

Open Innovation in SMEs: Exploring the Ecosystem

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ABSTRACT

Small and medium sized enterprises (SMEs) face the inherent tension of being dependent on external partners to complement their internal innovation activities while having only limited resources to manage such open innovation processes. This tension is augmented in the context of the larger ecosystem of complementary partners in which the SME is active. In this paper, we present an inductive case study of a particular regional innovation ecosystem. The case shows how the SMEs, embedded in the ecosystem, perceive and manage open innovation through strong collaboration ties with various stakeholders, including suppliers and competitors. When managing such open innovation processes, we find a particular set of challenges for the SMEs due to the misalignment between their and the ecosystem's (implicit) business model. More specifically, key findings include the diverging understanding of the notion of innovation across the ecosystem, constraints of the SMEs' internal organization, the importance of shared business objectives and leadership on different levels. These findings highlight specific attention points for managing and developing open innovation in a regional ecosystem, where both the SME and the ecosystem levels of analysis need to be considered.

Keywords:

Open Innovation, Ecosystem, SMEs

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INTRODUCTION

Open innovation, which describes knowledge inflows and outflows for improved innovation performance, is widely acknowledged as an important innovation management practice (Chesbrough et al. 2014; Chesbrough 2003; Dahlander & Gann 2010). However, many aspects of this field are not yet well explored and our understanding of the open innovation concept is therefore still under-developed (West & Bogers 2014; Huizingh 2011). For example, one of the areas that has received increasing interest in recent years is the role of open innovation in small and medium sized enterprises (SMEs) (Brunswick & Van de Vrande 2014; Van de Vrande et al. 2009). And while this emerging research has shown some of the main trends and mechanisms, a more detailed understanding of the exact conditions under which SMEs can successfully implement an open approach to innovation it still lacking. This is particularly true when considering the relatively few studies that focus on open innovation in business ecosystems (Van Der Borgh et al. 2012), thus amplifying the lack of understanding of how SMEs can manage open innovation in such ecosystems.

This paper investigates how SMEs embedded within a larger ecosystem understand and implement open innovation through a rigorous case analysis (Glaser & Strauss 1967; Eisenhardt 1989) of seven manufacturing SMEs, which are part of an regional ecosystem. Taking into consideration that generating new opportunities for additional value creation happens much more often in open innovation than while following closed innovation principles, this paper will explore the SMEs' current open innovation competences and challenges, and how they could improve their performance through various open innovation collaboration modes. The research specifically explores the ecosystem as a unit of analysis, in which the various SMEs are embedded, and thereby addresses their role in the larger ecosystem of complementary partners (Adner & Kapoor 2010; Moore 1993; Van Der Borgh et al. 2012).

The paper begins with providing a theoretical background of the study, including definition of open innovation, which is a context of the study as well as business ecosystem as a unit of analysis. Next, we describe the applied research strategy, including theoretical sample justification, data gathering protocols, and the analytical techniques used to develop the findings. Subsequently, the case study evidence is presented and discussed. We conclude with a summary of the key findings and implications for SMEs open innovation management in the context of the regional ecosystem, as well as their limitations and possible future research extensions.

THEORETICAL BACKGROUND

Open Innovation: State of the Art in Large Firms and SMEs

Open innovation has been defined as *“the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively.”* (Chesbrough et al. 2006, p2). Contemporary innovation model shifts from closed ‘in-house’ R&D to combining both internal and external sources of ideas, technologies and other kind of information that could help companies in their innovation effort. In the open innovation literature, most attention has been paid to the inbound process of knowledge inflows to accelerate internal innovation, with less attention to the outbound process of knowledge outflows (West & Bogers 2014).

For example, emphasizing external sources of knowledge, Laursen and Salter (2006, p.146) point out that *“searching widely and deeply across a variety of search channels can provide ideas and resources that help firms gain and exploit innovative opportunities”*. Besides, there is an increasing interest in the coupled process of open innovation, which combines knowledge inflows and outflows (Enkel et al. 2009). Such processes tap into a larger literature on inter-organizational collaboration, which has emphasized the general

importance of knowledge transfer for innovation and the specific relevant of inputs like time, labor and other resources. Along these lines, studies have shown that inter-organizational collaboration can be an important driver for innovation performance (Powell et al. 1996). Accordingly, firms embedded in networks can leverage their external environment to achieve better innovative output (Shan et al. 1994).

Initially, open innovation research provided evidence of various positive influences of its adoption in large multinational companies some of them focus on single firms like IBM, Lucent or Intel (Chesbrough 2003), DSM (Kirschbaum 2005), P&G (Dodgson et al. 2006; Huston & Sakkab 2006) Italcementi (Chiaroni et al. 2011), while there increasingly has also been a focus on cross-company analysis (Bianchi et al. 2010; Chesbrough & Crowther 2006; Chiaroni et al. 2010; Ferrary 2011). Recent studies started to focus more on implementation of open innovation practices, including in SMEs (see, for example, Bianchi et al. 2010; Lee et al. 2010; Van de Vrande et al. 2009). However, empirical research on open innovation practices in this group of firms is still relatively scarce, with a call for further theory-based empirical research (Wynarczyk 2013).

Building on the increasing interest in open innovation in both large companies and SMEs, a recent study focuses on the effects of open innovation practices in SMEs, relative to large companies (Spithoven et al. 2013). This research shows that open innovation activities are performed more intensively in SMEs. SMEs are also more dependent on open innovation than big companies, because its practices have much more significant impact on their revenues. In terms of search strategies, which generate innovative turnover, SMEs benefit from them much less than large companies. What is more, the researchers point out collaboration between SMEs and other innovation partners as a mean to foster the introduction of new offerings.

Open Innovation at the Level of Business Ecosystems

While open innovation has received an increasing amount of attention in innovation management research, it is mostly addressed at the company level of analysis, with a lack of research on other levels (West et al. 2006). One such level of analysis that relates to the constellation of innovation actors is the business ecosystem (Adner & Kapoor, 2010, Rohrbeck, Hoelzle, & Gemünden, 2009; van der Borgh et al., 2012). One of the original conceptions of a business ecosystem was first developed by Moore (1993) who emphasized cooperation and competition that happens simultaneously between companies that coevolve new capabilities leading to new innovations. In his view, *“a business ecosystem, like its biological counterpart, gradually moves from a random collection of elements to a more structured community”* (Moore 1993, p.76). He moreover distinguishes different stages of the ecosystem development where different challenges related to collaboration or/and competition may emerge.

There have been different views and related concepts that emerged in the context of business ecosystems. One argument is that an ecosystem is much bigger and richer than a firm's immediate customer-supplier network, but at the same time the perception of its dimensions could differ depending on the point of view (such as a single SME initiative or a collection of multiple large enterprises (Moore 1996). Considering indicators of an ecosystem, it could refer to a network of relationships that have a future potential regardless of the size of the system (Moore 1996). Some scholars refer to an ecosystem as a “community” (Iansiti & Levien 2004; Moore 1996), although that concept has been ill defined and approach in various different ways, not the least in the context of open innovation (West & Lakhani 2008).

Business ecosystems can be characterized by consisting of a variety of types of stakeholders, such as suppliers, customers, competitors, universities and other complementors, which all play a different role, relative to the other actors, in the process of

creating value (Van Der Borgh et al. 2012; Iansiti & Levien 2004; Eisenhardt & Galunic 2000; Moore 1996; Adner & Kapoor 2010; West & Bogers 2014; Afuah 2000). In the words of Iansiti & Levien (2004), these stakeholders are “*loosely interconnected participants that depend on one another for their effectiveness and survival*” (Iansiti & Levien 2004, p.5). A prerequisite of a “membership” in this ecosystem is then a certain level of inter-dependency between participants. In the context of open innovation, knowledge becomes an important medium of interaction between the members of the business ecosystem.

RESEARCH DESIGN

The main empirical basis of this study consists of a set of exploratory interviews that were conducted among 12 Danish manufacturing companies in the business ecosystem in Southern Denmark, which serves as the case in this study (Table 1). The sample of companies consisted of 10 SMEs and 2 large companies embedded in the ecosystem. During the data collection process, we realized that, due to the duration of the interviews (usually between 1 and 2 hours) and the high level of trust and openness of interviewees, the stage of data saturation was achieved much faster than planned. Therefore, we present evidence from a selected number of cases, to thereby illustrate some of the evidence, while the space constraints do not allow us to show more evidence (see Table 1, where no evidence is presented for the grey cases). The selection process was based on balance between the size of the companies (we discarded one small and two medium companies) and marginal contribution to data saturation.

Insert Table 1 about here

Having the seven SME cases embedded in the larger case of the regional ecosystem enabled us to predict similar results across the cases (literal replication) and predict contrasting results for predictable reasons (theoretical replication), in line with case study methodology (Yin 2003). There are various relationships between companies included in this ecosystem. Some of them belong to different clusters like mechatronic or lean energy – cluster and many different networks like Danish Industry, Rotary Club etc., as well as collaborate in various interdisciplinary projects. Employees of these companies also belong to various formal and informal working groups related to e.g. hardware, software, project management etc.

The theoretical sample was chosen based on: 1) openness to collaboration with other companies and institutions 2) size and the location of the company. First, we tried to select companies that show certain degree of openness for external sources of knowledge. That is why, we have focused on companies that are active in different types on local organizations (e.g. different clusters) as well as those that have documented history of collaboration (related both to core and noncore activities) with other local companies or public institutions (e.g. the university). Second, important criteria were both the size of the company (in order to achieve diversity within the SME sample) and the spatial proximity between the selected companies (the distance between the central city in the region and company should be within a radius of 25 km) (Freel 2003; Sternberg 1999).

All interviews were conducted face-to-face with CEOs, managing directors or co-owners of the company and they were combined with visit to their manufacturing facility. Most of the companies were interviewed twice in the period of five months. All the interviews were recorded, transcribed and shared with interviewees for data validation. Additional information about the companies was collected from publicly available registers, company web sites as well as documents received from the interviewees.

During the first round of interviews we addressed the questions related to the company itself with their competences and challenges as well as their understanding of open innovation together with related activities or initiatives which have been useful in embracing open innovation. In the second round of interviews the same people were asked more in-depth questions about open innovation and different elements of value chain where it is realized.

The data analysis related to an inductive qualitative study with a grounded theory approach, where we tried to extract, identify and develop themes that capture the innovation phenomenon in SMEs (Dougherty 2002). In this inductive analysis, we attempted to identify themes of findings from within the embedded cases, while comparing the finding across cases as an analytic technique. The grounded theory approach was reflected in the construction categories of findings by developing categories of information (open coding), interconnecting the categories (selective coding), and building a story that connects the categories (axial coding), upon which the final findings are based (Corbin & Strauss 1990; Dougherty 2002). As such, the construction of categories can be seen as an iterative process that establishes common meaning across multiple observations (Locke 2001).

FINDINGS

At the beginning of the research and data collection process, we considered the selected sample of SMEs as part of a particular cluster. However, during the data collection process we realized that membership in a particular cluster is just one of the initiatives that these companies are involved in. Each interview was revealing new connections between these companies, which were not necessarily related to mechatronics, which was the theme of the cluster. The CEO of the **Company F** framed it very well: *“If we have an organization and the chairman and if we pay to be a member or we don’t, the Mechatronics Cluster is*

there anyway. It doesn't need an organization to be there, it is there; and this is strength for all the other initiatives, because we don't need to be called the Mechatronics Cluster to be one. We are there. The companies are there. It is a cluster - real life."

The companies from the region somehow stuck to the idea of mechatronic cluster, due to the fact that it has always been there. However, we realized that the 'organization' that we have approached and talk about resembles more an ecosystem (Adner & Kapoor 2010; Iansiti & Levien 2004; Van Der Borgh et al. 2012). One aspect is that it is not only connected by one theme, but resembles a biological ecosystem (Moore 1996) given its a particular geographical location (see Figure 1).

Insert Figure 1 about here

Due to variety of stakeholders it is much bigger and richer than a firm's immediate customer-supplier network (cf. Eisenhardt & Galunic 2000; West & Bogers 2014). Moreover, it includes cooperation and competition activities (Afuah 2000; Moore 1993). There is also certain level of inter-dependency between participants (see Figure 2). Enterprises constituting our sample not only co-exist in the similar region, but also co-evolve.

Insert Figure 2 about here

Our empirical findings show that path dependencies in terms of collaborative traditions influence the extent to which SMEs are open for external sources of innovation. There is also a strong relation to the extent to which local firms take a risk of joining various innovative partnerships. Generally, the existing interdependencies drive this dynamic co-evolution (Figure 2).

Understanding of Open Innovation Across the Ecosystem

Adner (2006) brings the topic of interdependencies between innovation partners. Therefore, co-evolution of the partners and thus the ecosystem depends on innovation, but in order to innovate in an ecosystem, one is dependent on the innovation activities of the various partners. However, any misalignments or divergence of the perception on innovation could pose additional challenges to the ecosystem development. Especially, taking into consideration that various types of collaborative agreements initiated within the innovation ecosystems for many firms have become an important element of the growth strategies (Adner 2006).

We found that in this particular innovation ecosystem, there are limits with respect to the understanding of innovation across the ecosystem. While the SMEs in this ecosystem highly depend on each other, the empirical evidence also reveals that the perception of what constitutes innovation differs substantially across this group. This difference appears to be strongest for SMEs that are active in different types of business. However, the fact that these discrepancies of perception exist between SMEs is not surprising, especially in the light of the broader context of misalignment of the perception of what constitutes innovation between SMEs and other innovation stakeholders like academics and policymakers reported by Massa & Testa (2008).

The most significant differences can be observed in companies selling their products on regulation driven markets (Table 2, **Company D**). Various governmental regulations that a company is exposed to could be perceived as an opportunity, which could easily turn into threat. Knowing the future directives gives a chance to gain competitive advantage based on competencies and R&D performance. However, if anything unexpected happens and the new product could be too radical to comply with set standards it will be automatically rejected from the bid. Therefore, Lundvall et al. (2002) suggest to policymakers to change the legal

framework in a way that would weaken the position of imitators and strengthen the position of radical innovators.

Insert Tables 2-7 about here

Some SMEs perceive customization as process of delivering a novel solution (usually both to the company and to the market), what in this case could be perceived as product innovation (Table 2 **Company A, B, C, E**). In the context of open innovation, there is moreover a strong link to customers and their expectations, which a company tries to fulfil by creating a value added product (Table 2 **Company C, E**). Most of the SMEs in the ecosystem underline customization as their main strength (Table 2 **Company B, C, E**), which is in line with the literature that regards them for their operational expertise and customer knowledge (Massa & Testa 2008)

Moreover, customization or innovation through customization is perceived as user driven innovation (Table 5 **Company A**), due to users' involvement in development and production process and is perceived by SMEs as one of their strengths. The role of user innovation or involvement creates the need to appropriate process to transfer the users' sticky knowledge to the SME, possibly through the development of (SME) specific toolkits (Von Hippel 1994; Franke & Von Hippel 2003; Bogers et al. 2010). Besides, the involvement of employees in the decision making process it is also important in the innovation process. This is also mirrored in the company's strong focus on recruiting people, with some new (to a company) knowledge and skills (Table 2 & Table 5 **Company E**), which could be also a big stimulus for establishing collaboration (Rothwell & Dodgson 1991)

Literature reports that level of flexibility together with an ability to adjust the product according to customer needs make a significant distinction between SME and a large

company to the advantage of the first one (Narula 2004). However, some of the ecosystem members found a way not only to keep this flexibility, but also to combine it with scalability through mass customization platforms (Table 7 **Company E, F**). What is interesting, the same companies claim that they do not have any direct competitors due to the niche that they found.

Another perception of open innovation is also related to the knowledge that current or potential customers could provide for the new product development process (Massa & Testa 2008). One of the threats in the traditional (closed) innovation model used to be divergence between customers' needs and the product features. Not all of the interviewed companies would agree that special customers' involvement in the product development process would give satisfactory results. According to the Managing Director of **Company E** (Table 2) listening to the customers may not be enough. The problem may lie somewhere else as the user is pointing out. What is more, in his view the company has to have its own contribution to the solution.

Differences in perception of value creation and capturing could have its source in differences between the ecosystem participants' business models, which are defined as the logic of how companies create and capture value through their activities (Zott et al. 2011). This could explain why for some firms it is not always good to jump to the newest technology, better to have something reliable that will comply with various regulations and directives and what customers will be able to understand. It could also have something to do with existence of various levels of open innovation (West et al. 2014; West et al. 2006; Gupta et al. 2007).

Exploring Challenges in Adoption of Open Innovation Strategies

While exploring challenges in adoption of open innovation strategies in Portuguese SMEs, Rahman & Ramos (2013) found that one of the general constrains was lack of market

demand implied by low purchasing power of customers. They suggest that SMEs may not necessarily understand customer needs well, which could be resolved by better implementations of open innovation principles. Our study complements these findings by providing different explanation of the demand issues.

Some of the interviewed ecosystem members (Table 3 **Company D, E, F**) brought up the topic of challenges related to market and customer readiness to understand and buy the technologically advanced products. This could be particularly true for SMEs that engage in more radical innovations, which according to Wynarczyk (2013) are enabled by open innovation practices, which enhance their innovation capability. This would usually not be that big problem in case of large companies, but it could create a meaningful obstacle for SMEs. In this respect we have identified two challenges. First is to create market demand and convince customer to buy (Rahman & Ramos 2013). As a follow up there are a lot of investments that companies have to make not only to develop the product, but also to reach the customer, which is also aligned very much aligned with the findings of Rahman & Ramos (2013), where they classify it as a supply side challenge. Second is complexity of markets (Table 3 **Company C**), which could also include potential expansion to yet unknown and not well understood foreign markets (Rothwell & Dodgson 1991).

Not only developing the demand on the market is important but also creating something new i.e. product, process, technology etc.; however this requires trust and creditability (Lee et al. 2010; Powell et al. 1996), which may be a challenge for (sometimes) unknown SMEs (Table 3 **Company A, F, G**). Moreover, in the product development process it is not enough to listen to the customers and suppliers, but also have to be able to contribute to the process with your own competences and ideas – otherwise Ford would have to get customers faster horses (Table 2 **Company E**).

Additional challenges to in adopting open innovation strategies could be connected with IPR or widely understood knowledge leakage. The Managing Director from Company expressed his concerns related to a potential takeover of knowledge (Table 3 **Company C**), which could happen in collaboration with different stakeholders and competitors in particular (Table 7 **Company C**). Moreover, we observed that this potential threat concerned/or was expressed only by this one company. Additional input to this discussion was related to misalignment of ‘agendas’ or ‘approaches’ of potential partners. This in particular was directed towards universities and technology institutes, which have different focus than the industry (Table 3 **Company E**). This tension could emerge and lead to further conflicts on the basis of developing new technologies, which should generate research papers versus their implementation in the products, which should generate profit. Nevertheless, a university (Table 6 **Company C, E, F**) as well as other external partners - different than suppliers and customers (Table 6 **Company E, F, G**) could still be a good source of knowledge and ideas (Shan et al. 1994; Etzkowitz & Leydesdorff 2000).

Inter-organizational Knowledge Flows

As for technology exploitation, we considered activities that include acquisition of products, services, processes or equipment developed by third parties; outsourcing of upstream or downstream activities; as well as outward licensing intellectual property. We investigated during which stages of the value chain they take place. Despite the fact that SMEs in our researched ecosystem do not have any patents and thus do not license them, they value outsourcing of various activities (Rahman & Ramos 2013). Outsourcing/collaboration could be perceived as knowledge flows across organizational boundaries, which also implies mutually dependent inflows and outflows. This highlights an interactive nature of knowledge flows between different stakeholders as well as strong dependency between them, because

what is an inflow for one company is an outflow for another one (Enkel et al. 2009; Tranekjer & Knudsen 2012).

Efficient utilization of external knowledge sources seems to strongly contribute to open innovation development in SMEs. SMEs appear to be more aware of outsourcing opportunities; due to their size and financial resources they have to outsource R&D or manufacturing of some products (Teirlinck & Spithoven 2013).

For some SMEs (Table 4 **Company A, B, D, E, G**) outsourcing of various parts of the business could be a way to focus on developing core competencies. It can be observed that this development could lead to specialization (Table 4 **Company D, E**). This happens mostly due to a reverse effect of Not Invented Here (NIH) syndrome (Katz & Allen 1982) and Not Shared Here (NSH) syndrome (Burcharth et al. 2014). They have neither time (Table 4 **Company D**) nor money to acquire competences from various different fields. Focusing on their core competencies and getting better and stronger in what they already do is for them much more beneficial than trying to do everything (Table 4 **Company D, E**).

In terms of technology exploration, we focused our research on the sources of knowledge and technologies, and the activities that enable firms to acquire them (Van de Vrande et al. 2009). Following the Laursen & Salter (2006) and others who build on the Community Innovation Survey (CIS), we take into consideration external sources of information, among which one can find: market sources; commercial labs, private R&D organizations and consultants; institutional sources, government and public research organizations; as well as other available sources like industrial associations, trade fairs, exhibitions, and conferences, scientific journals and trade/technical publications. Diversification of knowledge sources combined with inter-organizational collaboration is also crucial for SMEs performance (Powell et al. 1996). For some of them, networking and good references are the main ways of acquiring new customers (Table 5 **Company A, B, D**).

Therefore some SMEs state that for them the main partners thus source of external knowledge are customers (Table 5 **Company A, E**). However, our findings show that SMEs in this ecosystem recognize suppliers as one of the key partners in doing business (Table 5 **Company A, B, C, D** & Table 4 **Company G**). Good relationships with suppliers could not only assure good service, but also knowledge about newest technology and possible product optimization (Table 5 **Company B, C, D**). Instead of acquiring knowledge by themselves, some companies prefer to partner with those that already have this specific knowledge. It may be the reason why for some SMEs (Table 5 **Company G** & Table 6 **Company F**) suppliers are not only a part of their vertical network, but an important business partner, which helps the SME to develop and deliver a value proposition to the customer (Rothwell & Dodgson 1991).

Organizational Aspects of Open Innovation in the Ecosystem

We have also explored how to organize for open innovation. A very special perception of “collaborators” could play an important role in the open innovation ecosystem. Our empirical evidence points out that, even if most of our interviewees are suppliers to some large enterprises (see Figure 1) (Table 6 **Company B**) or have some sort of partnerships relationship, they do not consider themselves as equals, which is in line with Narula (2004) who points out that SMEs “have relatively little to offer” (Narula 2004). Our empirical evidence from interviews with **Company A and G** (Table 6) illustrate this situation very well. Large and small companies seem to represent different interest groups. What is more, they not only put different value to the joined project than SMEs do and therefore may not treat one another as partners (Rothwell & Dodgson 1991).

Due to their size and financial capabilities SMEs are willing to cooperate not only with complementors, but even with the competitors (Ritala & Hurmelinna-Laukkanen 2009) (Table 7 **Company A, B, D**).; both solutions have their roots in increasing needs to acquire

multiple competences (Rothwell & Dodgson 1991; Granstrand et al. 1997). In their world, we are not necessarily talking about zero-sum game, when one has to lose to the other to win. If none of suppliers is able to handle the order it may be better for them to collaborate and share the money than fight and be left with nothing. Therefore, even a competitor has the potential to provide additional resources, which can contribute to mutual benefits (Lee et al. 2010; Kogut et al. 1992) . An illustration of this case is nicely exemplified by the **Company A** arguing that collaboration with competitors is not easy, but durable (Table 7). Additionally for very innovative companies the fact that competitor exists could proof that the product/service exist (Table 7 **Company F**).

CONCLUSION

This study explores how SMEs perceive and manage open innovation on the level of a regional innovation ecosystem. Our findings point out that, despite various interdependencies between the ecosystem members, the understanding of what innovation and knowledge-based collaboration comprises can differ widely. This may be linked to the differences between SMEs' business models, which constitute the overall ecosystem model of value creation and capturing. Acknowledging such inconsistencies is important for managers who want to collaborate in or develop an innovation ecosystem.

Furthermore, different ways of organizing open innovation practices could not only provide a source of knowledge for the ecosystem members, but they could also get companies closer in terms of potential partnering in new initiatives. Not only SMEs dependencies of open innovation, but also their openness for collaboration with various partners, imply that they, and thus not only large companies, can be involved in the coopetition relationships, while this could also become the selective domain of SMEs embedded in an open business ecosystem. Such a SME-specific perspective in the context of

ecosystems implies that a crucial role for these members when developing future projects and related initiatives.

Finally, we believe that the empirical findings have an important contribution to both academics and practitioners. From the theoretical point of view, the research adds both to the open innovation literature with a special focus on SMEs and to the literature related to regional collaboration and business ecosystem development. Thus, the ecosystem level becomes an important unit of analysis with particular emphasis on the role of SMEs (Chesbrough et al. 2014; West et al. 2014). Besides, the context of openness in manufacturing and process technology emphasizes the importance of broadening the typical scope of R&D and product technologies within open innovation research (Chesbrough & Bogers 2014).

From a practical point of view, we believe that our findings may serve as guidelines for SMEs, which either are involved in different types of collaboration or wish to do so. What is more, not only content-wise, but also method-wise, this paper's findings may be helpful for researchers who wish to establish successful projects with the industry. It could not only help in increasing our understanding of the drivers of inter-SME collaboration, but also prepare scholars for dealing with various challenges in project and process management, especially while adopting an action research design.

Limitations and Future Research

The main limitations of this study are related to the choice of a particular region with special characteristics; in this case a mix of high and low tech. This raises the question to what extent our findings could be replicable for other ecosystems with a substantial number of SMEs. Further research could take into consideration a comparative study of two or three ecosystems either from different countries and thus representing different cultural origins or

maybe “mixed” ecosystems in terms of companies’ strategic profile; this could be a mix of high-tech and low tech companies with service oriented enterprises.

Secondly, our study takes the ecosystem, with embedded SMEs, as a unit of analysis for understanding open innovation processes and practices, while further research could focus more on different or maybe also multiple levels of analysis (Gupta et al. 2007; West et al. 2006). Other units of analysis could focus more on the individual level of open innovation in a business ecosystem. This approach could concern managers and company executives and their role in value creation or in single firm contribution to ecosystem value capturing. Also the role of the “gatekeepers” in managing the knowledge flows across organizational boundaries within the ecosystem could be usefully explored. Another interesting unit of analysis could refer to inter-ecosystems relationships and the way how different ecosystems interact with one another as well as the role of SMEs embedded in various different ecosystems.

Our research findings point out the need of setting clear goals and business objectives for the ecosystem (Ritala et al. 2013; Adner & Kapoor 2010; Adner 2006), which imply further investigation of ecosystem leadership and a form of management, which could be suitable for the ecosystem members. Should the leader come from inside or outside of the ecosystem? If an outsider, how would it get the commitment of all members? If an insider, should this person come from a large company enterprise or from an SME?

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FIGURE 1
Map of the Ecosystem

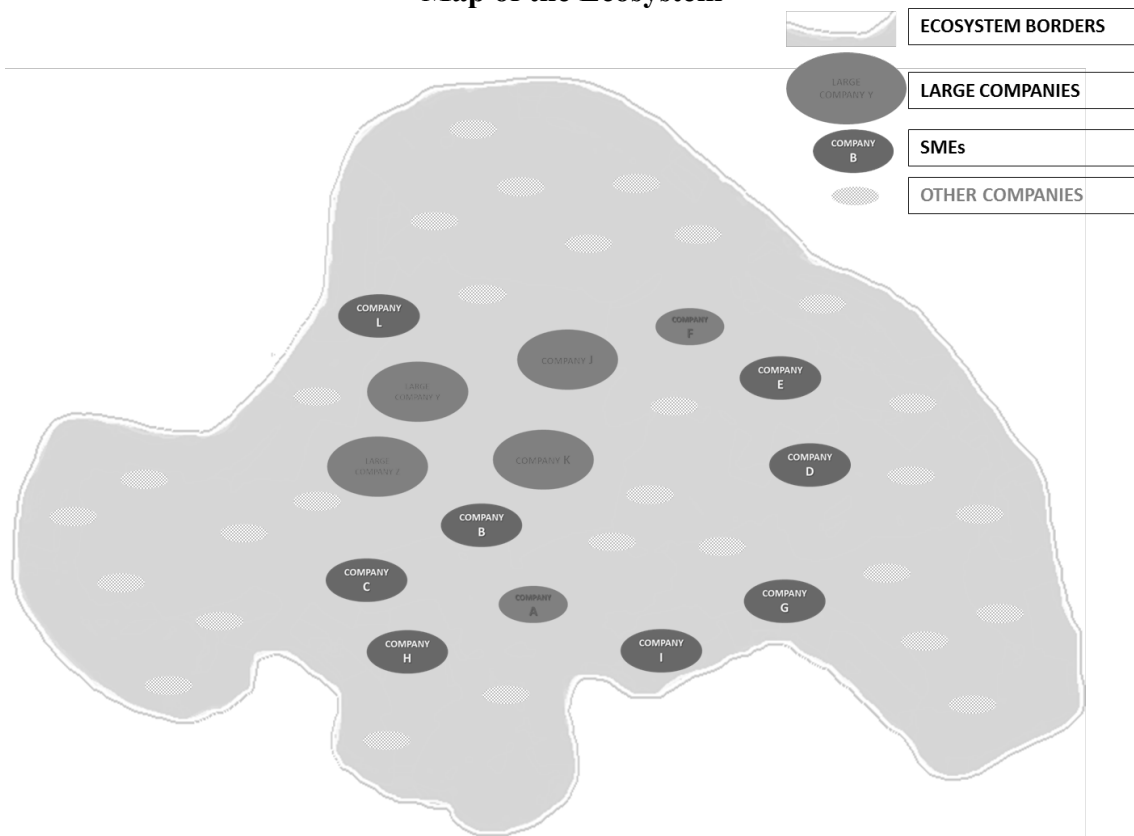


FIGURE 2
Map of Interdependencies between Ecosystem Companies

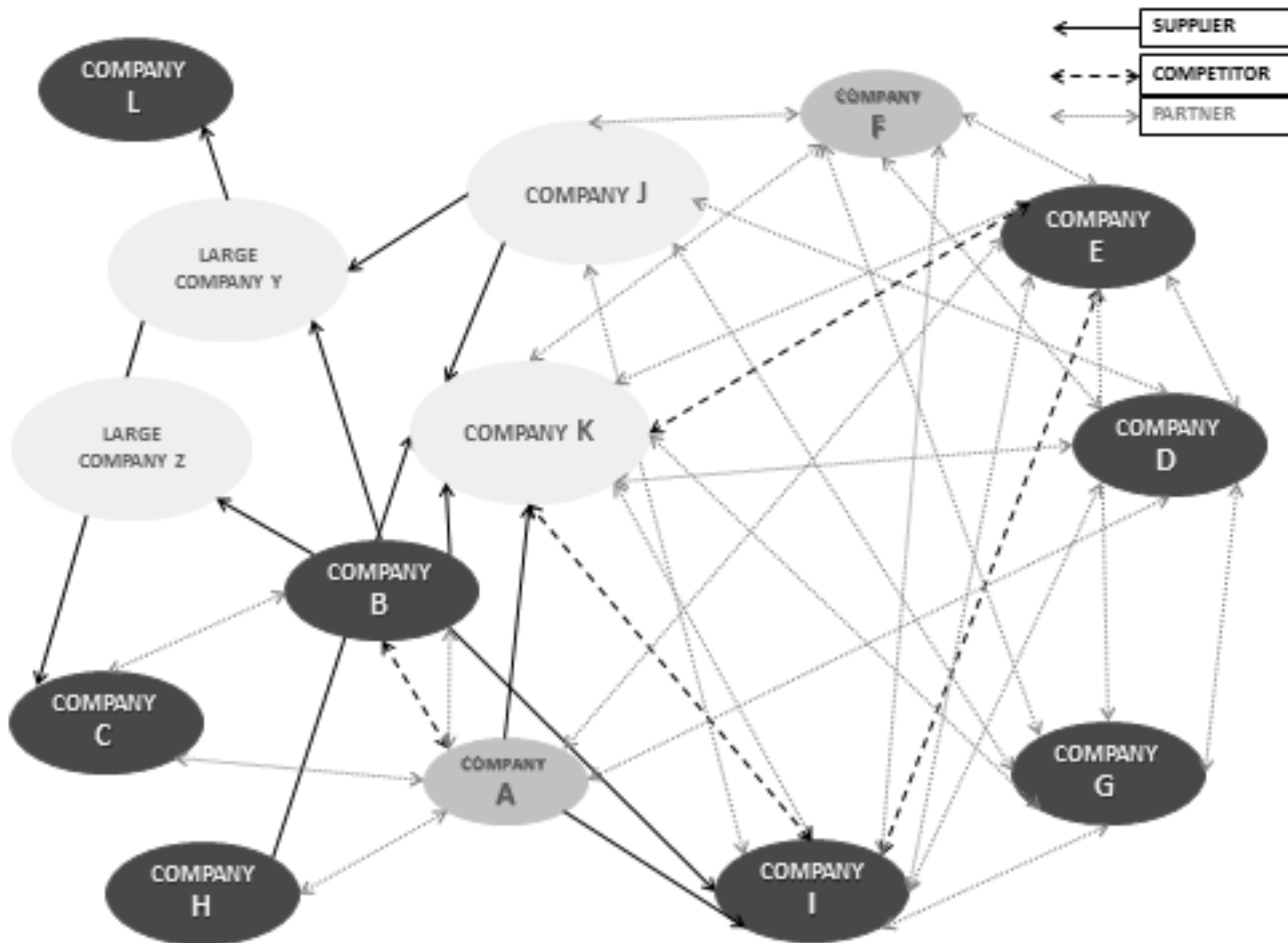


TABLE 1
Overview of Interviews

COMPANY	STRATEGIC PROFILE	NUMBER OF INTERVIEWS	INTERVIEWEE POSITION
A	Micro-enterprise	2	CEO
B	SME	2	Technical Manager
C	SME	2	Managing Director
D	SME	2	Development Manager
E	SME	2	Managing Director
F	Micro-enterprise	2	CEO
G	SME	2	Managing Director
H	SME	2	Managing Director
I	SME	1	Managing Director & HR Partner
J	Large company	2	Site Manager
K	Large company	2	Innovation Director & Head of R&D
L	SME	3	CEO

TABLE 2
Understanding of Open Innovation Across the Ecosystem

Evidence from Company A	Evidence from Company B	Evidence from Company C	Evidence from Company D	Evidence from Company E
<p>“we do that every day (...) the guys they don’t make anything else than new parts, so they do new parts and drawings and development and innovation every day, that’s actually also one of our strengths that we are able to make a solution for the customer”</p>	<p>”customer specify the solution we are making and it”</p> <p>”We have very few standard solutions, we’d like to have some more. But mostly it’s about 80% of our product is customized directly to one purpose”</p>	<p>“I think real innovation starts with what it is that the customer needs, and then we can say ok, how should we fulfil it (...). It’s not actually always what we are doing, we have one product that is new, and none of our competitors have.”</p> <p>“ (...) our production is 100% customized so we need to be close to our customers, and we focus on quality and we focus on delivery time and so on. ”</p> <p>”if you say product innovation, we innovate product every time. ”</p>	<p>“Innovation, in my view, is just having the right products at the right time. I mean, you may have a very, very smart solution but if it’s 5 years too early, I mean, there are no customers for it. So, what we do to be innovative is always to look at where the market is heading.”</p>	<p>“And we have from the beginning also been very focused on innovation we joined innovation camps - some years ago decided not to continue with this competition - but we still use what we have learned from that time having this whole organization to bring up ideas and have it structured so it’s not up to two or three managers to come up with new good ideas, but it is instead the whole company.”</p> <p>“I used to say a phrase from what Henry Ford said “If I have asked my customer what they really wanted? They would have said a faster horse, because they didn’t know it was possible to make a car. So nobody was asking for a car.” (...) if you are only doing what you asked to do, we don’t really do innovations. Because you have to bring in (...) the need, the problems that have to be solved, you need to get from A to B. It is not a faster horse you actually need. You need to get from A to B if it was back in Henry Ford’s time. And then you have to bring in new engineers and the technology how can we do this.”</p> <p>”I would not say if we are only doing what you asked us to do, we don’t really do innovations.”</p> <p>“(…) our main target is always to create value for our customer and their customers. Because at the end of the day we all trying to create added value for the end customer. (...) So we need to have the knowledge and what is the demand out there and to have this cooperation with our customer and to bring in our own ideas. And not just only do what they all ask us to do but also bring our own ideas.”</p> <p>”we are selling all our products to the companies they are building the xxx units. And they all have a strong content of customization. So that is our niche, we have standard platforms and standard products but we always or more-less always customize our products”</p>

TABLE 3
Challenges in Doing Business and Adoption of Open Innovation

Evidence from Company A	Evidence from Company C	Evidence from Company D	Evidence from Company E	Evidence from Company F	Evidence from Company G
„Trust as a key challenge in doing business.“	<p>“It’s a primary thing, the price, the quality, it’s delivery time, and it’s what our competition is about. Maybe the challenge could also be go into more complex markets“</p> <p>”So I think we will be afraid of [competitors] will take our knowledge out of the company. Because knowledge is everything that happens up there. ”</p>	<p>“Then we also try to influence the market by visiting conferences and doing speeches at transport conferences. So, we try to sell them this idea of modular solution and we try to tell them why we think it is a good idea to have a modular concept, instead of one of the projects.”</p>	<p>“Test facilities, prototypes, when you have the product you still need to develop the market, so it is not only product development.”</p> <p>“(…) generally universities and technology institutes have a different approach, different agenda. At the end of the day we are living from selling the products and technology institute and universities, are basically living from generating papers and research. (...) I do not fully understand and accept this focus for the universities and for the technical institute because that should be there, must be there to generate new technology but I think we just have to accept that we have different agenda. We are not interested in the technology for the technology; we are interested in the technology to bring it to our products, and agenda -sending an invoice. “</p>	<p>“We are creating a demand. Before us there would not be [product name] in any other Danish city”</p> <p>“The biggest challenge for a company like ours is the credibility in the outside, which makes it possible for you to sell to bigger player than yourself. This is always a problem for an entrepreneur in a niche market – why should we believe in you. “We don’t understand your technology, we cannot the evaluate it. So, we have to kind of rely on you.” (...) Building credibility in the outside is a big challenge. Then, of course, the finance, but those things are connected, because if you are credible, you can borrow money.“</p>	<p>“If you are a smaller company, you go to the market, you knock the door and they ask we already have anything, why should we buy things from you? We are better in this and this, so if we have a package, we can be better. That’s the strategy problems we have in small countries.”</p>

TABLE 4
Inter-organizational Knowledge Flows – Developing Core Competencies and Specialization

Evidence from Company A	Evidence from Company B	Evidence from Company D	Evidence from Company E	Evidence from Company G
<p>”AR: but then could you imagine having some parts to manufacture and outsource manufacturing to the supplier for instance? PH: that we already do! ”</p>	<p>”We are also outsourcing production to companies that have 100% percent focus on production they do it better than us”</p>	<p>“Well, I think we should be better at not inventing everything ourselves, but more using what’s available out there.’ (...) The system, the solution we supply is a combination products we develop ourselves and products we just buy and modify because, we are only [xxx] people here so we can’t invent or develop everything ourselves.”</p> <p>”Sometimes we use external contractors, because we don’t have the time and sometimes, of course, we don’t have the knowledge.”</p> <p>”we have outsourcing in our entire manufacturing process.”</p> <p>“We are very specialized in this field so... And that’s why I think that a lot of Danish companies should move to this specialized or experts in a certain area.”</p>	<p>“for instance you develop a product, but then (...) it would be good to be manufactured somewhere outside. (...) we don’t have our own manufacturing. “</p> <p>“(…) we did a lot of different things and we were not really good with anything of it because we were trying to do everything. So, what we decided in the beginning of 2000 was to really focus on one business (...), we had a quite good success with focusing on we took a lot of our existing products a lot of existing customers and also employees and we moved them to another company in [the city where the company is located]and said: ‘you can have our product and customers for free if does only one condition and that’s you can serve our customer for the next three or four years.”</p>	<p>“Our partners in China are manufacturing products (we have really embedded software), they do not know what it is. We ship these programmed components. So everything else you can copy, but we do not think this way generally, because we don’t have suppliers we have partners. And these partners we have worked with – te first one for 32 years now, the oldest one. At that time we didn’t know what we did, but it was before my time also, in the company. But at that time outsourcing was not a word, it was not known, but we just did it. And we have done it since and we were building up these relations; and still today we have these partners. “</p>

TABLE 5
Inter-organizational Knowledge Flows – Suppliers and Customers

Evidence from Company A	Evidence from Company B	Evidence from Company C	Evidence from Company D	Evidence from Company E	Evidence from Company G
<p>“AR: how would say, how much your orders depend on networking or the personal professional network that you have in the area? PH: 95%, it’s really much, really, really much. We don’t really have many customers, but they come again and again, so it is quite small amount of customers (...) luckily they are satisfied and they come several times. “</p> <p>“Our suppliers are very, very important, without good suppliers we could not exist.”</p> <p>”(…) you really need to instead of just look at you customer as a customer you need to look at you customer as a partner and involve you partner or the user in the project, you really need to challenge the end user in how do you want this, how will it be fit best into your company”</p>	<p>“AR: So how do you get to your customers right now? T: (...) we are making sell activities. We have also three salesmen to visit companies, but mostly it’s mouth to mouth. If we have an order to [Large Company Y – their biggest customer]., after some years they maybe go to LEGO and tell them that I have such good company and then LEGO will call us (...) A lot of it it’s based on network and people that we know, working together with them for ten years or more. “</p> <p>“The suppliers are making the research to make the products we need. And in this case, company like [supplier’s name], where we got robot technology, and then we are working together with them, the reason is not we want to take their knowledge of robot, and put into our own house. We want to work together, to create solution together for our customers.”</p>	<p>”what we know of technology comes from our suppliers. Because we are not producing electrical components, they are. They just tell us how they work, and it’s up to us to use them in our solutions. And we have to combine the components in the best way. A lot of knowledge could be software, could be what, components can do for electricity, they tell us. They have courses where we go to, so they are interested in telling about their products.”</p>	<p>“we have been active for more than 25 years, so we have a lot of good references. We believe that we are very innovative. Sometimes we are the first movers on implementing new technologies on [industry]. And it’s that we have a very close relationship with our customers and sub-suppliers. So, we always try to, in cooperation with our customers and sub-suppliers, try to find the best solution for everybody. “</p> <p>“(…) we talk a lot with specialized sub- suppliers who supply us an specific technology. We monitor how the technology changes because, I think, this is driven by the customer, but it is also driven by the technology. “</p>	<p>“A lot of knowledge we have learned got through our projects together with the customers. When we started this journey without some application knowledge today we have a lot more. And of course some of the knowledge also comes with the new employees that we get. “</p> <p>“two main partners are our customers and we have technical collaboration [with] either university or specific companies that have specialist and have very specific technology“</p>	<p>“(…) we don’t have suppliers we have partners“</p>

TABLE 6
Organizational Aspects of Open Innovation in the Ecosystem – Experience with Various Collaborators

Evidence from Company A	Evidence from Company B	Evidence from Company C	Evidence from Company E	Evidence from Company F	Evidence from Company G
<p>"I have been trying to work together with bigger companies and they don't think that way. They send you a bill like this so I cannot do this project with a bigger company because they don't care; (...) therefore I have chosen a smaller company that has the same opinion and the same challenge as we do and the same flexibility and also the same vision on what do we want in the future. "</p>	<p>"Our target clients now are mostly large companies near us, [Large Company Y] is our largest customer, and then of course [Company K] and xxx"</p>	<p>"I like to have the cooperation also with university and so on, because it's giving some inputs to me what is outside, together we are stronger"</p>	<p>"We have quite extensive collaboration with xxx University in terms of xxx and in term of xxx. So there we have PhD student and we have collaboration with them; and professors at the university make sure that we have access to latest knowledge "</p> <p>"we get a lot of ideas from outside, from customers, exhibitions, competitors, university, talking to different networks and we try to take the best idea, that is the most difficult parts, we cannot try to do them all. "</p>	<p>"We are pioneers in the field. So, we have to develop the knowledge. We do that mainly via public funded projects.(...) On the technology side we develop a lot by ourselves, but we have, most of it as background knowledge from our; from this environment, from [Large Company K], [Company D], from [Large Company Y] who have employees from almost all important companies here, in the region within the [their field of specialization]. And what we are talking about here is [their field of specialization] and generally good skills about manufacturing and product development which are more generic and more specific [their field of specialization]."</p>	<p>" (...) if you work in a company like [Company K], or like [Company Z] then you have to have different in your class and they have very different focus and very different perspectives and they know where to go and how to go and so on so forth. And that's exactly the difference between SME and the big companies, the entrepreneurship in the companies, the entrepreneurship and the innovation, sorry to say that but they don't belong to very small and high tech companies. They are not interested in what we are interested in, so we have tried so many times to cooperate with [Company K], we have had many more experiences with [Company Z], every time we failed. And then we can say why we failed. Is it their fault or our own fault? Or both together? But why we are not fitting, but it doesn't matter cause it's not working."</p> <p>"The product that we have developed and launched is the focus of our company. However, we have engaged in a new three year development project which we might put it in another company in order to avoid defocus (...). We are going to make [product] together with [xxx] as a partner. And also [the university supplying PhD students for the project]. We expect a lot from that project both of terms building more capabilities and knowledge, but we also think there's a market for that application. That's probably our most important innovation activity at the moment. Except of course, for all the incremental innovations that we do on the product itself.."</p>

TABLE 7
Organizational Aspects of Open Innovation in the Ecosystem – Competitors

Evidence from Company A	Evidence from Company B	Evidence from Company C	Evidence from Company D	Evidence from Company E	Evidence from Company F
<p>“ (...) it’s difficult, you need to trust, you really need to trust, but my theory is that instead of being two small companies which would not be able to take a big order then put yourself together with another company and take any order, which any of us would have had anyway, instead of competing for projects and customers saying your too small then do it together and (...) My theory is if we work together we can make really big stuff down here, but if you need to do it separately it would not be possible.”</p>	<p>“And to cooperate with more companies to get the right solutions. Sometimes it could be difficult, and could be large project that we can’t handle alone; therefore we have to go three or five company together to make solutions. “</p> <p>”AR: And how about competitors? Does that happen that you also cooperate with them? T: In some cases, like xxx that’s possible. Sometimes we work together with them, if it makes sense”.</p>	<p>What could be a risk? Of course the competitors, they are always risks. I think the risks are a lot about information and market data and what the prices are. It’s a lot about financial things, if you talk about risks. It’s not about knowledge because everyone can get knowledge about electrical components but maybe the risk is about strategy where to place your plugs and so on and what markets to focus on.</p>	<p>“it’s a small world, I mean every competitor, we know each other, we talk to each other, even when we are visiting fairs. I mean, we go to visit each other’s booth and check out the solutions so... Yes, and we also talk to them if there’s a new standard coming, we talk: Oh, have you heard about this standard? How are we going to approach it? So, it’s not that secret. “</p>	<p>“ (...) I thing we found a niche where we don’t have any companies do the exactly the same as we are doing. Of course there is one company here and one company there that are doing part of the same thing that we are doing, but we are, I would say, in a niche market where we are, we are selling only B2B”</p>	<p>“We love our competitors very much. AR: Why? RB: we have difficult time explaining, why to choose our solution. (...) and then they can see the competition and the prices are going down and so on. The customer thinks “Oh, that’s the norm”. If there is only one company trying to sell a product, they will never sell it. So, for us for the moment we know we are number one in quality and we are compatible on price and we make sure our competitors sell a little bit once in a while. So, we know that it doesn’t stop because we need both. “</p> <p>“I think we found a niche where we don’t have any competitors to do the exactly the same as we are doing (...) we use the same platforms for different customers. So we have small adaptations or sometimes in brackets only software that is the difference between products and even in the software we may be use the 80 percent of the software as the same for the different business area. So we can mass produce and have a small customization in the display, or in the box, or in the label, or in cabinet, or in the color, but not in the basic product, because that is expensive to make a new platform.”</p>