up being left behind on the forest owners' properties for too long as the information about timing of pick-ups did not always reach Sydved Bio when communication was mainly the responsibility of the specific forest buyer. This led to tension as forest owners suffered from products becoming too old on their properties, so additionally the systems integration's capability of communicating when Sydved Bio gained access to their product assortment led to increased quality in the team work and services.

“Well, it was irrational to send paper documents to one another. So therefore, we thought we needed to build interfaces where we send the information about the production projects digitally, directly to the systems of Sebab [the bio fuel firm]. Instead of writing and sending letters which would get lost when posting them [which affected the collaboration and information exchange negatively]. [...] I mean it has always been a tensional issue between Sydved and Sebab, the bio fuel becoming too old by the road side and both parties becoming upset. [...] I believe, perhaps somewhat naively, that [these integrations] improved our collaboration to some degree.”

Former CIO of Sydved

It was in 2016 that the concept “digital ecosystem” was sown in Sydved. After the at the time CIO participated in a one-week university MBA on digitalization, the curiosity about digital innovation was raised which resulted in this research project. Before the project was started, three university led workshops focusing on ecosystem visualization was held where Sydved identified central and peripheral actors, activities and resources in their surrounding ecosystem which thereafter was visualized with a software tool. One of the forest buyer participating in this workshop was frustrated at first, struggling to understand the implications of this mindset, but as he understood that the digital technology enabled new forms of business opportunities, others have described that “something was lit in his eyes”. In the turn of the year of 2017-2018, Sydved stood temporarily without CIO, why the CMO has taken the lead in driving the question of digitalization in Sydved.

As the research project has gone on, several interesting discussions have risen on what digital ecosystems means Sydved's context. At present time, Sydved has constructed the goal to grant the loggers increased autonomy and ultimately shift certain aspect of production leadership from forest buyers to entrepreneurs. In a meeting on this process, I had the opportunity to intervene through questioning about the role of digital technology in managing this relational change. Initially, the digital interface with the entrepreneurs was not included in this discussion but the reasoning focused on how the forest buyer could communicate the new expectations to the entrepreneurs in everyday practices. When questioning how this relational shift relates to the ecosystem visualization they had conducted, the entrepreneurs' application has been included in future discussions amongst Sydved's business developers. In another meeting former CIO participated and highlighted an example that did not come up in these prior discussions on the entrepreneurs' application. It turned out that there the software firm who had developed the application had been granted the opportunity to sell maps to entrepreneurs, offering a better

offline map that can be accessed through the application. Carl, one of the forest business developers, exemplifies that entrepreneurs might for example go hunting in our areas of Sweden in thus be in need of an offline map that Sydved does not supply. Another forest business developer, noted that he thought the comic aspect of this example is that Sydved's main function of the application already is to supply maps, and still this business opportunity for the software company emerged. Additionally, he questioned that these purchases did not at present time generate any monetary profit for Sydved. The following conversation took place.

“Well, in our apps there is now [an example], that is also one kind of platform. I heard you say this fall, Nils, that there were some entrepreneurs that wanted to buy their own maps and then add to our maps, or something like that?”

Former CIO of Sydved

“That is new in our latest update of our entrepreneurs’ app. The opportunity to buy [their own maps].”

Forest business developer 1 of Sydved

“That is interesting, how suddenly the entrepreneurs can make purchases through our app!”

Former CIO of Sydved

[...]

*“[...] Shopping in our app, they can buy maps **and** the comic aspect is that our app **consists of maps!** Offline or online, and now you can buy a better offline map.”*

Forest business developer 1 of Sydved

“Maybe they go hunting in Jämtland [northern part of Sweden outside Sydved’s business area] and wants to add [that specific area in their offline maps]. [...] Does this even generate any profit for us?”

Forest business developer 2 of Sydved

“No, but it should!”

Forest business developer 1 of Sydved

A discussion of drone resources illustrated another interesting discussion. In a meeting on forestry business development, a discussion rose about how to secure the resource supply of drones. While they concluded that supplying all buyers or all district offices would supposedly be an unprofitable solution, they did identify that having access to drone resources in certain extreme conditions such as forest inventory after storms would be crucial. The meeting resulted in the CEO giving the direction to one of the forest business developer to organize drone owners in the region that may offer their services in such circumstances. After the meeting when asking the forest business developer Nils on his ideas on how to coordinate drone owners, he expressed that he does not know exactly how but that he supposed that gathering a list with phone numbers and calling around would be a good start. When drawing a simplistic model of their ecosystem, I spontaneously visualized how drone owners could be position in this image and discussed how

digital technology could provide an architecture for organizing these resources. This appeared to trigger ideas in the forest business developer who responded through suggesting how gravel providers and snow-plowers could be organized in the same ways, adding these actors to the simplistic ecosystem drawing.

This research project has also thus far included presenting on the idea of ecosystems at some of the district offices, where one such meeting led to a spontaneous response. After presenting, the district manager along with one of the forest buyers and one administrator decided to present how they have developed a new form of service regarding forest management plans without informing Sydved management. This service consisted of a form of yearly subscription including yearly revisions of its content, where this specific buyer did this yearly follow up process manually why the administrator has recently been hired, partly to support this process. While speaking about digitalization and ecosystems in our presentation appear to have influenced to some degree the decision to bring up their service at this point in time, the main reason appeared to be that the current IT-systems poorly support the manual process of the forest buyer in charge of doing the yearly revision of the forest management plans. While the CMO, who led this presentation, promised to deliver the request for improvement to the IT-function, he was more intrigued about the subscription idea. This event appeared to have supported his hypothesis on once again emphasize the importance of team-work in Sydved, meaning for him to include the field organization in embarking on the digital innovation journey he believes is critical for Sydved's future endeavours in the Swedish forest industry.

Discussion

In this discussion, the Sydved case is firstly analysed through the lens of ecosystem orchestration; discussing Sydved as hub firm, initiatives for ecosystem design and current orchestration processes in Sydved. Secondly, I highlight examples for these empirical observations that expands our understanding of ecosystem orchestration in the digital economy. Lastly, I discuss what implications this has for practice among incumbent firms.

Understanding the Sydved case through the lens of ecosystem orchestration

Sydved as hub firm

Positioning Sydved as a hub firm is not unproblematic and highlights that defining a hub firm is a matter of perspective. The most clear examples of Sydved as taking on the role as hub firm can be found in the collaboration across organizational boundaries in the relationships with the loggers and transporters in everyday forest operations where Sydved's role in these collaborations include the notion of "subtle leadership" (Orton & Weick, 1990) through the forest buyer taking on the role as leading and coordinating the team work with the entrepreneurs. These coordination processes include the industry actors as well, in the matching the supply of forest raw material with the actors' particular demand. Generally, the scope of orchestration processes circuit around the core transaction, "from stub to industry", and the role of the forest buyer is the central agent in creating and sustaining these relationships, weather it regards recruiting new forest owners as customers or reassuring that the plans of raw material production are met in line with the demand of the industries. The linearity assumption inherent of the "from stub to industry" slogan highlights the presence of the linear logic (Porter, 1985) in how Sydved perceives value creation as well.

When applying a technological perspective to Sydved's ecosystem, which has been argued to be key in being a successful ecosystem leader in tandem with a business perspective (Gawer & Cusumano, 2008), understanding Sydved as hub firm becomes increasingly problematic. The inclusion of digital technology varies greatly in Sydved's ecosystem depending on which side (stub or industry) of the ecosystem one focuses on. As for the "stub" side of the ecosystem, the ecosystem is mainly designed by human agents (forest buyers) rather than with digital technology. This does not mean that technology is non-existing in managing these relationships, but rather supports the forest buyers' orchestration processes through for example phone-calling, e-mailing or creating Facebook groups. The main organizational agent performing this orchestration is the forest buyer. This leads us to specify the difference between a hub firm and a platform firm, where the former concept does not explicitly state the centrality of digital technology (Dhanarai & Parkhe, 2006). The Sydved case illustrates why this distinction is significant in understanding how the digital economy affects ecosystem orchestration. The first prerequisite for a platform in the definition of platforms federating and coordinating agents (Gawer, 2014), is thus the responsibility of the forest buyer. This creates a limitation, as Sydved cannot leverage economies of scale in demand enabled by digital technology (Parker et al., 2016b) and thus inhibits a risk for Sydved's future endeavours of ecosystem leadership as digitalization sweeps across the greater ecosystem, which I will explore in depth in the sections

below. Due to the low digital maturity, perhaps the most fitting conceptualization of Sydved's current position and context in the ecosystem is the early concept of business ecosystem (Moore, 1993), not specifying the centrality of the role of technology in forming collaborative networks. Without doing so, an incumbent firm risks understanding digital technology sustaining the orchestration processes of a human agent as digitalization, leading to failure in identifying how the digital economy is transformed by digitalization. Our data thus emphasize that the existence of an ecosystem does not require digital technology, but also means that the Sydved organization does not fulfil the third prerequisite of a platform, entailing a modular technological architecture (Gawer, 2014) which I assume in this paper to be constituted by digital technology. From a sociotechnical point of view, I mean that a hub firm would need to design its ecosystem with digital technology in order to be thought of as equivalent to a platform as defined by Gawer (2014).

Shifting our focus to another actor in the ecosystem, there are a few examples of digital ecosystem design. The most prominent example is the current ecosystem design initiative in progress, initiated by the industry third party association SDC, from whose perspective Sydved is rather positioned in the periphery of the ecosystem. This signals the presence on other powerful ecosystem actors in the ecosystem, and in this particular case SDC. SDC's role is interesting for other reasons as well, as its historical purpose has been to provide a more transparent infrastructure of information flows. This highlights how pursuing ecosystem health is not solely a matter of productivity but for providing robustness as well (Iansiti & Levien, 2004), and SDC exemplifies that there are currently more than one ecosystem actor engaged in this mission. As Basole (2009) notes, the role of hub firms is not always identifiable in evolving ecosystems and Moore (1993) describe as leadership struggles, why current roles cannot be perceived as static and this is yet another factor for Sydved to take into account when designing for an increasingly digital ecosystem. I will now delve deeper into the historical and current initiatives of ecosystem design and orchestration processes in Sydved to understand their role as hub firm deeper.

Ecosystem design in Sydved

In table 4 below, initiatives for ecosystem design in the Sydved case are identified. These initiatives are thought of as engineered and deliberate processes with the intention to form and stimulate growth in the ecosystem (Dhanarai & Parkhe, 2006; Doz et al., 2000). In an ecosystem context, these design initiatives can be seen as strategic, in the sense that they lay out the organizational and system design subsequently enabling orchestration. The Sydved case illustrates that such design processes can be either designed non-digitally, as for example through organizational design where converting the forest workers from employees to self-employed business-persons are one evident example, or designed with digital technology where building systems integrations with other ecosystem actors are other examples. I perceive designing an ecosystem with digital technology as equivalent to crafting a technological architecture of a platform, in line with the sociotechnical conceptualization of platforms (Gawer, 2014). For the purposes of underlining the significance of digital versus non-digital initiatives, these have been pointed out in the table below as well.

Sydved ecosystem design initiatives				
Ecosystem design form	Design initiative	Digital	Non-digital	External actor
Ecosystem membership - size	Founding subsidiary company meeting demands of specific subgroup of forest owners, thus potentially increasing size of the forest owner group in the ecosystem		X	Forest owners
	Providing financial loans to individuals seeking to become forest owners in exchange for deal to gain access to raw material on the same property, thus increasing the size of the forest owner group in the ecosystem		X	Potential forest owners
Ecosystem membership – diversity	Founding subsidiary company (currently sister-company) in order to create value chain for bio materials, thus expanding the diversity of external actors in the ecosystem		X	Bio fuel industries
	Coordinating plants and planting services for forest owners in need of replanting after felling through for example plant storage in offices or order services, thus expanding the diversity of external actors in ecosystem		X	Garden centres, plant supply and services companies
	Locating and forming relationships with drone owners in their geographical area in order to gain access to these resources in times of crisis such (for example storms requiring forest inventory), thus expanding the diversity of external actors in the ecosystem		X	Drone owners

	Enabling software company to supply digital maps on Sydved's proprietary application, thus increasing diversity of external actors in the ecosystem	X		Software company
Ecosystem structure - autonomy	Changing the form of the relationship from employment to external business partners, thus creating increased autonomy for entrepreneurs in the ecosystem		X	Loggers and transporter ("entrepreneurs")
Ecosystem structure – co-opetition	Initiating barter and exchange with other industrial actors in the forest industry, thus creating a dynamic of collaboration and competition in these relations in the ecosystem		X	Industrial actors
	Recruiting talented individuals for other roles from entrepreneur companies for example for educating and coaching other entrepreneurs, thus creating a dynamic of co-opetition regarding human resources in ecosystem		X	Entrepreneurs/talented individuals
Ecosystem positioning - coring	Building mobile applications for entrepreneurs and forest owners, thus strengthening Sydved's core position in the ecosystem	X		Entrepreneurs, forest owners
	Integrating systems of sister company for bio materials with Sydved systems in order to deal with friction arising between the companies and foster a better collaboration, thus strengthening Sydved's core position in the ecosystem	X		Bio fuel sister-company
	Initiating systems solution for transporters in order for them to be able to coordinate and optimize shipments using different applications when fearing threat of new entrants, thus strengthening Sydved's core position in the ecosystem	X		Transporters
Ecosystem positioning – periphery	Building systems integrations called upon by an external actor to enable future information exchange of production data, thus positioning Sydved in a peripheral position in the ecosystem	X		Third party association

Table 4. Ecosystem design initiatives identified in the Sydved case.

Orchestration processes in Sydved

In table 5 below, the ecosystem orchestration processes that are identified in the Sydved case are presented. In this table, the processes are organized dependent on their orchestration category as identified in the theoretical framework. The table contain both orchestration processes performed non-digitally by organizational agents, mainly the forest buyer, and those processes that are enabled by digital technology. In this table, the columns of digital and non-digital orchestration processes illustrate the agent performing the orchestration processes. From table 4 and 5, I can derive certain differences between the digital and non-digital processes, which will be addressed in depth in the next following section. Additionally, the notion of same-side and cross-side network effects generated through orchestration tactics are included, thus emphasizing that ecosystem orchestration may involve more than one ecosystem actor simultaneously (Eisenmann et al., 2006), illustrating the distributed character of the ecosystem (Briscoe et al., 2011).

Sydved orchestration processes					
Orchestration category	Orchestration process	Digital	Non-digital	Focal external actor	Cross-side external actor
Knowledge mobility – knowledge absorption	Educating and certifying both forest owners and entrepreneurs in forest care in order to apply to forestry standards supplied by third-party institution, thus stimulating enhanced knowledge through interactions within the ecosystem		X	Forest owners, entrepreneurs	Certifying agency
Knowledge mobility – ecosystem identification	Spreading products with the Sydved logotype to entrepreneurs and external consultants, for example is the goal that all forest machines are marked with the Sydved logotype, thus pursuing to create a mutual identity across firm boundaries		X	Loggers and transporters (“entrepreneurs”), consultants	N.a.
Knowledge mobility – inter-organizational socialization	Arranging social events such as inspirational lectures with prominent sportspersons, hunting activities, Christmas dinners (some for entrepreneurs, some for forest owners and some for both), thus stimulating the creation of social capital		X	Loggers and transporters (“entrepreneurs”)	Forest owners
	Creating a re-occurring meeting forum called the “hub meetings” where forest buyers gather the entrepreneurs in order to discuss mutual concerns and ideas, thus creating a communication forum for inter-organizational socialization		X	Loggers and transporters (“entrepreneurs”)	N.a.

	(Some forest buyers are) creating community groups on social media for their local production teams and forest owners, thus creating a mutual forum in order to simulate the creation of social capital		X	Loggers and transporters (“entrepreneurs”)	Forest owners
Creating appropriability regime – profiting from transactions	Encouraging entrepreneurs to seek for business opportunities in own personal networks, thus profiting from transactions occurring in ecosystem		X	Loggers and transporters (“entrepreneurs”)	Forest owners
	Building systems solution for transporters in order for them to be able to coordinate and optimize shipments using different applications, thus resulting in increased access to transport resources	X		Transporters	N.a.
Creating appropriability regime – new value proposition	(One of the districts are) providing a new service for forest owners through offering subscription of forest management plans, thus creating a new value proposition		X	Forest owners	N.a.
	Offering plants for sale and in the district offices as forest owners are required to reseed their properties after cutting, thus creating new value proposition		X	Forest owners	Garden centres, plant supply and services companies
Ecosystem stability – enhancing one’s reputation	Allowing software company to sell digital maps through Sydved’s application for entrepreneurs, thus enhancing their own reputation in the ecosystem amongst entrepreneurs as their own maps did not deliver sufficiently in comparison with the software company	X		Entrepreneurs	Software company
Fostering ecosystem stability – lengthening shadow of future	Building system integration in project initiated by the forest industry’s mutual information hub association SDC, thus lengthening shadow of future through reassuring future access to industry infrastructure and data resources	X		Third party association for raw material measurement and information flows	Forest owners

	Providing non-profit, long period deals in order to create stability in access of raw material on a longer time-span for specific forest owners with transparent prices, thus enhancing one's own reputation while lengthening the shadow of the future as well in these relationships with forest owners		X	Forest owners	Industrial actors
Fostering ecosystem stability – multiplexity	Recruiting talented individuals in entrepreneurs' companies for the purposes of coaching others, thus fostering multiplexity through creating joint projects and dual roles for ecosystem members		X	Loggers	N.a.
Fostering ecosystem stability – curation mechanism	Building systems integration with bio fuel sister company which enables better collaboration through information exchange, thus creating curation mechanism in the form of increased quality of matches between forest owners' raw material and Susab's transport timings	X		Bio fuel company	Forest owners

Table 5. Orchestration processes identified in the Sydved case.

Ecosystem orchestration in the digital economy

This research set out to answer how the digital economy affects how incumbent firms orchestrate ecosystems. In Sydved, there is a long-spanning history of non-digital ecosystem orchestration. This paper's starting point of theoretical framework merges the theoretical framework for innovation network orchestration (Dhanarai & Parkhe, 2006) with the ecosystems and platform literature. However, our data suggest that there may be more to a theoretical framework for ecosystem orchestration in a digital context than merely identified through existing literature. I will thus discuss how the digital and non-digital orchestration processes differ from one another below.

The first difference between digital and non-digital orchestration processes refer to scalability, where *digital orchestration processes are scalable to a greater extent*. One example of such scalability can be found in how the design of a systems solution for transporters enable them to coordinate and optimize shipments using different applications. In this sense, the ecosystem group of transporters who can coordinate shipments with one another is no longer dependent on the forest buyer to connect them, or even to be a current partner of Sydved. Neither is the geographical location no longer a limitation for the scale of the user group. This highlights how the scalability of non-digital orchestration is limited by the number of employees, in Sydved's case the forest buyer or potentially logistics manager. A second example can be found in how systems integration with their sister company for bio materials with Sydved systems enabled better matches between bio fuel material and pick-ups, which reduced the friction that rose of inefficient information flows. Once again, this was formerly solved by the forest buyer being the conveyer of such information between disappointed forest owners, transporters for shipments and the demanding bio fuel firm. The difference of scalability can be further supported by how digital technology provide more powerful, efficient and scalable tools for matchmaking (Evans & Schmalensee, 2016), much greater than what an individual human agent can perform.

Secondly, I propose that *digital orchestration need to be integrated with ecosystem design* to a greater extent while *non-digital orchestration is considered separate from ecosystem design*. For this statement, I draw from the empirical observations of how Sydved orchestrate their ecosystem non-digitally, which appear to be a tradition transferred to the few existing examples of digital ecosystem design. As for examples of non-digital orchestration as separated processes, one example is how Sydved *first* decided to let go of their forest workers and encourage them to run their own businesses, *then* Sydved has spent vast resources on evolving the forest buyers' leadership skills in managing these entrepreneurs, which are processes independent from one another. Once again, I must emphasize that this non-digital orchestration may still include technology, illustrated through there being examples of forest buyer *then* forming communication groups on other digital platforms such as Facebook, sustaining the orchestration process undertaken by the forest buyer. As for an example of digital ecosystem design, an attentive reader may have noticed that the mobile applications for entrepreneurs and forest owners are not included in the examples above of design initiatives enabling orchestration. While these applications may be seen as a take-off for digital ecosystem orchestration, these applications are in their current state difficult to understand in light of ecosystem thinking. The current design of the applications mostly enable use in isolation, where transferring one-way information from Sydved to users and navigating through a digital map constitute the major functionality. In this sense, they are not interactive and thus does not connect ecosystem actors to one another. This

form of network design with no interaction within or across user groups is more to be illustrated as a decentralized network rather than a distributed, as required for a digital ecosystem (Briscoe et al., 2011). Rather for Sydved, the main part of process of designing these applications had an end date rather as being seen as processual, why orchestration has remained limited through these apps. From the Sydved case, one thus sees how digital orchestration processes need to be integrated in the design process as the role as orchestrator need to be designed into the system itself, rather than being carried out by a human agent separately. Instead, the initiative of elaborating the design of the entrepreneurs' app was taken by a software firm to supply higher quality maps, an initiative that then proved beneficial for Sydved as well at that point, as the supply of higher quality maps enabled orchestration of entrepreneurs in the form of stability, enhancing Sydved's reputation amongst their own entrepreneurs. This highlights the interdependence of external actors in ecosystems (Moore, 1993; Selander et al. 2013). However, this illustrates how roles are emerging as ecosystems become increasingly digital (Basole, 2009) and traditional industry boundaries blur (Teece, 2012).

Thirdly, I propose that the digital and non-digital orchestration processes may be seen as either substitutes or complements to one another as ecosystems become increasingly digital. The examples I have lifted related to scalability above exemplify how digital ecosystem orchestration substitutes the current role of the forest buyer. This does not equal that all non-digital ecosystem orchestration processes need to be substituted by digital in the digital economy. For example, current social meetings between the forest buyers and their surrounding "personal network" may have a social value as well that digital orchestration processes do not provide. For example, the main agenda for the hut meetings would perhaps not be to exchange information related to forest work but to contribute to the robustness aspect of ecosystem health (Iansiti & Levien, 2004) through spurring social value exchange from physical interactions within the ecosystem. Conversely, digital orchestration process may be complements to non-digital orchestration processes as well, as the orchestration is no longer dependent on the ecosystem location of the human orchestrator agent, supported by the literature in how platforms can manage both a core and periphery of an ecosystem (Gawer 2014) .

In light of the differences between digital and non-digital orchestration, I present the following extension of the framework for ecosystem orchestration specifying the different characteristics of digital and non-digital ecosystem orchestration in figure 3 below. The framework does however contain certain questions that need to be addressed. For example, there may be other categories of digital orchestration or the existing categories may contain additional subcategories than those identified in the literature review, where future research may complement the framework. A second aspect of interest to address is how various categories of orchestration processes (knowledge mobility, appropriability regime and ecosystem stability) influence one another, which was also pointed out by Dhanari & Parkhe (2006) in their original framework. As mentioned above, the concept of hub firms does not emphasize the role of digital technology, why this model situates the platform firm (Gawer, 2014) as a sociotechnical organization as the orchestrator.

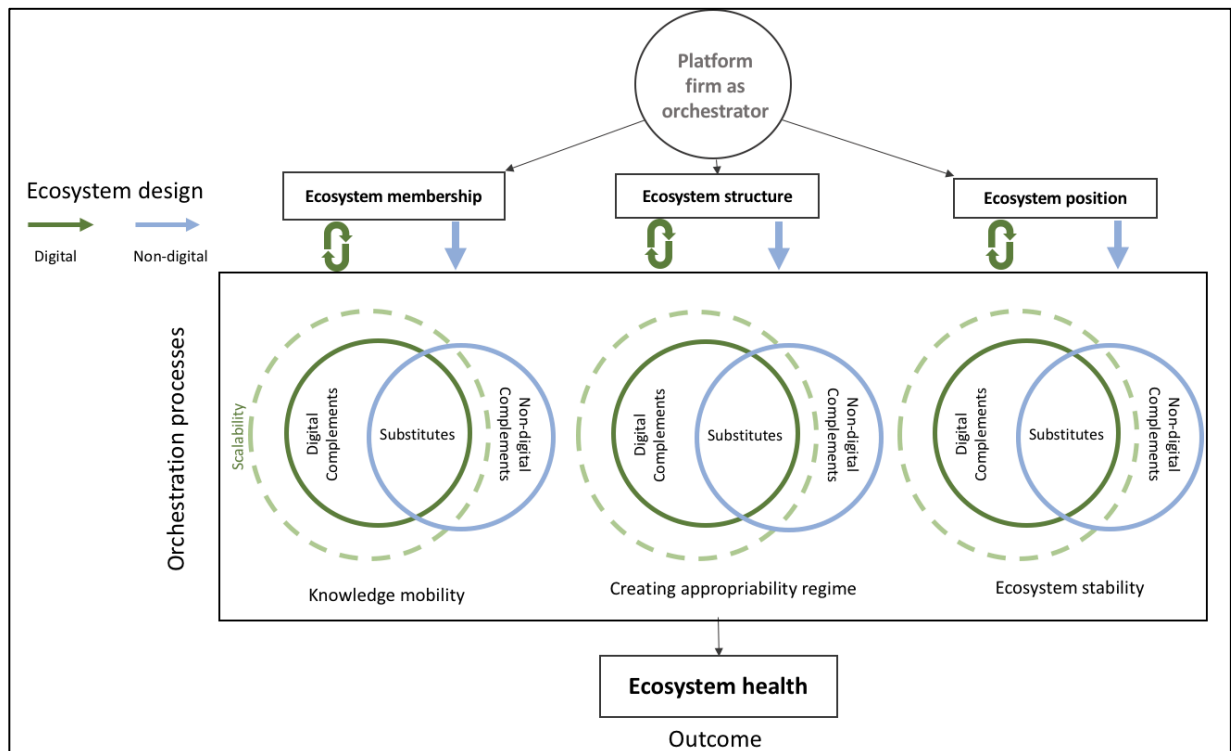


Figure 3. An extended framework for ecosystem orchestration in the digital economy.

The Sydved case not only expands our understanding of ecosystem orchestration, but also of the nature of evolving ecosystems. With evolution, I refer to how non-digitally designed ecosystems becomes increasingly digital. In the music ecosystem, Spotify was a new entrant firm, pioneering with driving the digital progression in the greater ecosystem. For Sydved’s ecosystem, this journey is just about to accelerate. One learning from the Sydved case is that an ecosystem exists a priori the construction of a platform and applications, contrary to Tiwana’s (2010) view, but remains limited in scale. In this evolution, one needs to ask to what extent digital orchestration processes can be substitutes to non-digital. As Gawer (2014) argues, “without autonomous agents and ecosystem governance, an industry platform is just a technological architecture”. The million-dollar question would thus be what our roles as human agents play in such ecosystem economy, a question of the future of labour. This imply that greater understanding for ecosystems is not only needed, but urgent, as markets as we know them are rapidly transforming.

Implications for practice of ecosystem orchestration in the digital economy

The traditional strategy in Sydved for ecosystem orchestration has been to create a decentralized organization and stimulate the leadership capabilities amongst district managers and mainly forest buyers. Leveraging digital orchestration processes contextualized for the digital economy would require Sydved to integrate the digital ecosystem design processes with a business perspective on how to digitally orchestrate ecosystems, as being a successful ecosystem leader need to balance the technological and business perspective in tandem (Gawer & Cusumano, 2008). The main challenge for Sydved is how the current strategy is heavily dependent on non-digital orchestration processes, and thus managing the competing concerns that unfolds when exploring digital innovation (Svahn et al., 2017). Gawer (2014) mean that the role of technological platforms is to federate and coordinate ecosystem actors. Introducing digital technology in the Sydved may thus create a conflict between current orchestration agents and the digital architecture of the platform the agent for orchestrating ecosystems. The most prominent competing concern identified in the Sydved case thus relates to conflicts between existing versus requisite capabilities (Svahn et al., 2017). The existing capability is the non-digital orchestration process, a capability that the Sydved strategy encourages forest buyers to develop, and the requisite capability is the digital orchestration process enabled by digital technology. The role of the forest buyers is therefore particularly exposed for disruption by digitalization.

Sourcing alternative roles for forest buyers as ecosystem members is thus a priority as Sydved sparks digital innovation, as Gawer (2014) means that agents of platforms, individuals or firms, play a variety of roles which may not be restricted a priori. This means that individuals currently playing the role of forest buyers may play other roles as the ecosystem evolve and that there may be benefits for Sydved in the pursuit of ecosystem health (Iansiti & Levien, 2004) in this as well, for example in the form of enabling niche creation. Interestingly, adapting the role of the forest buyer is not unfamiliar in the existing practices of Sydved. One example is how one of the district buyers with the co-working forest buyers developed a new value proposition in the form of forest management plan subscription, taking on the roles as service innovators. Embracing this emergent role playing can also be thought of as an orchestration process for fostering ecosystem stability, in the sense of multiplexity (Dhanarai & Parkhe, 2006) and frictionless movement in side-switching (Parker et al., 2016b). In transformational times and roles become fluid, multiple roles may be needed to be played simultaneously and individuals may need to perform this switching effortlessly.

One potential starting point for an ecosystem hub firm seeking to enter digital transformation can be to identify their current orchestration processes and determine which ones are to be viewed as substitutive or complementary of digital orchestration. Such an analysis would reveal what potential lies in digitalizing existing practices through leveraging network effects as well as predict the future labour needs of non-digital orchestration, and thus the potential in the future role of the forest buyer. This does not equal that current employees will be redundant, but as mentioned below, may play different roles in an increasingly digital ecosystem. In order to embrace how roles are changing when implementing digital technology, a key is thus to revise the incentive structure for the exposed individuals. As in the Sydved case, if Sydved would seek the engagement of forest buyers in innovation processes, there is no logic in linking performance and rewards to raw material volumes and profit margins. The current tactics have been mainly

through a current performance system incorporating four parameters (business results including both raw material volumes and profit margins, delivery precision, production precision and forest care); encouragement of representation activities included in district budgets; fostering leadership skills through various educations; and forming a culture across organizational boundaries based on the notion of “the winning team”. From the innovation literature, we learn that there are both extrinsic and intrinsic incentives to explore in seeking engagement to innovation (Boudreau & Lakhani, 2009). However, such an approach would not remove the competing concern as emerging service innovations may also eventually be a target for digitalization, highlighting the complexity in managing competing concerns in evolving ecosystems as roles played by human agents are challenged. With the progression of the digital economy, the health of the Sydved ecosystem is put to the test through challenging its robustness (Iansiti & Levien, 2004) in the form of managing this competing concern and will ultimately reveal the leadership role of Sydved within the greater ecosystem.

Reflections on future research

As this paper is part of a research project in process, reflections rather than recommendations for future research are included instead through presenting early ideas on how this research project in progress may contribute to further research outcomes.

Ecosystem evolution

The Sydved case reveals that there are other players than Sydved aspiring for the role as leading platform in the greater ecosystem. In ecosystem, emerging roles amongst leaders has been referred to as “leadership struggles” (Moore, 1993). Additionally, there may well be other actors such as new entrants aspiring for this role as well. Conducting a longitudinal study of the actors in an ecosystem evolving as it becomes increasingly digital, focusing on how roles and leaders emerge, would complement existing research as called upon by de Reuver et al. (2017). Such longitudinal case study could potentially enrich the framework for digital orchestration further, uncovering in-depth understanding the relations between ecosystem design initiatives and knowledge mobility, appropriability regimes, ecosystem stability and other potential orchestration processes in an increasingly digital ecosystem. Such study could additionally enhance our understanding of the complex interplay of how various ecosystem actors contribute to the overall ecosystem health (Iansiti & Levien, 2004). Apart from taking on the perspective of Sydved in such study, SDC is another actor with a current ecosystem position and mission of interest to follow due to SDC being a third-party organization with the mission to serve as the forest industry information hub.

The role of technological framing in learning to orchestrate ecosystems

Taking on a historical perspective on how Sydved has learnt to orchestrate the surrounding ecosystem, there are interesting examples in our data that appear to have preceded these processes. When learning to orchestrate the ecosystem in the current form, the metaphor of “the winning team” appears to have been central in the process of forming mutual understanding of what “a personal network” is. This metaphor has been applied in everyday communication and educations of forest buyers in combination with a methodology for visualizing a personal network for individual buyers. An event with great similarities is how this research process, where an education session at the university kicked off the project followed by workshops on digital ecosystems where a selected group of organizational agents were invited to visualize Sydved’s ecosystem. Therefore, I reflect on the significance of these processes as sense-making and what role these practices play in forming understanding of technology (i.e. the technological architecture of platforms (Gawer, 2014)) in designing ecosystems. An entryway for future research is to explore the role of framing (Cornelissen & Werner, 2014; Weick, 1995), and more specifically technological framing referring to the subset of organizational frames concerning sense-making of technology (Orlikowski & Gash, 1994), in learning to orchestrate increasingly digital ecosystems. Framing theory is a widely spread and widely used framework within social

sciences such as management and organizational theory, used for understanding cognitive, linguistic and cultural processes in organizational and institutional contexts (Cornelissen & Werner, 2014). In the Sydved case, some form of organizational framing appear to have played a role in making sense of their context with similarities to a business ecosystem (Moore, 1993), and therefore, as the metaphor of “digital ecosystem” is adopted in this project, studying how Sydved makes sense of this concept could be of research interest to the literature of technological framing.

The role of gender discourses in learning to orchestrate ecosystems

In traditional management theory following an industrial discourse, the default state of market analysis has been competition where Porter’s five competitive forces is one classic and influential example. (Porter, 2008) This is challenged by the ecosystems literature, stressing that the nature of inter-firm relations rather contain a complex dynamics between competition and collaboration, so called co-opetition (Brandenburger & Nalebuff, 2011; Ritala et al., 2014). Previous research has shown that the traditional management discourse, closely linked to a masculine discourse emphasizing control, conquest, competition, domination, rationality, self-sufficiency and self-sacrifice, tends to be reproduced rather than challenged when an open innovation discourse was introduced (Wikhamn & Knights, 2013). The open innovation discourse on the other hand, has been identified of having similarities with a feminine discourse, emphasizing aspects such as collaboration, inclusiveness and sharing (Wikhamn & Knights, 2013). While the open innovation discourse is not entirely similar to the ecosystem discourse, the notion of co-opetition (Brandenburger & Nalebuff, 2011) emphasizes a dynamic between competition and collaboration in ecosystems, why understanding what role gender discourses play in learning to orchestrate ecosystems could complement existing literature. For this approach, Sydved could be an interesting research subject for a longitudinal study focusing on the development of a discourse and its relation to succeeding with digital innovation. The discourse developed in regard to “the winning team”-idea emphasizes precisely collaboration, the importance of building a sense of identity and an explicit interest in reassuring the prosperity of other ecosystem agents’ businesses in the Sydved “stub”-ecosystem, which imply that a challenging discourse is already in progress.

Conclusion

This research contributes to enhancing our understanding on how ecosystems are orchestrated in the digital economy. This thesis complements existing research through highlighting the differences between digital and non-digital ecosystem orchestration. Ecosystem orchestration can either be stimulated non-digitally or enabled with digital technology, creating a challenge for incumbent firms in managing the competing concern that unfolds when firms need to balance these two processes in the digital economy. In this thesis, I identify the differences between these orchestration processes. While digital orchestration are to a greater degree integrated with ecosystem design processes and enable scalability of network effects (Parker et al., 2016b), non-digital orchestration processes are managed separately from designed and network effects are limited by the number of employees. It is due to the superior performance of digital orchestration processes, in terms of power, efficiency and scalability (Evans & Schmalensee, 2016), existing roles in organizations carrying out non-digital orchestration processes are challenged. The main contribution of this paper is thus to extend a framework for ecosystem orchestration for the digital economy, enabled by understanding platforms as sociotechnical constructs (Gawer 2014). Understanding non-digital orchestration as either substitutes or complements can provide a starting point for using this framework in practice. In leveraging digital orchestration, incumbent firms may learn how digital ecosystem orchestration need to be seen as an integrated process with ecosystem design, which stresses the importance of merging a business with a technological perspective for conducting ecosystem leadership (Gawer 2014). Another important implication for practice is to rethink existing incentive structures as orchestrator roles are changing due to this competing concern of orchestration. In this paper, we suggest that evolving the role of orchestrator in becoming a service innovator holds potential but would not ultimately remove the competing concern as new services may be a target of digitalization. This research thus sheds light over the need for deeper understanding of ecosystems as it questions our roles as human agents in labour as ecosystems become increasingly digital. In this sense, the ecosystem concept challenges the notion of markets as we know them.

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Appendix 1 – Overview of data sources through engaged scholarship

Data sources				
Research method	Description	Time period/date	Participants	Data records
Participant observation	Every-day participation, mainly at Sydved's head office	January – May 2018	Employees at the head office, guests	Research diaries, audio recordings, photos
	Meeting with new marketing partner	8 th January 2018	CMO, marketing team, four team members from marketing agency	Audio recording
	Follow-up meeting about new marketing partner	10 th January 2018	CMO and marketing team	Audio recording
	Region meeting on increased autonomy of business partners (entrepreneurs)	17 th January 2018	CMO, region manager, four district managers, business developer	Audio recording
	Meeting with media planning agency	26 th January 2018	CMO, planner from marketing agency	Audio recording
	Education for one of the districts on new digital tools	29 th January 2018	Business developer, district manager, forest buyers of the particular district	Audio recordings, photos, research diary
	Strategy workshop day with one of the district offices, held by external consultants, the CMO and the region manager	30 th January 2018	CMO, region manager, external consultant, district manager, forest buyers of the particular district	Research diary, audio recordings, photos
	Meeting with marketing agency (the newer partner)	5 th February 2018	CMO, marketing team, four team members from marketing agency	Audio recording
	Forest owner home visit along with lunch with entrepreneur firm	9 th February 2018	Forest owner, forest buyer, business owning entrepreneur	Research diaries (mine + my supervisor's), audio

				recordings, photos
	Meeting regarding raw material supply with one of the industrial owners	13 th February 2018	Chief of logistics and management representatives of the pulp mill	Audio recording, research diary, photos
	Meeting with media planning agency on digital marketing tools	28 th February 2018	CMO, marketing coordinator and two team members from the marketing agency	Audio recording
	Meeting with Sydved's web editor team	1 st March 2018	CMO, business developer, marketing coordinator, forest buyers and administrators from the districts who are responsible social media content	Research diary
	Meeting with Sydved's committee regarding forest business development	5 th March 2018	CEO, CMO, CIO, region managers and business developers	Research diary, photos
	Meeting with forest business developer regarding the digital application for entrepreneurs, discussing the platform concept	7 th March 2018	Three business developer, the former CIO (partly)	Audio recording
	Presentation with the CMO on the research project for one of the districts, with up-following conversation on new value proposition	12 th March 2018	CMO, district manager, forest buyers of the particular district	Audio recordings, research diary
	Social event for forest buyers, arranged by one of	13 th March 2018	CMO, district manager, forest buyers of the	Audio recording,

	the districts, mingle followed by lecture by one former Swedish Olympic ski competitor		district, co-arranging bank, guesting forest owners (about 200 guests)	research diary, photos
	Brainstorm on how Sydved can work with options methodology to spur digital innovation	5 th April 2018	CMO, CIO (half of the meeting), business developer, marketing coordinator, IT/marketing team member	Audio recording
	Meeting with university on research project application in progress on digitalization of forestry	18 th April 2018	CMO, CIO, three team members from university	Audio recording
	Joined one of the forest buyer and district managers for two separate “hut meetings” (meetings with partnering entrepreneur firms)	2 nd May 2018	Forest buyer, district manager, 3 entrepreneur teams, forest owner hosting one of the hut meetings	Audio recordings, research diary, photos
Interviews (unstructured and semi-structured)	Project start meeting with introduction about Sydved and time line creation	13 th December 2017	CMO	Audio recording, notes
	Conversation about Sydved’s web interface	4 th January 2018	CMO, marketing coordinator, IT/marketing team member	Audio recording
	Conversation about “the winning team”, hut meetings etc	10 th January 2018	CMO	Audio recording
	Conversation about daily operations at one of the districts held by district manager, one forest	15 th January 2018	CMO, district manager, one forest buyer, one administrator	Audio recording

	buyer and one administrator			
	Conversation regarding how the relationships with the entrepreneurs are managed	16 th January 2018	CMO, region manager	Audio recording
	Conversation regarding digital initiatives in Finland	17 th January 2018	CMO	Notes
	Conversation regarding accounting systems for business transaction and production data transactions	20 th January	IT/Marketing team member	Notes, photos
	Conversation regarding what role the application for entrepreneurs play in managing these relationships	22 nd January	Business developer	Notes
	Presentation by system developer, business developer and CMO of Sydved's information systems	24 th January 2018	System developer, CMO, business developer	Audio recordings, documents
	Phone conversation with external consultant engaged in educating the forest buyer in leadership	24 th January 2018	External consultant	Notes
	Conversation about Google analytics and AdWords and Sydved's current use of these services	31 st January 2018	Marketing coordinator	Notes, photos, audio recording
	Conversation about subsidiary company Susab	13 th February 2018	CMO	Notes

	and pricing models in the forest industry			
	Conversation regarding Sydved's history and logistics and digitalization	13 th February 2018	Chief of logistics	Notes
	Conversation and walk-through of the applications for entrepreneurs, forest owners and forest buyers as well as up-coming laser scanning of the Swedish forest	14 th February 2018	Business developer	Notes, photos
	Conversation about the role of Sydved's council for questions regarding forest business development	20 th February 2018	Business developer	Notes
	Conversation about access to data in Sydved's system databases	20 th February 2018	IT/marketing team member	Audio recordings, photos
	Up-following conversation about reflections related to the scenario workshop (focus group, see below)	26 th February 2018	CMO, marketing coordinator	Notes
	Conversation and lunch about how a platform lab could be designed	27 th February 2018	Business developer, marketing coordinator	Notes
	Up-following conversation about reflections related to the scenario workshop and general small-talk about digitalization	1 st March 2018	CIO (newly appointed)	Notes

Conversation about Sydved's potential participation in a hackathon	6 th March 2018	CMO, business developer, marketing coordinator	Notes
Conversation about how digitalization affects human resources management in firms	6 th March 2018	Chief of HR, business developer,	Notes
Conversation about recruitment of digital marketer, the idea to do a Sydved podcast about the research project and "the personal network"-thinking amongst forest buyers	7 th March 2018	CMO	Audio recording
Update on the course of events since last visit	26 th March 2018	Marketing coordinator	Notes
Conversation and brainstorming about process for options methodology that could serve as start point for digital platform lab	4 th April 2018	CMO	Notes, photos
Conversation about the idea of the "personal network"	4 th April 2018	CMO	Audio recording
Conversation and spontaneous brainstorming about digital options	9 th April 2018	Marketing coordinator	Notes
Update regarding how the idea about the platform lab are proceeding, discussing preparation for board meeting	9 th April 2018	CMO	Audio recording

	Conversation around the “fika” table about IT in use in Sydved amongst the forest buyers	10 th April 2018	System administrator	Notes
	Conversation about budgets within Sydved and gender discourses in relation to digital innovation	10 th April 2018	CMO	Audio recording
	Conversation about forest certifications, educations for entrepreneurs, integrations with bio fuel firm mm	17 th April 2018	Business developer	Audio recording
	Conversation about the research project in preparation for article in Sydved’s editorial magazine	17 th April 2018	Marketing coordinator	Audio recording, notes
	Conversation about relationships with SUSAB (subsidiary company) and bio fuel company	18 th April 2018	CMO	Audio recordings, notes
	Conversation about integrations with SUSAB (subsidiary company) and bio fuel company	18 th April 2018	External IT consultant	Audio recording
	Conversation regarding adaptation files in the forest production process	23 rd April 2018	Business developer	Audio recording
	Conversation around the “fika” table about recently held meeting with all of Sydved’s partnering transporters	24 th April 2018	CEO, logistics manager	Notes

	Conversation about general reflections on first time spent in Sydved, Sydved's system architecture, upcoming CRM system and platforms	24 th April 2018	CIO	Notes
	Interview with the former CIO of Sydved, talking mainly about the history of the organization and the role of IT	26 th April 2018	Former CIO	Audio recordings
	Update about upcoming board meeting and management team's meeting and how digitalization will be discussed	8 th May 2018	CMO	Audio recording
	Interviewing one of the forest buyers for upcoming Sydved internal podcast on research project	21 st May 2018	Forest buyer	Audio recording, photos
Focus group	Workshop - presentation and discussion about four future scenarios for Sydved and the forest industry related to digitalization held by us researchers	20 th February 2018	CEO, CMO, business developer, marketing team	Audio recording