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Exploiting the known or exploring the unknown?

A study of management and interaction strategies in open innovation arenas

Master's Thesis in the Master's Programmes
Management and Economics of Innovation

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Abstract

Open innovation arenas are intermediaries that encourage collaboration and enable knowledge sharing across organizations. This report aims to study how management in terms of structures and processes influence the open innovation collaboration in an open innovation arena on an organizational level. Furthermore, how the purpose and focus of the collaboration affects the interactions are examined. This study is of great interest for both policymakers and participating actors in the arenas in order to make the most out of the collaboration.

The study is a multiple case study based on interviews with respondents from 12 open innovation arenas that differ in terms of initiator, size and purpose. The interviews were analyzed in an iterative process, where the empirical findings were categorized into predefined themes as well as coded using an open coding approach.

The empirical findings show that there is a trade-off between structure and openness to idea exploration. To structure the open innovation resources in terms of appointing individuals with responsibilities, developing common processes and systems as well as building clear organizations enables speed and ease the cooperation of companies. On the other hand, more structures tend to inhibit the openness for new possibilities and having an explorative focus

The ways of collaborating across organizations are many and this study is based on the five levels of interaction strategies defined by Ollila and Yström (2016); networking, coordinating, cooperating, collaborating and co-creating. Different interactions often occur in parallel within the same open innovation arena. However, our findings suggest that there is a difference in interactions depending on the purpose of the arena. Arenas can be arranged on a spectrum from exploiting the known to exploring the unknown which affects the way of interacting and running innovation projects. The strategic choice could also be a question of incremental or radical innovation, and what strategy fits best into what the initiative aims to achieve. This problematize the concept of open innovation arenas and suggests that there is a need to develop a common definition for what an open innovation arena actually entails. Finally, it is questioned whether all open innovation arenas make an active choice of how to interact, or if they rather act upon intuition.

Based on this research it is recommended for open innovation arena managers to engage key individuals and give them the responsibility to enable open innovation by connecting different actors. Furthermore, it is proposed to develop new ways of evaluating ideas and collaborations in order to increase openness to new ideas. Lastly, it is stated that a key factor to succeed with open innovation work is to create a focus within the arenas and a mutual commitment to the collaboration, before deciding upon the most suitable interaction strategy.

Keywords: open innovation, open innovation arena, knowledge ecosystem, open innovation interaction strategies, inter-organizational collaboration

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1. Introduction

This chapter provides an overview of the research topic. Furthermore, the aim, research questions and delimitations of the thesis are presented.

1.1 Background

The aim of this thesis is to explore interactions in open innovation arenas between organizations as well as individuals. The concept of open innovation has rapidly gained ground in organizations searching for new ways to innovate (Huizingh, 2011, Schroll and Mild, 2011). Chesbrough (2003a) explains how factors such as increasing mobility and venture capital have made closed innovation, where firms completely rely on in-house resources and capabilities, obsolete in most industries. In addition to this, the increased quality and quantity of research as well as of human capital has further driven this development. These factors have made open innovation a more successful strategy. The open innovation process can be a success factor for all sorts of enterprises and given the dynamic nature of how technology and services evolve, finding ways of keeping up with the development is pivotal (Badawy, 2011). However, for organizations to engage in and gain from open innovation, it is critical to understand what it actually entails. Chesbrough (2003a, p. 5) explains "*Open Innovation can be briefly defined as utilizing external as well as internal ideas as inputs to the innovation process, combined with employing internal and external paths to market for the results of innovative activities.*"

The hope to create and capture value both from within and from actors outside of the organization has led to a conversion from firm-centric to network-centric innovation (Coughlan & Coghlan, 2011) which has given rise to a large spectrum of innovation initiatives across both organizations, sectors, industries and nations. Alliances, networks, communities, consortia, ecosystems and platforms are all ways of collaboration that has been described in open innovation research (West, 2014). These driving forces and the goal of fostering network-centric innovation has led to the emerge of "places" where collaboration among actors is encouraged, so called open innovation arenas (Elmquist et.al., 2016; Sivam et. al., 2019). As confirmed by both Sinnewe et al. (2016) and Järvi et al. (2018), such collaborating initiatives are complex and come with challenges. Therefore, an understanding of how these open innovation arenas are organized and how that affects the open innovation processes is of great

interest for both policymakers and the participating actors in order to make the most out of the collaboration.

Ollila & Elmquist (2011) portraits the open innovation arena as an actor aimed at enabling open innovation within a certain area of expertise. To achieve dynamics, the triple-helix model - where government, academia och industry collaborate - has been a common way to organize such arena (Leydesdorff & Etzkowitz, 1996). Apart from this, open innovation collaboration can take various forms and many of these constellations have been mentioned in recent research, such as knowledge sourcing (Laursen & Salter, 2006; Spithoven, Clarysse, & Knockaert, 2011), crowdsourcing (Jeppesen & Lakhani, 2010; Afuah & Tucci 2012), inter-organizational alliances (Stuart, 2010; Faems et.al., 2010) and licensing agreements (Arora, Fosfuri & Gambardella, 2001; Bogers, Bekkers & Granstrand, 2012). However, Bogers et. al. (2017) state that there is a need to connect and understand the links between this growing span of open innovation perspectives. Furthermore, Bogers et.al (2017) suggest that a multi-level perspective is essential, since factors on one level of analysis impact others. For example, at the organizational level, structures and processes that facilitate open innovation might create contingencies on individual capacities to drive open innovation or how the dependencies between the different actors evolve (Bogers et. al., 2017). Much of the conducted research has had a firm-centric view. This study focuses on the arena perspective and serves as a complement of the research on other levels and perspectives. This report aims to contribute to the research gap by studying how the management, in terms of surrounding organizational structures and management processes influence the open innovation process in an innovation arena on an organizational level.

When engaging in open innovation collaboration, an understanding of what interaction strategy or strategies to choose is useful in order to be aware of what to expect, how to act, what results to hope for and how to evaluate the value of the collaboration. Furthermore, it is important to acknowledge that organizations as well as open innovation initiatives are complex constructs and might need to employ multiple interaction strategies simultaneously. Nevertheless, strategy choices or the lack of a clear strategy can have significant influence on what management approach is suitable to achieve the best results in specific situations. Previous research on open innovation has examined how individual firms have opened up their innovation processes (Rohrbeck et al, 2009; Takahashi, 2002; West, 2014). Many of them are case studies from a focal firm perspective on how to organize for open innovation and reasons of both success and

failure. Thereby, we argue that this study contributes with a deeper understanding of the organization of as well as the interaction strategies used in open innovation arenas. Furthermore, we hope to add on to previous research on the structure, coordination and organization of innovation ecosystems and joint knowledge creation (Clarysse et al., 2014; Rohrbeck et al., 2009; Ritala et al., 2013; Järvi et al., 2018). On that basis, the following research questions will be addressed;

1. In an open innovation arena, how do surrounding organizational structures and management processes influence the open innovation processes?

2. How does the purpose of the interaction affect the choice of interaction strategy in an open innovation arena?

1.2 Delimitations

This study is delimited to open innovation arenas active in Sweden. The analysis and conclusions of this study will be drawn based on empirical findings from the managerial perspective and other roles' perspectives within the arena will not be considered. The research questions will be addressed delimited to the understanding of the reasons behind strategic choices, but the level of success for different arenas will not be evaluated.

2. Theoretical Background

This chapter introduces the concept of open innovation and provides the rationale behind the concept. Furthermore, different open innovation strategies are highlighted.

2.1 Characterizing Open Innovation

Chesbrough (2003a) describes that open innovation is to utilize from internal as well as external resources throughout parts of, or the entire, innovation process. Herzog (2011) explains the innovation process consists of two distinct parts, the generation of ideas and the commercial exploitation. In another study by Rohrbeck et. al (2009) four categories of activities are used; (1) *Idea* generation which includes all activities that contribute to development of innovation, (2) *Research* where resources are directed to research or sourcing of new technologies, (3) *Development* which includes the creation of new products or services and (4) *Commercialization* where activities such as bringing the product or service to market are included.

Herzog (2011) argues that firms have realized that the importance of overall control of innovations has diminished and that valuable ideas do not need to originate from within the firm. The author points out some underlying factors for the rise of open innovation. First of all, the technology intensity has increased, and most companies are unable or unwilling to afford the demanded R&D. Secondly, the complexity of the technology has increased, and the R&D often demands interdisciplinary research. This factor has caused the innovation process to result in higher costs and higher risks. A single firm is unlikely to rely on solely internal R&D to generate radical innovations. Another critical factor for open innovation is the increased availability and mobility of knowledge, implying that useful knowledge is widely distributed. Furthermore, using internal as well as external ideas and technologies as well as paths to market can advance innovation projects. Chesbrough (2003b) explains the difference between open and closed innovation in in six principles, see table 1.

Table 1. A comparison between the rationale for open versus closed innovation adapted from Chesbrough (2003c, p. 38)

Closed Innovation Principles	Open Innovation Principles
The smart people in our field work for us.	Not all the smart people work for us, so we must find and tap into the knowledge and expertise of bright individuals outside our company.
To profit from R&D, we must discover, develop and ship it ourselves.	External R&D can create significant value; internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to the market first.	We don't have to originate the research in order to profit from it.
If we are the first to commercialize an innovation, we will win.	Building a better business model is better than getting to market first.
If we create the most and best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our intellectual property (IP) so that our competitors don't profit from our ideas.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

Chesbrough (2003c) points out how open innovation enables idea generating, synergies and spreads and develops knowledge. Furthermore, the author highlights how open innovation creates opportunities for companies to commercialize ideas through external channels, which are not available in closed innovation processes. The author argues that open innovation is not only beneficial for the firm itself, but also for the society as whole. However, it is important to highlight that organizations should not necessarily use the same exploitation strategies for all services and products. Furthermore, Chesbrough (2003c) explains that open innovation is not a replacement for internal innovation work but rather a different way of generating ideas and develop innovation. According to Huizingh (2011), the effectiveness of open innovation is depending on the context and surroundings. In order to benefit from external resources and to move from closed to open innovation new ways of working and new structures need to be established within and around the firm.

2.2 Understanding the Open Innovation Arena

Collaboration across boundaries and across organizations has become a common way to meet the increased demand for complex innovation (Keys & Malnight, 2012). As Järvi et.al (2018) describes, the increase in complexity and scope of scientific and societal problems has given rise to knowledge ecosystems including individual and organizational actors as well as private and public sectors. National policy makers work to foster those ecosystems and promote knowledge and innovation. Gassmann and Enkel (2006) use an empirical database of 124 companies and identify three types of open innovation strategies; (1) The outside-in process where the knowledge is inbound e.g. crowdsourcing and innovation contests, (2) The inside-out process where the knowledge is outbound e.g. such as out-licensing and corporate venturing, (3) The coupled process where the first two processes are combined e.g. such as innovation jam and co-creation partnerships.

Tekic and Willoughby (2017) describe that companies rely more and more on contributions from externals, not only customers, but also networks of universities, start-ups as well as individual researchers and students. The increase in mobility of both skill and knowledge has given rise to innovation intermediaries (Afuah, 2003; Herzog, 2011). Knowledge tend to migrate more frequently between companies and since knowledge is distributed among various actors, companies have difficulties to protect, appropriate and control its R&D (Chesbrough, 2003b; Herzog, 2011). Another factor triggering companies to seek external collaborations is industry convergence (Herzog, 2011; Bröring & Leker, 2006; Bierly & Chakrabarti, 1999), which is the phenomena of that many industries face convergence when it comes to value proposition, technologies and markets (Choi & Valikangas, 2001). Moore (1996) argues that the result of these economic systems with complex network is hard to predict. However, companies in this kind of dynamic environment need to coevolve in an economic system in order to have a competitive advantage. This follows the evolvement of the different generations of innovation arenas as described by Thelander (2016). When innovation arenas and science parks emerged in the 1950's, the focus was to facilitate a physical space. As the arena evolved, it came to offer networks and venture capital. The most recent concept of the innovation arena is co-creation.

The actors involved in an open innovation arena can be from both the public and private sector, and very often a combination of both, that come together to work either with a technological

or societal challenge (van der Borgh et al., 2012; Clarysse et al., 2014; Valkokari, 2015; Doherty & Dunne, 2011; Järvi et al., 2018). It is also common that these initiatives arise out of geographical reasons by actors and organizations working in complementary fields (van der Borgh et al., 2012). Clarysse et al. (2014) explain that either way, these kinds of initiatives result in a greater effectiveness in the search for new knowledge and value creation since they make room for complementaries and synergies. Järvi et al. (2018) have studied the phenomena of knowledge ecosystems which they define as *"A knowledge ecosystem consists of users and producers of knowledge, organized around joint knowledge search."* which is aligned with the purpose of an open innovation arena initiative. Järvi et al. (2018) concludes that there are two distinct types; (1) the joint search *for* a knowledge domain and (2) the joint search *within* a knowledge domain. Table 2. visualize the differences and characteristics of the two ways of organizing.

Table 2. A summary of the characteristics of the two ways of organizing a knowledge ecosystem by Järvi et al. (2018)

Identification of a joint research domain	● Actors participation is affiliated, self-resourced and unobliged ● Aim to identify and establish shared knowledge as a basis for collective actorhood ● No formal rules or coordination mechanisms
Joint research within a domain	● The knowledge domain has already been identified ● Actors search and reveal problem- and solution-related knowledge ● Actors participate through formal membership and access to resources ● Actors contributions are monitored

Järvi et al. (2018) raise some challenges linked to the different ways of organizing the knowledge ecosystems. Starting with the one where the identification of the research domain is the objective, the formulating of the goal serves an important function. A common goal and formulation of a purpose make the research program more convincing and enable the participants to act as a bigger unit. This results in the research program having a higher impact and better chances in the seek for funding. On the other hand, their respondents argue that finding a common goal is complex because of the broad scope. Another challenge raised by Järvi et al. (2018) is that a chicken-and-egg problem often arise in the preparation of a research program. What is meant is that there is a challenge in deciding what actor should first set the target - the companies or the research partners? They put it; "*Should the research partners first*

define problems or opportunities that might prove to be of interest to companies, or should companies first indicate their needs, enabling the research partners to then provide solutions? (Järvi et al. 2018, p. 1530). Examining the purpose as well as the formulation of the common goal is therefore of interest when addressing how organizational structures affect the open innovation process.

A difference between the two knowledge ecosystems that Järvi et al. (2018) compares, is that the first one formulates a common goal, while the other reinforces the common goal. A result of the second one is that when new actors join the ecosystem they must align their activities and interests with the established domain. The respondents of the study argue that this does not delimit their work since the common goal can be updated and broadened. Other studies by Iansiti and Levien (2004) and Ostrom (1990) argue that any multi-partner collaboration requires some level of common objective. However, it would be of interest for this study to analyze if the identification versus reinforcement of a common goal affects the flexibility as well as openness to new ideas in the open innovation process.

2.3 Supporting structures and processes

Open innovation processes have proven beneficial expanding firms' boundaries and acquiring technological capabilities (Laursen and Salter, 2004, 2006). However, combining several internal and external sources of knowledge as well as different collaborations with external parties have been shown beneficial in several studies (Arora & Gambardella, 1990; Cassiman & Veugelers, 2006; Freeman, 1991) before the work of Chesbrough (2003a) and the emerge of open innovation as a management term. As stated by Freeman (1991), it is and has been common for firms to use their in-house absorptive capacity in combination with scientific, user, customer and competitor linkages in their innovation processes. Håkansson and Snehota (1995) describe that the aims and expectations tend to increase in complexity with the number of individuals and actors involved. Additionally, a firm's routines and processes are closely connected to the critical resources (Dyer and Singh, 1998). Innovation in an open innovation arena can therefore also come with several challenges, such as unclear system boundaries, heterogeneous actor preferences, lack of network competence or sensemaking, no legitimate authority or challenges coming with the fact that the network is self-organized (Yström et. al., 2019).

In a study of 756 multinational companies across a diverse set of industries, Zynga et. al (2018) show that supporting processes and structures are essential to enable open innovation. Despite the fact that Zynga et. al. (2018) study focusing on companies and not on open innovation arenas, it is highly relevant to this research since the underlying open innovation competencies can be argued to be enable open innovation in any type of organization. However, it is important to consider this difference in context in the interpretation of the findings. The identified open innovation capabilities are related to creating a successful open innovation organization.

Zynga et. al. (2018) highlight three categories of open innovation capabilities in terms of competencies and routines; (1) Key individuals, (2) Clearly defined innovation process and (3) Organizational structures. Key individuals can have two distinct functions, either as a scout or as a gatekeeper. The first identify advances in science and technology that can be useful and the later support the transfer and dissemination of external technology into the organization. Zynga et. al. (2018) explain that the more open a company becomes, the more likely the company is to have a company structure that involves technology scouts and gatekeepers. In addition to key individuals, the authors highlight the importance of clearly defined innovation processes. These open innovation capabilities are fundamental in order to cope with the external inputs and be able to select and integrate valuable ideas with existing knowledge. This involves processes to identify, evaluate and nurture ideas. Thirdly, organizational structures need to foster knowledge exchange. This includes dedicated responsibilities, incentive systems, informal network structures e.g. communities of practice.

In another study, Wikhamn and Styhre (2019) identify four processes for open innovation enactment, based on empirical data from a case study of Astrazeneca's open innovation arena, BioVentureHub. The processes are (1) Conceptualization, (2) Mobilization, (3) Operationalization and (4) Facilitation. The first three processes include activities to prepare for open innovation and are called open innovation groundwork. These activities are normally not considered as open innovation per se. However, they are essential for the innovation process. The fourth process involves translate the groundwork into open innovation. On a high-level perspective the four processes of Wikhamn and Styhre (2019) aim to establish the open innovation capabilities argued by Zynga et. al. (2018). The conceptualization and mobilization are processes to identify and involve key individuals and actors. Furthermore, the

operationalization is a process where the innovation process is defined and formalized. Lastly, in the facilitation process the organizational structures are created.

Conceptualization

In general, conceptualization is a high-level simplified view of a complex system containing objects, concepts and relationships between them. Wikhamn and Styhre (2019) mean that this process includes outlining the purpose and the aim of the initiative as well as establishing guiding principles that are important for the initiative. Furthermore, this process includes forming models and frameworks in order to structure work and resources as well as provide guidance to operations.

Mobilization

This process consists of gaining internal support from the top management within the firm, enrollment of partners and media attentions and focuses on mobilizing resources and allies to the initiative. Aldrich and Fiol (1994) highlight the importance of gaining legitimacy in order to succeed and to secure access to resources. Open innovation involves several stakeholders, as a consequence it is essential to develop attractive and plausible concepts that are tailored to the actors' specific needs.

Operationalization

The third part of the innovation groundwork is the operationalization which includes mapping offerings as well as creating infrastructure, processes and contract arrangements. A large part of this process is to create systems and routines to enable open innovation. Wikhamn and Styhre (2019) explain how formalizing activities and developing documents and protocols is time-consuming but eases the interactions and co-operation with new actors. The authors argue that operationalization is a key enactment process in any form of open innovation initiative.

Facilitation

On top of the open innovation groundwork, the preparing for and the facilitation of open innovation is crucial for the success of the innovation platform. As a part of this, the management team of BioVenture Hub emphasized the importance of encouraging and coordinating open innovation initiatives. In order to encouraging open innovation, there need to be a catalyst for collaborations. The BioVenture Hub team arranged structured activities such as shared workshops and monthly meetings as well as mingles and discussions of various

topics. In addition to this the authors highlight that the encouraging of discussing new ideas can be more informal as well, such as having a coffee or lunch together.

2.4 Open Innovation strategies

In a research based on a systematic study of empirical qualitative research, Ollila and Yström (2016) present a taxonomy of open innovation interactions. More specifically, 159 scientific publications on open innovation were analyzed and coded, resulting in a classification of the interaction strategies as an extension of the framework by Himmelmann (1996). As seen in figure 1, the categories are based mainly on the character of the relationship and the purpose of the interaction between participating organizations. The five strategies identified are networking, coordinating, cooperating, collaborating and co-creating.

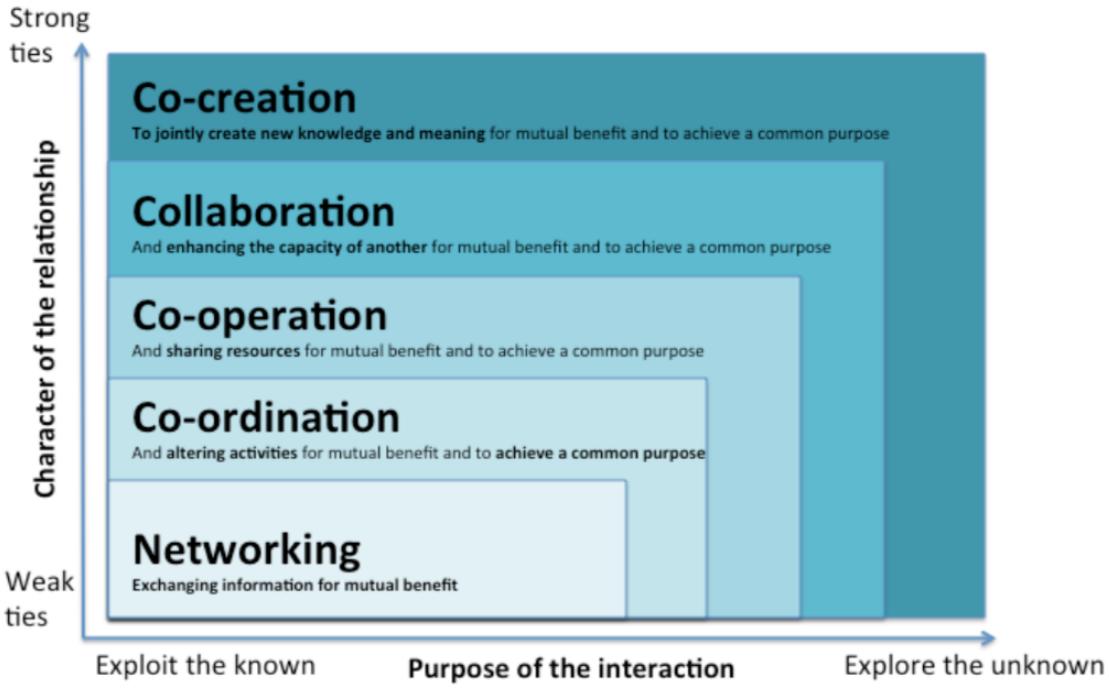

Figure 1. A classification of interaction strategies in open innovation (Ollila & Yström, 2016).

Networking

Ollila and Yström (2016) conclude that this interaction strategy is characterized by loosely coupled relationships and weak ties between the company and the end-users. The focal firm is the actor that primarily benefits on the exchange of knowledge and the opportunity of idea exploitation. Communities, innovation networks, crowd-sourcing, mass-customization, idea competitions and intermediation are typical forms of interaction that falls under the networking category (Ollila and Yström, 2016).

Co-ordinating

Similar to networking, the relationships in the coordinating category are loose and Sieg et al. (2010) describe that relationships typically are of arms-length. Coordinating differs from networking mainly in the sense of that the interaction process has a joint direction (Ollila and Yström, 2016). A way of coordinating the innovation process is to use an innovation intermediary (Howells, 2006; Sieg et al., 2010). Another way related to the coordinating interaction strategy is the formation of alliances (Bogers, 2011).

Co-operating

By using the cooperating strategy, the ties between the actors are stronger compared to the networking and coordinating strategies. Westergren (2011) describes that the relationships are based on mutual trust and that such a strategy should include the creation of mutual value. The interaction could be the formation of consortiums (Ponte et.al., 2009) or integration of suppliers (Sjödin and Eriksson, 2010) as well as users/customers working towards a common purpose (Westergren, 2011).

Collaborating

Open innovation ecosystems and open source developments are forms of interactions with stronger ties and relationships between the actors and related to the collaboration category (Ollila and Yström, 2016). Compared to co-operating, the relationship is not only about trust but also about commitment and Ollila and Yström (2016) explain that such collaboration involves a higher level of investments to enhance the capabilities of the other part. Furthermore, these interactions are typically characterized by a higher degree of uncertainty.

Co-creating

The co-creating category has the highest level of relationship strength, engagement, uncertainty and alignment towards a common purpose (Ollila and Yström, 2016). Co-creation is a fifth category proposed by Ollila and Yström (2016) as an extension of Himmelman's (1996) framework. The focus of this type of interaction is the joint creation of knowledge and collective exploration (Agogué et al., 2013). Ollila and Yström (2016) explain that this interaction strategy is common when the objective goes beyond both actors' capacity which implies that the purpose is to jointly explore and create a common meaning and benefit. Examples of such interactions are Living labs and open innovation arenas.

3. Methodology

The following chapter serves to give transparency in the research process and contains a discussion of the methodological choices of this study. The research design is described, followed by a reasoning of the logic behind the empirical context and data collection. Finally, we elaborate on the method of analysis and the approach to address the research questions.

3.1 Research Strategy and Design

The research design is a plan where decisions regarding how the research is to be conducted, with what research method and for what purpose (Babbie, 2004; O'Sullivan, Rassel and Berger, 2007; Creswell, 2008). The research questions are fundamental in these decisions, since the research are to be designed with the aim of answering these questions (Bryman and Bell, 2015).

This study originates from the managerial concept of open innovation, but since open innovation has grown to entail a wide array of meanings, the interest emerged to understand *how* this intra-organizational collaboration is actually conducted, and in what way actors interact and organize themselves to manage open innovation. When this study was proposed, it built upon the research done by Himmelmann (1996) and more specifically Ollila and Yström (2016) where they conceptualize five levels of interaction strategies in open innovation collaboration, and how they form in terms of relationship ties and purpose of the interaction. At a first stage, this study aimed to complement this conceptualization by delineate empirical cases of open innovation interaction strategies. As the data collection emerged, the interest grew to further understand the open innovation *arena*, where usually both academia, the public and private sector go together with the aim to intensify innovation in a certain area through open collaboration initiatives. The design of the research was thereby a progressive and iterative process, where attention was focused to further understand the organization of open innovation arenas and how the degree of structure affect the open innovation process. In that sense, this study is of exploratory kind with the purpose to give further insights and understanding for how open innovation is conducted in open innovation arenas, both when it comes to processes and structures as well as in terms of purpose of the interaction. Since the focus lie on how open innovation as a concept and not related a specific industry or technological field, the research strategy has been to study the structure and strategies of multiple open innovation arenas, rather than doing a case study observing one open innovation

arena. Since the purpose of this study is to *understand* how processes, structures and strategical choices affect the open innovation arena, it follows a qualitative research method which suits well for narrative research and grounded theory studies as described by Creswell (2008) as well as Abutabenjeh and Jaradat (2018).

An abductive research approach, referred to as systematic combining (Dubois and Gadde, 2002), was identified as a useful method in this study given the complexity of the different layers and interdependencies affecting the research topic. As Dubois and Gadde (2002, p. 555) states; *"Empirical observations might result in identification of unanticipated yet related issues that may be further explored in interviews or by other means of data collection. This might bring about a further need to redirect the current theoretical framework through expansion or change of the theoretical model."* Furthermore, abductive reasoning can increase the coverage of 'add-on objectives' that might not be identified the start (Woodside, 2010).

The study is designed as an embedded case study (Scholz & Tietje, 2002) of twelve arenas representing units of analysis. Since the starting point of the research was the five levels of interactions strategies, the data collection and interviews focused on the number of actors involved in the collaborations, how projects are run and how formal organization around them look like. However, as the data collection evolved, it showed a polarization between the arenas in the sense of having a well-defined structure and process or on the other hand having taken the active decision of having that minimum structure possible in order to increase openness for new possibilities and having an explorative focus. During the data collection the research questions were further refined towards examining this balance of structure a non-structure, and how these differences in approach affect their projects. The interview questions and discussion got into more detail on how projects are initiated, the driving forces behind the initiatives and if or if not they have pre-defined objectives. After this discovery, the research question was formulated with a clearer focus on the purpose of interaction to capture the spectrum of exploiting the known versus exploring the unknown. With that, the research question addresses the need to connect and understand the multiple levels of open innovation as proposed as by Bogers et al. (2017). Furthermore, contribute to an understanding on how arenas differ to each other on an organizational level and how the chosen strategy impacts the open innovation process, which are of interest for companies, research partners and policymakers working on innovation initiatives.

3.2 Data Collection

Dubois and Gadde (2002) explain that when collecting data, there is a risk that the researcher search for data that are in line with the current theory or framework. Therefore, it is recommended to use multiple sources that can lead to discoveries of new aspects and dimensions of the research problem which can redirect the study.

3.2.1 Literature study

An extensive review of previous open innovation literature and research was performed as a part of the definition of the project purpose and conceptualization stages following the framework by Babbie (2004). Approximately 200 articles related to Open innovation arenas, Open innovation strategies, processes and organization were studied. The literature studied has primary been published books and peer-reviewed articles. The literature study aims to provide an overview of the research field in question, identify themes and gaps of current body of literature and guide the direction of the study. The literature study also serves as a foundation for what data to be collected and how this data can be interpreted and analyzed to draw conclusions.

3.2.2 Interview design and interviewee selection

Since the purpose of this study is to understand the construct of open innovation arenas and their purpose of interaction, interviews are used as the primary data source. Qualitative interviews were held as proposed by Easterby-Smith et al. (2015) since it is a preferred method of discovering and understanding a phenomenon. Semi-structured interviewing format was used since it provided the flexibility to ask follow-up questions and thereby make sure that the concepts are fully understood (Bryman and Bell, 2015). Since this study is exploratory, semi-structured and open-ended interviewing techniques gives the possibility to gain further insights compared to a closed interview format or questionnaire. As Patton (1990, p.21) explains *"... the qualitative findings are longer, more detailed, and variable in content; analysis is difficult because responses are neither systematic nor standardized. Yet, the open-ended responses permit one to understand the world as seen by the respondents."* Furthermore, Patton (1990) argues that it gives the researcher the opportunity to capture points of view that does not fall into predetermined categories, such as a questionnaire. When conducting a qualitative study, Mason (2002) highlights the need to contextualizing the question. This means relating the

question something tangible in order to ensure the quality of the response. An interview protocol was prepared for each interview and the structure follows the suggestion by Mason (2002) to start with open questions and gradually go into more detail in the follow-up questions, preferably connected to specific examples. The interview guide can be found in Appendix A. All interviews were held in Swedish and the order and wording of the questions were adjusted in order to create a natural flow in the interviews. During the interviews, one researcher facilitated the dialogue and kept the interview structured while the other researcher focused on following up on interesting insights from the interviewee and to ask follow-up questions. This interview design was considered to enable structure as well as a deep understanding of the interviewees' perspectives. Each interview lasted between 40-90 minutes.

In order to address the research questions 12 interviews were held with respondents from 12 different open innovation arenas. In order to create a comprehensive understanding of different perspectives relating to our research questions, a variety of open innovation arenas were contacted. The open innovation arenas are arenas that describe themselves as arenas conducting open innovation work. In addition to this they operate in different industries and have different purposes, areas of focus and owner structures. Furthermore, the respondents from the arenas were chosen based on their role in the arena. In order to get a comprehensive description of the management processes and structures as well as the strategy choices people with a complete overview of the hub such as CEO, COO or Project managers were contacted and interviewed. The context of the open innovation arenas and the roles of the interviewees are presented in table 3 below. It is important to highlight that all of the interviewees have some kind of leader engagement and potentially have an over-optimistic view of their arenas work and strategies. This is a possible bias to the study.

Table 3. Overview of interviewees

	Respondant	Focus	Partners	Initiator
Bio Venture Hub	CEO	Biotech and medtech	31	AstraZeneca
Ericsson Garage	Innovation Leader	All industries outside Ericsson's core business	N/A	Ericsson
HSB Living Lab	Project Manager	Future living	12	HSB
Innovatum	CEO	Renewable energy, Maritime industries, Creative industries, Sustainable production and Sustainable transport	N/A	Triple helix
Lighter Arena	Programme Director	Lightweight solutions within Shipping, Energy, Aviation, Automotive, Workshop, Infrastructure, Construction, Meditech	70+	Triple helix
Lindholmen Science Park	COO	Transport, ICT, visualization and media, focusing on tomorrow's mobility for people and goods.	375+	Triple helix
Mobility XLab	Program Manager	Transportation	6	Triple helix
Sahlgrenska Science Park	Project Manager	Life science industry	90+	Triple helix
Swedish Food Arena	Steering Committé	Food industry	60+	Triple helix
Synerleap	CEO	Innovation transfer across industries; Industrial automation, robotics to grid technologies, smart cities, buildings and transportation technologies.	27	ABB
Urban ICT	Project Coordinator	ICT Technology	30	Triple helix
Visual Sweden	Project Manager	Visualization and image analysis	50+	Triple helix

3.3 Method of Analysis

Cooper and Schindler (2012) means that a useful approach to analyze data coming from open-ended interviews is to categorize or group the answers. All interviews were recorded. This improves the reliability since it makes it possible to go back and listen to the interviews. The first phase of the analysis phase was to transcribe all interviews. The transcriptions were read through several times and themes were identified, both through previous research as well as emerging from the empirical findings. From the research by Zynga et. al (2018) as well as Ollila and Yström (2016), several areas of interest were identified that lie as a foundation to the thematic coding performed in the analysis. However, through the data collection phase several other themes emerged that gave light to new dimensions that supplemented and modified the analytical framework. This continuous interplay between preconceptions and collected data has guided the research process as suggested by van Maanen et.al. (2008). This analytical approach goes in line with having a tight and evolving framework when performing

systematic combining as described by Dubois and Gadde (2002). The method of analysis has thereby been an iterative process, where the empirical findings were categorized into predefined themes as well as coded using an open coding approach. Table 4 contains examples of how the coding was conducted, starting from the raw data to the left. Excerpts from the raw data was coded into open codes as well as categorized into concepts/themes which led to the subheadings in the analysis and discussion. The open codes could vary in length and after each interview had been individually coded, the relevance of each codes was discussed according to the research questions.

Table 4. An extract of the coding process from the data analysis

Representative empirical material / Raw data	**Open codes**	**Themes / Concepts**
"A typical project is that we work with one large global supplier and their value chains with subcontractors and try to raise their level of competence and strengthen their products and services, so that they become more sustainable and competitive. Our focus lies on building entire industrialization value chains which might be different compared to an arena in a metropolitan area, since we work closer to the commercialization and introduction phase. We help build knowledge and increase productivity."	**Strengthening existing business**	**Exploiting the known**
"A project has usually started with some form of workshop or brainstorming where we try to make sure that all partners are involved. You work together for two days and look at where we find touching points between our companies and then you formulate a project after that."	**Identification of a common purpose** **High involvement** **Strong ties**	**Co-creating**
"We usually compare ourselves with a junction box, we sew together two worlds that do not always meet. Especially smaller companies do not really have the same inputs as AB Volvo, Ericsson or Astra Zeneca or similar large companies. We are a facilitator, catalyst or similar, to make it happen." "If I [project manager at the arena] lift up the phone and call SSAB, Siemens, the municipality or another large organization, it will be an easier conversation for me than for a small start-up company of 5 people who wants to access a big company. So, we are a coordinator or facilitator for impossible meetings, or at least very difficult meetings, to happen. Usually when a small company calls Siemens it is often that "Hi, we want to sell this", but if you can push them into a project that both can benefit from instead, that is to say, Siemens	**Enabling function** **Matchmaker** **Early project phase**	**Coordinating**

may benefit from investigating something but does not have the cutting-edge expertise that perhaps the small company has."		

3.4 Quality criteria of the study

Credibility, confirmability, transferability and dependability are criteria to ensure quality in qualitative research studies (Guba, 1991; Shenton, 2004). Credibility refers to internal validity and several methods recommended by Shenton (2004) have been used to ensure this criterion is fulfilled. Since the study is based on a wide range of open innovation arenas as well as informants, triangulation via data sources could be carried out to verify individual perspectives and different arenas against each other. This increases credibility as well as minimize the effect of conclusions being drawn on factors related to one organization (Shenton, 2004). Furthermore, using data collected from several different organizations generates a more stable yet diverse view on reality (Dervin, 1983). A risk when collecting data through interviews, there is a risk the interviewee does not talk freely or truthfully because they are afraid to lose credibility (Shenton, 2004). To decrease this effect, all respondents of this study were approached individually and have agreed to participate voluntarily. Furthermore, emphasize was put to make sure the respondent was aware of that there was no right or wrong answer to a question and that they could refuse or withdraw at any time. During interviews, iterative questioning was performed, and respondents were encouraged to provide examples from their own experiences, to further ensure credibility.

Confirmability refers to the objectivity of the research, and when carrying out research, both qualitative and quantitative, there is the dilemma of not achieving real objectivity (Patton, 1990). The triangulation of data sources contributes to a decrease of this. However, the fact that interviews was carried out in a sequence, meaning that one interview followed another, could lead to bias since the researcher probably will apply perceptions from previous interviews into the next. To minimize research bias, widen the researcher's perspective and gain perspectives from a senior researcher, debriefing sessions was held with the supervisor of this thesis as recommended by Shenton (2004). This has been helpful to discuss alternative approaches and ideas as well as capturing flaws not seen by the researchers.

Transferability refers to that the research should be transferable and possible to apply to other situations (Merriam, 1998). To ensure the possibility to do this, thorough information about the methods and data collected have been illustrated in the methods chapter of this study. In addition to this, boundaries and delimitations of this study can be found in the introduction chapter.

A challenge when it comes to the dependability of qualitative research is the changing nature of the research object (Fidel, 1993; Marshall and Rossman, 1999) and that the observations are closely linked to the time and situation the research is carried out (Florio-Ruane, 1991). Shenton (2004) argues that this could be handled by providing the reader with a description of the research design and details about the data collection. In addition to this, a reflective discussion is carried out in the research design and strategy chapter. This provides transparency of the process and evaluates the effectiveness of the research and how it changed over time.

4. Empirical Findings

This chapter illustrates the findings from the analysis of the data. The first part of the chapter will describe the findings related to the first research question. The second part, related to research question number two, describes the findings that can be derived from the purpose of the interaction and is further divided into the different levels of interaction strategies.

1. In an open innovation arena, how do surrounding organizational structures and management processes influence the open innovation processes?

2. How does the purpose of the interaction affect the choice of interaction strategy in an open innovation arena?

4.1 Actors, processes and structures

The arenas vary in surrounding organizational structures and management processes. This chapter presents our findings relating to how the different arenas work and how they are organized as well as how these factors influence the open innovation processes. The findings are divided into three sub-categories (1) Individuals and actors, (2) Processes and systems and (3) Organizational structures.

4.1.1 Individuals and actors

In the interviews, two types of key individuals to enable and facilitate open innovation were highlighted. Firstly, key individuals are used to transfer and facilitate ideas as well as connecting people. These individuals provide a bridge between companies and speed up the open innovation processes as well as enable open innovation. Secondly, at several of the arenas there is individuals scouting for useful advances in technology as well as in research. These individuals provide a bridge between academia and companies and enable ideas and technology to the companies.

Several of the interviewees highlighted the significance of using key individuals to transfer and facilitate the ideas and innovations. At Ericsson's arena – the Garage – there is always a project leader or coach from Ericsson whose task is to find and involve relevant departments and

people in order to get the project started. The interviewee explains "*Earlier we had Ericsson Research and they had a lot of smart ideas. However, they were too isolated and often when they finished developing something good, they continued to the next project. Nobody else at Ericsson knew what fantastic things they had developed and therefore nobody developed any products or services on them. One important role of the Garage is to pick-up these ideas and explore how we can use them in our business. Furthermore, we have realized that there is a lot of good ideas outside the walls of Ericsson and we need to pick up and facilitate these ideas as well*".

In the interview with Mobility Xlab, the importance of right contacts is emphasized. The interviewee explains the difficulties for small companies and start-ups to find key individuals within large companies and that the Xlab is a way to ease this process and shorten the time for the project to get started. He states "*We are offering a fast track to contact with the right people in our partner companies. If a start-up wants to collaborate with Volvo and comes knocking on their door today, it will take two years before they have the right people, resources and buy-in from the organization and managers needed. It is a long time. The advantage with us is that we already have the contacts and the mandate to get hold of the resources within our partner companies*". The respondent from Visual Sweden agrees "*I am neutral and have an established network within the large companies. This makes it easier for me, compared to a small start-up, to get hold of the right people and resources at the large companies such as Siemens for example.*". At Lindholmen Science Park a lot of effort is put into maintaining and creating a good network. According to the interviewee this is a result of the focus on large companies and the complex network structures. He states, *"Since we are working with large companies, the networks with the companies are very complex and in need of continual maintenance"*.

The BioVentureHub takes a broader approach, meaning that rather than focusing on a few key individuals they are focusing on a wider network. The interviewee highlights the importance of informal chats "*Every company works on their own project, but there is always opportunities to ask for help. Our model focuses on building a network community and creating a platform for informal chats. This is where the value is created and captured*".

In a few interviews the use of individuals to scout for advances in research and technology was highlighted. The interviewee from Innovatum explains: "*We have coverage toward the academia and are trying to understand what research exists in order to see if there are*

knowledge that can solve problems and needs in the companies". The interviewee from Visual Sweden describes the arena's role similarly: "*We have one ear in the academic world and is mapping out what is researched. Then we match the research with the needs of the companies*". He continues to describe the role of the arena: "*The large companies such as Gränges and SSAB are doing a very good job. However, we can push them to do an even better job by showing them opportunities and techniques from other companies and academia*". One of the main objectives of Swedish Food Arena is to connect the food industry and business to the research. The interviewee emphasizes that there is a gap between these two today and states *"There is no coordination between companies and the academia. The research conducted today is not driven by a need"*. One important role of the arena will be to identify advances in science and diffuse they to the industry and commerce. In addition to this, the arena will focus on steering the research towards subjects relevant to the industry.

4.1.2 Processes and systems

The findings from the interviews points out how clearly defined processes and systems create speed and ease cooperation. Some arenas have contradicting views on the importance of established processes and systems and the findings also indicate that there is a risk off missing out on valuable ideas if the processes and systems are too strict.

Several of the interviewees point out how established procedures in an arena facilitate and ease co-operation and open innovation. The representative from Lighter describes the connection between common structures and speed *"In the beginning the projects took off slower since a common ground needed to be established before one could create value together. But when common processes were built, the projects were faster and more efficient"*. The respondent from HSB Living Lab points out the importance of being flexible in your routines "*We end up in new situations all the time and our ways of working need to be adjusted. In the beginning we only had one category of projects, but we realized it took too much time for some projects. Now we have four different tracks.*" At Urban ICT there are three different categories of projects with three different work streams. The interviewee from Mobility XLab explains how a support structure eases the cooperation "*You build new structures within the company to ease the cooperation with the smaller companies. One of our companies realized that a lot of projects takes a lot of time since the small companies are given a 100-page agreement which takes 5 months for a small company to read and sign. They introduced a new purchasing system*

which downsized the legal parts and speeded up the process. I do not think it is the ways of working that is wrong, but the support structure for the companies are too slow."

Several of the interviewees point out that the innovation project initiating process is clearly outlined. The respondent from HSB Living Lab explains "*All projects need to be approved by the board and are initiated with project applications that needs to involve at least one of the twelve partners.* At several other arenas, the procedure is similar, but some of the arenas have activities to facilitate discussions and meetings outside established projects. The interviewee from Lighter explains "*We do not have workshops dedicated to creating new projects. However, by having workshops and creating a forum to meet and discuss challenges and opportunities projects are initiated (...) A project proposal is sent in and the board of Lighter decides which projects that will be financed*". The interviewee from Lindholmen Science Park describes a typical project in the arena "*Projects follow a typical work stream. The projects are demand-driven and is initiated in our different work-groups where we gather actors. Lindholmen Science Park pick up a demand and create a structure to nurture the project. Furthermore, we write a project plan and apply for funding*".

Several of the interviewees describe how a project plan is developed in the beginning of a project in order to seek funding or establish outcomes. The interviewee from Lindholmen Science Park explains "*When conducting these collaborative projects, it is very important to have a consortium co-financing. We are good at finding the funding needed and formulate a project plan and an application. A lot of projects are initially an idea or a need that we pick up and write a project application for funding from EU, Vinnova or Trafikverket.* The respondent from Urban ICT describes a similar work stream "*The steering committee meets and brainstorms the desired outcomes of the projects. For the big projects to happen, we need to find funding and then we usually apply to Vinnova. In order for Vinnova to decide on funding, we need to write a project plan. Then we need to deliver what we promised in the application. Early in the project plan, the activities to be conducted during the project must be decided. They can be slightly adjusted along the way, but usually there are not any big adjustments.*". At HSB Living Lab the respondent points out that they prefer clarity "*We prefer to include a hypothesis in the project application. In the start a lot of projects were very fuzzy. Now, you need to have a clear outcome and know the benefits from a sustainability perspective and the other perspectives that we have in the template.*"

At the Garage at Ericsson, there is a contradicting view on established procedures on identifying, evaluating and nurturing ideas. The respondent from the hub explains *"Ericsson does not have any structured programme, processes or resources at the Garage. We work more freely which creates a foundation for a lot of ideas to grow. The more you structure, the further away from the foundations of open innovation you drift."*. Furthermore, risks related to clearly defined criteria and processes are highlighted and the interviewee states "*More formality and structure would kill a lot of projects. Often several meetings are needed in order to find the right ideas and by judging by criteria you risk not only killing projects but also further dialogues"*. At BioVentureHub, the respondent agrees "*Earlier, you built a business case where you tried to understand return on investments and related risks. In order to know this, you need to understand the result of the co-operation or project. This model can be translated to "if we do not understand it, we chose not to do it". How innovative is that? We have tried to create an environment where experiments can happen even when we do not understand the ROI"*. However, the interviewee highlights that even if it is not in the structured activities the value is created, some structure is needed. At the hub there is processes and structures established in order to support the hub and help the companies in the hub to benefit AstraZeneca's resources. For example, the employees are educated in how they can help the companies in the hub and clear, standardized contracts has been developed. The respondent explains "*We have very loose structures and processes, but the rules of the game is clear*".

Despite the different views on structures and processes, several interviewees highlighted the benefits of agreement templates developed by the actors in the arenas. The interviewee from Lighter explains "*We have developed an agreement template for projects, which has been approved by the large companies. This makes the process a lot smoother.*". The respondent from Synerleap explains the rationale for agreement template "*One thing we have done in order for the collaboration to work out as good as possible is to develop agreement templates that works in these kinds of collaborations.*". The interviewee from Mobility XLab declare how agreements is used to regulate the large companies' playing field and enhance the benefits of the start-ups "*We have something we call multilateral agreement between our partner companies and the start-ups. The agreement is used to regulate the partner companies playing field within the Mobility XLab. We have agreed on a number of rules of the interaction within projects. (...). I cannot disclose the exact distribution between our companies, but we know that without a fair IP agreement no start-ups want to apply to Mobility XLab. We always strive to give the start-up most of the benefits of a cooperation, otherwise the cooperation will not work*

out in the long run.". At the Garage the interviewee explains the difficulties of not having an agreement in place and how this slows down the process "*The technology and the algorithms are developed and finished. However, the business model and the surrounding business has been a longer and more complex journey. It changes all the time and new partners connect. It is a long discussion. It is not a conflict, but it is new for everyone.*".

4.1.3 Organizational structures

From the interviews three primary organizational structures for the open innovation arenas emerged, (1) Common interests, (2) Lobbying and (3) Widen the horizon. The ways of organizing the arena impacts the work conducted in the arena. The findings related to this theme are presented in this section.

Some of the interviewees point out how defining different common areas of interests eases the mobilization of actors with common interests. In the interview with Sahlgrenska Science Park the interviewee explains "*In addition to the big network with all the companies and stakeholders we have created several smaller networks. In the last project we started a female engineer network. In addition to this we have a MedTech network and an executive network to share best practices and have informal chats. In these networks we share ideas and learnings.*". At Swedish Food Arena the actors have categorized their targets in three areas of focus and by that connect actors with common interests. The interviewee describes the initial work of the arena "*We do not have any clear strategies today. However, we have crystalized three main themes to research and work within. These three themes have then further been discussed in workshops and meetings. (...) Furthermore, the areas have been discussed with researchers. First we need to identify what the companies think is important and then we can see what research we need to focus on*". The work at Innovatum is divided in a similar way and the respondents from the arena explains "*We cluster the actors based on what work we do, and we have several types of networks where you can be a partner in a specialized network.*".

One important rationale for arenas is to gather knowledge and funding in order for open innovation to happen. The respondent from Swedish Food Arena highlights how this is fundamental "*One extremely important function for the arena is to make sure that the government invest in the food industry. There must be a significant increase in funding to the food research. Before we can start any projects there needs to be funding.*". The interviewee

from Lindholmen Science Park agrees and points out how an arena is valuable "*When conducting these collaborative projects, it is very important to have a consortium co-financing. We are good at finding the funding needed and formulate a project plan and application."*. In the interview with the respondent from BioVenture Hub the rationale for creating a hub is described "*The value for AstraZeneca is to increase the density of competence and we want the companies to move into the hub. (...) We try to increase the interest and competence within Swedish Life Science and by doing so we attract foreign capital to Swedish companies and more competence to the region.*".

The interviewee from Lighter highlight the value in co-operating outside your industry and how this can widen companies' perspectives "*You cannot copy solutions without modifications but you can inspire each other and see what other industries has focused on. In addition to this, people move outside their comfort zone and get questions they would not get otherwise. It takes a bit longer to establish a common frame of reference and understanding but the end result is different when you move outside of your usual area.*". In addition to this, the interviewee points out how collaboration across industries tends to decrease the rivalry "*We write an announcement and then any company can apply. We have had a surprisingly high number of small companies applying to Lighter. (...) When we move outside the industries' comfort zones there is less competition*". The respondent from BioVenture Hub describes how they use the same rationale "*It is all about creating the right conditions for new innovation. The foundation of this is that we are not competitors and can use the same knowledge without competition. It is all about spillover knowledge and creating a culture where people share knowledge and help each other. This is quite different from the industry, where you need an agreement*". HSB Living Lab has another way to broaden their horizon. The arena has identified seven areas they want to develop and improve. These areas are used to invite external companies and lecturers in order to find new projects. The interviewee explains "*We meet 2 full days annually and focus on one of the identified areas. We invite the steering group, as many colleagues as possible as well as external lecturers and companies. During these days we try to brainstorm and research the subject in order to find ideas for new projects.*"

4.2 Interaction strategies

The purpose of interaction varies between the different arenas, and projects place differently along the axis of exploiting the known to exploring the unknown. Some collaborations aim to

combine existing knowledge and processes, while others hope to explore areas together that might lead to a disruption of the core business. How the respondents view the arenas reason of existence as well as the formulation of the purpose also varies. The empirical findings around interaction strategies will first examine the different arenas purpose of interaction from a broader perspective, starting from collaborations based on existing solutions to more explorative ones. The findings will further be divided into the five levels of interactions; networking, coordinating, co-operating, collaborating and co-creating.

4.2.1 Purpose of interaction

The interviewee from Innovatum explains that their way of working might be different compared to other arenas because of their geographical location and regional conditions. Their projects lie close to the commercialization phase with a focus on transferring knowledge to small and medium sized companies within the region and to increase their efficiency and productivity. The interviewee explains; *"A typical project is that we work with one large global supplier and their value chains with subcontractors and try to raise their level of competence and strengthen their products and services, so that they become more sustainable and competitive. Our focus lies on building entire industrialization value chains which might be different compared to an arena in a metropolitan area, since we work closer to the commercialization and introduction phase. We help build knowledge and increase productivity."*

Another deciding factor that seem to be pivotal for what management approach to take, is the viewpoint and formulation of the what the collaboration is all about. The strategy choice can vary dependent on if the project arises from for example solving an existing problem, a need, a demand or the will to explore business opportunities beyond the current business. The interaction strategies used in Lighter Arena are influenced a lot by the reasons behind why the arena exists - to unite stakeholders who all have an interest in lightweight technology for their business to survive. *"That we are industry-wide is an innovative basic premise. It has influenced our entire way of thinking since we combine several industries that have different logic and strategies. What is common is that they all need lightweight technology to meet global environmental requirements.*" In a similar way, the projects run by Lindholmen Science Park usually arise from a problem that the actors unite around. "*A project usually arises out of a problem that the partners have a common interest in solving. It can be standardization issues*

or to demonstrate new technology. We rarely work with product development, that is done by the partners themselves. We rather that focus on pre-commercial issues, where there is a question that all partners seek the answer to. An example of such a project is that we investigate which charging infrastructure for electric chargers that is needed for heavy trucks in a 5-10 years perspective." The respondent from Sahlgrenska Science Park describe that the way the problem is formulated plays and important role of the innovativeness of the outcome. *"I am convinced that how the problem or the need is presented is very important. Instead of saying that you need a new hospital bed, you say that we have a patient who should be able to sleep, sit and transported and it must be ergonomic for the staff. It does not have to result in a bed. We try to get inspired by how other industries formulate their business nowadays, for example mobility instead of automotive."*

The interviewee from Mobility XLab describes that their strategy is to find common problem areas among the partner companies; "*A project has usually started with some form of workshop or brainstorming where we try to make sure that all partners are involved. You work together for two days and look at where we find touching points between our companies and then you formulate a project after that.*" The interviewee also describes that their projects and collaborations usually derive from an issue that one or several of the partner companies have a high interest in solving. That is because the bigger the problem, the more engagement and sponsorship it will get from the partner companies. *"A person at one of our partner organizations once said, that in order for us to get a commitment somewhere inside our large organization, it must be someone who has a huge problem that will have major effects if we do not solve it."* He continues; *"That is very true from my experience, it is usually that one or several of the partner companies have a pressure point that is difficult to solve and where a start-up company could be the key to the solution. Such projects have been the most successful, where we have gone from an idea in the lab to an integration in one of our partner companies in a short time."* That the collaboration has a focus on current issues of the partner organizations is also mentioned by the respondent from Innovatum; "*We have two ways of working, one of them is that we start from what is needed from the business sector and we work very closely with small and medium-sized companies. Our focus is to understand their reality, their needs and challenges and to match them with what research has to offer in this area. To see if there is knowledge that could help solve these needs.*"

In the interview with Synerleap, when discussing how to define the scope of what actors to involve as well as how specified the project area should be on beforehand, the interviewee explains; "*If one intends to disrupt it would be delimiting to define beforehand to look specifically at a certain area or to restrict what companies or people that are allowed to join. That will not lead to disruption, the output will be as what one could expect. However, the hit rate of collaborations is better if you try to match actors or areas that you think would work well together. So it is both ways, and we have rather focused on increasing the hit rate instead of working more broadly. There are limited resources, so you have to prioritize.*"

The interviewee from HSB Living Lab explains that their projects also often are formulated around a common need, such as climate change, and the idea behind the Lab is to tie business and academia closer together. However, she also explains that their arena is based on the acceptance of that inter-organizational collaboration is crucial for their business to survive in the long term. *"The pace of change has become so incredibly fast and the traditional model of managing development and innovation in-house is no longer enough. No one has the ability to keep up with all the areas you need to on your own."*

In other arenas, the main focus is not to solve current problems or needs, but rather use the arena as a way for the company to find business opportunities that goes beyond their core business. The interviewee at Ericsson Garage explains *"What we are trying to create and what we are looking for is new business opportunities for Ericsson and make them grow. The road to get there is not straight, because we usually do not start from a situation where we have a prototype and well-prepared business plan. We start from a dialogue and try to find good ideas, but few ideas have come further than just being an idea really."* Nor at AstraZeneca, the focus is the core business. They rather aim to create a culture where collaboration and helping is a natural way of working, both internally and externally, and to create conditions for innovation to happen by taking advantage of knowledge spillovers. The interviewee argues *"Everything that has happened regarding management research the past decades has been about optimizing efficiency, i.e. system performance, process performance and such. I argue that if you extrapolate and go five or seven years into the future, machine learning will be better at optimizing than any human. So, the management approach that has been advocated in large organizations is not the type of management needed to handle this. We try to go from managing systems and operations to managing creativity. That requires a completely different kind of leadership and the BioVentureHub is a way for our own organization to see that we can work*

in other ways to embrace innovation and make innovation happen. The Hub is so many different things, it is an industrial accelerator, but it is also a way to influence our internal culture."

4.2.2 Networking

Many arenas serve the purpose of being a place for people to meet and in more informal ways exchange information for mutual benefit, to foster meetings between actors and organizations that do not usually have a natural place to meet or collaborate. The initial strategy of Swedish Food Arena is to serve as this kind of platform for different actors within the food industry. "*There will be some form of network where companies can meet in different ways, both virtually and physically.*" Lindholmen Science Park describes "*We have a working process where we serve as a knowledge node and we are a neutral meeting place, where we are specialized on gathering different actors. We have project workshops where we can create new projects based on different needs.*" The respondent from BioVentureHub highlight that there does not have to be a structured process for different actors to network, but just by being located on the same place is an enabler for information exchange. "*There is no common system or process, but initiatives arise from the fact that we are sitting in the same place. The Hub is located in the heart of the site and it is completely integrated. The companies have the same authority on their access cards as all other employees.*"

The interviewee from Lighter have noticed that it is the informal chats in-between that is the most important. "*We have tried to create a lot of meeting places. We have also had a lot of workshops with many attendances where we purposely schedule a lot of breaks, because during the breaks they talk business. They get the chance to show their work and when the project groups are formed, it is not done in full publicity, but everyone wants to keep their ideas a little for themselves. When the ideas are formulated, many wants to hand-pick who they want to work with.* " The respondent from Sahlgrenska Science Park on the other hand, argue that information exchange for mutual benefit can happen without having to reveal your idea at all. "*I haven't experienced it that way [concern to reveal your idea]. If you can be open and transparent in the beginning, you do not always have to reveal your idea, but still find ways to exchange experience and work with your own idea without revealing it. For example, we arrange courses in business model canvas where you have to work with your own idea, without having to reveal it. I think there is too much reliance nowadays in protecting your idea. Many*

ideas today are about digital solutions and you can protect your code, but you do not talk about it in such contexts. One does not have to go into that level of detail."

The interviewee from HSB Living Lab also points out that it is not just about being part of the network, but that the results come from the energy and engagement that you put into it. "*The value you get out equals what you put into engagement. If you actively participate you will get a valuable network of contacts and a lot of new knowledge in areas that you did not know from before. Here we talk to kitchen manufacturers, architects etc. and it is a broad group.*"

According to these findings, networking seems to mean less organization effort from the arena to run projects, these responsibilities lie on the different companies participating. The network serves as a neutral zone for actors to meet and informal ways of networking seem to be preferred. Loose structures seem to lead to more freedom and could therefore be a way to explore the unknown without defining the boundaries in beforehand.

Arenas using the network strategy also have the aim of lobby and/or raise awareness around a certain area or industry. Both to be a knowledge hub that the different actors within the industry can reach for, but also to go together and be a greater voice on a higher level and apply for external funding.

4.2.3 Co-ordinating

The co-ordinating interaction strategy implies more organizational involvement than networking, since it also involves activities to achieve a common purpose. Some arenas describe their role as a "matchmaker" between different actors and beyond just gathering different actors into one place, they also put organizational effort into making projects happen. The respondent from Innovatum describes "*We usually compare ourselves with a junction box, we sew together two worlds that do not always meet. Especially smaller companies do not really have the same inputs as AB Volvo, Ericsson or Astra Zeneca or similar large companies. We are a facilitator, catalyst or similar, to make it happen.*" This enabling role, being the bridge between small and large companies, is also brought up by other arenas. Visual Sweden describes "*If I* [project manager at the arena] *lift up the phone and call SSAB, Siemens, the municipality or another large organization, it will be an easier conversation for me than for a*

small start-up company of 5 people who wants to access a big company. So, we are a coordinator or facilitator for impossible meetings, or at least very difficult meetings, to happen. Usually when a small company calls Siemens it is often that "Hi, we want to sell this", but if you can push them into a project that both can benefit from instead, that is to say, Siemens may benefit from investigating something but does not have the cutting-edge expertise that perhaps the small company has."

Matching actors with complementary competences are mentioned as key by other arenas too, as well as making actors aware of what competencies exist and what they might get out of collaborating with each other. The respondent from the Swedish Food Arena explains "*I imagine that the Swedish Food Arena will have a coordinating and information task in this complex and narrow path of what actually exists. To emphasize to the business community what is out there, what to take note of and help them incorporate it in a smart way. So much is already out there that the arena can connect companies with. If a company wants to do A, then the arena does not need to perform A, but it knows that there is a project about A and can connect the right actors. I think that will be an important role.*" The Urban ICT Arena has several categories of projects and describes that one type is projects where they are not the project owner but where they have an important role to get the project started. "*We were an enabling factor in the fact that the project actually started and acted as a gathering place for different actors. We followed up and asked questions such as; What did you think about this area? Do you want to invest in this project? We gathered different players again, but then they took the lead and from there, we acted mostly as the communicator, arranged reconciliation meetings and we still evaluate the project. We wrote project plans aligned with our digital sustainability goals, but otherwise we let our partners do the main job.*"

The respondent from Sahlgrenska Science Park describes a scenario where they also push actors together to work around a problem; "*In the project that I am now running, we will be inviting a very broad spectrum of organizations. We will arrange information meetings around a problem from the health and social care side of things. The actors will be able to submit notifications of interest where they have to submit if they want to move forward with certain solutions and continue work around an idea that can finally lead to a solution proposal.*" In the same way, Lindholmen Science Park act as a neutral arena that coordinates and enables innovation projects; "*So we have a very big coordinating role. It is important to highlight however, that we have no own IP, we have no own products after all. The word neutral is very*

important here, because we are no competitor to anyone else - we do not create these projects for our own but for others."

What arise from this is that if the arena has a scope that is hard to define or very broad, the organizational commitment from the arena is more important. Both to make actors find each other but also make them understand or see a common purpose. Most effort from the arena need to be put into the initial phase of a project, to get projects going and make actors commit to them.

4.2.4 Co-operating

Co-operating is the next level of organizational involvement, where also resources are shared between the actors in addition to exchanging information and transforming activities. Some arenas provide testbeds or other equipment that can be used in the projects, while other do not share any physical resources at all. Innovatum is one of the arenas that provide physical resources; "*We mainly have test beds in two areas, part-production and within new bio-based materials. We have a technical production center that is open to everyone.*" Also, Lighter Arena mentions physical resources as a part of their way to cooperate; "*We have identified that one of the most important part is trying to create more test beds. It is quite difficult to do so, because the technologies and interests are widely spread."* She continues; "*On the other hand, what we have as a tool is a common strategic research that covers basic research of less matured technologies which is more academical and from there you can pour ideas. The publications are common to all and in addition, we have tests and demos that we run across all work streams."*

The interviewee from Synerleap explains that as one of the similarities between their arena and Astra Zeneca's BioVentureHub; "*In that sense we are equal, that we make our internal infrastructure and industrial expertise available to the companies in the arena.*" Astra Zeneca on their side, put's it; "*We always work in projects and when we have resources available, we let the small companies use them. If we do not have full occupancy on one instrument, we can let the small company use that tool. If we have an expert who can be of use to the small company and this expert is in-between two projects, we let that expert take the time to help.*"

Time, commitment and knowledge from the different project leaders, teams and actors are resources that are being further discussed as a resource that are shared among the actors and partners within an arena. The Innovatum arena have an important role in helping their partner-companies keeping up with technological change which derives from the time and efforts coming from the Innovatum employees. "*It is linked to our basic task, we work a lot on external analyses, understanding the outside world and paradigm shifts that are about to happen. From our analyses we draw conclusions and give directions to our partner companies. What does this mean for our business community? In what way will we need to change? Our role is both to push and pull. We provide the companies with knowledge that can determine if they are able to stay competitive or not in the long term.*". The respondent from Lindholmen Science Park explains how they are a shared resource in the arena "*Lindholmen Science Park is often part of the project as a project leader. We are good and experienced in leading complex collaborative projects.*".

When arenas use the strategy of co-operating, in contrary to networking or coordinating, the scope and the purpose of the collaboration seem to be clearly defined. The arena does not need to put the same effort into align the companies towards a common purpose, because they already see it themselves. The actors are more familiar with the techniques and/or each other and are committed to the purpose.

4.2.5 Collaborating

Enhancing the capacity of another to achieve a common purpose with the main goal of helping each other become better is what takes the interaction into collaborating. The interviewee from AstraZeneca explains their core idea; "*It's basically about sharing economy, being able to utilize things, equipment, knowledge in a better way, in a larger ecosystem than just your own company.*" Furthermore, he adds; "*Can the expertise of one company be of use to the other company's strategy, without this company having any interests of owning anything, and if it goes the same in both directions, it will lead to an enormous efficiency when it comes to utilizing resources and human capital.*"

Lighter Arena describes that their core idea is to combine companies that currently work in separate industries, but where their knowledge or processes in combination can create win-win solutions. "*For example, in the aviation industry, you do quite a few but very complex and*

high-technology products. Therefore, the production series are low. In the automotive industry on the other hand, production series are high. Even though they work with completely different technical solutions, one can transfer competencies. The automotive industry is very good at automation in general that the aviation industry can learn from and, for example, automate their composite manufacturing process. At the same time the aviation industry is very good at the composite material, then the automotive industry can enhance that knowledge. One cannot simply copy each other's solutions, but one can inspire each other and see which questions one has focused on in the different industries."

The creation of synergies and knowledge spillover are other terms that has been brought up. From the interview with the respondent from Synerleap; "*As any business relationship, things must be regulated when you have a joint project. Our core idea is not that we should invent things together here, but where there are synergies, one tries to take advantage of them. And that depends on what synergy exists and what you want to achieve in that synergy.*"

The respondent from Innovatum describes that collaboration between the actors reach a certain point of ending; *"It is often the case that one develops certain parts within such projects together, then the company continue the further development themselves and implement it in its operations. Often, one develops things together to a certain limit and then they continue on their own to further develop, implement it into their operations and make fine adjustments. However, all results are available and should be available, that is a requirement. Otherwise, we are contributing to a distortion of the competition in the market."*

4.2.6 Co-creating

Collaboratively exploring the unknown is what differs co-creation to the previous levels of interaction. Working in the unknown can mean both an unknown field of knowledge as well as partners that are not yet known but that benefit and increase their potential. The interviewee from HSB Living Lab argue that working in the unknown requires another take on risk and that one must accept that not all projects will succeed; "*We are very open to the fact that projects can be changed along the way, that is the purpose with a living lab. It must be a free zone for both to success and failure. If not, we have done something wrong. If everyone has to succeed, we are not brave enough.*" At Visual Sweden, they have recently started to collaborate around what they call platform projects. The projects do not start from a current issue or need, but

rather from research and how it can be applied to visualization. From that, the partners aim to co-create models that could come to use. The interviewee explains that the idea behind the platform projects, compared to their other projects, is to develop even more visionary solutions and look deeper into the future. Furthermore, he explains that by taking the actors to a neutral zone that lies beyond their core business, makes it easier to collaborate; *"These companies might be competitors that usually would never sit in the same meeting room. However, this type of platform project enables knowledge sharing into a project without having to reveal business secrets. They get another benefit in this type of constellation."*

Ericsson Garage exemplifies a project whose purpose, area of use and business model completely changed from the start to the end. The project involved actors from three different industries with different competencies and resources. "*The idea came from here, but we needed all three players to do this. The three of us started to discuss, who should use this then? What is the business of this? It has been a long journey. Setting up the technique to collect the data and develop the algorithms was quite easy and quick. But building a business model around it has been a long and an unknown journey. The customers turned out to be someone completely different than we thought in the beginning. At first, we did not find a sustainable business model, but when we started thinking and discussing it with the different parties and other stakeholders it went from being used as an information tool to be about the security of an entire population. All of a sudden, other actors got interested and a completely different user case emerged, and the data was utilized for something entirely different. More and more customer value is created.*"

4.3 Empirical findings summary

The empirical findings show that there is a trade-off between structure and openness. Openness is defined as the openness for new possibilities and having an explorative focus. To structure the open innovation resources in terms of appointing individuals with responsibilities, developing common processes and systems and building clear organizations enables speed and ease the cooperation of companies. On the other hand, more structures seem to be inhibiting if the aim is to achieve radical innovation. Table 5 show a summary of the key findings related to the first research question of this study.

Table 5. A summary of the key findings related to the first research questions of this study

RQ1. In an open innovation arena, how do surrounding organizational structures and management processes influence the open innovation processes?	
Key individuals and actors	● Individuals appointed with responsibility to provide a bridge between companies ○ reduces the risk of not acting on valuable ideas ○ speeds up the process of collaboration by faster connect the right people and by gaining experience in leading complex collaborative projects. ○ are more important in complex network structures ● A wider approach can enable collaboration before any direction of the collaboration is established and can facilitate idea generation. ● The technology and research scouting can both include searching for useful advances in technology and research but also to steer the research towards subject relevant to the industry.
Processes and systems	● Common processes and systems enable speed and ease cooperation ● In order to get funding for projects and co-operations, objectives and project plans must be defined. ● Common evaluating processes result in companies not proceeding with projects if the outcome not is known and potentially miss out on valuable co-operations.
Organizational structures	● Organizing around common interests and gather different perspectives creates a focus and enables an excellence in the subject. ● Organizing around common interests enables lobbying and increase the density of competence of the area. ● Organizing for co-operations across industries enables useful solutions to be modified and dispersed in new contexts. ● Organizing across industries decrease rivalry.

What have arisen from the empirical findings is that organizations as well as open innovation initiatives are complex constructs and that most arenas have several types of project and programme portfolios, as well as different ways of running them. Therefore, multiple interaction strategies are often carried out in parallel within the same open innovation arena. However, it is possible to see differences between the arenas when it comes to the spectrum of exploiting the known or exploring the unknown and how this affects the way of interacting and running innovation projects. What also arise from the interview findings, is that the strategy choice could be a question of efficiency or creativity, and what strategy fits best into what the initiative aims to achieve. Table 6 show a summary of the key findings related to the second research question of this study.

Table 6. A summary of the key findings related to the second research questions of this study

RQ2. How does the purpose of the interaction affect the choice of interaction strategy in an open innovation arena?	
Exploiting the known	Arena's that focus on ***exploiting the known*** tend to; ● Aim for incremental innovation ● Run projects that lie close to the commercialization part of innovation ● Focus on increasing productivity and efficiency among the actors ● Define projects starting from a problem that the partners have a common interest in solving ● Have a greater coordinating role and show greater organizational commitment to make innovation happen ● Act as a catalyst for projects and put most of the effort in the starting phase ● Have an important role to lobby, seek for funding and aim to strengthen the industry ● Work to increase the actor's commitment to a certain area/issue/need ● Match actors that have complementary competences ● Enable start-ups and SME:s to access large organizations
Exploring the unknown	Arena's that focus on ***exploring the unknown*** tend to; ● Aim for radical innovation ● Focus on the idea generation part of innovation ● Prefer loose structures and less defined scope ● Show a will to make internal infrastructure and industrial expertise available to all the companies in the arena ● Seek for knowledge beyond the actor's core business ● Aim to create a neutral and non-competitive zone where IP is irrelevant ● Aim for knowledge spillovers and synergies ● Put less organizational effort to make the actors see the common purpose ● Put mutual effort along all phases of the project

5. Discussion

In this chapter, the empirical findings will be analyzed and discussed in relation to the theoretical background provided in order to address the aim and research questions of this study.

5.1 Balancing structure and openness

Previous literature has shown that surrounding organizational structures and project management processes influence the open innovation processes in an innovation arena. The findings of this study show that there is a trade-off between structure and openness for new possibilities and having an explorative focus. This balance is considered in the three dimensions; actors, processes and organizational structures.

5.1.1 Appointing individuals with responsibility realizes ideas and partnerships

In several of the interviews the importance of individuals with a certain responsibility is needed in order to facilitate and enable the innovation process. This was especially highlighted in connection to work with large organizations. This is aligned with the findings of Zynga et. al (2018) claiming an increased need of key individuals in more complex network. In larger organizations, more people are involved and therefore is the network more complex (Håkansson and Snehota, 1995). In smaller companies, it is easier to coordinate and find the right people. From the interviews several reasons for appointing individuals with certain responsibilities to provide a bridge between companies, such as project management or matchmaking of ideas and beneficiaries was found. Firstly, it reduces the risk of not acting on valuable ideas. Secondly, it speeds up the process both by faster connect the *right* people and by having project leaders experienced by complex collaboration projects take the lead. However, another approach highlighted in one of the interviews is to rather focus on a wide network than on key individuals. This model is built on gather the actors in one physical spot and enabling informal chats facilitating idea generation. In the more structured model, there is a need for a somewhat established direction in order to connect the right people. However, even in the second model based on creating a platform for informal chats and it is argued by Iansiti and Levien (2004) and Moore (1996) that a clear overarching goal is essential to allow the

members in the ecosystem to bond. This model enables more discussions and more meetings; therefore, it is likely that more ideas are generated. However, if there is no formal process, owner of the idea or experienced project leaders there is a risk that the idea is not realized. These findings imply that a model without appointed individuals serving as connections between companies generates more ideas and enables more open-ended collaborations. With a less structured approach and more informal chats, collaborations can start in an earlier phase, already in the idea generation. However, with this model there is a higher risk that the ideas are not realized on due to lack of experience of acting on ideas.

Another finding from the interviews, is how appointing individuals to scout for advances in research and technology that can be used for companies are useful. There is often a gap between the academia and the companies. These findings are aligned with the literature by Zynga et. al (2018). In addition to the one-way exposure, connecting and presenting the current research to companies, one arena highlights that the connection can be two-ways. Järvi et. al (2018) explains that there is a challenge in deciding if the companies or research partners should set the direction. Our findings suggest a two-way exchange and propose that in addition to scout for advances in research, one role of an arena can also be to steer the research towards subjects relevant to the industry.

5.1.2 Building clear processes enables speed but inhibits openness

From the interviews it is found that common processes create speed and ease cooperation. This finding is aligned with the findings of Wikhamn and Styhre (2019). However, some interviewees highlight the risk of missing valuable ideas and projects if the processes are too structured. This implies a trade-off between speed and ease of cooperation on one hand and openness on the other.

In order to conduct open innovation in the arenas funding is essential. In most arenas, funding is applied for to an internal board or to an external organization, e.g. Vinnova. These applications include pre-determined project plans and clear outcomes. It is challenging for actors to create innovation together if a common objective is not specified. Furthermore, without objectives, estimated ROI and considered related risks it is difficult to get the essential funding. These findings are aligned with the research by Järvi et. al (2018) and Ostrom (1990). However, in our findings it is questioned how innovative a project can be, if the outcome is

clearly defined before the project has started. Furthermore, it is argued that the current processes for evaluating projects, primary business cases, enable companies to explore the known and diffuse the use of new techniques but limit the level of openness. Several interviewees highlighted the risk of purely evaluating projects and co-operations based on business cases is that dialogues are ended to soon and potential valuable co-operations are missed. This finding implies a need for new ways to evaluate open innovation projects and potential collaborations. This is supported by Moore (1996) that argue that business advantages stem from coevolving relationships and it is complex to understand the future value of an economic system. To enable more openness and radical innovations, new processes for evaluating ideas need to be considered. The open innovation arenas can be key in developing new ways to evaluate ideas and forming new standards in the future due to their wide experience of collaboration projects. However, this is challenging due to the uncertainties and the complexity in assessing the related value and risks in a project without clear objectives.

5.1.3 Organizing is a choice between depth and width

The empirical findings of this study suggest that organizing an open innovation arena around a common interest enables lobbying and increase the density of competence of the area. Järvi et. al. (2018) explains how a common interest and purpose makes an initiative more convincing and enables the actors to act as a bigger unit. Furthermore, based on the interviews organizing around common interests and gather different perspectives creates a focus and enables an excellence in the subject. This is supported Zynga et. al. (2018) proposing communities of practice to foster knowledge exchange.

Another way of organizing an open innovation arena is across industries. Literature suggests that the increased complexity of technology and industry convergence often requires an interdisciplinary collaboration (Herzog, 2011; Bröring and Leker, 2006; Bierly and Chakrabarti, 1999; Choi and Valikangas, 2001). The interviewees in this study did not highlight this factor for organizing themselves across industries. However, they suggested this way of organizing in order to decrease rivalry and therefor enable new knowledge and connections. Clarysse et al. (2014) suggest that this kind of organizing results in a greater effectiveness in the search for new knowledge and value creation since they make room for synergies. The finding of this study suggests that decreased rivalry is another explanation of why this way of organizing is effective in the search for new knowledge.

5.2 Exploring the unknown calls for joint efforts and new relationships

The empirical findings of this study imply that the purpose of the interaction affect the choice of interaction strategy in an open innovation arena. The following part will discuss how the spectrum of exploiting the known to exploring the unknown are related to if the arena aims to achieve incremental or radical innovation, and how that affects the choice (or non-choice) of an interaction strategy.

5.2.1 Reinforcing or jointly identifying – a chicken and egg problem

The data analysis of this study shows that within an open innovation arena, projects and programmes can have different purpose of interaction and the arena take on a different focus depending on this. This demonstrates that there is a spectrum from exploiting the known to exploring the unknown. It could also be a distinction on whether the arena focus on achieving incremental or radical innovation. This conceptualization has similarities with the two ways of organizing knowledge ecosystems presented by Järvi et al. (2018) which are shown in table 7.

Table 7. Similarities between the empirical findings of this study and the characteristics of the two ways of organizing a knowledge ecosystem by Järvi et al. (2018).

Identification of a joint research domain (Järvi et al., 2018)	**Exploring the unknown** Empirical analysis	**Empirical findings examples**
● Actors participation is affiliated, self-resourced and unobliged ● Aim to identify and establish shared knowledge as a basis for collective actor hood ● No formal rules or coordination mechanisms	● The arena aims for a domain beyond their core business ● Actors collaborate voluntarily without obligations ● The arena aims to create win-win business models and a common purpose ● Less structure and less formal processes	*"What we are trying to create and what we are looking for is new business opportunities and make them grow. The road to get there is not straight, because we usually do not start from a situation where we have a prototype and well-prepared business plan. We start from a dialogue and try to find good ideas, but few ideas have come further than just being an idea really."* "*There is no common system or process, but initiatives arise from the fact that we are sitting in the same place."*

Joint research within a domain (Järvi et al., 2018)	**Exploiting the known** Empirical analysis	**Empirical findings examples**
• The knowledge domain has already been identified • Actors search and reveal problem- and solution-related knowledge • Actors participate through formal membership and access to resources • Actors contributions are monitored	• The arena domain is set within the actors' area of expertise, the partner companies have identified complementary knowledge • Project arise from a problem or need the actors face • Formal membership or partnering • Actors have monitored obligations	*"A project usually arises out of a problem that the partners have a common interest in solving. It can be standardization issues or to demonstrate new technology."* *"A person at one of our partner organizations once said, that in order for us to get a commitment somewhere inside our large organization, it must be someone who has a huge problem that will have major effects if we do not solve it."*

By seeing this connection to Järvi (2018), it is interesting to reflect on the challenges related to the different ways of organizing presented by Järvi et al. (2018) and if these challenges affect the choice of interaction strategy in an open innovation arena. A challenge in a knowledge ecosystem that aim to jointly identify a research domain is the confusion regarding goal setting, both since the scope is very broad but also if the target should be set by the research partners or the companies. In the set of arenas interviewed in this study, some have a set domain since the start. Those domains are problems to be solved or focus areas that the arenas aim to increase the innovation intensity within. The actors involved in those arenas are often technology neighbors, complementary in knowledge and/or aim to enhance the capacity of each other to achieve a mutual benefit. As the empirical findings show, those arenas mainly frame their projects starting from the company perspective.

Some of the arenas on the other hand, did not choose to define a domain at all or state that they have difficulties defining the domain because of the increase in complexity of the industry. For example, an arena that has defined their domain as "life science", questions what that actually contains since technology within different fields gets more integrated with one another in step with the expansion of digital solutions. In those arenas, the chicken-and-egg problem mentioned by Järvi et al. (2018) seem to be more present, deciding if the domain should be defined by the scope of the arena or by the projects. Some arenas solve this problem by having different starting points within their programmes. For example, the platform projects mentioned by Visual Sweden start fully from the research side and how current research can be pushed to and used by the companies. Others claim that they "work with both push and pull". On this basis, the arenas in this study that have a broad or undefined scope and projects

leaning towards exploring the unknown and achieve radical innovation seem to face the similar challenge as knowledge ecosystems that jointly identifies the research domain in the study by Järvi et al. (2018).

Even though a broad or undefined domain face these challenges, it can be argued that a too narrow domain could be delimiting for the open innovation process. This could be related not only to setting the scope, but also setting the targets. A result of the reinforcement of a common goal strategy mentioned by Järvi et al. (2018) is that when new actors join the ecosystem they must align their activities and interests with the established domain. This is reflected also in the data from our study, where the arenas have set objectives beforehand that the actors that join need to adapt to. In the conceptualization by Ollila and Yström (2016), the term *common purpose* is an important way to distinguish the levels on interactions strategies. The more the inter-organizational collaboration aim to achieve a common purpose, the stronger the relationship ties and the more the collaboration lean towards exploring the unknown. The definition of the strongest relationship level, co-creation, is *"to jointly create new knowledge and meaning for mutual benefit and to achieve a common purpose" (Ollila and Yström, 2016, p. 19)*. If so, the meaning should be jointly identified and phrased, in similarity to the partial form of knowledge ecosystem studied by Järvi et al. (2018) and could thereby strengthen the argument that the interaction strategies are defined by the spectrum of known and unknown as well as if the domain is reinforced or jointly identified.

Networking is defined as the most informal category of collaboration where the main focus is to exchange information for mutual benefit (Himmelmann, 1996; Ollila and Yström, 2016). The findings of this study show that networking often is the first level of collaboration and can be seen as being the first initiative for actors to meet and informally discuss what can be achieved together. In that sense, the empirical analysis goes in line with the work done by Himmelmann (1996) and Ollila and Yström (2016) when it comes to strength of relationship ties. What can be questioned however, is the other variable that the levels of interaction strategies depend on - exploring the unknown or exploiting the known. Networking entails loose structures which equals more freedom and it can therefore be argued that networking can be an interaction strategy with weaker relationship ties while still exploring the unknown. As several of our respondents argue, offering a place to meet is often enough to generate ideas and explore them collaboratively. A higher degree of organizational involvement from the arena might in some contexts be counterproductive. This because more structure often lead to a

higher focus on performance measuring could be argued to decrease the openness for new possibilities and having an explorative focus.

5.2.2 The self-image of the open innovation arena determines the strategic choices

As Ollila and Yström (2016) as well as Pisano and Verganti (2008) concludes, the outcome one could expect from the interaction strategy is dependent on how the arena define open innovation and what interaction it requires. What have arisen from our empirical analysis, is that the definition of open innovation is not fully aligned among the arenas and that they have different approaches on how much to push for projects to happen. The reason for this could relate to the evolvement of the innovation arenas from being a physical space to a place for co-creation as described by Thelander (2016). The arenas in this study could be of different generations or in different stages of evolvement, which make a considerable difference to their way of organizing. A theme that often are mentioned is the arenas self-image of being a catalyst or facilitator, opening doors and bridging actors. This is in line with the facilitation ground pillar in open innovation work mentioned by Wikhamn and Styhre (2019) and related to the later generation of innovation arenas focusing on co-creation. What is mentioned as important functions of the open innovation arena according to our findings are; being a matchmaker of competencies, bridging actors such as business and academia or large and small organizations, making actors aware of new technology and/or innovation opportunities, utilization of resources and initiating idea brainstorming. The arenas also seem to serve an important function in persuading different actors to start a collaboration.

As both Wikhamn and Styhre (2019) and Aldrich and Fiol (1994) highlights, it is important to gain legitimacy and secure access to resources in order to succeed with open innovation initiatives. It is essential to develop attractive and plausible concepts that are tailored to the actors' specific needs. Gaining buy-in and engagement from the different stakeholders is mentioned as key for making projects happen also according to several of our respondents. Many of the arenas highlight the importance of their neutrality, and being a neutral zone seem to foster a pre-competitive environment, but it is interesting to reflect upon how much engagement the arena lead needs to put in convincing and engaging the different partners and how that affect the interaction strategy. If the relationship ties are strong, the arena might not need to put as much effort in being the catalyst and engaging the different actors, since the

actors are more used to working together. If the relationship ties on the other hand are weak, the arena might need to put a larger amount of effort in persuading and getting initiatives started. The latter could imply that the arena choose the co-ordinating or collaborating interaction strategy. The organizational effort could thereby be related to the amount of engagement needed to build and maintain strong relationship ties. Our findings demonstrate however, that there is a variation in organizational effort not only between open innovation initiatives, but also within the concept of open innovation arenas. This study is based on arenas that all denotes themselves as doing open innovation work. However, there has not been a sample criterion defining what that actually entails, which can further explain the diversity within the open innovation arena concept.

5.2.3 The choice or non-choice of an interaction strategy

In the study by Olilla and Yström (2016), open innovation arenas are given as an example of an open innovation initiative that utilize the interaction strategy of co-creation. According to their conceptualization, co-creation is defined by very strong relationship ties among the actors, in combination with that the collaboration has a clear focus on making meaning towards a common purpose. Such projects aim at exploring the unknown since the concern is of such complexity that is goes beyond what the organization can perform on their own, making ambiguity an essential characteristic of such a strategy. However, the findings of this study show that within an open innovation arena, multiple interaction strategies can be carried out in parallel, which indicates that an open innovation arena initiative cannot only be classified as co-creation. In addition to this, our findings demonstrate, in contrary to the research by Ollila and Yström (2016) that not all open innovation arenas co-create. Elmquist et al. (2016) defines the open innovation arena as a management term, but there seem to be a gap between how it is defined in theory and how it is used in practice. Arena is not a limited concept and can be used freely by anyone. This discrepancy problematizes the concept of open innovation arenas and questions if there is a requirement for an intermediary to be called open innovation arena.

The empirical data suggests that the open innovation arenas can include all interaction strategies and there are no requirements of the characters of relationship nor the purpose of interaction. In order to further understand open innovation, it would be beneficial to update and align the established definitions of what an open innovation arena entails. However, it is important to highlight that there is no right or wrong in what strategies an open innovation

arena should use. Wikhamn and Styhre (2019) argue that conceptualization and mobilization are critical for open innovation enactment. By participating in an open innovation arena, these grounds have been covered per se. This implies that it might not be *how* the open innovation work is conducted that is important but rather that that it *is* conducted. Just by participating in an arena, regardless of the arena's interaction strategy, the participants open up for collaboration.

In addition, as discussed in previous section, different amount of organizational effort is put into different stages in a project. Not only can arenas carry out several strategies in parallel projects, but also alternate over time within one project. The empirical findings show that the projects in several arenas move from open to closed over time, both as their internal knowledge increase but also as a search for stability. This implies that arenas moving from open to closed also move along the axis of the purpose of interaction, from unknown to known, which further indicates that the purpose of the interaction affect the interaction strategy and thereby the open innovation process.

An interesting thing to reflect upon, that questions the premise of the research questions of this study, is whether all arenas actually do have a strategy for the way to interact, or if they rather act upon what feels best in that specific project or situation. What happens with the interaction between the different actors if the arena does not make conscious choices about what type of interactions that is supported and takes place within the arena? And what happens with the interaction if the arena makes an active decision of not having a strategy? Will it result in stagnation or improvisation? When analyzing the empirical material of this study, it turns out that most of the material touches upon the ambitions and defined purpose of the arena itself, what the arena aims to achieve and why that is important. However, there is considerably less data on what the arenas actually do to achieve it, even though examples are asked for. In previous sections, it is argued that there is a trade-off between structure and openness. By applying the same logic to the choice or non-choice of interaction strategies, it can be argued that by choosing clear interaction strategies the openness is inhibited. Doing the same things over and over again will not result in anything new but in order to find and realize new ideas, the strategies need to be dynamic and flexible. Furthermore, it questions whether *interaction strategy* is an appropriate concept to describe how the arenas are collaborating, since the word strategy is closely linked to making a choice. Based on this, it is recommended to refer to the

five levels proposed by Ollila and Yström (2016) as *interactions* rather than interaction strategies.

6. Conclusion

The emergence of open innovation initiatives with goal of fostering network-centric innovation has led to the rise of open innovation arenas. Inter-organizational collaboration initiatives are complex and come with organizational challenges. Therefore, the aim of this thesis was to increase the understanding of interaction strategies within an open innovation arena. Furthermore, how open innovation arenas are organized and how that affects the open innovation processes was examined.

Much of the previous research on open innovation has a firm-centric view. This study focuses on the arena perspective and contribute to the research gap by studying how the surrounding organizational structures and management processes influence the open innovation process in an innovation arena on an organizational level. Using a multiple case study, this thesis contributes to an understanding on how the chosen interaction strategies impact the open innovation process, which is of great interest for both policymakers and the participating actors in order to make the most out of the collaboration.

The surrounding organizational structures and project management processes influence the open innovation processes in an innovation arena in a way that it is a trade-off between speed and ease on one hand and openness to the exploration of ideas on the other. By appointing key individuals with responsibilities, ideas and partnerships will be realized to a greater extent, especially when it comes to complex networks and/or large organizations. Building clear processes and structures enables speed but inhibits openness, since the traditional way of using business cases to pitch for new ideas favors exploiting the known over exploring the unknown. If the objective is to explore the unknown, there is a need for new ways evaluate ideas and co-operations. This study suggests that organizing the arena across industries results in greater effectiveness in the search for new knowledge and value creation. Organizing across industries make room for synergies, while it also decreases rivalry among the collaborating actors.

The purpose of the interaction affects the choice of interaction strategy in an open innovation arena. The analysis shows similar results as the study on knowledge ecosystems by Järvi et al (2018). The choice of interaction strategy in an open innovation arena depend on if the research domain is reinforced or jointly identified. If it is reinforced, the strategy leans towards

exploiting the known, while if it is jointly identified, the strategy goes towards exploring the unknown. The interaction strategy is also defined by a chicken-and-egg problem, which means that the outcome of the collaborations is affected by whether the projects defines the arena, or the arena defines the projects.

The self-image of the open innovation arena determines the strategic choices. Furthermore, the definition of open innovation is not fully aligned among the arenas and that they have different approaches on how much to push for projects to happen. A higher degree of organizational involvement from the arena might in some contexts be counterproductive. This because more structure often lead to a higher focus on performance measuring could be argued to lead away from openness.

Our findings demonstrate, in contrary to the research by Ollila and Yström (2016) that not all open innovation arenas co-create. This problematize the concept of open innovation arenas and suggests that there is a need to develop a common definition for what an open innovation arena actually entails. This is essential in order to create a further dialogue and understand open innovation. In addition to this, the findings of this study show that within an open innovation arena, multiple interaction strategies can be carried out in parallel and that there are other factors affecting the interaction strategy. There are also arguments questioning whether all arenas have a strategy for the way to interact, or if they rather act upon what feels best in that specific project or situation. Based on this, it is recommended to refer to the five levels proposed by Ollila and Yström (2016) as *interactions* rather than interaction strategies. Furthermore, it is implied that it might not be *how* the open innovation work is conducted that is important but rather that that it *is* conducted.

Based on our research, the following recommendations for open innovation arena managers are offered. First of all, it is important to engage key individuals and keep them motivated and educated as well as align their vision with the objective of the arena. This is especially important in complex networks or networks involving large organizations where key individuals are essential to enable open innovation, realize ideas and connect the *right* people. Furthermore, in order to enable radical innovations and increase openness there is a need to develop new ways to evaluating ideas. Lastly, it is recommended to first establish the purpose of interaction — exploring the known or exploiting the unknown — and then deciding upon the interaction strategies and how to manage the arena by considering the trade-off between

speed and openness. In addition to this, it is important for open innovation arenas to exist in order to create a focus on collaboration and open innovation. However, it is stated that a key factor to succeed with open innovation work is to create a focus within the arenas and a mutual commitment to the collaboration, before deciding upon the most suitable interaction strategy.

7. Limitations, reflections and future research

The study is conducted as a multiple case study, which increases the generalizability and provides an overview of different perspectives. However, this research design in combination with time constraints limit the depth of understanding of each case that can be achieved. This thesis aimed to understand the arena perspective of open innovation, but only respondents from the open innovation arenas were interviewed. In order to increase the understanding of management processes, organizational structures and interaction strategies and their influence on innovation, it would have been valuable to interview other actors participating in projects in the arena and increase the multi-level understanding as proposed by Bogers et al. (2017). This study implies that there is not only a need for understanding the interdependencies between different levels, but also an understanding across it levels on a system-perspective. In order to build a more holistic view of open innovation in arenas, research on companies and academia view of management and interaction strategies are encouraged. In addition to this, only open innovation arenas in Sweden has been studied. In order to deepen the understanding of how management and interaction strategies affects the open innovation work, it is encouraged to conduct further research on open innovation arenas in other countries.

Furthermore, there seemed to be differences in the way of organizing depending on if the arena follows the triple-helix model or if there is one main actor behind the initiative. This insight would be interesting to investigate further. Due to a small sample size, with only 4 arenas with one main initiator, it was not possible to draw any conclusions upon this in this research. However, further research is encouraged to investigate this insight.

Lastly, this study did not consider the level of success of the different open innovation arenas. In order to understand and make the most out of collaborations in arenas it is valuable to understand the management processes, organizational structures and interaction strategy choices impact on results. It would be interesting for further research to examine this relation.

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Appendix A – Interview Template

In this appendix the interview template for the semi-structured interviews are presented. The interviews were held in Swedish.

Short introduction to the project and the structure of the interview

Introduction
Tell us a little about you and your role

About the arena:
How did the arena arise, and which actor initiated it?
What is the ownership structure of the arena?
What is the process for an actor to join the arena?
What obligations/rights have the involved actors?
Are there different levels of commitment and engagement from the participants?
How does your arena differ from other similar initiatives?
What is different about working with open innovation in your sector? Challenges? Benefits?
Are collaborations primarily based on product development, business model, distribution etc.?
How do you promote innovation?

About projects / collaborations between the actors:
How is the collaboration work conducted?
What is the ownership structure of resources? Do you have common resources or are they divided between the different companies?
How is a project initiated?
How is the participants of a project decided?

- Can companies outside the arena (not partners) participate?
- Is the generated knowledge dispersed somehow?

How does the interaction change over time in a project?

A project example / narrative:
What type of project do you work with right now? (or an example of an ongoing or finished project)
How many actors are/were involved?
Who is/was driving?
How is/was the project group organized?

What is the time horizon of the project?

What kind of joint activities are/were organized?

How were objectives set for the project?

In such a project, how do you interact with external actors and stakeholders?

How did the interaction / activities change over time?

Do the interaction/activities vary over different projects?

Is the interaction affected by what kind of project it is?

What is the main purpose of running a project together?

Are there different objectives / value for different actors?

How do you ensure that value is created for all actors involved?

Have you been involved in other projects where the project was conducted in a different way? How?