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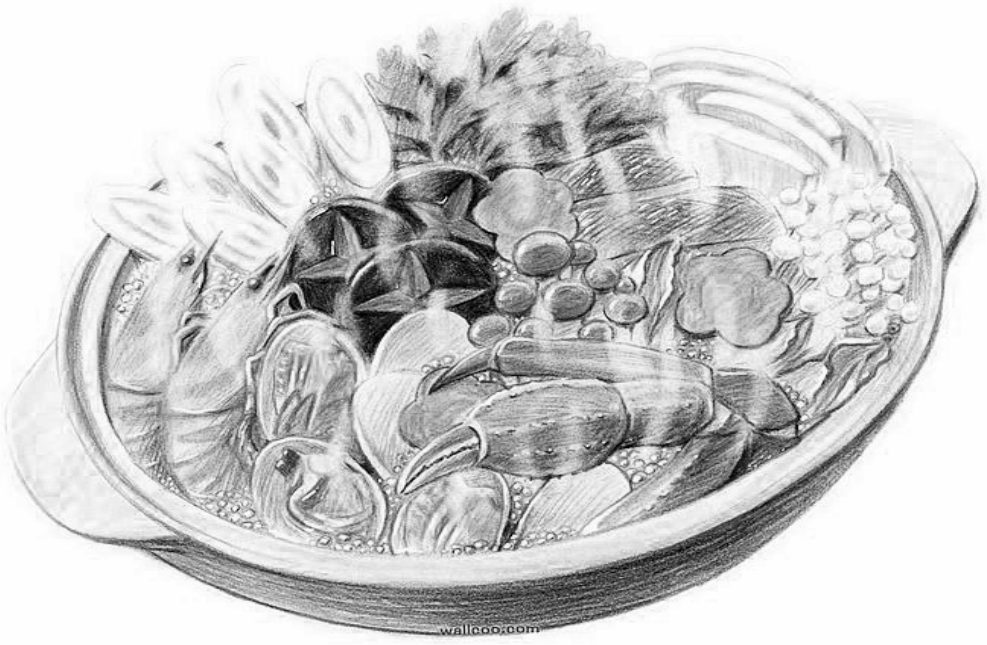

Creating Open Innovation Arenas

Towards a Framework for the Hot Pots of Open Innovation

Master of Science Thesis in the Master Degree Programme,
Management and Economics of Innovation

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Abstract

The purpose of this thesis is to investigate how a firm can create a physical arena for open innovation. More specifically the thesis examines how a firm can create conditions for tapping into external actors' knowledge at the intersection of the firm boundary and the outside world in an organized way by creating a physical place that facilitates interaction and allows the firm to leverage externally available knowledge in an effective manner. Such physical places are denoted open innovation arenas and have thus far not received much attention by scholars.

The thesis includes a review of open innovation literature that investigates the current standings on factors that are considered to influence a firm's ability to adopt and practice open innovation and what is important when tailoring external networks. Furthermore it contains an empirical study which investigates the findings from the literature review in the context of open innovation arenas and takes a further step to create an understanding of what firms should consider when creating the settings for open innovation arenas. It is based on interviews with firms and non-firm actors managing existing arenas for open innovation, as well as other practitioners of open innovation.

The findings of the literature review and the empirical study is structured in a framework for open innovation arenas that addresses (1) internal factors in a firm such as culture, practices and artifacts, and absorptive and desorptive capacity, (2) how to tailor the arena network with considerations such as types of actors, attention allocation, breadth and depth of sources, knowledge redundancy and innovative performance, and (3) how to create the setting of an arena with consideration to a formal dimension, an informal dimension, a structural dimension and a physical dimension.

The framework is tested by applying it to the company of Volvo Technology, a dedicated research organization of the automotive Volvo Group that has expressed a willingness to use the principles of open innovation and launch a physical open innovation arena of their own. The application of the framework both served as a way to qualitatively test the framework as well as a way to get a deeper understanding of the current situation at Volvo Technology and decide how the company should proceed in creating a physical arena for open innovation.

The thesis takes a first step towards an understanding of what to consider when creating open innovation arenas and paves the way for future research. We have investigated a limited number of actors and provided tentative dimensions regarding open innovation arenas. Future research should aim at a better understanding of the causal links between them as well as allow for more accurate recommendations for practical implementations.

Sammanfattning

Syftet med detta examensarbete är att undersöka hur företag kan skapa fysiska arenor för öppen innovation. Arbetet undersöker hur företag kan skapa förutsättningar, på en fysisk plats vid gränsen mellan företaget och dess omvärld, för att dra nytta av externa aktörers kunskap genom att på ett organiserat sätt underlätta interaktion och kunskapsutbyte. Vi benämner dylika platser arenor för öppen innovation. Öppen innovation har under de senaste åren fått mycket uppmärksamhet av forskare och företag, men arenor för öppen innovation har däremot hittills inte studerats i någon större utsträckning.

Detta examensarbete innehåller en genomgång av litteratur om öppen innovation och där faktorer som internt påverkar företag förmåga att utöva öppen innovation, samt hur nätverk för öppen innovation bör skapas, undersöks. Det innehåller också en empirisk studie, baserad på intervjuer med företag och experter, som söker skapa en förståelse för fenomenet öppna innovationsarenor.

Resultatet är en teoretisk modell för öppna innovationsarenor som tar upp (1) interna faktorer som kultur, vanor och artefakter samt absorptiv och desorptiv förmåga, (2) hur företag bör skräddarsy sina nätverk och ta hänsyn till typ av aktör, bredd och djup hos nätverket, kunskapsredundans och innovativ förmåga, och slutligen (3) hur förutsättningarna för en arena skapas genom att ta hänsyn till en formell dimension, en informell dimension, en strukturell dimension och en fysisk dimension.

Den teoretiska modellen testas slutligen på Volvo Technology, ett forsknings och utvecklingsföretag inom AB Volvo. Examensarbetet tar ett första steg mot en förståelse av arenor för öppen innovation och banar väg för vidare forskning i detta område med stor potential.

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List of abbreviations

CEO – Chief Executive Officer

CTO – Chief Technology Officer

HTCE – High Tech Campus Eindhoven

ICT – Information and Communication Technology

IP – Intellectual Property

NDA – Non Disclosure Agreement

NIH – Not-Invented-Here

OUH – Only-Used-Here

P&G – Procter and Gamble

RQ – Research Question

R&D – Research and Development

SMEs – Small And Medium sized Enterprises

VTEC – Volvo Technology

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This master's thesis has been conducted at Volvo Technology during the fall of 2011 and the beginning of 2012, and it has been written as a part of the master's program Management and Economics of Innovation. It has been conducted under the supervision of Maria Elmquist at the Center for Business Innovation at Chalmers University of Technology and Philip Wockatz at Volvo Technology.

We are highly grateful for all the guidance and support we have been given by our supervisors, since without their help and constructive criticism we would not have accomplished this much. Furthermore our appreciation goes to the employees at Volvo Technology for allocating their time for interviews. We particularly wish to thank Dr. Hans Persson who regularly made himself available, provided feedback, and gave direction to our work. A thank also to Lindholmen Science Park for access to their facilities, employees and for providing us with a workplace.

Last but not least we wish to thank all the interviewees in Sweden, Denmark, Belgium and the Netherlands for giving us the opportunity to conduct interviews with them and for their generous sharing of invaluable knowledge.

Gothenburg, January, 2012

Markus Hällbrant

Johan Ingvarsson

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1. Introduction

Behind the word innovation is the Latin word *innovare*, meaning renewal or alteration. Innovation is an essential part of the modern capitalist economy. Schumpeter wrote that "*the fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates*" (1942, pp.82-83). Modern firms are forced to innovate to stay competitive in the process of creative destruction through which innovation is incessantly destroying the old, incessantly creating new (Schumpeter, 1942). The words of Schumpeter still ring true more than half a century later.

The pressure to innovate has given rise to new theories of how innovation is best conducted. New models of innovation have highlighted the importance for innovators to collaborate with users, suppliers and institutions within their innovation system (Laursen and Salter, 2006). Some argue that they have found an antidote for the shortening product life-cycles, higher costs of technological development and rising competition. This antidote is spelled open innovation.

1.1 Open innovation

In recent years, open innovation has become one of the hottest topics in innovation management (Huizingh, 2010). The open innovation paradigm, which was first introduced by Henry Chesbrough in 2003, presented a distinction to what he called the closed innovation paradigm, see Table 1.

Table 1: Contrasting Principles of closed and open innovation (Chesbrough, 2003)

Closed Innovation Principles	Open Innovation Principles
The smart people in the field work for us.	If we create the most and the best ideas in the industry, we will win.
To profit from R&D, we must discover it, develop it, 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 to profit from it.
The company that gets an innovation to the market first will win.	Building a better business model is better than getting to the market first.
If we create the most and the 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 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 business model.

Whereas closed innovation requires a firm to generate, develop and nurture ideas inside the company until they are launched as new products or businesses, open innovation instead allows ideas to flow in and out of the company through what can be described as porous boundaries (Vanhaverbeke, 2005; Chesbrough, 2003). This interchange of knowledge with organizations or individuals that are not employed by the focal firm is at the core of open innovation and according to Chesbrough (2006) and Gaule (2006), companies should adopt this new way of thinking in order to exploit trends such as the increasing availability and mobility of skilled workers, the growth of venture capital and the rising quality of suppliers, trends that erode the advantages of closed innovation.

The promises of open innovation have engaged scholars from multiple disciplines who have provided conceptualizations that emphasize many different aspects of the paradigm. Open innovation literature tends to discuss notions of (1) inflows and outflows of knowledge, (2) the permeability of firm boundaries, (3) firm's deliberate adoption practices, and (4) factors that influence the success of open innovation adoption (Gianiodis, Ellis and Secchi, p.532, 2010).

Open innovation has not only received attention from academia. The interest from practitioners has also steadily increased. The phenomenon has moved from a small number of innovation practitioners, mostly active in high-tech industries, to a widely discussed and implemented innovation practice (Gassmann, Enkel and Chesbrough, 2010). Firms are adopting practices such as networking, collaboration, corporate entrepreneurship and proactive intellectual property (IP) management (de Jong et al., 2008). Such concepts that today are ascribed to open innovation have been practiced before the term was coined in 2003, which has given rise to criticism that open innovation only constitutes a repackaging of old concepts and findings that have previously been well discussed within the literature on innovation management (Trott and Hartman, 2009). However, by assigning a single term to a collection of developments, Chesbrough made open innovation very attractive for academics and practitioners (Huizingh, 2010).

In the closed paradigm of innovation, the locus of innovation was within the confines of the research and development (R&D) department. Open innovation is, on the contrary, a process where the innovation does not necessarily take place within the boundaries of the firm (Elmquist, Fredberg and Ollila, 2009). The changed locus of innovation raises interesting questions whether a firm can actively improve its innovativeness by tapping into the knowledge of external actors in an organized way. If innovation in an open paradigm no longer merely takes place within the walls of the firm it is interesting to explore how a firm can create conditions for it at the intersection of the firm boundary and the outside world. Furthermore it is interesting to investigate if these conditions can be created in a physical place that facilitate interactions with external actors and allow firms to leverage externally available knowledge in an effective manner. Such physical places can be denoted open innovation arenas.

Geographic co-location has been treated by scholars and is claimed to enhance trust and access to knowledge (Simard and West, 2006), but arenas for open innovation have rarely

been discussed in previous literature (Elmquist and Ollila, 2011). The available case studies have focused on other aspects rather than on how a firm can create such an arena. Still, companies' interest in practicing open innovation by creating various types of open innovation arenas is increasing (Almirall, 2008; Sundbo, 2011) and the fact that open innovation arenas have hitherto not been treated thus creates an opportunity to contribute to an interesting aspect of the theory of open innovation.

1.2 Purpose

The purpose of this thesis is to investigate how a firm can create a physical arena for open innovation.

1.3 Problem analysis

In order to fulfill the purpose of this thesis it is important to understand what influences how a firm can create a physical open innovation arena from the perspective of a focal firm. This in turn demands an understanding of the workings of an open innovation arena where the actual arena as well as the focal firm and the tailoring of the external network become important units of investigation. Consequently it becomes important to address: (1) what factors within firms affect their abilities to create the open innovation arenas, (2) what firms should consider when choosing the actors to include in the open innovation arena networks and (3) what firms should consider when creating the settings of their open innovation arenas. Understanding these three aspects is key to answering how a firm can create a physical open innovation.

The first step of the thesis is to investigate these three aspects by conducting a literature review in the open innovation field. As mentioned above, there is currently a lack of literature on open innovation arenas which complicates the investigation. However, there are still strains of literature that deal with factors within firms that affect their ability to adopt and practice open innovation. There is also literature dealing with the underlying rationale for networking, as well as the general considerations for companies when tailoring an external network. Hence, at least the first two aspects can be investigated in a general open innovation context. Two research questions are created to facilitate this investigation:

- *RQ1: What internal factors influence a firm's ability to adopt and practice open innovation?*
- *RQ2: What is important when tailoring a firm's external network?*

The lack of literature on open innovation arenas means that additional research is necessary in order to deduce if the findings of the literature review are applicable in an open innovation arena context. Therefore an empirical study is suitable to support the investigation of the first two research questions. An empirical study is also suitable to address the third aspect, which regards creating the settings for an open innovation arena. Thus the second step of the thesis is to investigate the three aspects in an empirical study where academics and practitioners, with insights in the field of open innovation and the workings of open innovation arenas, are interviewed. Three research questions are created to facilitate this study:

- *RQ3: What internal factors influence a firm's ability to create an open innovation arena?*

- RQ4: *What should firms consider when tailoring the network of their open innovation arena?*
- *RQ5: What should firms consider when creating the settings of their open innovation arenas?*

The third step of the thesis is to gather the findings of the literature review and the empirical study into a comprehensible format that highlights the three aspects that influence how a firm can create a physical open innovation. This creates a framework which facilitates the understanding of open innovation arenas.

The final step of the thesis is to test the framework by applying it on a case. The chosen company is Volvo Technology (VTEC), a company which is part of the Volvo Group with a mission to be in the forefront of technology and innovation. VTEC has declared an intention to create an arena for open innovation by making a part of their facilities open to external actors. Investigating how this can be done serves to deepen the understanding of arenas for open innovation and helps to revise and strengthen the framework.

2. Method

This chapter introduces the methodology that was used in completing this thesis. It includes reflections about the research strategy, research design and research process that were used in collecting and analyzing data as well as a discussion about the validity and reliability of the thesis.

2.1 Research strategy

Research strategy outlines the general approach on how to conduct a study. Bryman and Bell (2011) distinguishes between two such approaches: qualitative and quantitative. Although these two approaches are inherently different in their nature, research seldom adheres to one or the other. It is however important for researchers to understand the characteristics of each approach when setting up a research strategy. A quantitative approach is suited to statistically validate or falsify hypotheses, deduced from theory (Bryman and Bell, 2011). Not all quantitative research entails the explicit formulation of such hypothesis but it is of deductive nature with the aim to test existing theory with the use of measurements. Qualitative research is more explorative and inductive, where researchers use words rather than numbers to generate theory by observations and descriptions (Bryman and Bell, 2011).

The current lack of theory on open innovation arenas called for an inductive or abductive approach to research, rather than a deductive where hypotheses are developed from theory and thereafter tested. With an inductive approach theory is systematically generated from data and the main concern is related to the generation of new concepts and development of theoretical models, rather than confirmation of existing theory (Dubois and Gadde, 2002). This study was however not conducted as linearly as an inductive approach suggests, the theory was rather developed as new things were discovered during the generation of data. Dubois and Gadde state that an abductive approach stresses the *"continuous interplay between theory and empirical observation"* and that *"theory development, rather than theory generation [as in an inductive approach]"* is important (2002, pp.559). The research strategy of this thesis was chosen to accommodate the creation of a framework for open innovation arenas which then could be used with the company VTEC. It entailed using qualitative research methods and analysis and consequently an abductive, qualitative research approach was used throughout all the work.

2.2 Research design

The research design provided a framework for how to collect and analyze data during the study. Yin (2003) argues that the main purpose of the research design is to help avoid a situation where the collected data does not address the initial research questions. For researchers there are certain research designs one can adhere to. Depending on the research question and type of study different types of research designs are more or less suitable. Bryman and Bell (2011) describe five types of research designs; experimental, case study, cross-sectional, longitudinal and comparative design.

The purpose of this thesis is focused on discerning how a firm can create a physical open innovation arena. According to Yin (2003) a case study method is suitable when the researcher deliberately wants to cover contexts that are believed to be important for the

phenomenon of the study. Yin (2003) further states that the most important application of a case study is to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies and, for example, explain the link between a program's implementation with its effects. According to Bryman and Bell (2011) a multiple-case study is an extension of the case study design where a number of cases are studied and their specific contexts are regarded. A multiple-case study design is considered a suitable research design to fulfill the purpose of the thesis. However, due to limited access to other cases than VTEC and a constraint of time, some parts of the research aim to discern different patterns between the studied entities with less regard to the unique contexts of each case.

2.3 Research process

The research process included a number of distinct phases with different objectives. Although the phases are presented in a linear manner they were revisited several times over the course of the project. The phases will be shortly outlined below.

2.3.1 Research plan

The research plan was formed to create an early outline of the project to ensure the quality of the thesis and to make sure that the scope was appropriate. The plan included a background, a purpose, a problem analysis, a method, an expected outcome and a time plan. Moreover, the formulation of appropriate research questions was an important part of the research plan. The initial research questions guided the search of literature, the research design to employ and the decisions about which data to collect (Bryman and Bell, 2011). The research questions were changed several times over the course of the project as more information about the current situation was revealed.

2.3.2 Literature review

Reed (1998) states that the point of performing a literature review is to understand what others in the field have accomplished and how the work will differ from the works of others. According to her, the literature search is not only a step but also an iterative feedback loop. The defining of an unsolved problem determines the literature that will be searched for which then helps defining the unsolved problem. Reed (1998) suggests that an expert can produce valuable insight and possibly save a lot of time and effort in finding out which literature will be needed.

The first body of literature that was reviewed was within the area of research on open innovation. Here different strains of literature were studied in order to create a comprehensive understanding of the concept.

The next step of the literature review was to address and provide answers to the first two research questions. This meant looking for factors that can influence the adoption and practice of open innovation as well as what the current standings are on what is important for firms consider when tailoring networks. Also literature related to open innovation arenas was investigated, the lack of which prompted the use of empirical research, as will be outlined below.

For the literature review secondary sources were used. Secondary information offers quick and inexpensive answers to many questions and is usually the point of departure for primary research (Stewart and Kamins, 1999). The information utilized was in the form of proceedings, journals, and books. Journal articles are according to Reed (1998) the most current sources of information, and such were also primarily used.

2.3.3 Empirical study of open innovation arenas

The empirical work of this thesis was designed to facilitate the understanding of what is important when a firm creates an arena for open innovation. The first two research questions regard the internal and external context of a firm. These aspects have previously been treated in open innovation literature and could thus beforehand be investigated in the literature review. The insights gained there were then explored further empirically through interviews with people having experience in open innovation arenas to ascertain that these findings apply in the context of open innovation arenas.

Addressing the final three research questions called for a different approach in comparison to the first two. Here theory was developed abductively by interviewing people involved in different cases of open innovation arenas. In this approach, as explained by Eisenhardt and Graebner, theory is emergent and is *"developed by recognizing patterns of relationships among constructs within and across cases and their logical arguments"* (2007, p.25). In such an approach, real-world contexts where the phenomena occur are emphasized and the theory building process is recursive as case data is gathered (Eisenhardt and Graebner, 2007). The authors state that it perhaps is the best bridge from rich qualitative evidence to mainstream deductive research and it is likely to produce theory that is accurate, interesting, and testable.

Selecting instances

For the empirical study, academics and practitioners, with insights in the field of open innovation and open innovation arenas, were searched for. Here, people with relations to different types of open innovation arenas were chosen using convenience sampling since the selection of open innovation arenas was scarce and since the empirical study was limited in time and resources.

The first bulk of interviewees chosen were associated with firms that have created their own open innovation arenas. These were most relevant for the thesis as they provided information relevant in every aspect of an arena, and consequently to the three research questions addressed in the empirical study. However, since firms that have created arenas were rare to be found, people associated with non-firm actors that facilitate open innovation arenas were also interviewed. These people worked in more neutral environments compared to open innovation arenas created by firms, but conducting interviews with them was a good way of triangulating and collect enough data to reach saturation, something that would be more difficult merely adhering to firm-driven arenas. The neutral actors normally act as arena facilitators for larger government funded projects. Such projects usually involve the triple helix or users in particular and are set up with a specific topic in mind. Finally practitioners that have experience in open innovation were interviewed to provide input to aspects of adoption and practice of open innovation. The interviewed people are presented in more detail

in the empirical study and information about their associated entities can be seen in Appendix I.

Data collection

The information from the actors in the empirical study was gathered through semi-structured interviews. Bryman and Bell (2011) relate that semi-structured interviews entail having a list of questions, often referred to as an interview guide. This guide enable the researcher to ask follow up questions and create a deeper understanding, while making sure that the interviewees provided the researchers with information regarding all areas of interest. Moreover, semi-structured interviews reduce the difficulties in coding of the answers.

The use of semi-structured interviews facilitated the generation of thick descriptions while allowing for flexibility to change the questions as the understanding evolved. Holmén (Presentation, 2011-03-16) related that using interviews open up for the possibility of receiving biased answers. Moreover he explained that semi-structured interviews are time consuming and not easily repeated, and it can be difficult to ensure access to relevant people to interview. Still, semi-structured interviews were used in the empirical study since they aided the creation of a deep understanding of important factors.

The interviews were primarily conducted face-to-face but also over telephone. The interview guides for the semi-structured interviews can be found in Appendix I. Two interviewers were present at each interview and every interview was recorded. The recordings were then used as an aid when the interview was transcribed.

Data analysis

With the large amounts of data produced during the research, in the form interview transcripts, recordings, observations and photographs, handling everything was not straight-forward and therefore much attention was directed to the analysis part of the research. According to Eisenhardt (1989) people are poor processors of information and there are several risks with data analysis. Due to information-processing biases, researchers may leap to conclusions based on limited data, they may be influenced by elite or more vivid respondents, or they may drop evidence that does not fit the rest of the findings. Eisenhardt (1989) states that a tactic to alleviate the problems is to devise categories or dimensions, chosen by the researchers or by existing literature, that are used to look for similarities and differences among the cases. Another tactic is to list similarities and differences between pairs of cases. The first tactic described by Eisenhardt (1989) was applied as a number of categories and dimensions were chosen to structure the findings. The interview transcripts were analyzed by both researchers and a coding was made by grouping different pieces of information that fitted into the different categories together. The coding was performed as soon as possible to sharpen the understanding of the data and the transcripts from the interviews were revisited several times over the course of the study, as recommended by Bryman and Bell (2011).

2.3.4 Creating the framework for open innovation arenas

The literature review and the empirical study provided answers to the five research questions formed to facilitate the fulfillment of the purpose of this thesis. Gathering the findings of the literature review and the empirical study into a comprehensible format meant the creation of a

framework for open innovation arenas. This framework facilitates the understanding of open innovation arenas and is a tool that can aid in determining how a firm can create a physical arena for open innovation.

2.3.5 Using the framework for open innovation arenas

The last part of fulfilling the purpose of this thesis was focused on applying the understanding gained in the creating the framework to VTEC. As mentioned above, VTEC has declared an intention to create an arena for open innovation by making a part of their facilities open to external actors. The application of the framework both served as a way to qualitatively test the framework as well as a way to get a deeper understanding of the current situation at VTEC and decide how the company should proceed in creating a physical arena.

Selecting instances

To get input on how VTEC could create an arena, key personnel within the company was interviewed to get an understanding about the company and their internal factors, as well as to get their views of how the arena should be created. Personnel working at different positions in the organization were chosen to triangulate the data collected. The interview guide and the people interviewed can be seen in the Appendix II.

To get further input on how VTEC could open up an open innovation arena, the viewpoints of representatives from external actors were gathered. The representatives were being chosen with regards to their appropriateness for VTEC's future open innovation arena and since it was defined that the arena should be directed towards small and medium sized enterprises (SMEs) in the information and communication technology (ICT) and transport industry, such actors were interviewed. The interview guide and the SMEs interviewed can be seen in Appendix III.

Data collection

The interviews with the goal of gathering information about VTEC and SMEs in the ICT and transport industry were semi-structured. The data was collected using an interview guide that retained the possibility to vary the sequence and leave out questions that were not relevant to the interviewees.

2.3.6 Revisiting the framework for open innovation arenas

Finally the insights gained in the use of the framework, were discussed leading to a better understanding of how a firm can create a physical arena for open innovation. Here the frameworks practical applicability was discussed along with areas for future research.

2.4 Research quality

The quality of this study can be assessed by the degree of validity and reliability. Bryman and Bell (2011) relate that the validity of the study concerns whether or not the conclusions drawn from the research can be said to be valid and the reliability of a study concerns whether it is repeatable or not. Except validity and reliability it is also important to assess the overall quality of the work and whether or not respondents have given biased information.

2.4.1 Reliability

Bryman and Bell (2011) relate that there are two measure of reliability for a qualitative research. These have also been described by LeCompte and Goetz (1982) and are internal and external reliability.

The internal reliability of a study concerns whether or not the observers agree on the content of the data that has been gathered (Bryman and Bell, 2011). The internal reliability of the study is considered to be adequate. Two interviewers were present at each interview and it was discussed directly afterwards. All interviews were recorded and the recording was used as an aid when the interview was transcribed, hence increasing the internal reliability.

Bryman and Bell (2011) state that the external reliability is *"the degree to which a study can be replicated"* (Bryman and Bell, 2011, p.395). The empirical study and the application of the framework are described in this method section and the interview questions are enclosed in the appendices. However, the replicability of the study as a whole suffers as the way the study has been designed does not lend itself to replication easily. The main issue preventing a replication is the sampling and the inability to replicate the settings of the interviews. This in turn makes the external reliability fairly low.

2.4.2 Validity

The validity of a study can be established by looking at construct validity, external validity, and internal validity (Bryman and Bell, 2011). These are described below.

Construct validity

According Cepeda and Martin (2005), construct validity is concerned with whether a measure devised for a concept actually reflects the concept. According to Bryman and Bell (2011), the issue of construct validity is something that mainly applies to quantitative research. However, if a measure of a concept is unstable it is not validly reflecting the concept in question, which makes the study unreliable. Drawing conclusions about the construct validity of the study is difficult, but by pretesting interview guides and continuous discussions with the supervisors from Chalmers University of Technology and VTEC, it was possible to rather well ensure that what was intended to be measured, actually was measured.

External validity

Scandura and Williams (2002) relate that the external validity concerns whether the results of the research are possible to generalize to different populations. The framework for open innovation arenas is intended to be generalizable and used by different firms acting in different contexts. Thus the external validity is important which makes the representativeness of the instances in the empirical study and in the application of the framework interesting. It can be argued that the external validity is greatly helped by the fact that the empirical study presents a relatively large sample. However it might be that the representativeness of VTEC and the external actors of their arena are rather low and that the conclusions drawn from the application of the framework suffer from a rather low external validity. These conclusions

from the application are for that reason used with caution when feeding back into the framework.

Internal validity

Bryman and Bell (2011) describe how internal validity is an issue of causality and whether or not such causality exists between what has been measured and deduced. This tends to be a strength of qualitative research. The qualitative case study design generates thick descriptions which will underpin the analysis and conclusions. Continuous feedback from supervisors from Chalmers University of Technology and VTEC has contributed to strengthening the internal validity of the thesis.

2.4.3 Overall quality

It is important to assess the quality of the data that has been gathered during the study, i.e. whether or not the interviewees have given biased information. This is recognized by Porter (1991) who relates that experts may be biased but that the quality of data can be ensured by using multiple sources. Thus, interviews were triangulated with persons in different organizations without natural connections to each other. However, the sampling in the empirical study was somewhat ad-hoc since there was a shortage of time, resources and availability of open innovation arenas. Moreover, the sampling of external actors in the application of the framework was tailored to suit VTEC's open innovation arena. Such samplings could very well be a point of weakness in this thesis.

An additional weakness could be that the framework was applied to a company that was about to create an open innovation arena. The conclusions of the application could definitely have been lent more weight if the framework instead would have been applied to a company with an arena already up and running. This would have meant an investigation of an existing phenomenon and an analysis on how the factors actually do influence rather how they potentially could do so.

3. Literature review

In this chapter, previous literature regarding open innovation is reviewed in order to create a comprehensive understanding of the paradigm. Also, literature related to open innovation arenas, what internal factors influence a firm's ability to adopt and practice open innovation and what is important when tailoring a firm's external network, is investigated.

3.1 Open innovation

In today's highly globalized world, high availability and mobility of skilled workers, venture capitalists fostering the creation of startups and an increased number of qualified suppliers work to erode the possibilities for firms to be closed. It forces them to look externally to seize opportunities that fall outside of the organization's current business or combine their technology with external technologies to unlock their potential (Chesbrough, 2003). Firms have understood that in order to maximize profits from innovation they need to seek beyond in-house capabilities and resources and not leave innovations that they cannot commercialize themselves "*on the shelf*" (Giannopoulou et al., 2010). According to Chesbrough and Appleyard (2007) the external resources of volunteer contributors, innovation communities and ecosystems, and surrounding networks represent a growing source of value creation.

According to Simard and West (2006) open innovation is a value-creation strategy that is an alternative to vertical integration. Firms either identify external knowledge that they incorporate into the firm or seek external markets for their existing innovations. By accessing a network firms may fill in knowledge needs rapidly without the efforts to develop it internally or acquiring it through vertical integration. Networks also facilitate efforts to commercialize internal technologies.

Open innovation has promoted a trend to further move from the highly structured stage-gate model of innovation to an interactive probe-and-learn process that supports early interaction with customers, suppliers and R&D partners. Firms described in early works on open innovation have been large corporations, but recently smaller and medium-sized firms are opening up their innovation process to overcome their liability of being small (Gassmann, Enkel and Chesbrough, 2010).

Albeit being something of a management buzzword the paradigm has not made its rise uncontested. Trott and Hartman (2009) relate that many researchers argue that open innovation constitutes a repackaging of old concepts and findings that has been previously presented within the literature on innovation management. It has been argued that the dichotomy between open and closed innovation is exaggerated and that the principles of open innovation have been practiced in the industry long before the concept was conceived. For instance, Cohen and Levinthal (1990) already, in the year 1990, stated that outside sources of knowledge are often critical for innovation processes and that the ability of exploiting external knowledge is a critical component for the success of firms.

It may very well be that open innovation, as Trott and Hartman (2009) claims, is old wine in new bottles, but Huizingh (2010) states that the term has undoubtedly become a label that encompasses, connects and integrates this range of developments, enabling academics and

practitioners to reconsider innovation strategies in a networked world. Additionally, as the critics have noticed, open innovation may provide a psychological encouragement that further stimulates companies, which have almost adopted the principles, to go all the way (Trott and Hartmann, 2009). Chesbrough assigned a single term to a collection of developments and it has become an umbrella for existing practices, which has made it very attractive for academics and practitioners (Huizingh, 2010).

Lichtenthaler (2009), Chesbrough and Crowther (2006), Enkel, Gassmann and Chesbrough (2009) among other scholars have chosen to separate the processes of open innovation into two dimensions; inbound and outbound. Each dimension includes different activities but the direction of the purposive flow through the firm's boundary, is different. Figure 1 below depicts the flow through the firm's boundary.

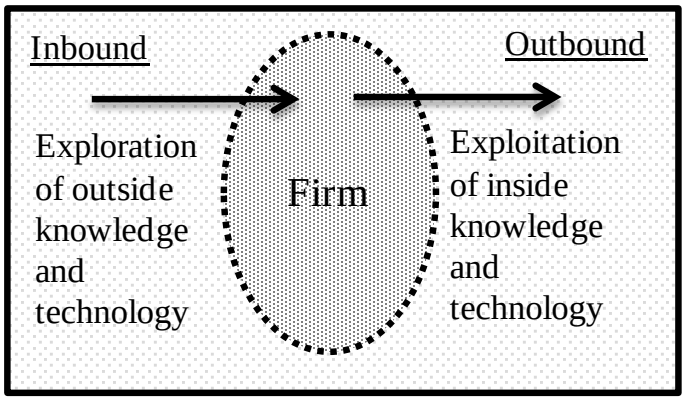

Figure 1: Inbound and outbound open innovation processes

The flows referred to as inbound (or outside-in processes) come from the outside into the firm and are aimed at an exploration of outside knowledge and technology. The flows referred to as outbound (or inside-out processes) come from the inside of the firm are aimed at exploitation of inside knowledge and technology. These flows have different goals and lead to different results for the firm, which has implications for how and when to implement them and how to manage them.

Open innovation has in previous literature mostly been focused on pecuniary activities such as selling and licensing IP, outsourcing R&D, and creating new ventures. It has to a lesser extent addressed non-pecuniary activities where the focus is on indirect benefits rather than direct financial benefits. Lichtenthaler (2006) points out that it is not only literature that has focused on the monetary dimension. Firms have also mainly been adopting such open innovation practices. Dahlander and Gann (2010) divide activities of open innovation into pecuniary or non-pecuniary. The difference is that the former, in terms of inbound activities, regard acquiring input to the innovation process through the market place whereas the latter refers to scanning the environment and using ideas and technologies readily available. The difference in the outbound dimension is regarding a commercialization of inventions or a revealing of them without an immediate financial reward. From the definitions by Dahlander and Gann (2010) it is however uncertain on what basis pecuniary and non-pecuniary activities are

divided. On one hand it could be interpreted as whether the firm seeks indirect benefits versus financial rewards and on the other hand whether a monetary transaction occurs or not.

3.1.1 Exploration

Cohen and Levinthal (1990) point to the fact that outside sources of knowledge are important for innovation and the ability to use external knowledge is a critical component of innovative capabilities. As previously mentioned, the inbound open innovation process refers to the flow from the outside environment of the firm through its boundary. It involves opening up the innovation process to exploration of knowledge (Lichtenthaler, 2011) and technology (Van De Vrande, et al., 2009). The aim is to enrich the firm's knowledge base through external knowledge sourcing by opening up to, and establishing relationships with external actors such as suppliers or customers (Enkel, Gassmann and Chesbrough 2009). March (1991) ascribes terms such as search, experimentation, play and discovery to the process of exploration.

Lichtenthaler (2011) argues that firms set up knowledge exploration processes when unexploited opportunities are perceived. By accessing the technical and scientific competences of external actors the firm may improve its innovative performance (Chiaroni, Chiesa and Frattini, 2010). Chesbrough and Crowther (2006) further argue that firms look for external technologies to extend or defend their core business and by doing so they minimize risks since they invest in technology already proven in other applications.

3.1.2 Exploitation

Exploitation refers to the outbound flow of knowledge and technology through the firm's boundary to its environment. It entails opening up the innovation process to knowledge and technology exploitation. Lichtenthaler (2011) refers to external knowledge exploitation as the commercialization of technological knowledge. March (1991) ascribes terms such as refinement, implementation and execution to the process of exploitation.

The aim with exploitation is to earn profits by taking ideas or internal knowledge to the market (Gassmann and Enkel, 2004; Van de Vrande et al., 2009) or to achieve strategic opportunities (Lichtenthaler and Lichtenthaler, 2009). Chesbrough (2006) notes that firms often need to transfer some of their own knowledge in order to gain access to external knowledge. Chiaroni, Chiesa and Frattini (2010) describe it as the practice of establishing relationships with external organizations with the purpose to commercially exploit innovation opportunities. More specifically firms may partake in activities such as licensing out of technologies, selling IP (Gassmann and Enkel, 2004) or selectively revealing internal resources to the outside environment seeking indirect benefits (Dahlander and Gann, 2010). The locus of exploitation is shifted outside of the firm and ideas are transferred to other companies. Thus the firm no longer restricts itself to the markets it is currently serving (Gassmann, Enkel and Chesbrough, 2009).

According to Lichtenthaler and Lichtenthaler (2009) academic research has previously mostly focused on the inbound activities of open innovation. They state that outbound activities of open innovation are growing in popularity in practice but they have been neglected in academic research. Several empirical studies have consistently found that firms perform more inbound than outbound activity (Huizingh, 2010). Torkkeli, Kock and Salmi (2009) also state

that the exploitation dimension has previously been neglected but the interest has recently grown significantly. As Chesbrough and Crowther points out *"every inbound technology effort by one organization generates a reciprocal outbound effort from some other organization"* (2006, pp.232-233), thus there is reason to believe that the preponderance result from which actors the studies have focused on rather than a trend in practice.

It is important to highlight that the exploration-exploitation dimension is not concerning separate stages of the innovation process where exploration refers to an early stage and exploitation a late stage. As Van de Meer argues, an open approach to innovation *"allows money to be made in every stage: not only by selling, but now also by licensing out or spinning out at earlier stages"* (2007, p.197). Thus an exploitation of knowledge or a technology may as well take place while it is in an early stage of development.

To capture the variety of strategic opportunities that may accrue if internal technologies are leveraged externally, the dimension of whether an exploitation activity has a pecuniary or strategic purpose can be used (Dahlander and Gann, 2010). An activity that has a direct financial reward as the primary purpose is referred to as a pecuniary activity. An activity that does not have a financial reward as a primary purpose, but may have indirect benefits, is here said to be strategic. Although the pecuniary activity can have indirect benefits it is carried out with an immediate end in view, as when the decision to license IP or spin out a technology is made. A strategic activity is, on the contrary, primarily of importance to the greater whole and without an immediate end in view, as when the decision to reveal internal knowledge is made to gain access to external knowledge as Chesbrough and Crowther (2006) has noted.

This concludes the review of the general field of open innovation. Henceforth mainly literature that might be relevant in the context of an open innovation arena is considered.

3.2 Open innovation arenas

Open innovation is aimed at tapping external knowledge and technology and putting it to use internally in the firm. It is simultaneously aimed at commercializing internal knowledge and technology by finding new pathways to the external domain. As Figure 2 illustrates, a firm is surrounded by an external domain, where external knowledge and technology resides and the open innovation arena acts as an interface between the firm and its surrounding.

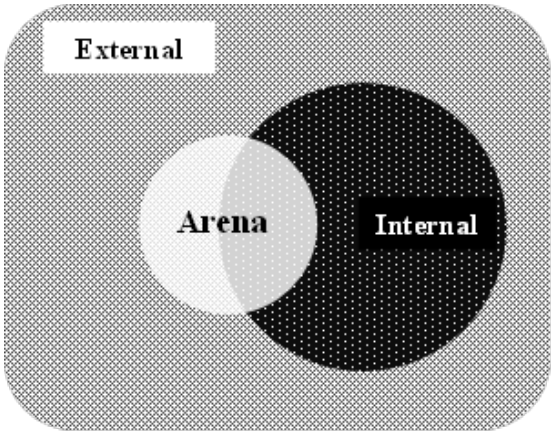

Figure 1: The firm and its surrounding domain

The fact that arenas for open innovation have not received much attention in the research field of open innovation so far (Elmquist and Ollila, 2011) makes it difficult to find relevant factors in the literature to answer what firms should consider when creating the settings for an open innovation arena. However, in the light of the increased importance of external resources academics have discussed related topics of networking, co-creation and collaboration on several different levels. Vanhaverbeke (2005) identified three different levels of analysis of the open innovation framework. The first level is the intra-organizational networks where the internal organization's effects on the firm's ability to integrate externally acquired knowledge have been analyzed. The next level is innovation at the dyad level which studies two (or more) firms tied to each other through alliances, corporate venturing investments, etcetera. The final level of analysis consists of the national or regional innovation systems. West, Vanhaverbeke and Chesbrough (2006) have similarly used five levels of open innovation, ranging from the level of individuals and groups, firms, inter-organizational value networks, industries and sectors to national institutions and innovation systems.

Several ways of practicing open innovation at the different levels have emerged. Hagel and Brown (2006) discuss the phenomenon of creation nets where hundreds or even thousands of participants collaborate to create new knowledge with a gatekeeping network organizer that coordinates the distributed, collaborative and cumulative innovation. Etzkowitz and Leydesdorff (1995) have discussed the triple helix which is based on ties among overlapping institutions and describes how industry, academia and governments can collaborate to create innovation. Von Hippel (2005) has highlighted to the potential of users in developing innovations instead of just being passive adopters of innovations. According to Almirall (2008) user participation is still emerging and is lacking structure and governance. Intermediaries such as InnoCentive and Yet2.com have provided a structure for users to participate but have a narrow focus on inflow/outflow of ideas. Living labs are arenas where actors can experiment in open, real life environments (Almirall, 2008). In Living labs firms, public authorities and citizens collaborate to create, prototype, validate and test new services, businesses, markets and technologies (Niitamo, Kulkki, Eriksson and Hribernik, 2006). Other forms of open laboratories have been described where experiments and events are carried out with customers, employees, suppliers and experts (Sundbo, 2011).

The field of open innovation is at an early stage and there are knowledge gaps that should be addressed (Gassmann, Enkel and Chesbrough, 2010). The lack of literature regarding open innovation arenas creates an opportunity to contribute to this knowledge gap by using empirical research. This is addressed in the section regarding the empirical study of open innovation arenas. Literature that relates to factors within the focal firm as well as to the tailoring of a firm's network is investigated below.

3.3 Internal factors influencing a firm's ability to adopt and practice open innovation

RQ1: What internal factors influence a firm's ability to adopt and practice open innovation?

Investigating the internal factors that influence the creation of an open innovation arena means investigating what decides how a firm can make a transition towards openness and thus how well the firm later can practice open innovation. Several concepts regarding this internal dimension have previously been discussed by academics and are closely related to the paradigm of open innovation, although many of them originated much earlier.

Herzog and Leker (2010) argue that a cultural change has to accompany a change from closed to open innovation. While it is difficult to define what culture constitutes, definitions that appear in the literature are often similar and emphasize things such as values, norms, attitudes, and behavior patterns that form the core identity of an organization (Herzog and Leker, 2010). Related to culture are the symbols, heroes and rituals of an organization as explained by Hofstede et al. (1990). These are practices and artifacts that are extended to incorporate internal processes and structures as they link to the inner and outer levels. Moreover, central tenets in open innovation are the use of external knowledge to leverage internal innovation and the exploitation of internal knowledge externally. The former has been discussed by Cohen and Levinthal (1990) as absorptive capacity and the latter has been treated by Lichtenthaler and Lichtenthaler (2007) who terms it desorptive capacity, depicting the parallelism to absorptive capacity. The culture, practices and artifacts, and absorptive and desorptive capacity, are discussed in more detail below.

3.3.1 Culture

Hofstede et al. (1990) argued in his study that there was no consensus about the definition of culture pointing to the difficulty of defining what culture consists of. Nonetheless the definitions that appear in the literature are often similar. Schein (2004) states that formal definitions of culture emphasize how people perceive, think about, and feel about things. Herzog and Leker (2010) similarly define culture as something that groups share or hold certain and they attribute things such as values, norms, attitudes, and behavior patterns that form the core identity of an organization or of its sub-units. We choose to divide culture into different categories depending on how deep they manifest and therefore how observable they are, similarly to Hofstede et al. (1990).

The shallowest manifestations, symbols, heroes and rituals, are termed practices (Hofstede et al., 1990). Schein (2004) discusses artifacts, as the shallowest manifestation of culture. According to him these include organizational processes and *"structural elements such as charters, formal descriptions of how the organization works, and organization charts"* (Schein, 2004, p.26). In this thesis the term culture is referred to as the deepest level with values, beliefs and norms, things that are not readily observed. The more visible manifestations are referred to as practices but to emphasize the importance of structural elements, artifacts are included in the model.

The importance of the culture to facilitate a transition towards an open innovation strategy has previously been discussed in the literature on open innovation. The principles of open

innovation brought forward by Chesbrough (2003), that contrasts the closed principles, make up the set of norms, beliefs and way of thinking that innovation in an open system requires (Van de Meer, 2007). As Herzog and Leker (2010) also point out, open innovation requires a different way of thinking compared to closed innovation. They argue that a change in a firm's innovation culture is needed to make the move towards open innovation. Furthermore the authors state that previous research has neglected *"the people side of the equation"* (2010, p.323), and that little is known about innovation cultures in open innovation settings.

Herzog and Leker (2010) are highlighting the importance of an ability to modify the culture. They present three specific manifestations of culture that influence a transition towards an open innovation strategy and should therefore be given special attention. At the deeper level of cultural manifestations the authors address the "Not-Invented-Here"-syndrome. A related syndrome that has been discussed and is said to affect the ability to exploit knowledge and technology is termed "Only-Use-Here "syndrome (Lichtenthaler and Ernst, 2006). At the surface level, which constitutes observable practices, organizational risk-taking and general management support is addressed. Gassmann Enkel and Chesbrough (2010) states that a culture that values outside competence and know-how is crucial but besides the values of the company there are concrete artifacts influence the culture. The authors mention things such as incentive systems, management information systems, communication platforms, project decision criteria, and supplier evaluation lists, etcetera.

Not-invented-here and only-used-here syndromes

Dodgson et al. (2006) studied the case of Procter & Gamble (P&G) and learned that a significant cultural change accompanied the move towards the company's open innovation strategy, which was also pointed out by Huston and Sakkab (2006), at the time the vice president of innovation and senior vice president of corporate R&D at P&G respectively. One of the challenges was to convince the *"R&D organization to move its culture from "not-invented-here" to one based on "proudly-found-elsewhere""* (Huston and Sakkab, 2007, p.23). P&G is a case in point but the story may be different in other companies as a researcher states *""Proudly developed elsewhere" is a great claim by P&G, but not in the culture of most companies yet"* (in Fredberg et al, 2008, p.30).

The not-invented-here syndrome (NIH) can be defined as a syndrome which *"represents a negatively biased, invalid, generalizing and rigid attitude of individuals or groups to externally developed technology, which may lead to an economically detrimental neglect or suboptimal use of external technology"* (Mehrwald, 1999, p.50, translated and quoted by Lichtenthaler and Ernst (2006). It may have severe consequences for a company striving for implementing an open innovation strategy. Herzog and Leker highlight that *"because sourcing ideas, technologies and knowledge from the external environment is a major building block of a firm's open innovation strategy, being infected with the NIH syndrome would be disastrous for such a firm"* (2010, p.328).

As the NIH syndrome is related to the use of externally developed technology it impedes the exploration dimension of open innovation. Chesbrough (2003) uses a complementary concept which he names "not-sold-here" attitude. It relates to the exploitation dimension of open

innovation and according to the author it stems from the fear of losing control of a technology that outside companies steal and make money off. It is closely related to the only-used-here (OUH) syndrome which according to Lichtenthaler and Ernst (2006) refers to a negative attitude to external knowledge commercialization. These attitudes are strengthened by limited experience with external knowledge exploitation and inadequate incentive systems that reward only internal innovations (Lichtenthaler and Ernst, 2006).

Lichtenthaler and Ernst (2006) further state that the OUH syndrome results in an incomplete exploitation of a technology's monetary and strategic potential, which can lead to a failure in establishing industry standards and difficulties in gaining access to external knowledge. Thus, to make the transition towards an open innovation strategy fruitful, both syndromes should be addressed by the company, as to enable the company both to explore external knowledge and finding new paths to exploit the internal knowledge.

3.3.2 Practices and artifacts

Practices are the symbols, heroes and rituals as explained by Hofstede et al. (1990). In this thesis the view of practices is extended to incorporate internal processes and structures as they link to the inner and outer levels. They are termed artifacts, a term overlapping practices but including organizational processes and structural elements that describe how the organization works (Schein, 2004). Especially two concepts are of interest here; organizational risk-taking and management support.

Organizational risk-taking

Developing a new technology or product is inherently a risky endeavor and an open approach to innovation is associated with greater risk than a closed approach (Herzog and Leker, 2010). As Adner (2006) points out, an innovation has less control over its success the more it depends on other developments as the probability of something going wrong increases. There is also a risk related to the eventual value of an external technology, which for different reasons is harder to assess. Chesbrough (2006) argues that although an external technology may have a higher expected value than an internal technology, the variance of the expected value may be higher as well. As Herzog and Leker (2010) argue, the difficulties for the firm in assessing the external technologies are in essence an issue of information asymmetries. The authors state that information asymmetries leave room for opportunistic behavior at the technology provider and high transaction costs due to the tacit nature of technological knowledge.

Chesbrough (2004) introduces the metaphor of playing chess and poker from Jim McGroddy of IBM to manage innovation in an uncertain environment. He argues that the company must play chess in order to minimize the false positives – projects that fit the business model but turn out less valuable – and play poker in order to manage the false negatives – projects that seemed unpromising at first but turned out valuable. The difference between chess and poker is that while chess is played with a known playing field, defined pieces and possible moves, poker is uncertain and decisions must be made as more information is revealed. Chesbrough (2004) explains that when a new technology is targeted at a known market, the possible moves are known. But when both the technology and the market are unknown, the path to the

market is not only unknown, but unknowable. Companies should therefore stage the investments into projects upon receiving new information and expose failures to outsiders to get their perspectives on the potential.

Management support

According to Herzog and Leker (2010) the management should support innovation by providing sufficient resources in terms of people, budget, and time. The authors also relate that a form of support is if the management is involved personally in the innovation process. The value of management playing a visible, involved role has been much studied. Herzog and Leker (2010) argue that a supporting and encouraging management is a prerequisite for any innovation culture, regardless of whether the strategy is open or closed. The support can come in the form of a champion or promoter.

Champions have been much discussed in the literature and in the context of open innovation two different roles of champions can be distinguished. In the case of Italcementi studied by Chiaroni, Chiesa and Frattini (2009) the new head of R&D became a champion for open innovation which facilitated the change towards an open strategy. When Chesbrough and Crowther (2006) studied 12 early adopters of open innovation they found that the adoption issue was addressed by ensuring senior management support and creating open innovation champions to manage the process. In the above mentioned examples the champion takes the role of proclaiming the change and thus inducing a cultural change. Many researchers agree that cultural change is essential and the management must lead the way. The leader must find and fight resistance to change while supporting and motivating people involved with the open innovation process (Giannopoulou, 2011).

The second role is related to the assumption that particular innovations will meet resistance. Laursen and Salter (2006) argue that external sources of innovation may confront internal resistance from the technical staff and according to Herzog and Leker (2010) these barriers can be overcome by innovation promoters or champions. In the case of Italcementi innovation champions were established for each main research area as a measure to institutionalize the transition towards an open innovation strategy (Chiaroni, Chiesa and Frattini, 2009).

3.3.3 Absorptive capacity

When Cohen and Levinthal coined the term absorptive capacity, they defined it as *"the ability of a firm to recognize the value of new information, assimilate it, and apply it to commercial ends"* (Cohen and Levinthal, 1990, pp.128). Although the concept of absorptive capacity was developed long before Chesbrough conceived open innovation, researchers and practitioners are currently discussing it in the context of the open innovation paradigm. Simply put, a firm's absorptive capacity is one factor that determines how porous its boundaries are, for exploration purposes. Spithoven, Clarysse and Knockaert (2010) argue that having absorptive capacity is a pre-condition for organizing inbound open innovation activities. The authors state that although firms that want to engage in inbound open innovation need to develop it, thus far little attention has been paid to the concept in an open innovation context.

Lane and Lubatkin (1998) put forward a revised form of Cohen's and Levinthal's (1990) absorptive capacity that they term relative absorptive capacity. This concept is related to the

inter-organizational level, highlighting that absorptive capacity is relative and depends on the situation. The authors argue that a firm's ability to learn from another firm "*depends on the similarity of both firms' (1) knowledge bases, (2) organizational structures and compensation policies, and (3) dominant logics"* (Lane and Lubatkin, 1998, p.461). They state that the focal firm should develop self-awareness in terms the knowledge it holds, the processes by which knowledge is converted into capabilities, and how those capabilities can meet demands of the environment.

The absorptive capacity of a firm hinges on its internal resources. More explicitly, Cohen and Levinthal argue that *"the ability to evaluate and utilize outside knowledge is largely a function of the level of prior related knowledge"* (Cohen and Levinthal, 1990, pp.128). That prior related knowledge determines firms absorptive capacity has been recognized by many researchers and much of the related literature suggests that it is more precisely a firms internal R&D that is the determinant (Rosenberg, 1990). This argument has been adopted by Chesbrough (2006) who presents a new rationale for internal R&D. He argues that companies should organize their R&D to:

- Identify, understand, select from, and connect to the wealth of available external knowledge
- Fill in the missing pieces of knowledge not being externally developed
- Integrate internal and external knowledge to form more complex combinations of knowledge, to create new systems and architecture

It is clear that internal R&D enable absorption of external knowledge. However, there are also structures within organizations that allow them to access and integrate this knowledge into internal innovation processes, (Chiaroni, Chiesa and Frattini, 2009). One example of this is the case of Procter & Gamble who strengthened their absorptive capacity by setting up dedicated organizational structures for open innovation (Lichtenthaler, 2011).

One structural component that facilitates the external knowledge exploration is knowledge management systems. These systems consist of information and communication technology that foster the diffusion, sharing and transfer of knowledge inter and intra firms (Chiaroni, Chiesa and Frattini, 2009). In their case study of Procter & Gamble, Dodgson et al. (2006) describe the role of technology in open innovation. They argue that Procter & Gamble successfully use technologies such as simulations, prototyping and visual representation to support their application of open innovation.

Another aspect of the organizational structures can be found on the individual level in companies. In an effort to investigate communication between organizations and their external environment, Tushman and Katz (1980) describe the organizational role of gatekeepers as "one vehicle to link organizations to external information areas" (Tushman and Katz, 1980, pp.1083-1084). These gatekeepers are individual within an organization that gather, understand and translate external information into terms that are meaningful and useful to internal colleagues (Tushman and Katz, 1980).

3.3.4 Desorptive capacity

As been described above, a firm's absorptive capacity refers to its capability of external knowledge exploration. When it comes to the reverse, i.e. the capability of exploitation of internal knowledge, Lichtenthaler and Lichtenthaler introduces the concept of desorptive capacity. They describe that "*desorptive capacity comprises the process stages of identifying external knowledge exploitation opportunities and subsequently transferring the knowledge to the recipient"* (Lichtenthaler and Lichtenthaler, 2009, pp. 1322). The concept of desorptive capacity is strongly related to Gassmann's and Enkel's (2004) multiplicative capability which they describe as a company's capability to multiply and transfer its knowledge to appropriate outside partners (Gassmann and Enkel, 2004, pp.13).

In order to exploit internal knowledge it must first be generated internally. This is in line with Gassmann's and Enkel's (2004) argument that one part of being multiplicative is the capability to multiply knowledge. Chesbrough (2006) recognizes the role of internal R&D in this context and further argues that companies should organize their R&D to generate output that can be exploited externally.

At the same time as it generates technology for possible exploitation, internal R&D also facilitates the identification of exploitation opportunities, something that is considered an essential managerial challenge by Lichtenthaler and Lichtenthaler (2009). Moreover, the identification of exploitation opportunities parallels the strategic selection of appropriate external partners that is considered an important element by Gassmann and Enkel (2004). One example of successful identification of opportunities and exploitation of technology can be found in Procter & Gamble. There, employees are encouraged to find external exploitation opportunities for their technologies (Sakkab, 2002). This has increased the technology exploitation to the point where only ten percent of the company's technology used internally (Sakkab, 2002).

Gassmann and Enkel (2004) argue that a company must be able to codify and share its knowledge with the external entity for successful exploitation. As with absorptive capacity, this requires organizational structures that are able to transfer that knowledge and again gatekeepers are important.

3.3.5 Synthesis

From the study of the literature a number of factors were arrived at that are considered to influence the adoption and practice of open innovation. These have been discussed long before the term open Innovation was coined but they have later been discussed in the context of open innovation by different scholars. The concepts can be treated at different levels, as they manifest in different ways. Figure 3 depicts how the different concepts manifest in a firm, from deep, not readily observable such as cultural values, to shallow, such as processes and practices or artifacts.

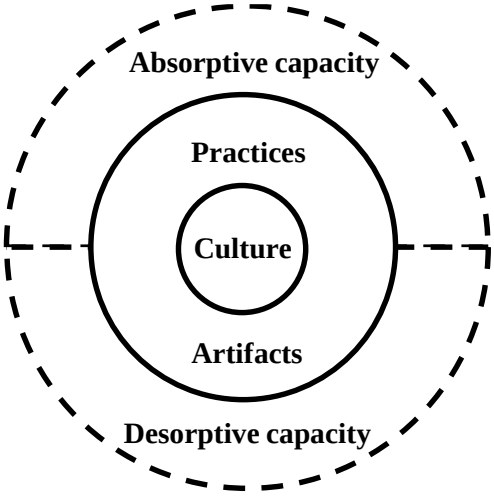

Figure 3: Factors in the internal dimension

At the deepest level, which is the least visible to an observer, is the culture. Culture is nonspecific, unconscious, feelings of what is right and wrong or important and unimportant etcetera, (Hofstede et al., 1990) and open innovation literature has highlighted the not-invented-here and only-used-here syndromes (Lichtenthaler and Ernst, 2006). The subsequent level is practices and artifacts. Organizational risk-taking and management support are among the practices discussed in literature regarding open innovation (Herzog and Leker, 2010). We treat artifacts as overlapping practices but they also include organizational processes and structural elements that describe how the organization works, as explained by Schein (2004). At the outermost level is the absorptive and desorptive capacity. Absorptive capacity is the ability of a firm to absorb new knowledge and finally apply it to commercial ends (Cohen and Levinthal, 1990), and it has been argued to be a pre-condition for inbound open innovation (Spithoven, Clarysse and Knockaert, 2010), i.e. exploration. Desorptive capacity regards the ability to identify opportunities where knowledge can be exploited externally, and acting on the opportunities (Gassmann and Enkel, 2004).

3.4 Tailoring a firm's external network

RQ2: What is important when tailoring a firm's external network?

In order to answer the second research question it is crucial to understand the underlying rationale that a company has for networking, as well as the factors that a company should consider in tailoring its network. Based on our findings from the literature regarding networking and open innovation, it can be argued that considerations on how capabilities and knowledge can be complemented, as well as how breadth and depth of sources can be ensured, are important. These are outlined below.

3.4.1 Rationale for networking

Using external ideas, knowledge and technology in the innovation process is at the center of the open innovation model and open innovation is almost by definition related to establishment of ties with external actors (de Jong et al., 2008). Knowledge flows through and resides in individuals, and is often divided in tacit knowledge and explicit, where the former is

not articulated or codified (Simard and West, 2005). Simard and West (2005) state that the flow of knowledge through formal and informal ties between actors is crucial to many innovations. External actors used for innovation can range from (1) suppliers, (2) clients or customers, (3) competitors, (4) consultants, (5) commercial laboratories or R&D enterprises, (6) universities or other higher education institutes, (7) government research organizations, to (8) private research institutes (Laursen and Salter, 2006).

The benefits of networking are well discussed in the open innovation literature as a source of new knowledge and a way to commercialize internal knowledge. Networking includes all activities to acquire and maintain connections with external partners (de Jong et al. 2008) and comprises both formal collaborative projects and more general and informal networking activities (Van de Vrande, et al., 2009). Networks allow firms to rapidly fill in specific knowledge needs without having to spend enormous amounts of time and money to develop that knowledge internally or acquire it through vertical integration. Chesbrough (2003) argues that if firms are too focused internally they will miss opportunities because they fall outside of the organization's current business or need to be combined with external technologies to unlock their potential. According to Acha and Cusmano, a network serve as a *"locus of innovation because it provides timely access to knowledge and resources that are otherwise unavailable, while also testing internal expertise and learning capabilities"* (2005, p.2), which is related to absorptive and desorptive capacity.

The motives for firms to collaborate are many. According to Tether (2002) firms enter into collaborative arrangements for innovation because they internally lack necessary resources to develop an innovation or because they wish to reduce the risks associated with innovation. In his study, Tether (2002) found that both motives could be present at once and that they are interrelated. Another finding was that cooperative arrangements for innovation were more common amongst firms that introduced innovations that were both new to the firm and to the market. The author state that firms developing radical innovations are more likely to cooperate with external partners, suggesting that externally sourcing ideas and technologies is important, since it can reduce the uncertainties inherent in the innovation process and expand the market.

3.4.2 Complementing capabilities and knowledge

Larger firms and smaller firms complement each other in terms of innovative capabilities. Lee, Park and Yoon (2009) argue that large firms are less flexible and innovative in new areas but will tend to have stronger resources to develop inventions into products or processes, resources SMEs usually lack. The authors argue that it attracts SMEs to collaborate with larger firms. However Jong et al., (2009) argue that SMEs collaborate with external partners to a lesser extent. Van de Vrande et al. (2009) found that the motives for SMEs to engage in open innovation are mainly market-related such as keeping up with current market developments, customers and increasing their growth and/or market share. Gaining new knowledge and tapping into external expertise was also found to be an important motive. Furthermore the authors state improving product development and process/market innovation as well as managing costs and improving efficiency as important.

Clearly different actors possess different knowledge but they also differ in terms of how to tap into that knowledge. The concept of relative absorptive capacity conceived by Lane and Lubatkin (1998) suggests that the type of actor the firm chooses to collaborate with is important for how well the sought knowledge can be tapped into. Using the metaphor of student-teacher learning, the authors argue that since firms have high relative absorptive capacity with their peers they are the most easily understood teachers.

Simard and West (2006) argue that an optimal innovation strategy exploits multiple types of institutions as each institution favors flows of different pieces of knowledge. For example, universities are known for creating basic knowledge and high-quality research universities produce knowledge spillovers. Furthermore venture capitalists are an important source of knowledge as they have ties to multiple startup companies and are focused on commercializing technologies. According to Simard and West (2006) they can help to identify needed knowledge and potential synergies beneficial to startups and established companies. Other actors that may play an important role are key government entities, such as the military. Law firms and consultants may also act as sources of knowledge or bridges to other organizations.

3.4.3 Breadth and depth of sources

Laursen and Salter (2006) have investigated the concepts of breadth and depth as two components of the openness of individual firms' external search strategies and their influence on innovative performance. Breadth is defined as *"the number of external sources or search channels that firms rely upon in their innovative activities"* and depth is defined in terms of *"the extent to which firms draw deeply from the different external sources or search channels"* (Laursen and Salter, 2006, pp.134-135). The authors also argue that firms may 'over-search' which leads no negative effects on the innovation performance, too many external and internal communication channels lead to an attention allocation problem. Innovation search is not costless and can be time consuming, expensive, and require labor, and the authors confirm empirically that 'over-search' hinders innovation performance. Laursen and Salter (2006) found strong support for their hypotheses that external search depth and breadth are curvilinearly (inverted U-shape) related to innovative performance. They found tipping points of a search breadth of 11 sources and a search depth of 3 before negative returns set in.

Simard and West (2006) similarly to Laursen and Salter (2006) distinguish ties to network actors as either deep or wide. They also argue that firms need to build ties that are both wide and deep while making sure that the value of the outflowing knowledge is less than the value of the knowledge flowing into the company. The authors state that several scholars have pointed out that the complementing knowledge stock and knowledge deficits of actors involved in networking activities leads to a "learning race". Simard and West explain it as when *"one organization tries to maximize its learning from the other and minimize the amount learned by the other while trying to retain trust"* (2006, p.22). Repeated interaction is one factor that fosters trust between partners, as pointed out by Galati (1995; quoted in Simard and West, 2006). According to Simard and West (2006) knowledge contained in deep networks is easier to capture but it is likely to be redundant, which consequently is likely to

lead to incremental innovation. Wide networks on the other hand provide access to non-redundant information. Thus wide networks provide greater potential for radical innovation but the authors claim it is at the cost of trust inherent in deep ties. Furthermore wide networks are more difficult to coordinate and manage.

Simard and West (2006) subdivide the deep and wide ties between individuals and organizations into formal and informal. The authors state that formal ties are contractually agreed upon, planned channels for knowledge exchange, such as joint research, licensing agreements or marketing agreements. Informal ties, on the other hand, are unplanned and can stem from labor movements, regional communities of practice or past common organizational affiliation. Informal ties are important since they may provide an inbound flow of commercially valuable knowledge, but Simard and West (2006) also argue that they are difficult to predict and furthermore difficult to incorporate into a strategy.

The findings of Laursen and Salter (2006) and Simard and West (2006) are summarized in Figure 4 below. The focal firm has limited attention it can allocate for external search for innovation. Thus a balance of the breadth and depth of the sources should be kept in order to reach maximum innovative performance. Maintaining broad or deep networks is associated with difficulties that have to be managed. A broad network is, as mentioned above, more difficult to manage as a larger number of ties strain the attention allocation, thus overwhelming the firm's ability to recognize the relevant knowledge in each tie (Beckman and Haunschild, 2002; quoted in Simard and West, 2006). Alongside it becomes more difficult to build trust if the ties lack depth. In a network with deep ties the firm runs a risk of becoming closed to outside knowledge and forces it to rely too much on repeated interactions which lead to the firm becoming over-embedded with the network partners and ultimately the firms will only have access to redundant information.

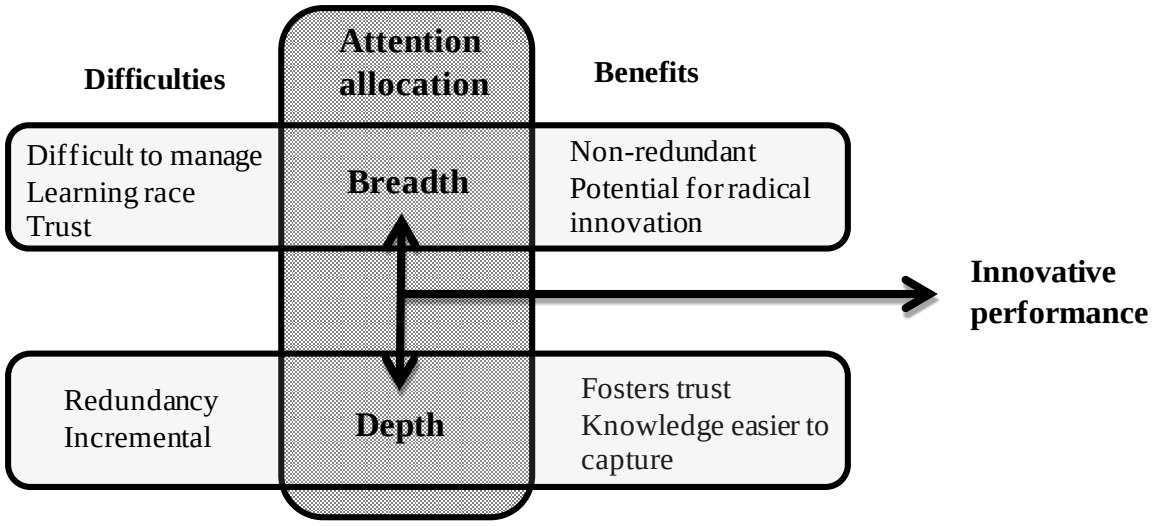

Figure 4: Aspects to consider when creating and managing a network

3.4.4 Synthesis

Open innovation is almost by definition related to establishment of ties with external actors (de Jong et al., 2008), such as (1) suppliers, (2) clients or customers, (3) competitors, (4) consultants, (5) commercial laboratories or R&D enterprises, (6) universities or other higher education institutes, (7) government research organizations, to (8) private research institutes (Laursen and Salter, 2006). Firms collaborate for many reasons, such as gaining complementary resources and capabilities or reducing risk associated with innovation (Tether, 2002). Searching for and maintaining connections with actors to cooperate with is not costless and can be time consuming, expensive, and require labor, thus, as Laursen and Salter (2006) found, 'over-search' hinders innovation performance. In other words search suffers from diminishing returns and the attention firms should allocate is limited. Simard and West (2006) distinguish two types of ties, either deep or wide, where the former fosters trust but may provide redundant information and the latter provides non-redundant information and thus greater potential for radical innovation. They argue that firms need to develop both broad and deep ties.

4. Empirical study of open innovation arenas

The empirical study investigates if the internal factors and the factors that influence how firms tailor their external network also apply in a context of open innovation arenas. Moreover it investigates what firms should consider when creating the settings of their open innovation arenas. For the study, academics and practitioners, with insights in the field of open innovation and open innovation arenas, were searched for. As described in the method section people related to different types of open innovation arenas were interviewed. These people were associated with firms that have created own open innovation arenas as well as with more neutral open innovation arenas. Also practitioners with experience in open innovation were interviewed. The people interviewed as well as their position can be seen in Tables 2 - 4. More information on their associated entities can be found in Appendix I.

Table 2: Interviewees associated with firm driven open innovation arenas

Firm driven arenas	Position of interviewee	Date
High Tech Campus Eindhoven, Netherlands	Manager of Business Development and Communication	2011-11-16
Södra PulpLabs, Väröbacka, Sweden	Manager	2011-11-14
Greenovate!, Brussels, Belgium	Managing Director	2011-11-15
Holst Centre, Eindhoven, Netherlands	Communication Assistant	2011-11-17
Tryg, Copenhagen, Denmark	1: Head of Strategy and Innovation 2: Innovation Consultant	1: 2011-11-18 2: 2011-11-18
Flemish Living Lab, Mechelen, Belgium	The Platform and Infrastructure Manager	2011-11-14

Table 3: Interviewees associated with neutral open innovation arenas

Neutral arenas	Position of interviewee	Date
SAFER, Gothenburg, Sweden	1: Director 2: Open Innovation researcher	1: 2011-11-08 2: 2011-11-09
Security Arena, Gothenburg, Sweden	1: Project Manager 2: Innovation Designer	1: 2011-11-02 2: 2011-10-10
Botnia Living Lab, Luleå, Sweden	General Manager	2011-10-28

Table 4 Open innovation practitioners

Enterprises	Open innovation practitioners	Date
SCA, Gothenburg, Sweden	1: Open Innovation Programme Manager 2: Director of Innovation and Knowledge Management	1: 2011-12-01 2: 2011-12-01
NineSigma, Leuven, Belgium	Vice President, Europe	2011-11-14
Opticom International Research AB, Stockholm, Sweden	Co-founder and CEO	2011-11-03

Among the studied arenas, most had a clear purpose, while some have more sweeping reasons behind their conception. When there is a governmental agency involved, that manages or sponsors the arena or projects in the arena, it has normally been set up with a specific goal e.g. run projects in areas that span several fields of knowledge such as civil security, traffic safety and environmental issues. Such projects are carried out over longer periods of time with formalized project management and the arena is used as a place for co-location and meetings.

There are also arenas that have started out as a way of learning and inducing change in the organization. The Manager of Pulp Labs (Interview, 2011-11-23) relates that Södra's open innovation arena was about taking on a challenge where they did not know where they would end up. An arena was a good way to draw attention and advertise the company, but also induced an open culture in the organization. The application for their material, which was the starting point for the arena, emerged as they moved along. The Head of Strategy and Innovation at Tryg (Interview, 2011-11-18) states that the purpose with their Business Lab was not explicitly to come up with new things but rather to show a different approach to the generation of new products and challenge the current strategy at the traditionally introvert firm. An Innovation Consultant, also at Tryg (Interview, 2011-11-18), explains that the new things could be shown off as successes which created momentum. The arena fulfilled the purpose of challenging the traditional mindset and the next step is to make the innovation work more strategy driven.

Finally there are the arenas that serve as a resource for the firms that utilize them, either by connecting firms or involving customers and users around a certain technology area. The arena draws from large networks of actors that can be involved in different projects. The General Manager of Botnia Living Lab (Interview, 2011-10-28) explains that their lab is a way for companies to engage end-users and customers. The lab helps actors in the information technology industry with need-finding and idea-generation in their fuzzy front end phases. Flemish Living Lab, a member of the European network of Living Labs just like Botnia Living Lab, has a similar approach. According to The Platform and Infrastructure Manager (Interview, 2011-11-14) they focus on interaction with users. It is a playground where assumptions about users can be validated. On a different scale in comparison with the Living Labs is Philips High Tech Campus Eindhoven (HTCE) which clusters different firms and

promotes openness. The clustering leads to decreased costs and increased quality of the output. The actors are however not forced to be open and the Manager of Business Development and Communication at HTCE (Interview, 2011-11-16) relates that there are more or less open organizations at the site.

Below the empirical findings regarding what internal factors influence a firm's ability to create an open innovation arena, what firms should consider when tailoring the network of their open innovation arena and what firms should consider when creating the settings of their open innovation arenas, are presented and discussed.

4.1 Internal factors influencing a firm's ability to create an open innovation arena

RQ3: What internal factors influence a firm's ability to create an open innovation arena?

One objective of the empirical study was to understand whether the internal factors that have previously been highlighted in literature regarding firms ability to practice open innovation were salient or not in the context of an open innovation arena. Thus the answer to the third research question was searched for in the empirical study and discussed in light of the internal factors found in literature. The empirical findings and discussion is presented below.

4.1.1 Culture

The importance of the cultural side of practicing open innovation was frequently emphasized by the interviewees. At Södras Pulp Labs, the Manager (Interview, 2011-11-23) related that the right kind of culture had to be created to make the arena function as a part of the organization. It was important to make everyone that were involved feel involved, since people think it is exciting when they are included in the journey.

The importance of creating early successes to get cultural momentum and show that open innovation works was pointed out by the Vice President of NineSigma Europe (Interview, 2011-11-14), in line with Kotter (1995) who states early successes as one stage of changing an organization. Moreover, an early success in a project at Italcementi, described by Chiaroni, Chiesa and Frattini (2009), led to further increased innovation efforts in the company. The study provided evidence that in many of the firms the creation of an arena for open innovation constituted the early success that is needed to create momentum and, in the long run, change the mind-set in the firm. An Innovation Consultant at Tryg (Interview, 2011-11-18) describes that the company was not very aligned with opening up their processes, or with innovation at all in the start, and how the thought of creating intentional chaos met with resistance. However, the efforts of the innovation department and the success of the BusinessLab have changed the mind-sets of many employees and the culture of the whole company. Sundbo (2011) who made a case study of the BusinessLab states that it acted as a change agent in the organization. It was created with the intention to establish an organizational unit that could bring creativity to the organization and train employees in becoming innovators.

Involving people in the open innovation has been identified as an effective way to reduce the NIH syndrome by Clagett (1967) and de Pay (1989) (quoted in Lichtenthaler and Ernst, 2006). SCA has been working for a long time with open innovation and both the Open

Innovation Programme Manager (Interview, 2011-12-01) and the Director of Innovation and Knowledge Management (Interview, 2011-12-01) agrees that culture is important, but they don't believe in cultural change programs where management tries to induce cultural change through top-down decisions. Instead they promote a bottom-up approach with a viral cultural change where the goal is to make open innovation a normal way of working, a part of the mind-set. On this note the Vice President of NineSigma Europe (Interview, 2011-11-14) explain that people play an important role when it comes to the company's ability to link to the outside world. He furthermore argues that people with the right profiles are needed for practicing open innovation, such as risk takers and people with the ability to see opportunities.

In open innovation literature, culture is seen as highly interrelated with practices and artifacts and none of them can be seen in isolation. The empirical findings has shown that culture can be seen as a result of practices and artifacts but the opposite can also be true, i.e. that the culture influences the practices and artifacts as when the cultural change is viral and subsequently changes how the organization works. Bottom-up cultural change is the preferred approach at SCA but establishing whether the change has been viral or if it has resulted from decisions by top management is difficult and presents a kind of chicken-or-the-egg problem, which would require a different research approach. Nonetheless our research has shown examples of when top-down decisions equally have paid off, as will be explained below.

4.1.2 Practices and artifacts

The empirical study has indicated that an open culture is an important ingredient in a successful open innovation strategy. However, changing the deep cultural manifestations is not always straight-forward, as these are not readily observable. The Vice President of NineSigma Europe (Interview, 2011-11-14), argues that it is in fact not possible to directly change the culture. He states that "You cannot change the culture. Y*ou can only change how people work. Then the culture will change"*, indicating that a cultural change must take place in concert with support from management. The fact that resistance to change is problematic has also been discussed by academics. As Van de Meer (2007) found, it is one of the top factors hampering innovation in Dutch companies. The Manager of Business Development and Communication at HTCE (Interview, 2011-11-16) explained that moving Philips High Tech Campus from a closed to an open culture encountered some internal resistance, but this was mitigated by promoting openness from management and by creating structures to facilitate the new way of working – seminars, meeting places, etcetera. Moreover, according to an Open Innovation researcher at SAFER (Interview, 2011-11-09), to be open, companies must change their internal processes to promote and give incentives for using open innovation. Culture can only change incrementally as a result of changing the practices as stated by the Vice President of NineSigma Europe (Interview, 2011-11-14).

There are examples when artifacts are used as to influence the culture in a firm or arena. HTCE communicate their positive attitude towards open innovation on their web page and frequently arrange different types of events to promote openness (High Tech Campus, 2012). Similarly, although not specifically regarding an arena, SCA explicitly work with open innovation and frequently communicate it to its employees to make it a natural way of working and a part of the mind-set (SCA, 2012).

At Tryg and Södra, management played an important role when introducing an open innovation arena. At Tryg, the former CEO launched the innovation efforts and brought innovation thinking into the firm, an organization operating in the insurance business and thus traditionally being introvert. At Tryg the idea of working with customers in a new way met resistance and according to the Head of Strategy and Innovation (Interview, 2011-11-18), employees *"were rolling their eyes"* by the thought. She furthermore states that there were parts of the company that were not excited by the new innovation approach although employees that worked with the innovation department were enthusiastic. The reason she states is that the culture of Tryg was not aligned with opening up or with innovation at all from the beginning. An Innovation Consultant at Tryg (Interview, 2011-11-18) explains how the efforts of the innovation department and BusinessLab changed the mind-set of many employees and therefore the culture of the whole company. Similarly the open innovation initiative at Södra was taken by the research director, a top-down decision, which according to the Manager of Pulp Labs (Interview, 2011-11-23) was very important since a person in a managing position has the ability to anchor the project in the organization.

At Holst Centre, located at the HTCE, an active work is conducted to foster an open climate by different cultural artifacts. The Communication Assistant (Interview, 2011-11-17) stated that the fact that they have 25 different nationalities work to *"create a vibe that helps everyone to be open minded"*. Furthermore they are employing younger people for the reason that they are more creative and they have made sure that people are gathered during their meal time by placing microwaves for warming food centrally in the building.

The study has shown that different artifacts are used by companies to make the culture more open and foster the practice of open innovation. An Innovation Designer associated with Security Arena (Interview, 2011-10-10) explains that employees give meaning to cultural artifacts and it is through their participation in open innovation activities that such artifacts increase openness over time. According to the Manager of PulpLabs at Södra (Interview, 2011-11-23) it is important to have a formalized plan regarding the open innovation efforts, that e.g. states what employees are allowed to share and not. She explains that the plan may change over time but it is important to have it from the beginning. At the High Tech Campus, Philips set up formal contracts for actors that locate at the Campus. However, as the Manager of Business Development and Communication (Interview, 2011-11-16) relates, no one is forced to be open and there are more and less open organizations at the site.

4.1.3 Absorptive and desorptive capacity

The absorptive and desorptive capacities of a firm are difficult to study in isolation as they to a high degree depend on things such as the culture and practices. According to the Manager of Business Development and Communication at HTCE (Interview, 2011-11-16), a deciding factor for whether a firm is absorptive or not is the people. He states that a firm must employ people that are able to judge what information is valuable to explore and exploit. This view is shared by The Vice President of NineSigma Europe (Interview, 2011-11-14), who states that it is important to have people that have the ability to see opportunities.

An Innovation Consultant at Tryg (Interview, 2011-11-18) describes how the absorption of ideas into the organization was a big challenge, and that implementing ideas into their company was basically a cultural problem rather than a question about structures and processes. The Head of Strategy and Innovation (Interview, 2011-11-18) added that the really good ideas didn't really belong in the organization and there was no obvious place to nurture them and make them survive. She states that those ideas were kept at the innovation department and the BusinessLab where they were taken care of until they were mature enough to survive in the organization.

Whether or not a firm is able to absorb and desorb information depends on if the information is coded in a transferable manner. Furthermore an Open Innovation researcher of SAFER (Interview, 2011-11-09) explains that it is important that it has been made clear what information the company allows to be spread and what information employees are allowed to bring in from external actors. The director of SAFER (Interview, 2011-11-08) describes that they, in formal project specific contracts, specify which actors are involved in projects, who brings what knowledge, who will share the results and whether or not the publication of the results should be delayed. She adds that it is important to clarify if the data that is created during the project should be available for everyone, which data that will be available after the projects is concluded and who owns the data.

At Holst Centre they do several things to increase the absorptive and desorptive capacity. The Communication Assistant (Interview, 2011-11-17) states that the fact that they are located at the HTCE facilitates absorptiveness and desorptiveness. Furthermore they have external people who work in the labs at Holst Centre once a week. They have two annual meetings with partners where they evaluate the work and results. They also have shared IT-applications. Also SCA actively manages to be absorptive in many ways. The Open Innovation Programme Manager (Interview, 2011-12-01) states that they put much focus on that people are active throughout the projects and make sure to make everyone have the right expectations. She states that SCA works a lot internally with the expectations of open innovation and that it is a question about motivating people. She furthermore states that it is important that the open innovation efforts lead to something.

4.2 Tailoring the open innovation arena network

RQ4: *What should firms consider when tailoring the network of their open innovation arena?*

Another objective of the empirical study was to understand whether what literature relates regarding how a firm are to tailor its external network are salient in the context of an open innovation arena. Thus the answer to the forth research question was researched in the empirical study and the empirical findings are discussed below in the light of what was found in literature.

Choosing actors to involve in an arena is not always straight forward. The choosing of actors to include in the network of an open innovation arena is often rather ad-hoc and incremental. According to an Open Innovation researcher at SAFER (Interview, 2011-11-09) this often boils down to things like personal contacts and randomly identified needs. Many of the interviewees described networks built on personal contacts. The Director of SAFER

(Interview, 2011-11-08) stated that the inclusion of new partners in their network is ad-hoc and that new actors are sometimes invited to cooperate in a project and then become formally introduced to the network of SAFER. The actors in the network of Greenovate! were chosen based on prior personal connections. The Managing Director (Interview, 2011-11-15) relates that actors in their network had good connections and trustful relations from before they started Greenovate!. Moreover, the network they draw from in projects consists of people in their network's networks. The Platform and Infrastructure Manager of Flemish Living Labs (Interview, 2011-11-14) state that they combine capabilities of different stakeholders when choosing actors and more or less *"take what is around"*.

At Tryg BusinessLab inviting many different actors lead to inadequate results. The ideas the many actors brought in were not very good and did not have any potential to be developed into products or Tryg did not have the ability to execute them. Therefore they focused on fewer actors and tried to dive deep into understanding customer behaviors. The Head of Strategy and Innovation (Interview, 2011-11-18) relates that it meant involving customers but also other companies and experts. She states that when choosing which external actors to involve a systematic approach is used, but that everything is not planned from the beginning. She further argues that *"it needs to be a learning process"*, and that *"you cannot know everything from the beginning and thus not be certain about who to involve"*. The Innovation Consultant (Interview, 2011-11-18) states that it is always a dialogue and that it is ultimately the purpose of the activity that guides the selection.

SCA uses a systematized way of defining and choosing how to work with their actors. According to the Open Innovation Programme Manager (Interview, 2011-12-01) they structure their network in different layers with SCA is in the middle. The following layer is suppliers, which they traditionally have worked closely with; thereafter customers, where they involve "lead customers"; thereafter academia and research institutions, which they have worked with for a long time; and intermediaries and brokers, such as InnoCentive, who they, as she explained, involved as an experiment with the intention to *"try and see"* what the benefits could be. Finally, the outer layer, which they refer to as the world, meaning all actors that approach SCA such as inventors, consultants and startups.

The owner, co-founder and CEO of Opticom that arranged the workshops for Södra's PulpLabs (Interview, 2011-11-03) explains they used a value-chain model to identify actors that could be interesting to include. In their case, all actors who influence how packaging is done today and in the future were considered which resulted in a number of types of actors being identified. The different types are users and brand owners such as firms that use packages, professional designers, producers of machines, design institutes and academia. He stated that *"We had to do our homework to understand what role which actor plays"*, and that the value-chain they identified should neither be defined too narrow nor wide. Holst Centre does not have a formalized model for finding partners. They rather target partners with relevant interests and applications for their technology. The Communication Assistant (Interview, 2011-11-17) however described that they use some kind of value chain-thinking when finding partners. The Business Development and Communication Manager at HTCE (Interview, 2011-11-16) stated that the Campus Site Management evaluates the strengths of

the region and the campus and clusters actors based on the strengths and identified opportunities they are in a position to solve. The actors should also be related to the fields of technology at HTCE. He stresses the importance of a good mix of actors and the HTCE has multinationals, SMEs, startups, institutes and service companies, all in relevant technological fields.

Choosing actors after what they can contribute with and having a value-chain approach to cover all parts seems to be the typical approach when the choice is somehow systematized. Actors are however not always brought in to add value directly as the Open Innovation researcher of SAFER (Interview, 2011-11-09) explained. She stated that the motives for bringing in certain players can be political. For example, having a prestigious firm participating in the arena raises the status of the whole arena and makes it more desirable for other actors to attend.

The importance of having both breadth and depth in the networks is argued important by academics and most arenas seem to be aware that it is important to maintain a good mix of actors. Choosing to define the network as a value-chain may imply that the network achieves a rather satisfying breadth without requiring large amounts of attention. Moreover there does not seem to be a problem with too deep ties in the networks in the context of arenas, since the network is often created for specific reasons based on the nature of the project. However, in the cases where prior personal contacts are used to form the network it is often stated that trust is the reason, which is believed to overshadow other reasons. The fact that networks are often formed ad-hoc and are allowed to emerge in the studied arenas could indicate that they are either not optimally composed and leave room for further improvement to achieve innovative performance, or that it, as the Head of Strategy and Innovation at Tryg (Interview, 2011-11-18) states, should be a learning process and that it is not possible to know everything from the beginning. Chesbrough (2004) has himself stated that the path to an unknown market for an unknown technology is actually *unknowable*, why firms in those cases should be able to play poker.

Both Holst Centre and HTCE in Eindhoven point out that they choose actors to partner with in relevant technological fields. A choice most certainly based on a corporate strategy to continue on a winning path and advance the skills in those technological fields. However, as Lane and Lubatkin (1998) describe the concept of relative absorptive capacity, it is the similarity in two firms' knowledge bases, structures and dominant logics that decides how easy they can learn from each other. Thus it might indicate that a firm easier cooperates with a peer and is therefore rather path dependent when it comes to choosing partners. Consequently it is perhaps less likely that one will see a complete change of direction, where the firms suddenly choose partners in completely unrelated technological fields. Södra might however be an exception to the rule with their PulpLabs, which allows them to find partners and markets in unthought-of areas.

4.3 Creating the settings of an open innovation arena

How to create the settings of an open innovation arena could, on the contrary to the internal factors and the tailoring of networks, not be drawn from the literature, as a sufficient theoretical foundation did not exist. Therefore the different interviews of the empirical study were used as the basis from which theory was developed while searching for the answer to the fifth research question;

RQ5: What should firms consider when creating the settings of their open innovation arenas?

As the study progressed, the answers from the interviewees were codified so that patterns could be compared and it became clear that most aspects could be organized along four different dimensions. These were tentatively named (1) the formal dimension, (2) the informal dimension, (3) the physical dimension and (4) the structural dimension, and are explained in detail below.

4.3.1 The formal dimension

The need for formalization in practicing open innovation has been recognized by many researchers in the open innovation field. For example, Van de Vrande et al. (2009) suggest that more advanced open innovation practices can require a higher degree of formalization and Vanhaverbeke describe how *"formal contracts bring people from different firms together"* (2005, p.5). Thus it is not very surprising that all interviewees relate that some sort of formalization is also important in creating an open innovation arena. The handling of intellectual property (IP) rights seems to be of prime importance in this context.

IP can, according to much open innovation literature, act as a carrier of knowledge which can be exchanged as a part of a firms open innovation strategy (Chesbrough, 2006; Gassmann and Enkel, 2004; Chesbrough, 2003). Other researchers point to IP as an issue that should be dealt with in more collaborative activities (Alexy, Criscuolo and Salter, 2009). For example Dahlander and Gann (2010) describe how firms often demand IP agreements to work together in an effort to appropriate commercial returns from their open innovation efforts. It is this latter aspect of IP that is pointed out as the main concern in open innovation arenas. The Manager of PulpLabs at Södra (Interview, 2011-11-23) explains that it is important to have a plan and a strategy about what information can be revealed and the Director of SAFER (Interview, 2011-11-08) relates that it is important to specify which actors bring what knowledge into the project, which actors will share the results and should there be a delay on publications of the result. Interesting to note is that the interviewees in the study are mainly working with open innovation arenas in pre-competitive phases but still consider IP an important aspect. The General Manager of Botnia Living Lab (Interview, 2011-10-28) argues that it could be even more important when working farther along in the development process.

Another approach to dealing with the issue of IP is presented by the Vice President of NineSigma Europe (Interview, 2011-11-14) who explains that NineSigma uses a problem based approach where they first break down companies' problems and help them instead define their needs. In this way they do not work with technical solutions and details, but on a

more abstract level where no confidential information needs to be exchanged. The companies' problems are then packaged and sent to a tailored network of experts that are believed to have expertise to solve them. NineSigma thus circumvents the need for IP agreements by working on a level that does not implicate exchange of confidential or competitive knowledge. This approach is logically not always possible but it points to the difficulty with IP and the cautiousness those that are exposed to it show.

Albeit its importance, IP it is not the only factor that is formalized in open innovation arenas. Contractual agreements that are written define, what the General Manager of Botnia Living Lab (Interview, 2011-10-28) calls, *"the rules of the game"*. These are formal agreements which specify parties underlying interests and responsibilities, and regulate the collaborative activities. According to the Managing Director of Greenovate! (Interview, 2011-11-15) and the Platform and Infrastructure Manager at Flemish Living Lab (Interview, 2011-11-14) they include things like a code of conduct, non-disclosure agreements (NDA), the expectations of everyone, arrangements for profit splits, etcetera.

It seems that formalization is an especially important issue when the arena is created or when new actors are involved and new projects or activities are initiated. For example, the Manager of Business Development and Communication on Philips HTCE (Interview, 2011-11-16) describes how the Campus Site Management set up formal contracts for actors that locate to HTCE and the Communication Assistant at Holst Centre (Interview, 2011-11-17) highlights that IP is most important when an external actor is about to join the center. This is according to the Project Manager of Security Arena (Interview, 2011-10-10) needed to make everyone feel safe in participating.

To further complicate the matter of formalization in an open innovation arena the Project Manager of Security Arena (Interview, 2011-10-10) states that too much of it may act inhibiting. As an Open Innovation researcher of SAFER (Interview, 2011-11-09) states, it can be an advantage not to formalize what each actor should bring to the table when going into an open innovation arena or project as this could hamper the innovative outcome. Moreover the Platform and infrastructure manager at Flemish Living Lab (Interview, 2011-11-14) states that *"everyone thinks it [formalization] is important, but it is a hurdle for innovation"*.

4.3.2 The informal dimension

Besides the formal dimension in open innovation arenas an informal and to a higher degree intangible dimension has been identified. This dimension concerns softer issues such as creating trust between, and motivation for, actors in an open innovation arena.

Trust

The importance of trust between actors, engaged with each other in open innovation activities, is recognized by many scholars. For example Lichtenthaler (2009) emphasize the critical role of inter-organizational trust in processes of open innovation and Lee et al. further argue that *"mutual trust in a cooperative relationship is essential to its ultimate success"* (2009, p.298). Moreover Azeredo (2007) found that the feeling of trust in relationships is fundamental to the effective flow of knowledge.

Trust is also put forward by many of the interviewees as one of the most important factor for a successful open innovation arena. For example the Platform and Infrastructure Manager at Flemish Living Lab (Interview, 2011-11-14) states that trust is the most important factor. He relates that without trust people do not want to talk to each other. Moreover, the Manager of Business Development and Communication on Philips HTCE (Interview, 2011-11-16) relates that although they have an infrastructure so that people can work on different places on the campus and so that the companies can communicate, trust is still the essential factor for this to work. Also the Director at SAFER (Interview, 2011-11-08) points out that mutual trust is crucial for the knowledge sharing between actors in the network and that without trust they will not bring their best things to the discussions.

The issue of trust seems to be important on two different levels. One of these is on an organizational level and can be denoted inter-organizational trust. Trust on the organizational level seems to a large extent to be a matter of formalization. For example, an Innovation Designer associated with Security Arena (Interview, 2011-10-10) explains that individuals might participate in open innovation because it can be exciting and fun whilst companies need more formalization. Moreover, the Platform and Infrastructure Manager at Flemish Living Lab (Interview, 2011-11-14) argues that a first step when companies are to join an arena can be to sign something like an NDA. He states that it is respected by involved actors and creates an environment where it is possible to proceed in the process and get started with the work. This is in line with the arguments of Newell and Swan (2000) who argue that formalization can lessen mistrust on an inter-organizational level and make processes more efficient.

In short formalization seems to create the necessary conditions for organizations to participate in an open innovation arena. An exception to the rule is Tryg where trust is said to more or less grow by itself. An Innovation Consultant at Tryg (Interview, 2011-11-18) states that he has never met any distrust from external actors and the Head of Strategy and Innovation (Interview, 2011-11-18) explains that this may be because they do not talk about products or services, but instead focuses on customer's needs. The approach to rather discuss needs than solutions is similar to that explained by the Vice President of NineSigma Europe (Interview, 2011-11-14). Furthermore many of the arenas exclusively work in pre-competitive phases where it is easier to trust each other, as not as much of direct economic value such as IP is put on stake.

Having succeeded in bringing people together into an arena, how trust can be created on an individual level becomes the issue. This is the second level of trust and can be denoted inter-personal trust. It is hard to exactly establish what creates trust between two individuals and makes them open and willing to share in an arena. However the Managing Director of Greenovate! (Interview, 2011-11-15) suggests that *"seeing people physically creates trust"*. To manage this, she explains that Greenovate! bring people together physically twice a year and organize social assemblies. The proposition that trust is facilitated by face to face meetings between individuals is also illustrated by the measures taken at HTCE. There, the Manager of Business Development and Communication (Interview, 2011-11-16) describes that to create trust HTCE organizes events and facilitate meetings for people. He explains that a very important part of this is the Strip which is a hub of cafes, restaurants, meeting rooms, a

Conference Center, lounges, etcetera located centrally at the campus. This is a place that facilitates meetings, both formal and informal, between people. Moreover, to inspire people to utilize this hub, the Manager of Business Development and Communication relates how restaurants, cafes and large meeting rooms were removed in old building and relocated to the Strip.

There are other examples on how management can try to increase the inter-personal trust in the arena. For example at SAFER, the Director (Interview, 2011-11-08) describes how that trust are be created over time by promoting successful projects as examples and encouraging the sharing of knowledge in the arena. Moreover, at Holst Centre, the Communication Assistant (Interview, 2011-11-17) describes that much effort is put into the application process and that care is taken to only involve people with good social skills. There they test people for how open and communicative they are, if the possess the right mindset.

The distinction of trust on different levels is not always made clear in literature but the empirical findings show that it is of importance when discussing how trust influences in an open innovation arena context. In the end, dealing with trust on an organizational level seems to be a prerequisite for bringing people together. However trust on the individual level is still described as the grease that makes the arena work on a daily basis. Or as stated by the Manager of Business Development and Communication at HTCE (Interview, 2011-11-16): *"in the end it's all about people and what makes them more or less open and willing to share."*

Another interesting aspect put forward by some of the interviewees is whether the arena represents an economic actor or appears as a completely neutral and what effect this has on the trust by external actors. The Platform and Infrastructure Manager at Flemish Living Lab (Interview, 2011-11-14) somewhat sits on two chairs as he is an employee at Telenet, the largest provider of broadband cable services in Belgium (Telenet, 2012). He explains that when people come to talk to him it is sometimes an advantage that he is working at Telnet but sometimes, he states, it can also a disadvantage since people may think he or Telenet will take advantage and make use of the ideas they bring. Therefore he creates a brand with the Living Lab and tells a story about it to people. Similarly the Project Manager of Security Arena (Interview, 2011-10-10) argues that a very important factor for an open innovation is that it is neutral.

Motivation

Besides trust it is also important to consider why different actors want to involve themselves and take part in an open innovation arena. An Open Innovation researcher of SAFER (Interview, 2011-11-09) describes how different actors have different incentives and different goals that they want to achieve in an open innovation arena. However, they need to be able to co-exist and cooperate, which means that managing their expectations and understanding their incentives for participation becomes very important for the management of the arena. The General Manager of Botnia Living Lab (Interview, 2011-10-28) describes that, if an environment is to be created where activities based on the open innovation paradigm are to be held, it is important to understand what different actors want and require for participating.

The Vice President of NineSigma Europe (Interview, 2011-11-14) describes that motivation is created when people and organizations that participate in open innovation find that their agenda is met and that there are relevant results. The Director of SAFER (Interview, 2011-11-08) relates that management of SAFER actively tries to create incentives for as many organizations as possible to participate. She also points to the importance of having a joint conception of what you want to achieve in the arena. Here, an interesting notion is brought forward by the General Manager of Botnia Living Lab (Interview, 2011-10-28) who explains that it is still important to keep an open mind and accept that anything can come up. In order to have a well-functioning open innovation arena, the actors involved must accept that the output from the activity may not create value directly for everyone.

As was the case with trust, motivation also seems to be important on different levels. On an organizational level, the Project Manager of Security Arena (Interview, 2011-10-10) relates that an important incentive is that a win-win situation exists and that all actors gain something in the open innovation arena. This is also recognized by the Head of Strategy and Innovation at Tryg (Interview, 2011-11-18) who describes how not only their company gains from their open innovation activities, external organizations are also learning and receiving insights.

On a more individual level, the incentives to engage in an open innovation arena seem to be somewhat different from the organization that they represent. For example, as stated above by the Innovation Designer associated with Security Arena (Interview, 2011-10-10), individuals can participate in open innovation arenas for the fun of it, since open innovation arenas foster an exciting environment for collaboration, which he states appeals to people. Moreover, the Communication Assistant (Interview, 2011-11-17) explains that people at Holst Centre forms an appealing community of inventiveness and pioneering.

4.3.3 The physical dimensions

The role of the physical environment in which creative and innovative activities take place has according to Moultrie et al. (2007) been noticed by firms, but have received little academic attention. The physical environment's effect on individuals has been studied somewhat in the field of environmental psychology and it is generally recognized that architectural settings have a crucial influence on people's behavior (Stokols and Clitheroe, 2005). This is recognized by the Head of Strategy and Innovation at Tryg (Interview, 2011-11-18) who explains that their *"BusinessLab was created to set people free"*. It was designed to give people a sense that it is not a regular working day and that there will be no negotiations - only free thinking. Moreover, at Tryg an Innovation Consultant (Interview, 2011-11-18) demonstrated the different design values and imagery at their BusinessLab. Depending on the topic of the event it was possible to completely change the lightning, turn on background music and different sound and lighting effects as to set a mood and reinforce desired feelings. Furthermore there were tools and material available for different creative activities.

More than providing an environment that influences how people act a physical arena can also be a place of shared resources. For example, according to the Manager of Business Development and Communication at HTCE (Interview, 2011-11-16), they provide facilities

with the most modern and best equipment that are shared among all actors on campus. Such equipment is very expensive and the sharing of it thus decreases the cost of usage. The equipment is also scalable so that actors of all size can use it. A clever way to gain value from this sharing of resources that is utilized is having a team of 600 experts working with the equipment. Although these experts cannot share the IP developed for another party, the experience that they get in using the equipment benefits all customers.

The physical dimension of an open innovation arena can, according to the Manager of Pulp Labs at Södra (Interview, 2011-11-23), be extended into the virtual world as also discussed by Moultrie et al. (2007). She relates that by using a web portal, Södra are able to reach external actors and communicate how the activities within the arena progresses. She further explains that this is important since PulpLabs would not have time to contact everyone that might be interesting to involve in the arena. The Manager of PulpLabs at Södra does however explain that meeting physically and working face to face is still very important. She states that it is difficult to create relations that can be maintained merely through the internet. This is also recognized by the Director of SAFER (Interview, 2011-11-08) who relates that the possibility of co-location is important for a well-functioning open innovation arena and the Managing Director of Greenovate! (Interview, 2011-11-15) who states that *"In the end of the game you need to have physical meetings"*.

The role of physical co-location has also been noticed and discussed by scholar where Gallaud and Torre (2005) argue that thanks to the technological evolution of computer sciences, which offers possibilities such as informal or visual communication, long-distance sharing or co-producing of tacit knowledge is made possible. Thus constraints of geographical proximity can be resolved without permanent co-location. Moreover Carrincazeaux and Coris (2009) discuss temporary proximity as a way to coordinate specific phases in innovation projects. The authors state that strong technological complexity should be associated with temporary co-location for the creation and transfer of emerging knowledge.

4.3.4 The structural dimension

The structural dimension is the processes and activities of an open innovation arena and concerns what the different actors of the arena actually do together in practice. Shorter activities can according to the General Manager of Botnia Living Lab (Interview, 2011-10-28) be held using different qualitative and quantitative empirical research tools such as workshops, brainstorming and focus groups. For example, Tryg's open innovation process is built by such activities and an Innovation Consultant at Tryg (Interview, 2011-11-18) relates that this is a flexible process whose tailoring depends very much on its purpose.

In open innovation arenas where the time scale of the collaborative activities are longer, the activities become merged together to form projects. When such open innovation projects are formed, the issue of providing structure to the processes starts mirroring the issues of project management. An Open Innovation researcher of SAFER (Interview, 2011-11-09) describes that when people are brought together in open projects, project management becomes an issue. Things like dividing responsibility and setting deadlines becomes important. One example of this is Greenovate!. There, the Managing Director (Interview, 2011-11-15)

explains that they have standard operating procedures. Projects are run as typical projects with work packages, task leaders and regular reporting etcetera. The communication is handled through physical meetings every 6 months and the projects usually span 2-4 years.

Thus the structural dimension is dependent on the time window of the co-operative engagement of actors in the arena. If the window is short then this becomes a focus on specific activities, while for a longer time period the different activities are merged together to form a process.

4.3.5 The four dimensions of open innovation arenas

The empirical findings discussed above suggest that there are four dimensions of open innovation arenas. Firstly, the formal dimension concerns formalization through formal contracts and IP agreements which always seem to be an issue in open innovation arenas. Some write formal contracts while others try to circumvent the need for it by working on a level with no need for exchanging confidential or competitive knowledge. Secondly, the informal dimension is concerned with the creation of trust and motivation within an open innovation arena. Thirdly, the physical dimension concerns how the architecture influences the people within the arena and by this allowing people to work together effectively and share resources and whether the arena extends into the virtual world. Finally, the structural dimension concerns what the different actors of the arena actually do together and how its activities and processes are structured. The four dimensions of an open innovation arena are shown in Figure 5 below.

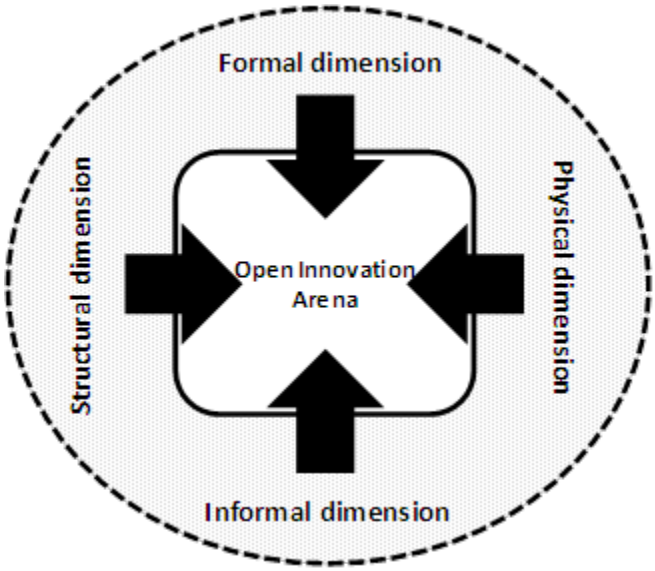

Figure 5: The four dimensions of an Open Innovation Arena

None of the four dimensions of an open innovation arena can or should be considered separately. The point of dividing the aspects into different dimensions is mainly to highlight and structure them in a way that lends itself to analysis and discussion. All dimensions relate to each other and help create the whole concept of a physical open innovation arena. In short the formal and informal dimensions create the open environment while the physical provide the facilities and the structural the structure.

The four dimensions of open innovation arenas highlights what firms should consider when creating the settings of their open innovation arenas, however there is still a question regarding how these dimensions should be created. The empirical study has provided some examples to how the dimensions have been designed in different open innovation arena. Here, no open innovation arena has used the exact same approach. Still it is clear the common practice is to align the notions the different actors of the open innovation arena by making compromises between their requirements. This practice, which arguably is an intuitive way of creating an environment for co-existence, is deemed suitable when creating the dimensions of open innovation arenas.

5. Towards a framework for open innovation arenas

The findings in literature and in the empirical study provide answers to the five research questions. These findings are here gathered and concretized into a framework for open innovation arenas, the aim of which is to provide an understanding of open innovation arenas and to be a tool that can aid in determining how a firm can create a physical arena for open innovation.

5.1 Internal factors

Internal factors have been discussed in previous academic literature, which has however to a lesser extent regarded the internal dimension of open innovation. Not much light has been shed on cultural aspects with some exceptions, Herzog and Leker (2010) being one of them. In other strains, different concepts related to how culture affects innovativeness and what makes firms more or less capable of absorbing external knowledge and desorbing internal knowledge or technology, has however been discussed. Hence a number of concepts that are believed to influence the creation of open innovation arenas were derived.

At the innermost level, which is not readily observable by outsiders is the beliefs and values of employees. It has been argued that the not-invented-here and only-used-here syndromes are strongly constraining open innovation. These syndromes were difficult to perceive in the empirical study, although things that are considered as remedies for the syndromes were present in the form of gatekeepers and champions for open innovation. Furthermore support from management surfaced as a very important factor for open innovation arenas, as well as willingness to take risk. At the level of the firm's border to its surrounding, absorptive and desorptive capacity was discussed as important. What influences these capacities was strongly on a personal level, to which degree employees are open and their capability to understand external knowledge. Knowledge management systems have also been discussed, but there is no consistency in how they are used.

The empirical findings suggests that the people dimension need more attention from researchers, which has been argued by Herzog and Leker (2010) who state that the people side has been ignored by academics in open innovation, and our findings shows that this aspect should neither be overlooked in the context of an arena. The Manager of Business Development and Communication at HTCE (Interview, 2011-11-16) sums it up by stating that: *"It's all about people. Everybody is talking about processes and companies…You can talk about architecture but in the end it's all about people and what makes them more or less open and willing to share"*.

5.2 Arena networks

Previous scholars have discussed different ways to collaborate and have stressed the inherent complementarity in the capabilities, knowledge and resources of different external actors. It has also been argued that networking is a way to keep up with current market developments and the customers. Firms may 'over-search' in their network activity which hinders innovation performance and Laursen and Salter (2006) found a curvilinear (inverted U-shape) relation for both breadth and depth. It was found that the networks for open innovation arenas are very often built on prior personal contacts. The reason is that this facilitates

communication as there is already a basic level of trust. In some cases there are attempts to structure the selection of partners in the network such as thinking in value-chains. As previous literature has discussed, the search should not be too wide or narrow nor should the ties be too deep or wide. Empirically evidence was found for these assumptions and the right mix of actors chosen after a specific purpose was deemed a good approach by many of the arenas.

5.3 Open innovation arenas

By studying multiple cases, it was possible to look for patterns and thus build an understanding about which factors influence the arena. These were structured in four different types of dimensions. In the different studied cases, each dimension's importance was not equally strong depending on a number of contextual factors. They were however present in some way or another, why it was concluded that they should be considered in the general case.

The findings suggested the factors to be classified into four dimensions, tentatively named formal, informal, structural and physical. All dimensions relate to each other and should therefore not entirely be considered separately. They aid to create the whole concept of a physical open innovation arena and provide a structure for a number of important issues to address when an arena should be created. In short, the formal dimension is about bringing people from different firms together under formal agreements which moderate opportunistic behaviors, increases trust between the actors and brings structure to the activity. It was pointed out that too much formalization may impede innovation and that it can be a good approach to let the formal agreements emerge in concert with the progress of the work.

The informal dimension acts to create an open environment built on trust and motivation to contribute. Without mutual trust knowledge sharing is limited and the actors are not spurred to contribute. Trust was explained to work on two different levels, either the organizational level which to a large degree is about formalization and on the personal level which stem from bringing people together physically and over time. Motivation, like trust, is also seen on two different levels. The organizations expect situations where it directly gains something from their participation while individuals can often participate for the fun of it.

The physical dimension creates possibilities to meet and work together, either physically or virtually, and can facilitate knowledge sharing and creative work. The architectural settings of an arena were found to influence how individuals behave. Furthermore sharing of expensive equipment can be possible in a physical space which decreases costs and increases knowledge spillovers.

Finally, the structural dimension regards what processes and activities are undertaken in the arena and thus what the different actors actually do in practice. Activities can either span a short time, such as workshops, brainstorming sessions and focus groups, or a longer time where the work resembles typical projects.

5.3.1 Related theory

Since there is a lack of theory on open innovation arenas in the research field of open innovation, we find that an interesting comparison can instead be made between the four

dimensions presented above and the theories of proximity, knowledge, and the relation between them.

Knowledge is commonly divided into tacit and explicit knowledge. Grant (1995) identifies tacit knowledge with *knowing how* and explicit knowledge with *knowing about* and states that their distinction lies in the transferability across individuals, time and space. Explicit knowledge is *"revealed by its communication"* and tacit knowledge is *"revealed through its application"* (Grant, 1995, p.111). According to Gassmann and Enkel (2004), tacit knowledge is required to innovate. They compare Nike (sports clothes manufacturer) which has a low demand for tacit knowledge and can therefore outsource production to China, with Pratt & Whitney (producing rotors in turbines) which have complex interfaces and a high degree of tacit knowledge required to innovate. Therefore, the authors argue, Pratt & Whitney can use an open innovation approach to increase their innovativeness (Gassmann and Enkel, 2004).

The fact that interchange of knowledge is central to open innovation provides a rationale for an open innovation arena. An open innovation arena co-locates actors to increase geographical proximity, which has been discussed in the literature on open innovation and is argued to reduce uncertainty and solve problems of coordination, thus facilitating innovation (Simard and West, 2006). In the 1990s the French School of Proximity Dynamics proposed that proximity covers a number of dimensions, therefore meaning more than geographical proximity (Boschma, 2005). The dimensions are argued to facilitate learning and innovation and are all salient in the case of an open innovation arena. The dimensions and their suggested correspondence to the four dimensions can be seen in Table 5 below.

Table 5 Dimensions of proximity

Type	Explanations (Boschma, 2005)	Dimensions
Organizational	Organizational arrangements are mechanisms that coordinate transactions and act as vehicles that enable transfer and exchange of knowledge. Are needed to control uncertainty and opportunism in knowledge creation within and between organizations.	Formal dimension
Social	Socially embedded relations between agents at the micro-level involving trust based on friendship, kinship and experience. Social relations affect economic outcomes by facilitating interactive learning and thus increasing innovative performance.	Informal dimension
Institutional	Similar to social proximity but at the macro-level. It is the *"sets of common habits, routines, established practices, rules, or laws that regulate the relations and interactions between individuals and groups"* (Edquist and Johnson, 1997, p.46) which enables or constraints knowledge transfer, interactive learning and thus innovation.	Formal and structural dimensions

Geographical	Bringing people together in a physical space facilitates exchange of tacit knowledge. The larger the distance between agents, the more difficult it becomes to transfer tacit knowledge.	Physical dimension

An open innovation arena facilitates and provides structures for the dimensions of organizational, social, institutional and geographical proximity, which are argued to provide solutions for coordination between actors and thus are effective mechanisms to transfer complementary pieces of knowledge. Organizational proximity constitutes a formal dimension in an arena while social proximity constitutes an informal dimension, relating to trust based on friendship. Institutional proximity constitutes an internal dimension as well as a structural and formal in the arena.

Another dimension discussed by the French School of Proximity Dynamics is cognitive proximity, which is an absorptive capacity (Boschma, 2005), similarly to what Cohen and Levinthal (1990) have discussed. Boschma (2005) defines the cognitive proximity dimension as the similarity of two actors' knowledge bases and expertise, indicating its ascendance with relative absorptive capacity discussed by Lane and Lubatkin (1998). Knowledge creation and learning depends on combining diverse and complementary capabilities and cognitive proximity facilitates effective communication of tacit knowledge. The cognitive dimension does not correspond particularly to any of the four dimensions of an open innovation arena. Instead a parallel is drawn between it and theories of absorptive and desorptive capacity which we denote as internal factors.

For further research we suggest that the relevance of the dimensions of proximity could be investigated more thoroughly, as to see if it is a valuable body of knowledge to draw from in the context of open innovation arenas.

5.4 The framework for open innovation arenas

The visual representation of the complete framework for open innovation arenas can be seen in Figure 6 below. It addresses internal factors that influence a firm's ability to create an open innovation arena, what firms should consider when tailoring the network of their open innovation arena and what firms should consider when creating the settings of their open innovation arenas.

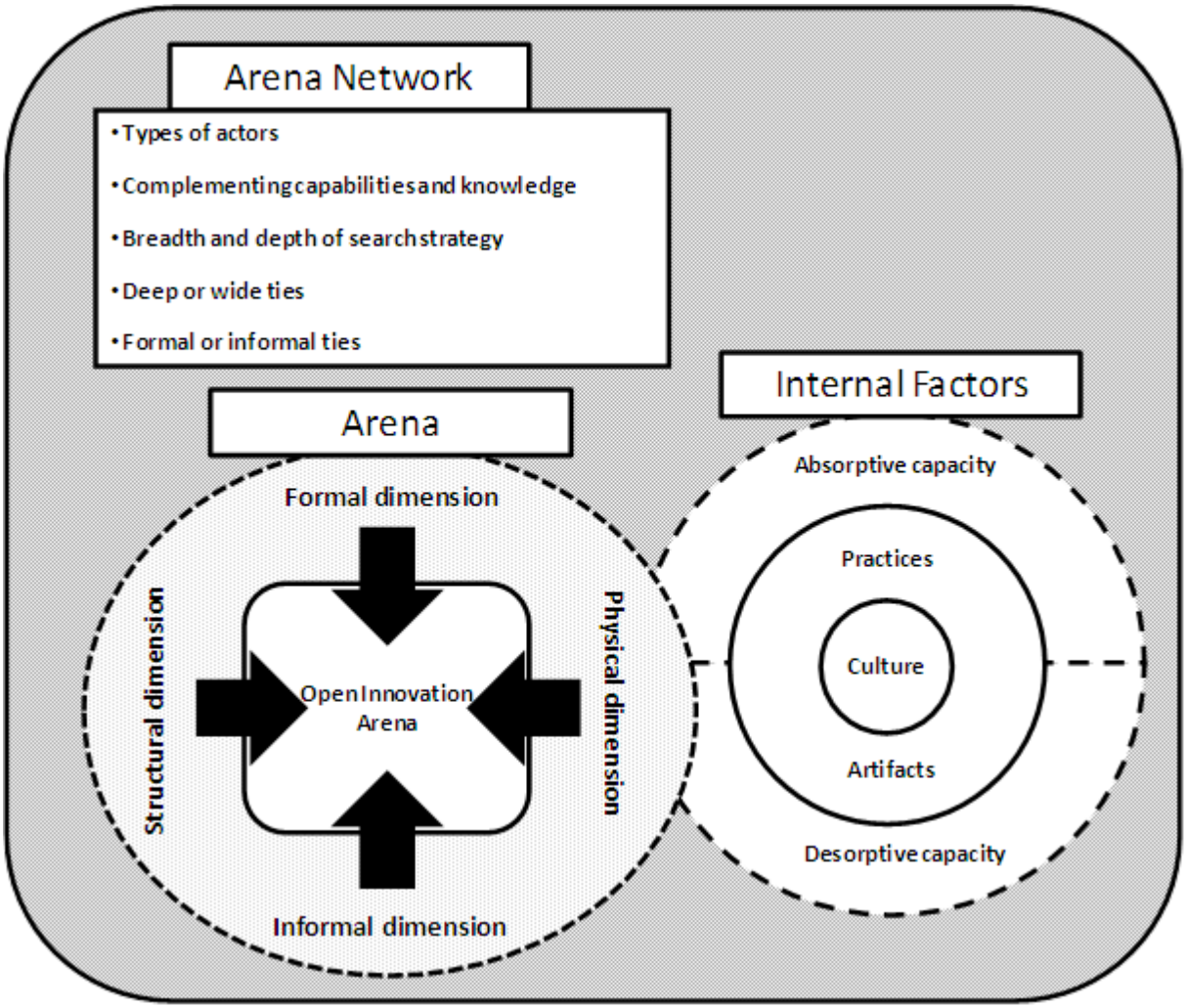

Figure 6: A framework for Open Innovation Arenas

6. Using the framework for open innovation arenas

To evaluate and test whether the framework is useful for a firm that wishes to create an open innovation arena, it was applied in a case study of Volvo Technology (VTEC), a dedicated research organization of the automotive Volvo Group. VTEC had expressed a willingness to use the principles of open innovation and launch a physical open innovation arena. Here the framework aided in delineating how such an arena could be created through investigation and analysis of the internal factors of VTEC as well as by aligning the notions of VTEC and the external network concerning the four dimensions of an open innovation arena. This in turn served to deepen the understanding of arenas for open innovation and helped to revise and strengthen the framework. To get an understanding about the VTEC and the company's internal factors, as well as to get their views of how the arena should be created, individuals in different positions in VTEC were interviewed, see Table 6. The interview guide can be found in Appendix II.

Table 6: Interviewees in VTEC

Interviewee position in VTEC	Date
Communications Manager	2011-11-28
Innovation Director	2011-12-02
Project Manager and Test Leader	2011-12-02
Innovation Designer	2011-12-06
Senior Vice President	2011-12-07
IP Project Leader	2011-12-07

6.1 Volvo Technology

VTEC is an innovation company with more than 400 employees and a turnover of over 550 MSEK (allabolag.se, 2012) that develops new products and business concepts within the automotive industry. VTEC's mission is to develop a lead in existing and future technology areas which are of great importance to the Volvo Group. VTEC partake in national and international research programs that involve universities, research institutes and other companies (Volvo Group, 2012). VTEC has the mission to be in the forefront of technology and innovation and according to a VINNOVA report (Arnold et al., 2008), they have a research focus and sufficient scale means so that they can provide a 15-20 year perspective on technology to the Volvo Group. The authors of the report further state that VTEC is key to the Volvo Group and the Swedish automotive industry in general thanks to a high yielding R&D activity. As a result, the group has a portfolio of technologies in the pipeline that cover not only short- but also long-term needs.

VTEC already have several activities which link them with the outside world. They are currently one of the part-owners in Lindholmen Science Park. Lindholmen Science Park is an innovation network focused around mobile internet, intelligent vehicles and transport systems and modern media and design. It is based in Gothenburg with an aim of providing a setting for knowledge exchange between industry, academia and society.

Another way of reaching outside the own organization and tapping into external knowledge is InVolve. InVolve is an idea competition created by VTEC where the company turn to the global community to identify new solutions to key challenges. The competition has to current date been held one time. During the competition ideas were gathered and explored together with Volvo Group experts and in the end a winning idea was awarded.

VTEC is also participating in several research projects that are partly publicly funded. According to an online article in Metro (2010), VTEC were number one in Sweden in getting projects publicly funded in the year 2010. The public funding often cover around half the projects' budgets, and the rest is put in by the actors involved. The involved actors come from academia, society and industry, although the actors from industry seem to consist mainly of large firms. Through working with these, VTEC get many contacts and has created a large external network.

On an organizational level there are some strategic thinking guiding the creation of VTEC's external network. There the majority of the external contacts are established in the technology areas that are deemed relevant for the products of the Volvo group. There are of course also large networks on an individual level where employees in VTEC have many different personal contacts. *"Good people know good people"* as the Senior Vice President (Interview, 2011-12-07) puts it. There is however no formalized strategy for which external actor to approach on this level.

6.2 Volvo Technology's internal factors

6.2.1 Culture

"We [VTEC] don't have the best people in the world – neither do we have the best ideas in the world", the sentence was uttered by an Innovation Designer at VTEC (Interview, 11-12-07) and it speaks for itself. Such insightfulness might not permeate the whole organization, but steps are taken to increase the openness of the company. As related above, VTEC have used their InVolve concept, they have a substantial engagement at Lindholmen Science Park, and that they are very good at working with projects that are in part publicly funded. Thus it is becoming natural for VTEC to work with different external actors.

That VTEC's employees are open to usage of outside knowledge and technology and the fact that they have a willingness to learn from the external world is also shown by their positive supposition towards things that are not invented in the company. Here, it is actually considered better to work with external actors. Especially people that are working with producing new value are focused on learning from actors outside VTEC.

Although VTEC employees are keen to learn things from the external world, they are not as keen when it comes to diffusing internal knowledge externally. Here VTEC readily shares knowledge within the Volvo Group, but not much information and knowledge is released to actors outside of the Group.

Even though VTEC's employees are willing to learn from the outside, they might have an inclination towards developing the actual technology in-house anyway. This is indicated by

the fact that the company rarely license in or out and that there is a lack of policies and guidelines for such practices. Actually, most employees in VTEC do not to worry much about protecting IP. However the IP Project Leader (11-12-07) states that this is slowly changing and that VTEC are becoming more skilled and open when it comes to licensing activities.

6.2.2 Practices and artifacts

Since VTEC is the dedicated research organization of the Volvo Group, being in the forefront of technology, the company cannot take a risk-averse stance. Instead VTEC are relatively prone to risk taking and boost a climate of experimentation with innovation champions on management level who communicate an acceptance of failure. This is a must in the long term perspective and it is VTEC's task to advocate this perspective within the Volvo group. The Innovation Designer states that "*the best way to have a good idea is to have lots of ideas*".

The management of VTEC is trying to foster a culture that promotes openness, creativity, and innovation. In this they encourage individuals to search for and make use of knowledge and information outside the company. Thus there is strong management support of open innovation in VTEC. One example is that the CEO of the company clearly has communicated the importance of collaboration and expressed that it is important to work with external actors.

VTEC are like many other larger companies in that there exist systemized ways of doing things. Many practices, such as purchasing and handling employees pay, go through centralized functions in the Volvo Group. The artifacts advocating conformance to processes and systemized ways have to a large extent been created in the Volvo Group and communicated down in the organization where they have also reached VTEC. One example is the Volvo Way, a document with cultural guidelines that permeates the whole Volvo organization.

6.2.3 Absorptive and desorptive capacity

There is an assortment of knowledge management systems within VTEC. However these are mainly used for internal communication. The connection to the outside instead happens mostly through individuals. Many employees at VTEC are enthusiastic about their work and a part of this is to keep updated what happens within their specific field. These individuals search for new knowledge and trends each day and communicate this to the relevant people within the company. Information and knowledge is also obtained from the outside through attending seminars and conferences and participating in publicly funded projects. Basically these individuals act as gate keepers through whom information and knowledge flow into VTEC.

There is clearly a willingness to absorb and learn from external knowledge in VTEC. However there are no clear or formalized ways of how to do this. One issue with this is that much of the information that has been obtained from the outside is not shared throughout the organization but is kept by the gate keeper or in groupings around these individuals.

One exception is the existence of a technology scouting department in VTEC. This department, which exists on an organizational level, works with business intelligence and competitive intelligence and are good at feeding information about the outside into the

company. This is then discussed during meetings on the management level. This means that VTEC is rather well up to speed of what is going on externally and what technology their competitors are working with, at least on an abstract level.

The level of competence within R&D is extremely high in VTEC, and the core areas of competence within the company revolve around the technologies that form the products of the Volvo Group. Employees in VTEC have always been encouraged to becoming experts within their fields which have made many employees specialist with deep competences.

6.2.4 Reflecting on Volvo Technology's internal factors

VTEC already have a rather open culture where working with external actors is considered a good thing. Moreover VTEC participate in numerous publicly funded projects and have launched an open innovation initiative in InVolve. It can be argued that VTEC's open culture can facilitate the creation of an open innovation arena and validate it throughout the organization. This is most likely so, the question however remains of how much a more closed culture would have impacted the open innovation arena. As was discovered in the empirical study there are arenas that have started out as a way of learning and inducing change in the organization. Since these arenas can be considered successful, an open culture will not be a determinant of success or failure for VTEC's open innovation arena.

The same logic can be applied to the artifacts of VTEC. These, have to a large extent been created in the Volvo Group and communicated down in the organization. Today they are advocating the conformance to processes and systemized ways which makes for a rather bureaucratic organization. However the arena can be created as a new entity without the same artifacts that are evident in VTEC. In other words, the artifacts need not influence the creation of the open innovation arena. Instead it may just work the other way around.

When it comes to the practices of VTEC, there is a strong management support for open innovation in VTEC and the organization does not mind taking risks. These are definitely factors that should facilitate the creation of an open innovation arena in the company. Creating an open innovation arena is a risk which should easier to take in an organization which is prone to risk taking. Moreover the management support can be argued to be extra important, since managers have the ability to make projects happen at all, as well as to anchor them in the organization.

Making sure that VTEC can be both absorptive and desorptive when engaging in the open innovation arena is important in order to ensure that the company can maximize its gain. As have been recognized in the empirical study, this is a question about having the right people in place. There should be many employees in VTEC who would be willing to partake in the arena since many have a willingness to absorb and learn from external knowledge. However it is important that the people that participate understand and can contribute in the arena. Moreover they should make sure to share the information obtained from the outside throughout the organization. The latter is something that can be facilitated by arranging formal channels or systems for information sharing. Having the right people in the arena will be discussed more under the topic of tailoring the arena network.

6.3 Tailoring the network for Volvo Technology's open innovation arena

When tailoring the network, many factors are important to consider. A firm may collaborate with external partners for innovation because they internally lack necessary resources to develop an innovation or because they wish to reduce the risks associated with innovation. Furthermore it may be favorable to cooperate when introducing radical innovations, innovations that are both new to the firm and to the market (Tether, 2002). There are several future areas VTEC wish to explore in order to have a head start of 15-20 year on the Volvo group, and naturally due to different constraints such as time and resources, it is unlikely that they can focus on all of them. However, as a large company, VTEC has the resources to develop the right inventions into products or processes.

Volvo Technology has expressed a willingness to direct their open innovation arena towards SMEs in the ICT industry. There is sense to this, since that sector partly overlaps that of VTEC, and as Lane and Lubatkin (1998) argued, a firm's ability to learn from another firm is influenced by the similarity of both firms' knowledge bases. Most likely VTEC and SMEs can find ways to complement each other in terms of innovative capabilities. Lee et al. (2009) have argued that smaller firms complement larger ones since they have more flexibility are more innovative in new areas. Simard and West (2006) state that an optimal innovation strategy exploits multiple types of actors, such as universities and venture capitalists, as each of them have different pieces of knowledge. Universities are known for creating basic knowledge and high-quality research universities produce knowledge spillovers. Furthermore venture capitalists are an important source of knowledge as they have ties to multiple startup companies and are focused on commercializing technologies. VTEC would therefore benefit from choosing multiple types of actors that can complement their capabilities. If mainly SMEs are brought into the open innovation arena, their perspectives could be too similar. A mix of actors is, according to the findings desirable and it might thus be prudent to consider including other types of actors after a while.

The type of actors is however not the only thing that matters. Laursen and Salter (2006) and Simard and West (2006) have also discussed breadth and depth of sources. A broad number of sources for innovation are beneficial as it increases the possibilities for non-redundant knowledge and thus potentially for radical innovations. Breadth however implies difficulties in retaining trust as well as managing a large network, something repeated interactions facilitate. Maintaining deep ties for innovation can however be less beneficial if the exchange of knowledge merely is redundant. VTEC should therefore maintain a network as broad as the attention they can allocate to manage the network allows them while, to a certain degree, foster trust by repeated interactions.

In getting this right mix of the arena network, the empirical findings have shown that not only the selection of organizations matters. The people dimension of the open innovation arena is also very important and must thus be considered carefully. Since SMEs are interested in making a connection with VTEC the people involved should have some authority to take decisions. Moreover, since SMEs point to the importance of having both a technical and commercial viability in the open innovation arena activities, it would be suitable if the participants had an understanding of both these dimensions. Something that is important since

VTEC is an organization of engineers that have long lead times on their projects which means that the market perspective is sometimes lacking.

6.4 Volvo Technology's open innovation arena

To decide how VTEC can create a physical arena for open innovation, the framework for open innovation arenas has been used above to discuss VTEC's internal factors, as well as the tailoring of the arena network. Next the four dimensions of an open innovation arena will be discussed with regards to the different positions of the actors within the arena.

Due to VTEC's choice to direct their physical open innovation arena towards SMEs in the ICT industry, six would-be actors of the arena were approached. These companies can be seen in Table 7 below and are more thoroughly described in Appendix III. The companies can all be classified as small or medium-sized in accordance to criteria stated by the European Commission that defines small and medium-sized enterprises with regards to headcount as well as turnover or balance sheet total (European Commission, 2012). For the purposes of this thesis firms are considered as being small if they have below 50 employees and medium sized if they have between 50 and 250 employees.

In addition to the approached SMEs, Business Region Göteborg in Gothenburg was interviewed for their knowledge about the ICT sector in Gothenburg and their experience in maintaining a network consisting of SMEs and start-ups in the ICT industry.

Table 7: Approached SMEs

Company	Position of interviewee	Date
Business Region Göteborg	Head of IT Center West and Center of Visualization	2011-12-09
Consat Telematics	Sales and Marketing Manager	2011-12-13
InformAsic	1: CEO 2: CTO	1: 2011-12-13 2: 2011-12-13
Talkamatic	CEO	2011-12-14
Movimento Group	1: CTO 2: Service Account Manager	1: 2011-12-14 2: 2011-12-14
Diadrom	CEO	2011-12-14
Idevio	Chief Sales Officer	2011-12-15

6.4.1 The formal and informal dimensions

Formalization and trust

VTEC are like many other big companies in that their interactions with external actors are mostly rather formalized. There is more informality and inter-personal trust in for example publicly funded projects where the people involved do not to worry much about protecting IP. However, VTEC still go through rigorous formalization when entering such projects. Thus the sentiment is that there has to be some formal contracts and NDAs in a new open innovation arena.

The degree of formalization that SMEs consider necessary depends on the technical level of the discussion. If the focus is on parts and technologies in their products then they would need contractual agreements while a demonstration on a more abstract level would not be any problem.

SMEs would not open up and show their secrets or special competences to anyone unless a relatively quick commercial end can be seen. Moreover they want to be sure that their contributions and their ideas will stay in their possession. Still SMEs do not seem very prone to writing formal contracts. They do not view it as a big question. Instead the important thing is not to get stuck with too much paper work. The building of trust would then be done by working face to face in the open innovation arena over time.

In summary, the sentiment of VTEC is that there should be some formal contracts and NDAs in their new open innovation arena and the degree of formalization that SMEs consider necessary would depend more on the level of the discussion. The latter want to be sure that their contributions and their ideas will stay in their possession, but are not very prone to writing formal contracts and do not want to get stuck with too much paper work. Thus a compromise must be made so that SMEs are not scared off by too much bureaucracy, but that all actors still feel safe in contributing in the arena. Here an NDA could at least be a first step to make people talk and come together.

For SMEs, trust is built by working together in the open innovation arena over time. This is endorsed by the findings of the empirical study, where inter-personal trust is to a large extent a product of face to face meetings. There is however also a need to consider the inter-organizational trust where VTEC argue that formalization creates the prerequisites. By combining these two views, trust can be created both between organizations and people in the arena, through formalization and face to face meetings respectively.

Motivation

The driving forces that spur Volvo Technology to open up an open innovation arena are to get new ideas for service offerings, product improvements, new products and new areas of use for mature technologies. They also seek collaboration with external actors around challenges for the future and are interested in having external development of products for unused, patented technologies within Volvo which then can be licensed.

VTEC also view the opening of a physical arena as a way of establishing contacts with SMEs in the ICT industry. In the long term they also see this as a way to change the way of working within VTEC to a more open approach

All approached SMEs believe in the concept of an open innovation arena and are interested in a possible participation. However they all relate that they need to get something in return for the time they put in. The SMEs do not have the time to put into big projects which according to the Sales and Marketing Manager of Consat Telematics (Interview, 2011-12-13) sometimes can have a tendency to burn through large amounts of capital. So, if a project is launched in the open innovation arena the results must have a proven technical and commercial viability and there has to exist a business case which deals with this aspect.

Financing the business is the top priority for SMEs and this keeps them very busy. Thus they always need to see short-term incentives for their activities. In this, the theme of the arena becomes very relevant since it signals whether or not the activity in the arena is relevant and if they stand to gain something concrete from their participation.

An important driving force for SMEs to participate in VTEC's open innovation arena is getting the opportunity of meeting VTEC. In general it seems that the only viable way for SMEs to approach large firms today is through another partner. This is a dilemma for small firms working with large where small firms have to work as second or third tier, which makes contracts and the economy hampering factors. The CEO of Talkamatic (Interview, 2011-12-14) relates that VTEC's open innovation arena should be a place where it is easy to cooperate. Thus the activities in the arena cannot be bureaucratic. Instead flexibility and simplicity must be key aspects.

SMEs also find it interesting to meet other firms similar to them to see if synergies or new areas to use their technology in can be found. The Sales and Marketing Manager of Consat Telematics (Interview, 2011-12-13) recognizes this aspect and relates that which actors that are invited are in general very important and that it would be necessary for Consat Telematics to know who these actors are when they decide whether or not to participate.

According to some of the SMEs, a valuable function of an open innovation arena could be to educate them about the market and its trends. For example Movimento Group (Interview, 2011-12-14) would like an opportunity to spot what is happening in the business and to get influences that could help steer the company in the right direction for the future. This is something that would be facilitated by meeting other companies such as Volvo and their suppliers.

In summary, the incentives that drive VTEC to create an open innovation arena differ somewhat from the incentives for SMEs to participate. VTEC's incentives are generally more abstract and have a longer lead time then would suit SMEs. Although different, the incentives of VTEC and SMEs should not be impossible to combine. SMEs have a shorter horizon in their activities and since it is essential to attract their interest and get them to participate and contribute in the arena, the first priority should be to make sure that the theme, the activities and the people of the arena are interesting for SMEs. Since VTEC cannot drive the arena on their own and since their incentives have longer lead times, their incentives can be regarded to be of secondary importance. This does however not entail that they will not be met. It might just take a longer time.

6.4.2 The Physical Dimension

The idea of opening up a physical arena has been anchored at management level and received support where some resources have been dedicated to this project. These resources are two physical facilities that consist of a garage and a concept studio.

The garage and the concept studio are owned by VTEC and are located in close proximity to Lindholmen Science Park in Gothenburg, Sweden. The garage includes a large hall for storage, an electricity lab, a mechanical workshop, an office space and some conference

rooms. Today the tools are mainly used for the purpose of testing and simpler prototype creation. VTEC has explained that it will be possible to change the interior and content of the garage to suit the demands of their open innovation arena.

At the moment the garage is host to a number of projects. All of those are partly publicly funded and have external people working there. The VTEC employees in the garage are thus used to working with external personnel and are very positive towards bringing in more external actors.

The SMEs would be very interested in the possibility of moving some of their activities to the open innovation arena and work beside each other and VTEC over time. According to some of the SMEs, the arena could be a site where equipment can be shared. This would mean lowered development costs and an access to high end equipment. The kind of equipment that would be relevant does however seem to differ much between the interviewees. Some only need a computer for their work, while others would like to have access to Volvo's trucks and simulators.

Ultimately, what can be done in the physical dimension boils down to the resources that VTEC and SMEs are willing to dedicate to the project. Since VTEC have explained that it will be possible to change the interior and content of the garage to suit the demands of their open innovation arena, designing the physical dimension of the arena should be made through discussions in the arena network, where the terms of investment and use can be set. There it can be decided which equipment that should be added.

Having a web portal that reflects the activities in the open innovation arena could extend the arena virtually. Like Södra, VTEC and the other actors in the arena could reach more external actors and communicate how the activities within the arena progresses. Having a web portal does however entail updating it continuously.

6.4.3 The structural dimension

VTEC keeps an open mind about how the activities in the open innovation arena are to be structured and although the company has many systemized ways of doing things internally, they do not demand that the activities in the arena should be equally structured.

SMEs also seem to be rather open about how the activities in the arena should be structured. At least as long as the garage does not turn into, what the Sales and Marketing Manager of Consat Telematics (11-12-13) calls, a "*club for discussion*", and as long as the activities ensure that they get something in return for the time they put in.

Since both VTEC and SMEs keep an open mind about how the activities of the open innovation arena can be structured, it is difficult to draw significant conclusions regarding the structural dimension of the open innovation arena. On a general level, it can however be argued that the activities should be tailored so that both VTEC and SMEs have the potential to get the results that motivates them to open up and participate in the arena can be met.

7. Revisiting the framework

The usage of the framework in the case of VTEC was a useful exercise to gauge the limitations of its practical use as well as gaining insights in what should be further improved, or elaborated on regarding the framework. Here it became clear that the framework is of a rather theoretical nature and does not provide specific guidelines for how a company can go on to create an open innovation arena in practice. The framework does however fill the purpose of providing a structure for what to consider when creating such an arena. An analogy would be the difference between a shopping-list and a recipe, where the former does not allow for making a complete dish.

Using the framework to reflect upon how VTEC could create an open innovation still provided some practical insights when it came to the four dimensions of an open innovation arena. Firstly, when it came to the formal dimension, the case of VTEC showed that there are important differences to what degree different actors require formalization. Here, it is reasonable to believe that another type of actor's participation in the arena would force yet another degree of formalization. Secondly, in the informal dimension, the case study revealed that trust might be created by formalization and face to face meetings. Moreover it was argued that the first priority in the arena should be to make sure that the theme, the activities and the people of the arena are interesting in order to motivate the actors that are to be involved. Finally it was argued that what can be done in the physical dimension practically boils down to the resources that are dedicated to the project by management.

For the internal dimension, it was argued that neither an open culture nor the right artifacts in place need to have a strong influence on the creation of the open innovation arena. Instead it may just work the other way around, that these things gradually change when the arena is established and it becomes an integral part of the organization. The management support was, on the other hand, argued to be very important from the start since managers have the ability to make projects happen at all, as well as to anchor them in the organization. Furthermore making sure that VTEC can be both absorptive and desorptive when engaging in the open innovation was appointed to be a question about having the right people in place and less about reorganization of the R&D or knowledge management systems.

More than giving practical insights, the usage of the framework also reinforced the notion that the framework can be considered on two different levels, the organizational and the individual. Here the importance of having the right people in place when tailoring the network of the arena was highlighted and it was found that the participants should have an understanding of both the technical and commercial viability in the open innovation arena activities. Thus, when inviting external actors to an arena, attention should also be paid to inviting the right individuals.

The lessons learned from using the framework in the case of VTEC were many but still the relevance of VTEC as a case, for testing the framework, must be questioned. VTEC differs from cases studied in the thesis in the way that they currently don't have an arena. Moreover, VTEC have somewhat different goals with their arena compared to other investigated cases.

For example, they wish to use the arena as a way to brand themselves as an exciting and open company. Thus, the case of VTEC might not be the best test of the framework.

A final aspect worth considering is that the empirical study was conducted at arenas which had been up and running for some time. Some empirical findings point to differences in the importance of the four dimensions of an open innovation arena over time. For instance, the formal dimension was said to decrease in importance as the informal dimension gets strengthened due to repeated interactions between involved actors. This in turn implies that when constructing a framework of how to create an arena, studying existing arena might not be enough.

All in all, the framework for open innovation arenas is not perfect. Neither does it provide a complete answer to the question of how a company can create an open innovation arena. Still the framework constitutes a first step towards understanding open innovation arenas from the perspective of a focal firm. Our wish is that it might be used and developed in future research on the topic. Here future research could aim at a better understanding of the causal links between the dimensions of open innovation arenas as well as allow for more accurate recommendations for practical implementations. For further research we also suggest that the relevance of the dimensions of proximity could be investigated more thoroughly, as to see if it is a valuable body of knowledge to draw from in the context of open innovation arenas.

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Appendix I

Enterprise	Description
Botnia Living Lab, Luleå, Sweden	Botnia Living Lab is a Living Lab located in Luleå, Sweden, with a focus to support human-centric innovation of advanced ICT Services for extended capabilities and mobility. They help actors from the IT industry with need-finding and idea-generation in their fuzzy front end phases. They work with open innovation and aim at engaging end-users and customers. The initiative for Botnia Living Lab was taken by Telia and Ericsson, two major actors within the telecom industry in Sweden, as well as internationally, and the partnership now includes some of the strongest international ICT/Telcom organizations, numerous SMEs as well as national and regional public authorities.
High Tech Campus Eindhoven, Netherlands	The campus is an area of one square kilometre in Eindhoven, Netherlands, where more than 8,000 researchers, developers and entrepreneurs work closely together. The campus is targeted at fostering open cooperation between different companies and institutes. In 2003 Philips decided to open up the campus to other technological companies and today there are over 90 different companies on site. These companies share facilities, knowledge and experience which decreases their costs and raises their output quality. Open innovation is claimed to be their way of working, and they cooperate with some 100 different universities and external companies in Europe and across the globe.
SAFER, Gothenburg, Sweden	SAFER Vehicle and Traffic Safety Centre is a joint research unit using competence from 24 partners from academy, society and industry. SAFER is hosted by Chalmers and provides multi-disciplinary research and collaboration to eliminate fatalities and serious injuries. Their goal is to make their partners world leaders in vehicle and traffic safety. SAFER provides its partners with an environment where they can meet and work together. This environment is a physical location at Lindholmen Science Park, Gothenburg, Sweden.
Flemish Living Lab, Mechelen, Belgium	The lab in Mechelen, Belgium, was an initiative supported by private parties which was initiated in 2010. It is managed by a consortium of private partners led by Telenet and it is financially supported by the Flemish government. It provides an environment where users can test new technology, products and services during a longer period in their own living environment. Products that are about to be launched in the market are brought to the lab for testing and researchers at the Vrije Universiteit Brussel and Universiteit Gent monitor the users' experiences while collecting and validating feedback.
Södra Cell, Väröbacka, Sweden	Södra is an economic association with 51000 members and Södra's mission is to care for the members forests in the best possible way. Södra Cell focuses on special paper, tissue and labels for packaging. Södra Cell has 50 employees at the research plant in Väröbacka, Sweden and their expertise is in the fields of fiber research and pulp technology. Their Pulp Labs is an IT platform for open innovation which was launched in 2008 by an advertising agency. It was

	aimed at making Södra more open and to take on different challenges. The challenges until today have regarded durable pulp, foamed paper and the strongest ever paper.
Greenovate!, Brussels, Belgium	Greenovate! is an independent European expert group dedicated to open innovation for sustainable business. It is a non-profit, membership based organization and their business covers facilitation of open innovation processes, management of innovation projects and eco-innovation policy design. They provide innovation support services at European Union level to research laboratories, technology developers, investors and companies willing to acquire or spin-out new technologies.
Security Arena, Gothenburg, Sweden	The arena, which is located in Lindholmen in Gothenburg, Sweden, is a national arena for projects that focus on societal security. They pursue development projects and research in several public security fields, such as information and communications security, transportation security and surveillance and early warnings. Their partners include the Swedish Civil Contingencies Agency (MSB), Chalmers, the University of Gothenburg, Ericsson, Saab AB and AB Volvo, in addition to end users and teams of experts.
Holst Centre, Eindhoven, Netherlands	The center is a research and development center located at the Philips High Tech Campus in Eindhoven. It was founded in 2006 by IMEC, a micro- and nanoelectronics research center headquartered in Leuven, Belgium, with offices around the world, and TNO, a not-for-profit organization in the Netherlands that focuses on applied science. Holst Centre consists of 170 staff researchers from over 25 different nationalities and 70 resident researchers from the industry and universities. Holst Centre receives funding from the Dutch government.
Tryg, Copenhagen, Denmark	Tryg is the second largest general insurer in the Nordic region and is present in Denmark, Norway, Sweden and Finland. In 2006, Tryg decided to establish a separate organisational unit of four people dedicated to innovation. They built a living lab environment called BusinessLab where experiments and events are carried out with customers, employees, suppliers and experts.
NineSigma, Leuven, Belgium	NineSigma is an experienced Open Innovation service provider. The company claims to be responsible for a large part of how open innovation is practiced today. NineSigma is a multinational company with one of its offices in Leuven, Belgium. They enable their customers to leverage a network of external resources to solve challenges, fill product pipelines and integrate new knowledge and capabilities into their organizations.
Opticom International Research AB, Stockholm, Sweden	Opticom is a leading global market research and consulting firm whose mission is to help our customers make better business decisions. Opticom comprises four business units, Pulp & Paper, Medical & Healthcare, IT & Telecom and Industries & Services. They have set up a Future Lab in the on behalf of Södra Cell. Future lab is a platform that combines market research with professional networking with key stakeholders by organizing round-table

	discussions.
SCA, Gothenburg, Sweden	SCA has four business areas. They are one of the world's largest companies in personal care products and among the largest in tissue, packaging and forest products. SCA apply the open innovation model, primarily by using open innovation for patent exchange, partnership with suppliers and selected companies, and by utilizing innovation brokers. They also work with customers, academia and researcher institutions, and actors approaching SCA, such as inventors, consultants and startups.

Interview guide for Open Innovation Arenas

The interview guide for the Open Innovation Arenas is presented below. Under each question in English is the Swedish translation.

Open innovation

1. **How would you define open innovation?**
   Hur skulle du definiera open innovation?

2. **What is your purpose with practicing open innovation?**
   Vilket är ert syfte med att utöva open innovation?

The internal factors

1. **What is important internally in a company to successfully pursue your purpose with open innovation?**
   Vad är viktigt internt för att bedriva open innovation i ert syfte?

2. **Are there cultural factors?**
   Finns det kulturella faktorer?

3. **What is important to be able to make use of externally obtained knowledge?**
   Vad är viktigt för att kunna använda kunskap inhämtad utifrån?

4. **What is important to be able to exploit internal knowledge externally?**
   Vad är viktigt för att kunna utnyttja intern kunskap?

The settings of an open innovation arena

1. **How have you created an arena for open innovation?**
   Hur har ni skapat en arena för open innovation?

2. **What is important in managing an open innovation arena?**
   Vad är viktigt för att hantera en open innovation-arena?

3. **Comments on these factors:**
    a. **Motivation**
    b. **IP**
    c. **Trust**
    d. **Physical arcitecture**
    e. **Commitment**
    f. **Co-location**
    g. **Risk handling**

4. **Are there other factors?**
   Kan du komma på andra faktorer?

5. **Are there relations between the factors?**
   Är faktorerna relaterade till varandra?

The arena network

1. **How do you choose which actors to include in the arena?**
   Hur väljer ni vilka aktörer som ska ingå i arenan?
    a. **Which knowledge should be included?**
       Vilken kunskap ska inkluderas?

2. **Which tools/models/framework do you use to choose and manage the actors?**
Vilka verktyg/modeler/ramverk använder ni för att välja och hantera era aktörer?

3. **What is important in handling the actors in the arena?**
Vad är viktigt vid hanteringen av aktörerna som ingår i arenan?
    a. **Is there a difference between how different types of actors are handled?**
       Finns det en skillnad mellan hur olika typer av aktörer hanteras?

4. **How do you make sure that you get knowledge that you can make use of from these actors?**
   Hur säkerställer ni att ni får kundskap som ni får användning av från dessa aktörer?

Appendix II

Interviewee position in VTEC	Date
Communications Manager	2011-11-28
Innovation Director	2011-12-02
Project Manager and Test Leader	2011-12-02
Innovation Designer	2011-12-06
Senior Vice President	2011-12-07
IP Project Leader	2011-12-07

Interview guide for Volvo Technology

Examples of questions from the interviews at Volvo Technology are presented below.

Culture

Not invented here syndrome (Mehrwald, 1999; Quoted in Herzog and Leker, 2010)

- Does VTEC rather develop a technology on your own than buying a pig in a poke?
- Can VTEC achieve market success without using external technology?

Only used here syndrome (Lichtenthaler and Ernst (2006) and Boyens (1998), quoted in Lichtenthaler and Ernst (2006)

- Will VTEC strengthen its competitors and negatively affect their core competencies by selling, licensing out or giving away knowledge?
- Does VTEC have experience in commercializing knowledge externally?

Practices and artifacts

Risk-taking (van de Ven and Chu (1989); Calantone et al. (2003) and Amabile et al. (1996) quoted in Herzog and Leker (2010))

- Is failure acceptable in VTEC, if the effort on the innovation project was good?
- Are risky activities common in VTEC?

Management support (de Brentani and Kleinschmidt (2004), van de Ven and Chu, 1989 and Amabile et al., (1996) quoted in Herzog and Leker (2010))

Has the management created an open and innovative culture in VTEC by…

- encouraging individuals to use external knowledge in their work?
- actively encouraging employees to submit new product ideas?

Absorptive and Desorptive capacity

(Inspiration taken from: M. Nietoa, P. Quevedob, (2004), Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort)

Level of knowledge and experience within VTEC:

- Are VTEC innovations mainly the result of R&D carried out within the firm?
- Does VTEC have the capacity to adapt and use others' technologies?

***Diversity and overlapping of knowledge structures within VTEC*:**

- Does VTEC have staff with a wide range of training and educational backgrounds?
- Does VTEC specialize in a small or large number of technologies?

Knowledge management systems

How VTEC's knowledge is managed:

- Are there systems used to communicate external knowledge into the organization/internal knowledge out into the external world?

Gatekeepers within VTEC

- Does VTEC's staff have the technical competence to understand new technical knowledge?
- Does VTEC's staff have the competence to communicate new technical knowledge into the organization?

Networks

Links between VTEC and the surrounding environment:

- Does VTEC conduct frequent market research so as to be aware of customer needs?
- Does VTEC often use licensing as a method to obtain technology?

Purpose, goals and resources of VTEC

VTEC's purpose and goals

- Are VTEC's efforts with open innovation aimed at getting new ideas/developing new products/advancing current R&D/improving existing products/maintain or improve brand image/reducing costs?
- What is the short term/long term goal(s)?

VTEC's resources:

- What resources could be made available for an open innovation arena?
    - Physical? Monetary? Staff?

Appendix III

Enterprise	Description
Consat Telematics AB	Consat is a consulting company with a dedicated telematics department. This telematics department is rather autonomous in their activities and their biggest clients are Volvo Buses and Västtrafik. Consats revenue comes from consultancy fees, licensing internally developed technologies and offering whole service packages.
Talkamatic	Talkamatic offers dialogue systems with a built in naturalness that allow users to talk freely to their system. The system contains a feedback model, which provides the user with the right feedback at the right time. The dialogue context model enables the system to interpret the intentions behind unclear user utterances. The technology of Talkamatic is based on research on human dialogue. Talkamatic have 4 employees and the interviewee is the only one working full time.
Diadrom	Diadrom is a leading consultancy for diagnostics of high tech products. They are engaged in the wireless information technology (IT) and mobile informatics sectors. The major services of the company are categorized into, diagnostics, telematics and simulation. These services are offered to areas such as pre-studies and project planning; projects assessment and evaluation systems; business case development and strategic planning; technical and business project management; requirements engineering and management.
Informasic	Informasic was founded in 2001 by people that left Ericsson. They are today 7 employees and their aim to offer its customers help in developing and delivering solutions built into cost effective integrated circuits with optimized functionality. They have developed solutions in several different application areas, but have specific skills within security, wireless communication and high speed design areas. The solutions are usually developed using ASIC, FPGA or standard processors. The customers are ranging from global high tech companies to SMEs with less competence and experience in designing electronic solutions. They take responsibility for the complete development process and also assist customers by providing highly experienced engineers. According to the CEO of Informasic, they have ignored the automotive industry since they usually not pay good and let the smaller supplier act as "*a bank*" and make them bear the development costs. They are however ready to reevaluate that point of view.
Idevio	Idevio is a software company that develops map solutions and delivers mapping, geocoding and routing software based on RaveGeo, their own patented and award-winning compression and streaming technology for vector-based geographic information. According to Idevio's Chief Sales Officer they have 4 segments: Defence; Transport and Forwarding; Mobile Applications; and Business Intelligence. Idevio currently have 10 employees. They have been active for 10 years and have had customers for 7-8 years. Among their customers are Ericsson, Saab, G4S, etcetera.

Movimento Group	The Movimento Group is a technology driven company providing solutions to a broad range of industries and products. The Movimento Group portfolio provides software reflash and data logging technologies delivered by its proprietary Secure Cloud Computing System. Movimentos business is divided into consulting and product development. The company was started in 2003 and currently has 22 employees in Sweden.

Interview guide for Small and Medium sized Enterprises

The questions used during the interviews with the SMEs are presented below. Under each question in English is the Swedish translation.

How would you be motivated to participate? Which are your driving forces?
Hur motiverar man er att medverka, vilka är era drivkrafter?

How can your trust be created in an arena?
Hur kan man bygga tillit och förtroende i en arena?

What would you like to gain from your participation in the arena, more concretely?
Vad skulle ni rent konkret vilja ha ut av en involvering i arenan?

Which contracts are important to make you want to cooperate?
Vilka kontrakt är viktiga för er för att ni ska vilja delta?

What tools, resources and information would you like to see in the arena?
Vad för utrustning, resurser och information skulle ni vilja se i arenan?

What would be interesting to have in an IT-tool?
Vad skulle vara intressant att ha med i ett IT-verktyg?