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**MANAGING CUSTOMER CO-CREATION: EMPIRICAL EVIDENCE
FROM FINNISH HIGH-TECH SMEs**

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ABSTRACT

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The purpose of this thesis is to find out how customer co-creation activities are managed in Finnish high-tech SMEs by understanding managers' views on relevant issues. According to theory, issues such as firm size, customer knowledge implementation, lead customers, the fuzzy front-end of product/service development as well as the reluctance to engage in customer co-creation are some of the field's focal issues. The views of 145 Finnish SME managers on these issues were gathered as empirical evidence through an online questionnaire and analyzed with SPSS statistics software. The results show, firstly, that Finnish SME managers are aware of the issues associated with customer co-creation and are able to actively manage them. Additionally, managers performed well in regards to collaborating with lead customers and implemented customer knowledge evenly in various stages of their new product and service development processes. Intellectual property rights emerged as an obstacle deterring managers from engaging in co-creation. The results suggest that in practice managers would do well by looking for more opportunities to implement customer knowledge in the early and late stages of new product and service development, as well as by actively searching for lead customers.

РЕЗЮМЕ

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Целью этой работы является выяснить, как создание ценности совместно с клиентами управляется в финских высокотехнологичных малых и средних предприятиях, понимая взгляды менеджеров на актуальные вопросы. Согласно теории, такие вопросы, как размер фирмы, реализация знаний клиентов, ведущие клиенты, размытый передний край разработки продуктов / услуг, а также нежелание вовлекаться в созданию ценности совместно с клиентами являются одними из центральных вопросов области. Мнения 145 финских менеджеров малых и средних предприятий по этим вопросам были собраны как эмпирические данные с помощью онлайн-анкеты и проанализированы программным обеспечением SPSS Statistics. Результаты показывают, во-первых, что финские менеджеры осознают проблемы, связанные с созданием ценности совместно с клиентами и способны активно управлять ими. Кроме того, менеджеры выполнили хорошую работу в отношении сотрудничества с ведущими клиентами, и реализовали знания клиентов равномерно на различных стадиях развития новых продуктов и услуг. Права интеллектуальной собственности стали препятствием, сдерживающим менеджеров от участия в создании стоимости совместно с клиентами. Результаты говорят о том, что на практике менеджеры преуспели, если бы искали больше возможностей для реализации знаний клиентов в ранних и поздних стадиях развития новых продуктов и услуг, а также занимаясь активными поисками ведущих клиентов.

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1. Introduction

Today's companies find themselves operating in markets where it is no longer enough to simply react to the needs of their target audiences. Customers are becoming used to active involvement in their supplying companies' new product and service development processes. They are becoming used to a new standard of inclusion and customization, and feel the increased value in collaborating with their upstream partners in more ways than just financial. This is also something that firms entering new markets must take into account, as standardization is no longer enough to differentiate themselves from their competitors in ever more fragmented target markets. The winning companies are those that are able to deliver superior products by including their most innovative customers to their new product and service development efforts, while at the same time making their customers feel like they are valued and getting value.

Customer co-creation has mostly made a name for itself as something that big-ticket firms have included into their strategy. For example, Apple used co-creation as a part of its App Store strategy to enhance the speed and scope of its innovation together with partner developers. Unilever and P&G alike collaborate with customers, partners and NGOs to make their products more socially responsible and appealing to customers. This research paper will look at smaller firms, SMEs, to see how customer co-creation is managed in the Finnish high-tech sector. Smaller firms necessarily practice a lot of customer co-creation as they must cater to their more limited customer bases by customizing solutions. This is likely to be the case especially in the high-tech industry where a lot of software, components, and other products have to be tailored to customers' needs.

1.1. Research Objectives and Questions

Recent developments in innovation management theory have highlighted the importance of new paradigms that put emphasis on cooperative innovation with customers. Customer co-creation is such an emerging paradigm, which combines aspects from the relatively fresh fields of open innovation, b2b innovation and user innovation as well as the time-tested theories of new product development. Customer co-creation is a management initiative that brings the supplying company and the customer together to innovate a mutually valued outcome. Some of the current literature on customer co-creation focuses on making sense of the so-far published research (e.g. O'Hern & Rindfleisch 2008, Greer & Lei 2012). Other researchers have created typologies for customer co-creation (Piller *et al.* 2010) or measured the importance of variables such as communication and internal coordination capacity for effective customer co-creation (Gustafsson *et al.* 2012, Luo *et al.* 2010). Although typologies and at least some empirical studies exist, due to the newness of the customer co-creation paradigm there is still a definite lack of real-life managerial insights into the field. This is why the main research question of this thesis is focused on the managerial aspect of customer co-creation. The aim is to see how the managers themselves relate to collaborating with their customers to create new products and services. For example, what are perceived as the greatest risks involved and how is customer knowledge implemented?

In the following, the research questions of this thesis will be listed. The questions consist of a main research question that aims to describe the current state of managing customer co-creation, showing the descriptive nature of this study. To answer the main research question, five investigative research sub-questions are used. According to Cooper & Schindler (2012), investigative questions represent the information the researcher must know in order to reach a conclusion about the main research question. Later, in the theory section,

each of the topics touched upon by the investigative sub-questions will be presented with detail. Hypotheses that reflect the current best available knowledge and assumptions will also be derived from theory to enable answering the research questions with supporting quantitative data.

Main research question	How are customer co-creation activities managed in Finnish high-tech SMEs?
Research sub-question 1	Do customer co-creation activities become more important for management as the size of the firm increases?
Research sub-question 2	Do managers prefer to incorporate customers' innovations in the early or late stage of developing solutions, and how much freedom do they allow for the innovating customer?
Research sub-question 3	Why are some managers reluctant to involve customers in the innovation process?
Research sub-question 4	Do managers feel increased pressure in the fuzzy front-end of product/service development because of customer co-creation activities?
Research sub-question 5	Are managers conscious of their firms' lead customers?

Table #1. Thesis research questions.

1.2. Theoretical Framework

According to Bogers *et al.* 2010 and Greer & Lei (2012), a comprehensive framework for customer co-creation is yet to be created. Greer & Lei (2012) present the most advanced state of the framework as a synthesis of conceptual frameworks by various authors. The synthesized framework consists of elements such as the driving and restraining forces for co-creation, the feasibility of co-creation, and the implementation of it (for a full view, see Appendix III). In the grand scheme of things, the eventual framework for

customer co-creation will be based largely on innovation management frameworks, open innovation frameworks as well as user innovation frameworks. Additionally, elements from fields such as new product development, organizational science and cost analysis should be included. For the purposes of this research, this chapter will present a hybrid framework that shows the underlying greater base elements for the theory of customer co-creation, as well as includes some of the finer concepts associated with it according to modern literature. Later, in the literature section, some of the base elements and especially the finer concepts will be explored further.

The customer co-creation framework created for the purposes of this thesis is presented on the next page, in figure 1. The overall framework for customer co-creation encompasses a great variety of concepts, as Appendix III shows. To avoid cluttering and maintain clarity in this research, only the concepts that are relevant the particular research issues at hand will be included in the framework presented here. The framework is based on the framework synthesis by Greer & Lei (2012) which in turn is based on the works of previous authors. In addition to those authors' work, the framework also includes two outside elements, IP rights and the fuzzy front-end of new product development, the relevance of which will be tested to a degree in this research. For a list of relevant authors for those two concepts, see Table 4.

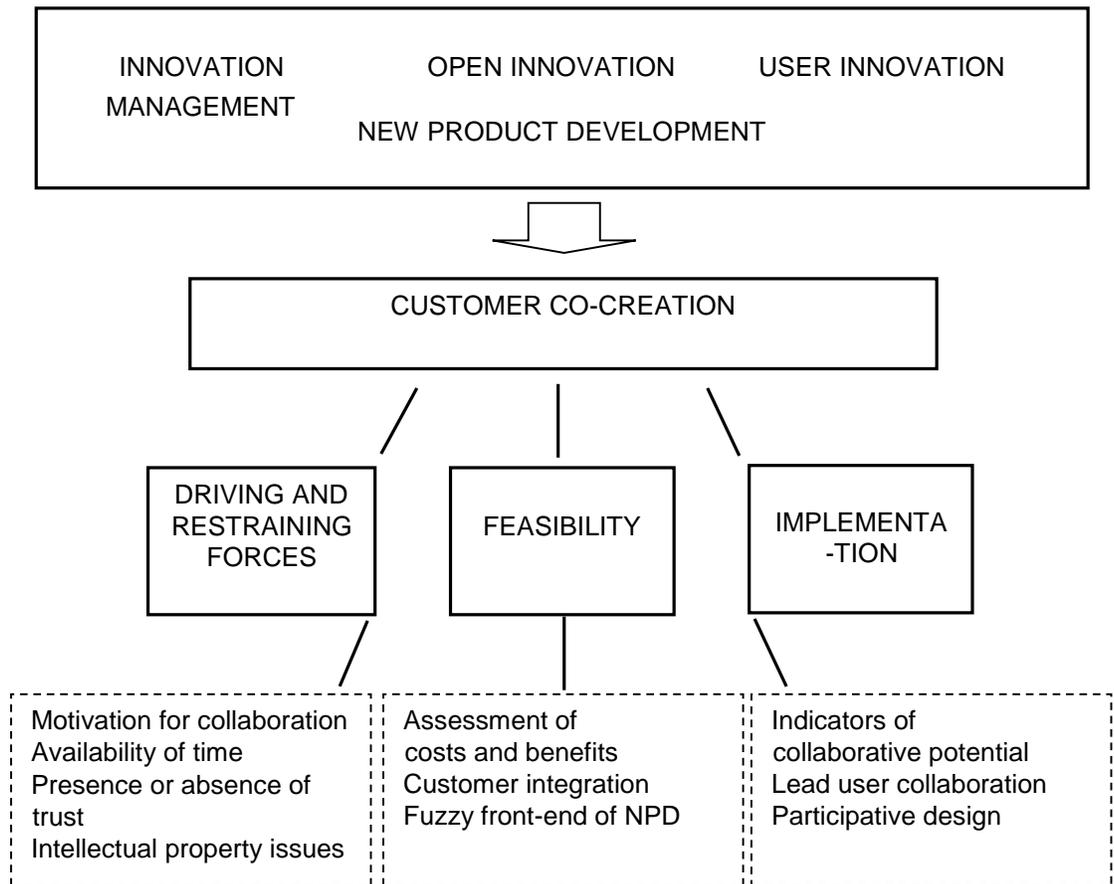


Figure #1. *Theoretical framework of the thesis. Based on (Greer & Lei 2012, Etgar 2008, Ojanen & Hallikas 2009, Bilgram et al. 2008, Fuller et al. 2007, von Hippel 2005, von Krogh 2006, Lettl et al. 2006, Buur & Matthews 2008, Pals et al. 2008).*

The framework used in this research shows customer co-creation as a theoretical whole that draws influences from innovation management, open innovation and user innovation literature. The research focus of this paper justifies including the driving and restraining forces, the feasibility, and the implementation of customer co-creation to the framework. Included in these elements are more refined concepts that are embodied in the research sub-questions, and later, in the self-administrated survey used as a research tool.

1.3. Research Design

The purpose of explicating a research design is to give the research, which is essentially a project, a strategy and a plan with which the strategy will be carried out (Cooper & Schindler 2012). The most important points are to specify the methods by which data is collected, measured and analyzed, as well as to recognize whether the study is exploratory or formalized in nature. As is often the case especially with master's thesis works, the direction of the research was not clear from the beginning with this paper either. In such a situation Cooper & Schindler (2012) recommend a three-staged approach, where the overall situation regarding research-relevant theory is first charted, and then hypotheses are formed and data collected and analyzed. The following figure shows the stages of this research, with the involved working activities included, in chronological order.

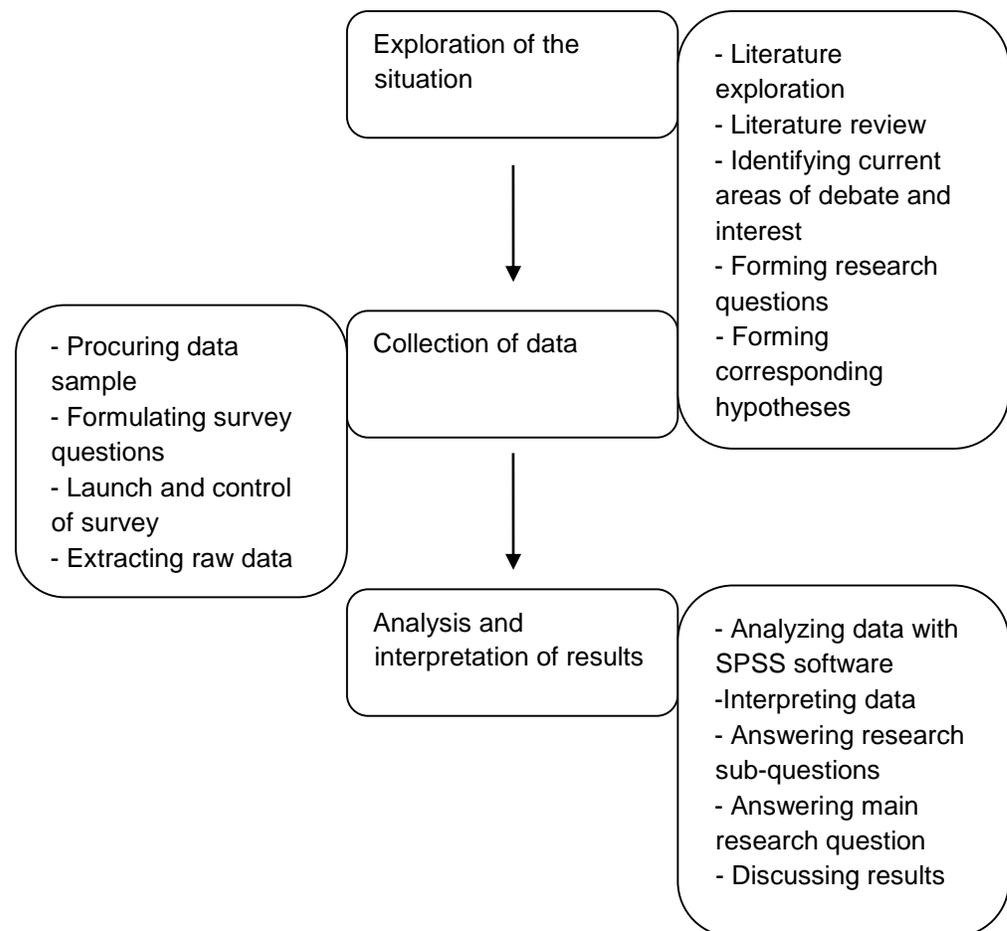


Figure #2. *The realized three-stage research procedure in chronological order. Based on (Cooper & Schindler 2012).*

This research is a descriptive study that is of a formalized nature. Clearly stated investigative questions and hypotheses aim to shed light on the main issue, the state of customer co-creation in Finnish high-technology SMEs. Finding answers to the main research question involves finding out about and understanding various characteristics and behavior of the subject population. From the research sub-questions we can see that the questions seek to find whether or not managers are engaging in certain types of activities and why they are doing so. The main research question, on the other hand, asks what is the state of managing customer co-creation in general, and answering it will require deducing facts from the research sub-questions' answers as well as the overall correlations found within the collected and analyzed data.

There are numerous ways to more accurately describe the nature of a study than the simple division of exploratory versus formalized. The following table shows some of the more well-defined characteristics of this study:

Category	Attribute	Explanation
Method of data collection	Communication study	Data is collected via a self-administered survey
Researcher's ability to change variables	Ex post facto	Variables are not changed during the course of the study
Purpose of study	Descriptive	The study aims to describe the current state of customer co-creation within the sample
Time dimension	Cross-sectional	The study results represent the situation in a single point in time
Topical scope	Statistical study	A wide population of subjects are analyzed quantitatively
Research environment	Field setting	Research results represent direct findings from real-life conditions

Table #2. *Attributes of the research design. Based on (Cooper & Schindler 2012).*

As seen from the above table, the data collection method employed is communicative. This means that a sample of industry players are contacted and asked to complete a self-administered survey. The resulting data will be measured using appropriate analysis software and analyzed in the empirical section. The data and data collection methods as well as analysis processes are discussed in more detail in chapter 5.

1.4. Thesis Structure

This introductory chapter has familiarized the reader with the most recent developments in open innovation, user innovation and customer co-creation in a superficial capacity. These recent developments and areas of interest have been translated to research objectives which were presented in the form of a main research question and supporting research questions. To support an early understanding of the relevant concepts that will later form the basis of achieving results in this research, key concepts and frameworks have also been presented. Lastly, this introductory chapter has provided information about the design of this research, as well as the realized research process.

The rest of this research paper is divided into two sections, the first one theoretical and the second empirical. After the conclusion of this introductory part, chapters 2 and 3 will form the theoretical section. The reader will first be introduced open innovation and then user innovation and customer co-creation. Chapter 4 will represent a transition between the theoretical and empirical sections in the form of a research methodology section. There, a more detailed look at the research methodology, data, and data analysis methods will be taken. The empirical part will consist of chapters 5 and 6, starting with a look at the gathered primary data and its deeper analysis, and

concluding with a discussion about the results, their relevance and implications. Lastly, a bibliography will catalog the sources used in this research, and the appendix section will contain research instruments such as the survey and information about the used dataset.

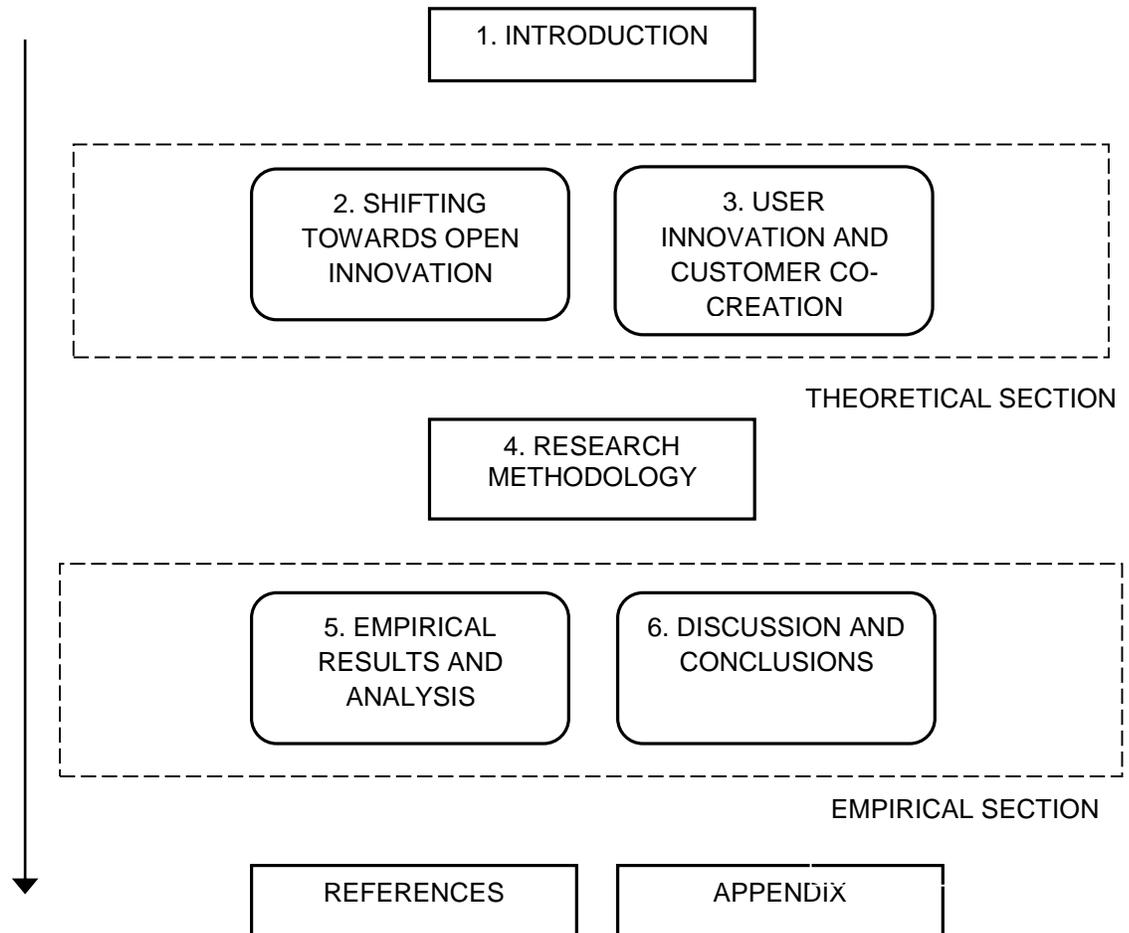


Figure #3. *Research paper structure.*

2. Shifting towards Open Innovation

The goal of this literature review section is to provide the reader with a solid picture of how open innovation functions according to up-to-date business literature, and to show how more refined concepts such as user innovation and customer co-creation have emerged. It's useful to note already at this point that many firms don't necessarily see themselves as practitioners of open innovation or customer co-creation, but if they were asked whether they engage in collaboration with partners to further product- or service development, the answer would probably be yes. So, there are differences in the terminology that academics and firms use to relate to the concepts at hand. In this literature review section, terms like open innovation and customer co-creation will be used widely. In the empirical section, terms like collaboration will be used more to make the findings more relatable for readers from various industries.

This chapter brings about the first central paradigm of this thesis, open innovation, and its various sub-themes such as open innovation strategies, managing OI and the costs and risk associated with OI. To make sense of the wide body of literature that exists on these topics, they will be considered individually in an attempt to reach the most up-to-date understanding about each of them. The basis for this thesis' research questions will also be laid by identifying gray areas and points of interest within the literature. Later, the same approach will be taken with user innovation, which will be treated as a concept that is closely related to open innovation but diverges from it nonetheless.

Understanding that firms do not innovate in a vacuum led to a significant revelation in innovation theory when Henry Chesbrough introduced the open innovation concept in 2003. He showed that two major factors contributed to the emergence of the open innovation paradigm:

1. Shortening product life cycles and opportunity windows lead to shrinking revenues
2. Rising innovation costs contributed to increases in product and service development costs

Chesbrough argued that due to these factors, it is increasingly hard for companies to justify closed-circuit R&D operations, as there is a huge wealth of resources available outside the boundaries of the firm (Chesbrough 2003a, 2003b). Consequently, firms should practice open innovation by buying and licensing inventions from other firms (Inbound Open Innovation) and spin off, license or otherwise pursue value from their own unused innovations (Outbound Open Innovation), thus achieving joint value maximization (Chesbrough 2003b). This approach was in opposite to what firms of the 20th century had generally done, which was investing heavily in in-house R&D, hiring the most talented people, and then protecting their innovations with intellectual property strategies. The created profit was then re-invested into the closed innovation circuit. (Chesbrough, 2003a)

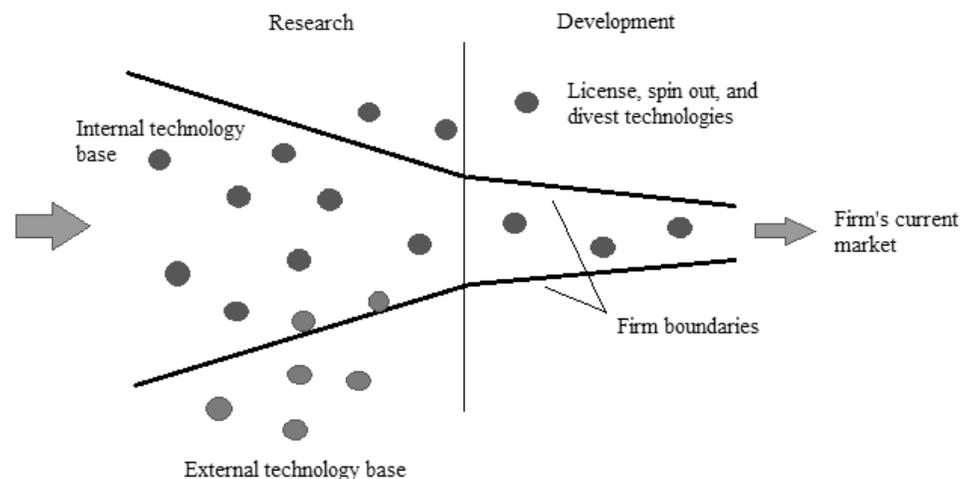


Figure #4. A visualization of a firm developing new products on an open innovation basis. Adapted from (Chesbrough 2003a).

Since its introduction, the open innovation paradigm has attracted a tremendous amount of interest from researchers and practitioners alike (Elmquist *et al.* 2009). Indeed, the body of open innovation literature has grown so rapidly that definitions for the concept, such as Davis's (2006) "*The process a company employs to externally search for and source research, innovation, new technologies, and products*" are felt by many to already be inadequate (Elmquist *et al.* 2009, Piller & Walcher 2006). A lack of unified terminology and confusion about the boundaries of open innovation are a real problem as the number of published OI studies keeps increasing (Duarte & Sarkar 2011). For instance, Bogers & West (2012) speak about "distributed innovation" as a parent concept to open innovation and user innovation. Other similar designations exist: collaborative innovation, disintegrated innovation, distributed innovation, and the list goes on. Commenting on the state of definitions for the open innovation concept is not something that will be undertaken here, however it is very useful to note that open innovation and user innovation are two diverging veins of research (Bogers & West 2012), Duarte & Sarkar 2011)

2.1. Open Innovation Strategies

The basis of how firms might relate to open innovation in a strategic capacity was laid by Chesbrough (2003) with the terms *inbound* and *outbound* innovation. These terms refer to the acquisition of knowledge resources from outside the organization and commercializing inventions made within the firm by licensing them or creating spinouts, respectively. Gassmann & Enkel (2004) looked at inbound and outbound innovation from the perspective of the firm, and attempted to classify the strategic processes involved in open innovation. They came up with three key processes:

1. **The outside-in process:** The company enriches its own knowledge base by integrating knowledge from suppliers, customers and other external sources, thus increasing its own innovativeness
2. **The inside-out process:** The company exploits its ideas externally by channeling them to outside markets via selling or licensing IP and multiplying technology
3. **The coupled process:** The company links the outside-in and inside-out processes and achieves success through working in alliances with complementary companies

The researchers also remind that open innovation is not something that is necessarily advantageous for all firms. This is usually the case in slow-changing industries, and for firms that do not require high product modularity and gain limited positive effects through technology licensing. Thus, on the other side of the spectrum, a **closed innovation process** also exists. A study by Gianiodis *et al.* (2010) largely echoes these findings, with changes in terminology and a few illuminating new observations. They classify four types of firms that follow different strategic approaches to open innovation:

- **The innovation seeker** searches for innovative solutions outside its boundaries to complement and build on its existing technology portfolios
- **The innovation provider** does not build commercial solutions on its own, but instead distributes its innovations as products to partners
- **The intermediary** acts as a catalyst for market exchange of innovations and thus may help some firms adopt open innovation behavior
- **The open innovator** is a hybrid of the first two types, a firm that has integrated in- and outbound open innovation to its core business practices

Fiengenbaum *et al.* (2014) take a fresh approach in their study of open innovation strategies, in an attempt to break the pattern of repetition in the literature. They recognize several problems in the field, the most important of which being that there is a lack of a unified pattern in what researchers think constitutes the subject of OI transactions. With this in mind, they took a knowledge-based approach to analyzing open innovation, and chose to look at OI transactions as knowledge transactions. A following simulation model showed that open innovation is likely to be a more profitable long-term strategy than closed innovation.

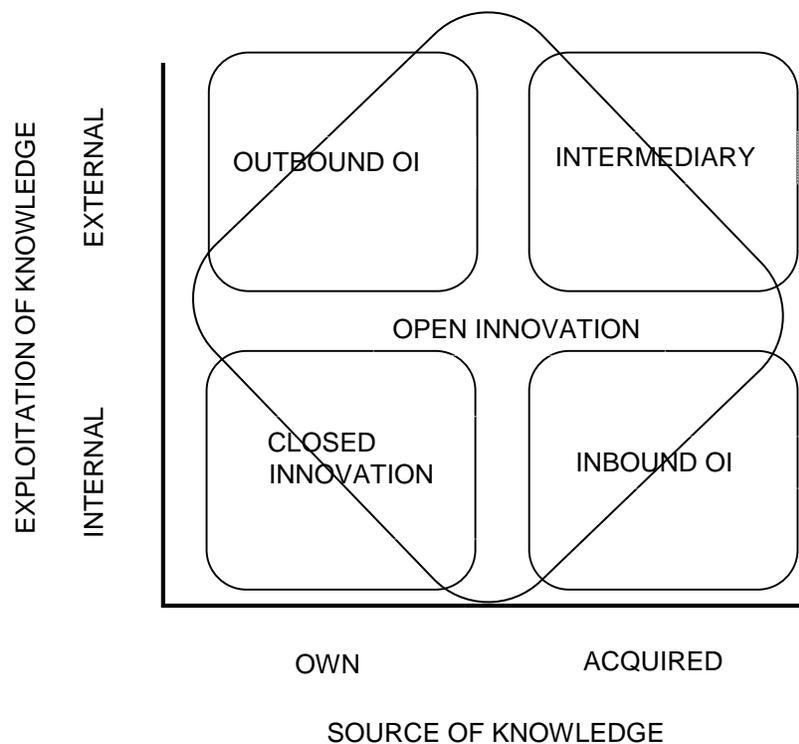


Figure #5. Knowledge-based innovation strategies differentiated by source of knowledge and locus of knowledge exploitation. (Fiengenbaum *et al.* 2014)

2.2. Innovation Networks

Innovation networks were known as an area of research interest much earlier than open innovation. In fact, innovation networks gained active interest from the research community already about 25 years ago (Freeman 1991, Camagni 1991, DeBresson & Amesse 1991). Open innovation itself can be understood as a theory that is based on trying to understand the transactions between innovating actors, whereas innovation networks focus on the nature of the cooperative webs formed by the actors themselves. Innovation networks are mostly investigated within the field of knowledge management, where the main early interest was effective knowledge sharing among geographically dispersed groups and individuals (Swan *et al.* 1999). Rallet & Torre (1999) found out that geographic distance is not a hindrance for innovating in networks, and that in fact nonlocal relationships appeared to be of key importance in fostering innovation.

There are certain issues that need to be navigated when operating in innovation networks. The first one is knowledge mobility: ideas and knowledge that exist in the network can be used to solve existing problems, but only when connections are built between them (Hargadon & Sutton 1997). This is made more complex due to “information stickiness”, which refers to the fact that implicit information is hard to codify and transfer (Von Hippel 1994). Building trust within the network and ensuring that all participants benefit from its labors is also an issue, as it has been shown that freeriding can be a problem within innovation networks (Teece 2000). Network stability is a natural concern, as obviously the network must maintain the necessary level of cohesion to create value (Kenis & Knoke 2002). Dhanaraj & Parke (2006) have pointed out the importance of a central hub firm that addresses these issues and orchestrates the functions of the network, without assuming the role of a hierarchical authority.

Network actors are connected to each other through ties, which can be characterized by various attributes. Dittrich & Dyusters (2007) identify weak ties, which can be more conducive to identifying external business opportunities than normalized long-term partnerships. Deep ties help firms to find value from existing knowledge, while wide ties can help to find new technologies and market opportunities (Simard & West 2006).

Recently, a refreshing new direction for innovation network theory has emerged in the form of “creation nets”. Hagel & Brown (2011) have identified that even though open innovation is a hot topic and even somewhat of a buzzword in the business community, not many practitioners actually have any idea how to implement it. They argue that this is due to uncertainty about what kind of management initiatives should be used to continuously create value out of open innovation, as well as the fact that managers have a poor idea about what actually constitutes OI, thinking about it too narrowly or in an extreme way. A somewhat vicious circle emerges as managers who are unsure about OI management practices fall back to a narrow view of what initiatives should be taken. The proposed solution is a network called the creation net, where a certain organizing party called the gatekeeper chooses the network participants and focuses their efforts towards value-creating innovation through various institutional mechanisms. (Hagel & Brown 2011, 2006)

2.3. Business Models and Open Innovation

Not long after introducing the open innovation concept itself, Chesbrough (2004) also pointed out the importance of adapting business models to better fit the OI environment. With the importance of networks and b2b partnerships in open innovation, organizations should also renew their business models to accommodate the fact and so reach better value creation (Chesbrough 2007, Chesbrough & Schwartz (2007). On a practical level, this entails committing the top management to a new culture where the business model is more open

to experimentation, thus enabling the flow of dormant innovations and ideas between organizations and to those actors who are best able to create value out of them (Chesbrough 2007). Companies divest many innovations that turn out to be “false negatives”, and a new process must be integrated into the business model to manage innovation more effectively. An effective analogy of chess and poker illustrates the matter: *“In a new market, you have to plan your technology entirely differently. You’re not playing chess any more, now you’re playing poker. You don’t know all the information in advance. Instead, you have to decide whether to spend additional money to stay in the game to see the next card”* (Chesbrough 2004).

Opening business models to the OI environment is no easy task. Amit & Zott (2001) find significant cognitive resistance to changing firm asset configurations.. Chesbrough (2010) sums the main challenges as adopting a positive attitude towards business model experimentation, committing top- and middle level managers to business model change, and forming an overall corporate culture that supports open business models. A case-study of Dutch companies conducted by Van der Meer (2007) shows that the dominance of existing business models is the main obstacle for open innovation. Additionally, the fact that most of the case companies did not have an explicit definition for their business model at all suggests that the most advanced and self-aware companies are in the best position to consciously adapt their business models for OI. This thought is supported by the fact that case examples of companies that have successfully integrated a business model-based thinking into their OI activities are very repetitive, mostly circulating between the IBM, P & G, Merck, and a number of others.

2.4. Managing Open Innovation

As established, much of open innovation is about being able to leverage external knowledge sources to enhance your own innovation activities

(Chesbrough 2003). This means that companies must invest in capabilities that enable the absorption of such knowledge (Lane *et al.* 2006, Laursen & Salter 2006). According to literature, these capabilities should include managers who have capabilities that support those absorptive activities, because managers have access to external organizations and are in a position to introduce beneficial knowledge from them to their companies (Lichtenthaler, 2011). However, it is also pointed out that the management of open innovation on a managerial level is also an under-researched field. (Elmquist *et al.* 2009, Gupta *et al.* 2007).

Organizational external knowledge absorption capabilities (ACAP), however, are a thoroughly researched concept. The established understanding is that ACAP is a process that consists of various steps, although the construct varies somewhat between research publications. Zahra & George (2002) presented organizational ACAP as consisting of the potential capability of organizations to acquire and assimilate knowledge, and the realized capacity to transform and exploit knowledge. Lane *et al.* (2006) used a three-step construct, where organizations explore, transform and exploit external knowledge. Using the latter construct, da Mota Pedrosa *et al.* (2013) identified a set of manager characteristics and practices associated with each of the three knowledge absorption steps:

1. Exploration

- Managers are predominantly open-minded
- Managers have expertise and lively interest in new technologies

2. Transformation

- Managers engage in formal and informal meetings to overcome cognitive resistance brought on by new knowledge structures
- Knowledge transformation is easier for managers who know the organization's capabilities and language

3. Exploitation

- Managers' ability to abstract and promote transformed knowledge
- Formal meetings create occasions to exploit transformed knowledge

According to Dodgson *et al.* (2006), organizational culture and new skills have a big role in open innovation. They also point out that new technologies do not replace existing practices, nor do they overcome the uncertainty associated with innovation. These observations provide a layout in which managers and leaders should operate. Fleming & Waguespack (2007) point out that the leaders of open innovation communities must be able to provide significant technological contributions, while Witzeman *et al.* (2006) show that there is powerful resistance to open innovation within organizations. Witzeman *et al.* (2006) also argue that as the amount of sourced external knowledge increases, the need to transform organizational culture and systems increases. This, of course, has significant implications for managers from a change management perspective.

Another management issue that has long existed in literature is the so-called fuzzy front-end of innovation, sometimes also known as fuzzy gates (Herstatt & Verworn 2001). The fuzzy front-end refers to the early stages of the process of innovating new products and services, where ideas are assessed and concepts and products might be preliminarily planned. Determining whether or not to proceed with development at an early stage is extremely important, as development becomes more costly at each step of the way towards the finished result (Khurana & Rosenthal 1997). Recently it has been suggested that the importance of managers' adopting a conditional go-mindset and understanding the fuzzy front-end of innovation becomes even more relevant as external knowledge and innovation sources are introduced into the product and service development equation via open innovation (Vanhaverbeke *et al.* 2008).

2.5. Intellectual Property Appropriation and Patenting

Intellectual property has been at the center of the open innovation paradigm from the very start, as Chesbrough (2003a) explained the phenomenon as firms acting as buyers and sellers of patents and innovations. It is therefore justified to include IP-related matters to the wider sphere of open innovation research. The matter is made more complex by the fact that technology appropriation and patenting are conducted within national government-operated systems, which are designed for closed innovation (Baldwin & von Hippel 2011). In recent years several papers have shown the inherent problems a strong intellectual property regime poses for open innovation. For example, Fiegenbaum *et al.* (2014) show that in such scenarios firms following inbound- and coupled open innovation strategies may lose their leading position due to information accessibility problems. It is also shown that closed innovators hold the largest number of patents. Finally, the researchers note that the use of patent data for analyzing innovation activities in OI research has decreased in recent years, most likely due to its insufficiency in reflecting informal IP protection and transferring activities.

Hurmelinna *et al.* (2007) show that tight appropriability regimes can help firms create and protect competitive advantages, but on the other hand, weak appropriability regimes facilitate easier knowledge transfer. While the matter is more complicated than that, the authors suggest that companies taking an intermediate appropriability regime position may be able to protect their critical IP interests while maintaining the necessary flexibility to take advantage of market opportunities and in so doing achieve substantial competitive advantage.

Baldwin & von Hippel (2011) call for further research into the matter of social welfare effects caused by closed and open innovation. The relevance of the matter for IP rights lies in the aforementioned fact that current technology

appropriation and patenting mechanisms were created for closed innovators. The authors suggest that open innovation has positive effects for social welfare. This argument is supported by the findings of Strandburg (2008) who shows that many innovators are motivated by simply the process of developing something new for their own and for others' use, instead of financial gains. These innovators (as well as some profit-seeking organizations) often practice "free revealing", where information is made freely available for the benefit of all (Von Hippel & von Krogh 2006, Strandburg 2008). However, due to the nature of the current appropriation and patenting mechanisms, innovation-related information can be owned, which can force such innovators to either conduct costly searches for existing owners or run the risk of litigation (Dreyfuss 2010, Baldwin & von Hippel 2011). These observations lead Baldwin & Hippel (2011) to suggest that a significant effort should be made to discover how IP appropriability policies should be changed in order to better facilitate open innovation. Other researchers predict the emergence of a secondary IP market which consists of IP aggregators, insurers and even common IP pools via which free revealing could be practiced (Gassmann *et al* 2010).

2.6. The Costs and Risks of Open Innovation

Baldwin & von Hippel (2011) show that each innovation opportunity has four generic costs: design cost, communication cost, production cost and transaction cost. The authors argue that actors in open innovation networks face increased design costs, as there is a need to develop a modular architecture for the innovation. On the other hand, they point out that as the contributors are able to share the design cost burden, this disadvantage is negated and large-scale innovations become viable even for small individual actors (von Hippel & von Krogh 2003, Baldwin & Clark 2006). Production and transaction costs may or may not be an advantage for open innovators in various situations. While economies of scale and mass production technologies have generally created a production cost advantage for closed

innovators, that is increasingly changing with the advent of mass-customization production possibilities that favor open innovators (Baldwin & von Hippel 2011). Transaction costs refer to the costs of appropriating an innovative design as well as protecting it by restricting access and, for example, enforcing non-compete agreements (Marx *et al.* 2009). As such, open innovators generally incur lower transaction costs because they do not view protecting their knowledge being as crucial as closed innovators, and even practice free revealing in some instances (de Jong & von Hippel 2009). However, open innovators do still face transaction costs as some innovations, especially large and successful ones, must be protected from exploitation (Baldwin & von Hippel 2011). Keupp and Gassmann (2009) in particular see transaction costs and intellectual property issues as some of the main issues faced by open innovation.

Communication costs are the key costs in any open innovation project. Baldwin and von Hippel (2011) explain that the easy and low-cost communication possibilities enabled by the Internet are a critical driver for open innovation, as the actors must communicate with each other continuously. For an open innovation network to be viable, the communication costs it incurs to a single participator must be more than offset by the value increase offered by the other participators' ideas and designs. Baldwin and von Hippel (2011) show that the value of an innovation network increases as the number of participants increases. However, the free-rider problem is an inherent risk in running innovation networks: as the communication setup has to be as low-cost as possible, including barriers for free riding would increase costs and reduce the amount of participants and the value of the network. (Baldwin 2008, Baldwin & von Hippel 2011)

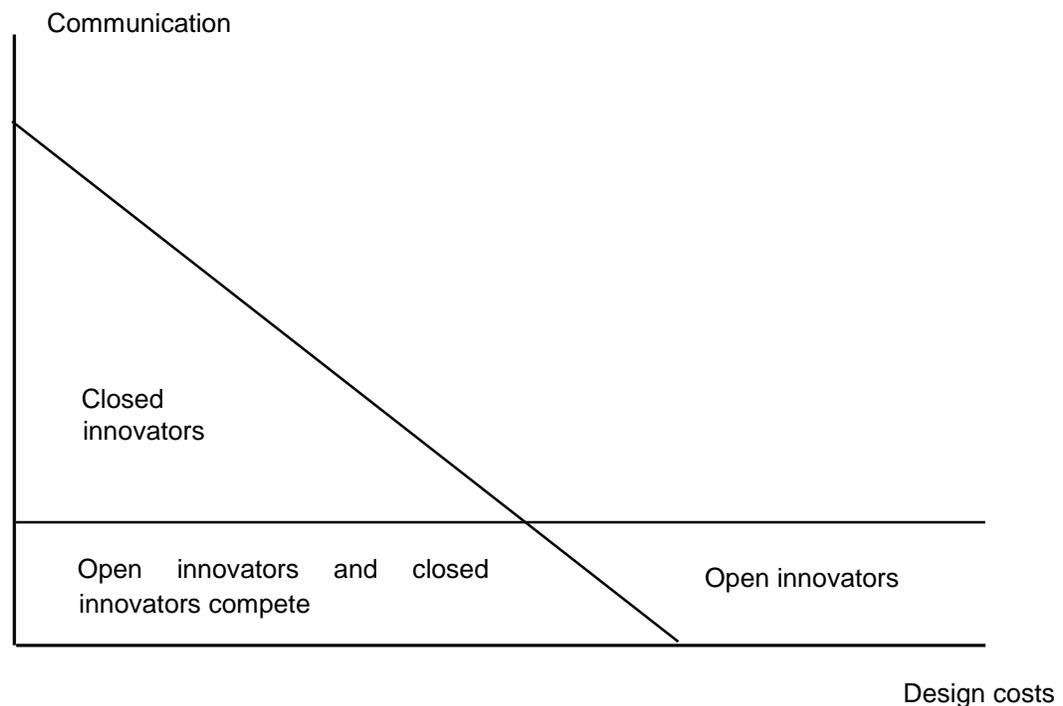


Figure #6. *The bounds of viability for closed and open innovation in a communication- and design cost-only environment. Adapted from (Baldwin & von Hippel 2011).*

The costs approach to open innovation suggests that companies face financial risks in implementing open innovation if they are not aware of what kind of costs they should effectively manage in respect to their strategy and market position. Additionally, Elmquist *et al.* (2009) as well as Huizingh (2011) find that recent research suggests there are likely to be several other sources of risks for open innovators.

A number of researchers suggest that too much openness may in fact be detrimental to open innovators. For example, Norman (2004) and Oxley & Sampson (2004) show that leaking commercially sensitive knowledge and technologies is a significant problem for companies which take an open

approach to knowledge sharing, especially for companies that participate in R&D alliances and should thus maintain certain levels of openness to facilitate cooperation. Laursen and Salter (2006) found that the relationship between OI activities and firm performance is nonlinear, implying that OI activities should be optimized instead of maximized. Tomlinson (2010) provides some reinforcement to this view by finding that it is the strength of vertical cooperation ties that matters, instead of their number. Huizingh (2011) further postulates that the nonlinear relationship between OI activities and firm performance may be a result of the firm losing focus on its internal activities as a consequence of putting too much emphasis on exploiting external knowledge. Such an approach may result in short-term gains from licensing technology at the expense of the firm's long-term strategy. Interestingly, Hacıevliyagil (2007) finds that at Philips and DSM, the incorporation of open knowledge sharing between collaborators led to tightening of knowledge flows within the companies themselves. In their article which takes a critical view towards OI, Trott and Hartmann (2009) suggest that this might be a common side-effect of open innovation. In practice, de Wit *et al.* (2007) as well as Lichtenthaler & Ernst (2009) both found that firms are quite reluctant to implement OI activities. Fiegenbaum *et al.* (2014) suggest that this is because firms do not have an adequate understanding of what exactly constitutes OI and the knowledge transactions involved. Their research also sheds light on some of the risks associated with OI, suggesting firms should manage their level of openness according to the stage of their business maturity and/or product life cycles. Theoretically, in early stages firms should remain more closed to foster radical innovations and gain competitive advantage, and increase openness when they have established a tenable position in the market.

3. User Innovation and Customer Co-Creation

The relationship between open innovation and user innovation is somewhat complex. User innovation was introduced first, and its importance was established mostly by von Hippel (for example, von Hippel 1976, 1988, and 2005). Recall the fact that open innovation was conceptualized only as late as 2003, even though many researchers and practitioners were, on many levels, quite aware of the effect collaboration had on innovation before that. In modern innovation literature, open innovation and user innovation are considered the major divergent research directions of the grand paradigm of distributed innovation (Baldwin & von Hippel 2011, Chesbrough & Bogers 2014). Nevertheless, both directions are closely related and have overlapping parts. As users interact with suppliers to create innovations, it is impossible to neglect the knowledge- and technology transfer considerations that the open innovation paradigm brings to the table. Still, while in some papers (e.g. Gassmann *et al.* 2010, Lichtenthaler 2011) user innovation is considered a part of open innovation, in this paper the chosen stance is that the two fields are divergent areas of distributed innovation research which are best reviewed together due to their overlap and synergy.

User innovation encompasses a variety of innovation activities that users engage in. Users innovating by themselves or in user networks are a part of the paradigm, just as are users as customers who innovate together with suppliers or producers (von Hippel 2005). User innovation also includes individuals (instead of firms) innovating for their own benefit and pleasure (Baldwin & von Hippel 2011, Strandburg 2008). The width of the field creates a need to limit the focus of this literature review on users so as to support later empirical research. For this purpose, the focus will be placed on the b2b relationships that exist between supplier- and producer firms and their customers, who are defined as the users in this case. The innovation activities

that take place within these relationships are referred to as customer co-creation (Bogers *et al.* 2010), or collaborative innovation with customers (CIC), a term used by Greer & Lei (2012). Although user innovation is seen as a very well-researched open innovation-related field (Gassmann *et al.* 2010), the customer co-creation view is somewhat new, and several academics have called for further investigations into the particularities of innovations in the customer-supplier interface.

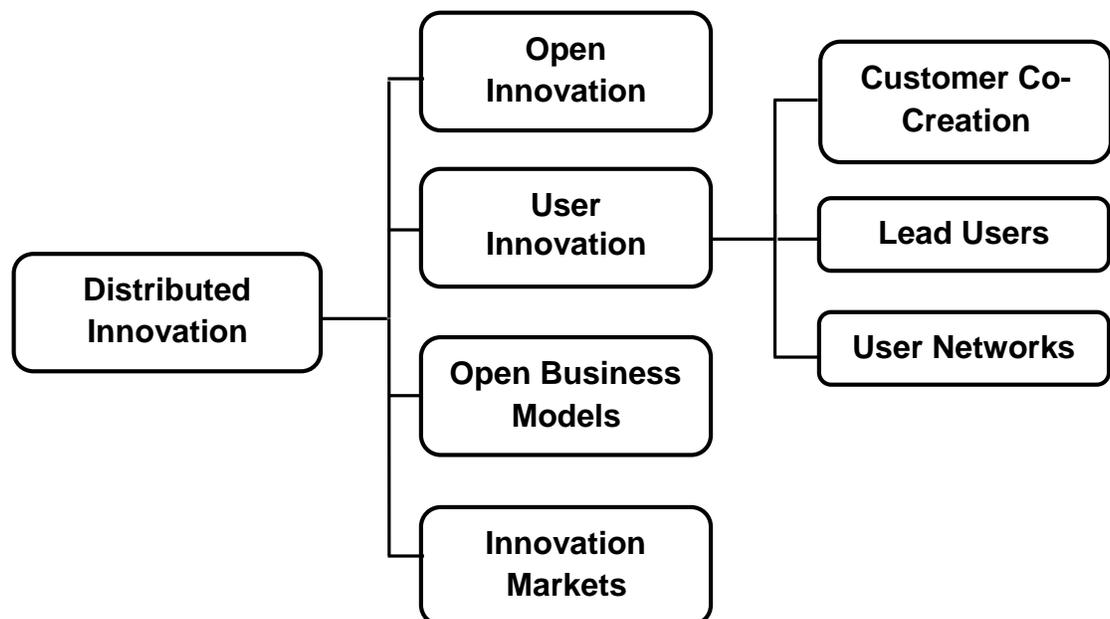


Figure #7. *The distributed innovation paradigm together with its constituent parts, focusing on user innovation. Adapted from (Bogers & West 2012, Lichtenthaler 2011, Greer & Lei 2012).*

In the following subchapters, some particular research issues found within the user innovation paradigm are presented. The descriptions of these issues will draw from existing literature, and they will form the basis for this thesis' research questions. Understanding these issues will also provide a key foundation for effective empirical data gathering via a questionnaire that asks the right questions.

3.1. Customer Co-Creation and Firm Size

Whether or not firm size is positively related to the number and quality of customer co-creation relationships is a somewhat under-researched area, with limited evidence both for and against (Greer & Lei 2012). In a study of 154 Dutch middle- and large-sized companies, Lichtenthaler (2008) found out that large companies are the main driving force in open innovation implementation. He further speculates that this is probably due to the diverse technology base they employ, leading them to rely less on internal activities. Lichtenthaler (2008) also shows that large firms approach their innovation activities more systematically, and have the necessary resources to set up corporate venturing units and similar processes and structures dedicated to open innovation. An empirical study by Prandelli *et al.* (2006) shows that large, household brand companies and multinationals are the ones most likely to employ web-based tools in including the customer in the innovation process. Furthermore, apparently only the largest and most diversified companies employ the most innovative tools as opposed to simple customer input collection tools etc. On the other hand, although Faems *et al.* (2005) find a significant positive correlation between the number of co-creation relationships and the performance of improved products, they also show that being a subsidiary of a multinational company is severely detrimental to product improvement via collaboration. In a similar vein, Van der Meer (2007) argues that SMEs are more naturally suited to open innovation and collaborative activities, while larger firms have a tendency to revert back to closed innovation when “things really start to matter”.

Even though existing theory is not fully unanimous about the matter, there is enough evidence to form a hypothesis which assumes that co-creation activities become more important to managers as the firm's size increases. This seems to especially be the case as companies become very large. It

seems also reasonable to assume that the same effect might apply as SMEs increase in size. Thus:

- H1.** Customer co-creation activities become more important for managers as the firm's size increases.

3.2. Determinants and Stages of Customer Co-Creation

Piller *et al.* (2010) show that the concept of customer co-creation is a resulting development of a long-lasting debate in academia and discussion in management practice. Its roots are in the 1950's, when the introduction of mass production capabilities enabled companies to focus more on their markets instead of their products. This led to market segmentation, which continued to evolve into more refined forms in terms of how markets could be segmented. Later, companies became more customer-oriented and even customer-centric, putting the customer's interest first and in some cases even managing their value chains from the customer's viewpoint. As the importance of customers continues to grow, firms have started to include customers in their innovation processes more and more, resulting in academic interest in the customer co-creation phenomenon. According to Anbardan & Raeyat (2014) the term customer co-creation now refers to the process where customers collaborate with companies (or other customers) to produce valuable goods and services. Humphreys & Grayson (2008) further add that sometimes the distinction between producer and consumer is made.

Building on a framework created by Dahan & Hauser (2002), Piller *et al.* (2010) provide a structure of three different modes of how information can be acquired from customers and used in new product development:

1. **“Listen into”** – Producers design products on behalf of the customers, basing their product development decisions on customer information that is derived from channels such as sales feedback, sales data analysis, third party consulting, reviews of existing product performance etc.
2. **“Ask”** – Producers explicitly ask for customers’ opinions on product development via surveys, interviews or focus groups, use the information to support their innovation process and later test their products in cooperation with customers.
3. **“Build”** – True customer co-creation, where companies integrate their customers into their innovative processes by empowering them to innovate new solutions by themselves and/or implements initiatives to transfer innovations from the customer into their own domain.

Based on the third mode where producers and customers collaborate to co-create innovations, a set of factors that constitute customer co-creation have been deduced. Piller *et al* (2010) present the newest version of this framework as based on earlier work (Piller & Ihl 2009, Diener & Piller 2010). These factors are as follows:

- **The stage in the innovation process:** the particular point in time where the customer input enters the new product development process – it can be early (idea generation, concept development) or late (product design and testing).
- **The degree of collaboration:** The width of the open innovation structure used to co-create – is there a dyadic producer-customer relationship or does the process involve a network of customers?
- **The degrees of freedom:** The nature of the task issued to customers – are customers issued predefined tasks with little freedom or open tasks with plenty of freedom to innovate and reach unforeseeable results?

This framework provides an interesting background against which the co-creation activities of empirical firm datasets could be tested. The stage in the innovation process where customer input is used and the degrees of freedom they are allowed are especially interesting here, since this research focuses on dyadic b2b co-creation relationships and largely disregards innovation networks. Since Piller *et al.* (2010) don't offer any empirical data or assumptions about the state of their three factors, two null hypotheses are created here for later testing:

- H2a.** Managers use customers' ideas evenly in the early and late stages of new solution development.
- H2b.** Managers issue their customers equal numbers of predefined and open tasks.

3.3. Involving Customers in the Innovation Process

Several authors view interaction with customers as an important driver of increased inter-firm collaboration and a gateway to future forms of open innovation (Chesbrough & Appleyard 2007, Lichtenthaler 2008, Prandelli *et al.* 2006). There is also strong empirical evidence of the positive effect inter-firm integration has on collaborative product development (Luo *et al.* 2010). Nevertheless, real-life firms must weigh the pros and cons of including customers in their innovation process. Raasch (2011) makes the point that the most important question for firms is exactly how such involvement affects revenues, costs and the profit margin. Raasch (2011) further argues that customer involvement can create value in two ways. The first way is the so-called marketing effect, where the producing firm can reap value from word-of-mouth effects that occur as a result of having a network of community members through which it can communicate. The innovation effect, on the other hand, refers to the increased value that results from the betterment of the producer's offering via ideas and solutions generated by the customers. Although these

avenues of value creation are mentioned in a context where individual customers are considered the user, they are arguably still relevant in a b2b context. Furthermore, it is important to note that both of these avenues can also have a negative impact on value as word-of-mouth can be harmful, and customers' ideas can spawn solutions that compete against the producer's original offering (Flowers 2008). The difficulty of predicting the financial value gained from these subjective and unpredictable variables suggest that uncertainty about the monetary benefits of customer co-creation could be a source of reluctance for firms to engage in it.

Economic uncertainties are not the only reason why firms are reluctant to engage in customer co-creation. Noordhoff *et al.* (2011) show that fears of opportunism are an inherent dark side of b2b innovation that companies face. This is especially the case in deep relationships, as the opportunity to take advantage of a business partner becomes more lucrative as the relationship becomes more embedded. Opportunism can manifest in several forms, for example, customers may see an opportunity to take advantage of some co-created idea or innovation and become competitors of the original producing firm (Schultze *et al.* 2007). In fact, user entrepreneurship is an area that has gained interest only very lately, as it has become evident that users are more active in commercializing innovations than previously believed (Shah & Tripsas 2012). Managers also have concerns about losing managerial control over all aspects of the customer experience as well as not being able to completely manage their brand (Pitt *et al.* 2006, von Hippel 2005). Another perhaps even more significant issue is the matter of IP rights. Many academics have pointed out that complex situations and conflicts of interest can arise from the need to appropriate innovations in a situation where the innovations or parts of them are co-created (Noordhoff *et al.* 2003, Strandburg 2008). Where contractual agreements don't prevent it, a customer could even license jointly developed solutions to competitors (Mehlman *et al.* 2010). In user innovation literature,

strong IP regimes are usually seen as detrimental to producer-customer collaboration (von Hippel, 2005). Bogers *et al.* (2010) see the exploration of the harmful effects that producers face when including users in the product development process as important. Due to the sheer width of literature regarding IP rights issued that the past couple of decades have seen published, it is considered here as the most powerful factor deterring firms from customer co-creation. This assumption will be tested in the form of a hypothesis:

- H3.** Managers' uncertainties about issues related to intellectual property rights are the most important factor discouraging them from engaging in customer co-creation.

3.4. Customer Co-Creation and the Fuzzy Front-End of Product Development

Another interesting challenge faced by managers is the difficulty of making right decisions in the fuzzy front-end of product development in a customer co-creation situation. Recall that decision making in the fuzzy front-end is already very difficult and wrong decisions can result in significant financial losses when bad concepts are let through to the development phase. Vanhaverbeke *et al.* (2008) pointed out the increased decision-making difficulty firms face when open innovation considerations such as external knowledge and innovation sources are added to the mix. In later research, Vanhaverbeke & Du (2010) argue that innovation partners are usually too reluctant to kill failing projects, incurring significant financial losses. Tight managerial controls on new product development have been shown to increase NPD success (Cooper 1990, Song & Parry 1997), and it would seem that co-creation activities could undermine that control and thus contribute to managers' reluctance to engage in them. Cook (2008) cited the importance of quality assurance and the need for overall control of the firm's processes as factors that discouraged top-level managers from adopting co-creation practices. According to O'Hern & Rindfleisch (2010),

there has been significant variance in the degrees of autonomy granted to customers in the NPD process in co-creation initiatives. This fluctuation may be a result of producing firms' managers' uncertainty about how much they should commit to NPD initiatives in the fuzzy front-end of development. More precisely, the problem could lie in the overall confusion created by the increased amount of contributed ideas and the need to select the most promising ones. O'Hern & Rindfleisch (2010) further suggest that co-creation activities can be denoted with the contributions made to the NPD process and the selection of those contributions. The authors show that the degree of autonomy in the co-creation relationship can be measured by differentiating between the autonomy the producing firm grants to the customer in the contributing and/or selection phase.

The aforementioned research, especially that by Vanhaverbeke *et al.* (2008), Vanhaverbeke & Du (2010) prompt the testing of the theory that customer co-creation activities complicate the fuzzy front-end of new product and service development. A corresponding hypothesis is created:

- H4.** Managers feel the fuzzy front-end of new product/service development becomes more complicated with increasing customer co-creation activities.

3.5. Identifying Lead Users

The idea of lead users was introduced by the same researcher who conceptualized user innovation itself, Eric von Hippel. According to von Hippel (1986), market research performed poorly in reflecting the market's needs in rapidly changing sectors such as the high-technology segment, because too few potential users had the necessary experience and insight for problem-solving. The proposed solution were the so-called lead users of products or processes, whose present needs reflected the needs of the general market months or even years in advance. Von Hippel (1986) argued that by focusing

market research on lead users, analysts could reach powerful insights about the development of the market, and even find novel product concepts in the solutions the lead users had innovated for themselves. Lead users have a propensity to innovate because they are in a position to benefit considerably from solutions to their particular needs (Morrison *et al.* 2004). Lead users' higher levels of innovativeness have also been documented empirically (for example, Morrison *et al.* 2000, Franke & Shah 2003). They are also found to be very early adapters of new products and services, adopting new technologies 7 years earlier on average than their non-lead user counterparts (Urban & von Hippel 1988). Another attribute of lead users are that they are likely to be opinion leaders who are instrumental in helping to facilitate the diffusion of new solutions to the general market (Urban & von Hippel 1988, Foxall 1989, Morrison *et al.* 2000).

Lead users and lead customers can be considered synonymous terms. The main difference is that the lead user term encompasses individuals that are not involved in any financial transactions, while lead customers only refer to users in the role of a customer, be they individuals or organizations. Lead user is the term used in this theoretical section because it is more widespread in literature. In the empirical section, the term is replaced by lead customers because this study focuses solely on corporate customers instead of individuals innovating on their own accord.

Since the conceptualization of the lead user phenomenon, some academic research has been devoted to find ways to analyze lead users according to their various attributes, and in so doing, to help identify them. The need to identify lead users was brought to attention early by von Hippel (1986), but without a clear framework to help in search activities. Von Hippel (1986) also offers some important considerations for lead user identification, noting that valuable lead users may also be found outside the customer base or even the

industry the producing firm operates in, and that a lead user may not necessarily be able to contribute an entire novel solution, but instead valuable parts of it. Lilien *et al.* (2002) provided some further evidence supporting the argument that the best lead users and most novel and profitable new solutions come from outside the producer's industry. An empirical study by Hienerth *et al.* (2007) provided further support to the argument. Hienerth *et al.* showed that the novelty of contributed solutions was a function of the market distance between the lead user and the target market where they faced their concept development challenge. Technological distance, on the other hand, was found to be a factor hindering novel solution contributions. Furthermore, the authors found that experienced lead users are more effective in generating novel solutions than their inexperienced, albeit qualified counterparts.

Although academics clearly agree that lead users should be identified to enhance the effectiveness of innovative activities, outside of individual case studies there is little knowledge about whether or not managers actually have identified any. This research will look at a wider data sample to see whether or not this is the case. In the tested hypothesis it is assumed that managers do know who their lead users (or customers, in this case) are:

H5. Managers know who their lead customers are.

An early model for analyzing lead user attributes was developed by Morrison *et al.* (2002). Their Leading Edge Status (LES) construct analyzes lead users on the basis of their two key attributes, "the degree to which organizations use and apply technology innovations in new and different ways to solve problems faced by the organization, and the degree to which they perceive the benefits of new products earlier than the rest of the marketplace". In their empirical verification, the authors found that the users showing high LES correlated strongly to those found within a lead user cluster they analyzed. Another way

of finding lead users is the Technology Readiness Index (TRI) which was found to be a powerful tool for finding users who have significant ability to generate novel innovations, and are early adopters and eager to tackle technological challenges (Matthing *et al.* 2006). Research implies that the lead user method is very effective in enhancing producing firms' value creation capabilities, although some evidence suggests that technological distance may be negatively affecting firms' willingness to commit to it (Olson & Bakke 2001). Current research offers no shortage of methods and scales for identifying lead users, but whether or not modern firms actually make a conscious effort to identify lead users as part of their day-to-day activities is something that is not clear at all.

4. Research Methodology

The purpose of this chapter is to present and justify the research methods used in this thesis. This chapter will be presented in three parts, the first of which will focus on the theory of the main quantitative research method itself, while the second will go into detail regarding the execution of the empirical research with the help of an online survey. The third and final part will familiarize the reader with the empirical dataset and illustrate the survey-based data collection process, as well as introduce the methods used to analyze the gathered data.

4.1. The Research Method

This research is conducted using a quantitative approach. The main goal of the research is to reach an understanding about the current state of customer co-creation activities among Finnish high-technology SMEs, thus providing insight into how those activities are managed. When the goal is to understand the current status of a variable (instead of seeking correlations among variables), the descriptive research method of quantitative research is justified.

Descriptive quantitative research seeks to provide systematic information about phenomena.

On the basis of the literature analysis regarding customer co-creation and with support from a wider understanding of open innovation and user innovation, the topics that were identified as most important for further research were selected. These five topics were translated into research sub-questions that, when answered, would provide insight about the wider state of co-creation affairs within the chosen sample. To refine the focus even further, hypotheses were developed from the five research questions, so that assumptions regarding the main topics could be tested empirically in a quantitative manner. The empirical testing in question will consist of measuring and rating attitudes and behavior using closed-ended questions that output numerical data. Creswell (2003) lists these attributes as hallmarks of the quantitative research method.

4.2. The Survey

The goal of the survey is to provide answers to the research sub-questions by exploring and quantifying managers' views about the particular areas of interest denoted by the questions. Answering the sub-questions serves the larger goal of trying to answer the main research question. The survey is self-administered and consists exclusively of closed-ended questions. According to Cooper & Schindler (2012), such a survey is a low-cost option for gathering large amounts of data relatively easily.

The survey consists of three different kinds of questions. A couple of general questions regarding the participants' firms and customers are to be answered in numerical form. Most of the questions are binary choices that require the participant to pick one of two choices, usually "yes" or "no", but in some cases the choices are between other options. The third question type is one that

measures managers' perceptions about certain issues with the help of a numerical scale. This numerical scale ranges from 1 to 5 and is balanced, meaning that an example scale would look something like "very easy, easy, average, difficult, very difficult", with an equal number of choices above and under the mid-point.

The main research question of this work has to do with showing what kind of actions firms within the sample take, or are likely to take, regarding customer co-creation. To reach an understanding of these actions, managers' attitudes towards a set of smaller issues are measured. These smaller issues can also be regarded as actions and behavior found inside the firm. It is important to understand that what is measured are the attitudes and beliefs of managers, as only a small number general questions can be answered by looking up a fact from the company site, yearbook or even private corporate materials.

The answer to a question such as "are intellectual property rights concerns an issue for you when deciding about sharing information with customers?" is based on the individual manager's attitude, which is generated through cognition and behavior. Although the relationship between attitudes and behavior is not straightforward, researchers and managers nevertheless measure attitudes because they have been shown to offer insights about current behavior as well as how behavior will evolve in the future (Cooper & Schindler 2012). To increase measurement validity, the survey was tested and re-tested on one industry expert and one professional senior consultant.

Next, the 5 survey items attached to the research sub-questions will be presented in the form of a table with their respective theoretic backgrounds included. For the complete survey questionnaire, see Appendix I.

Research Sub-Question	Survey Measures	Key Points	Theoretical Basis
Do customer co-creation activities become more prevalent as the size of the firm increases?	General questions relating to the firm, perceptions about the importance of co-creation	Employee amount, number of customers collaborated with, importance of co-creation	Greer & Lei 2012, Lichtenthaler 2008, Prandelli <i>et al.</i> 2006, Faems <i>et al.</i> 2005, Van der Meer 2007
Do managers prefer to incorporate customers' innovations in the early or late stage of developing solutions, and how much freedom do they allow for the innovating customer?	Questions that assess the nature of collaborative relationships between the firm and its customers	Early versus late stage application of customers' ideas, complexity of tasks issued to customers	Piller <i>et al.</i> 2010, Piller & Ihl 2009, Diener & Piller 2010
Why are some managers reluctant to involve customer in the innovation process?	Questions that assess managers' attitude towards including customers in product/service development processes	Evaluating financial aspects of co-creation, information sharing, concerns about customers becoming competitors, IP rights	Raasch 2011, Flowers 2008, Noordhoff <i>et al.</i> 2011, Schultze <i>et al.</i> 2007, Harhoff <i>et al.</i> 2003, Strandburg 2008, Mehlman <i>et al.</i> 2010, Bogers <i>et al.</i> 2010
Do managers feel increased pressure in the fuzzy front-end of product/service development because of customer co-creation activities?	Questions that measure managers' concerns about complications in the product/service development process	Keeping track of new product/service concepts and ideas, ability to develop new concepts inside the firm	Vanhaverbeke <i>et al.</i> 2008, Cook 2008, O'Hern & Rindfleisch 2010
Are managers conscious of their firms' lead customers?	Questions that measure managers' attitude and perceptions about lead customers	Existing lead customers, deepening collaboration with lead customers, finding lead customers	Von Hippel 1986, Lilien <i>et al.</i> 2002, Hienerth <i>et al.</i> 2007

Table #4. *The research sub-questions and the survey measures attached to them with included details and theoretical background.*

4.3. Data Collection and Analysis Methods

The empirical dataset of 1002 firms and over 2000 key personnel was provided by a Finnish consulting company that provides access to the dataset as part of a consulting service it sells to companies seeking partners, investors and clients among Finnish high-tech companies. The key contacts listed include company CEOs, business development managers, heads of sales, and other high level management, all operating within key Finnish technology clusters. According to the consulting company, the dataset covers all major high-tech industries (for a detailed view, see Appendix II).

The firms and contacts in the dataset were verified manually using company information databases and company websites found on the Internet. This was necessary firstly in order to make sure that all the companies included in the survey process were engaged in business with other firms, i.e. were operating on a b2b principle and had corporate customers to co-create with. Secondly, updating the contact information was necessary to ensure proper delivery of the survey e-mails. As a result, about 400 contacts were dropped as a result of firm inactivity, unsuitable business model, or inactivity of the contact itself. The unsuitable firms mainly included ones that operated in the b2c market, most of which were involved in developing mobile apps or games for consumers, evidently a very active industry in Finland.

The Qualtrics online survey service was used to compile the questionnaire and manage its distribution. A final total of 1637 respondents had e-mails sent to them via Qualtrics in mid-March. A reminder was sent to the ones who had not yet responded two weeks later. The survey was closed after another two weeks. A grand total of 143 complete answers were recorded, resulting in an

answer rate of 8.9 percent, which can be considered a success according to most researchers' survey standards. After the survey was closed, the resulting data was exported as a Word document suitable for a general overview as well as a data file to be used in IBM's SPSS 22.0.0.0, the main statistical analysis tool used in this research. The possibility to export the raw survey data to an analyzable form greatly simplified the data transfer process. However, due to the survey being bilingual, the Finnish and English parts had to be exported separately and combined. Some additional cleaning up was required to get rid of incomplete answers, resulting in the final tally and dataset of 143 complete answers.

5. Empirical Results and Analysis

This section will systematically present the empirical observations gathered from the dataset and further analyses of the available data. To provide structure, the observations are divided into five subgroups based on the research questions and hypotheses. Before going into the analysis, some descriptive data about the companies in the dataset will be provided.

5.1. Descriptive Data

The dataset companies reported an average of about 20 employees, with answers ranging from a single employee to a maximum of 150. For more accurate data about employee amounts, see Appendix IV.

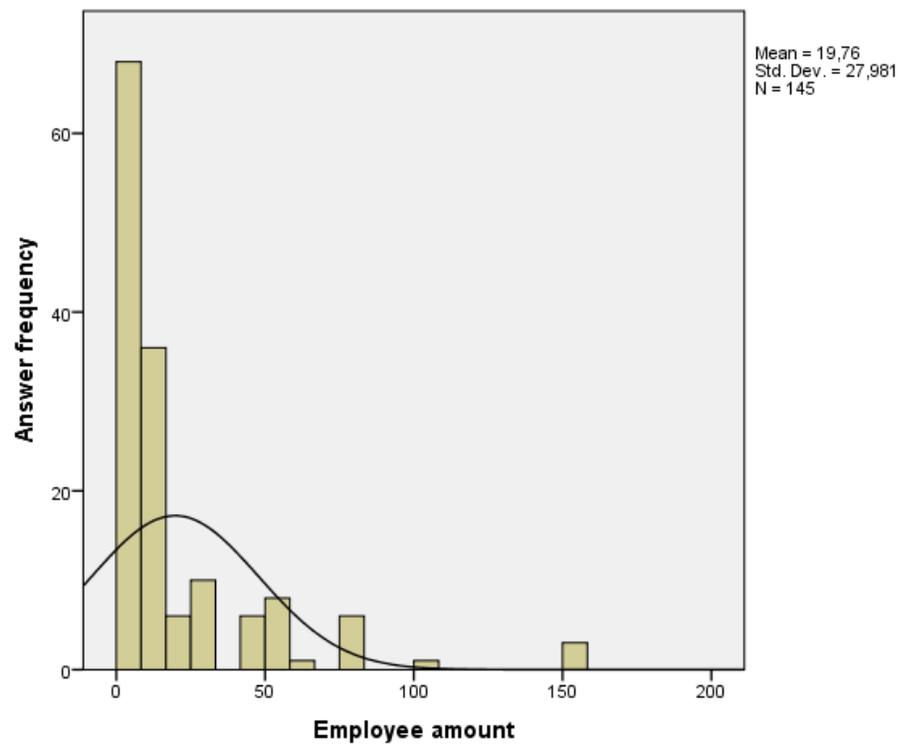


Figure #8. *Employee amounts of dataset firms with normal distribution curve included.*

As seen from the above figure, the values of this variable are heavily non-normally distributed. The descriptive data shows skewness and kurtosis values of 2.8 and 8.9, respectively. According to George & Mallery (2010), asymmetry and kurtosis values should range between -2 and +2 to ensure normal distribution of values and thus ensure the validity of further correlation analyses. To ensure the validity of such analyses yet to come, the natural logarithm of employee amounts was introduced as a new variable for use in later tests.

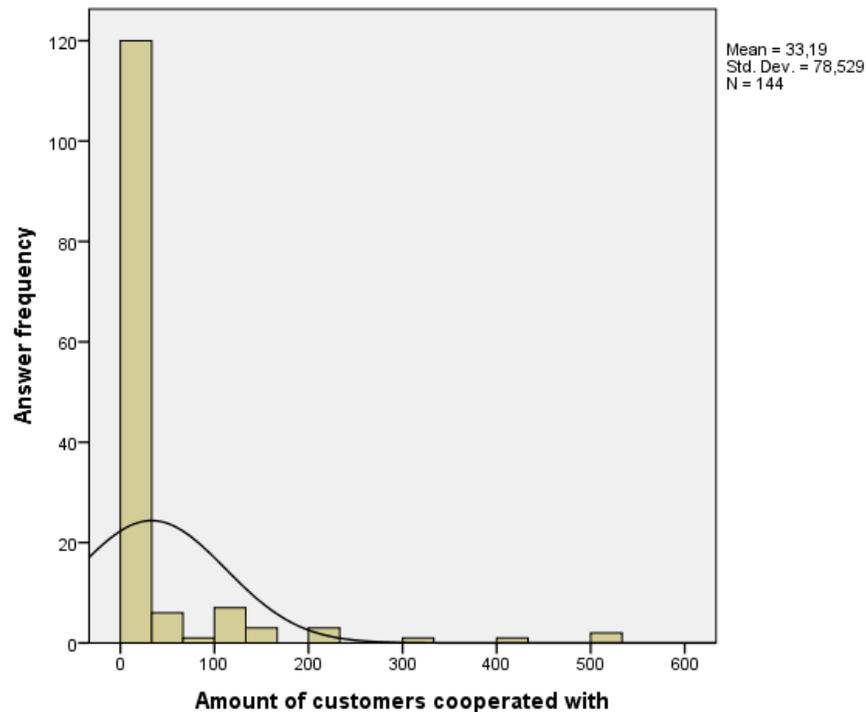


Figure #9. Amounts of customers the dataset firms cooperate with to create new products and/or services with normal distribution curve included.

Figure 9 shows how the dataset firms answered when asked how many customers they collaborate with to create new products and services at any given time. The average amount is found at 33, and about 50 % of respondent firms reported co-creating with 7 customers or less. This variable too shows heavily non-normally distributed values with high skewness and kurtosis (see Appendix IV for details). The same procedure of computing the natural logarithms of values was followed here too, to ensure validity of further analyses.

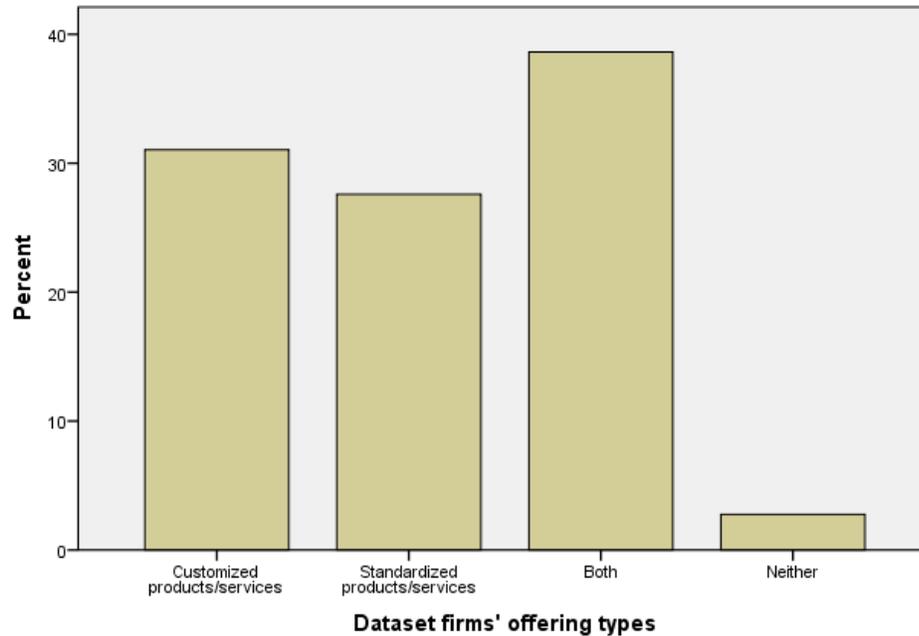


Figure #10. *Distribution of the types of products and services offered by dataset firms.*

The types of the dataset firms' offerings are shown here as the last general descriptive indicator. The data is gathered from the survey results and thus represents the knowledge of the surveyed managers. It appears that customized and standardized products and services are produced fairly evenly, with many firms reporting as producing both. This data will be put to use later to show how widely the various groups employ customer knowledge.

		Number of employees (log)	Number of customer collaboration (log)
Number of employees (log)	Pearson Correlation	1	,302
	Sig. (2-tailed)		,000
	N	145	143
Number of customer collaboration (log)	Pearson Correlation	,302	1
	Sig. (2-tailed)	,000	
	N	143	143
How important do you feel collaboration with customers is to your company when developing new products and/or services?	Pearson Correlation	-,080	,198*
	Sig. (2-tailed)	,341	,018
	N	145	143
How easy or difficult do you find evaluating the financial gains and losses of collaborating with customers to create new products and/or services?	Pearson Correlation	,036	-,137
	Sig. (2-tailed)	,668	,102
	N	145	143
How concerned are you that your customers might one day become your competitors?	Pearson Correlation	-,015	-,049
	Sig. (2-tailed)	,861	,560
	N	145	143
How easy or difficult is it difficult to keep track of customers' ideas and concepts in the early stages of product or service development?	Pearson Correlation	,189*	,144
	Sig. (2-tailed)	,023	,087
	N	145	143

Table #5. Bivariate correlations between employee and customer amounts and variables with balanced answer scales.

To close out the introductory section to this empirical section, some of the bivariate correlations gathered off the top of the dataset are shown above.

Apart from the employee amount and cooperative customer amounts' natural logarithms, all the variables which were answerable in a balanced scale format are included. Initial data suggests that managers' views on the importance of customer co-creation are correlated with the amount of customers that are co-created with. Firm size seems to be a factor correlated with complications in the fuzzy front-end of product and service development.

5.2. Firm Size and Customer Co-Creation Activity

The relationship between firm size and customer co-creation activities is somewhat unclear according to innovation literature. This research will attempt to shed further light on the topic by measuring managers' opinions about the importance of customer co-creation and seeing how it relates to firm size as well as the amount of customers the firm collaborates with. Employee amount is used as a measure for firm size. The hypothesis that will be tested is as follows:

- H1.** Customer co-creation activities become more important for managers as the firm's size increases.

Before looking at the results of the analysis, the following figure will show the raw data regarding managers' opinions about collaborating with customers:

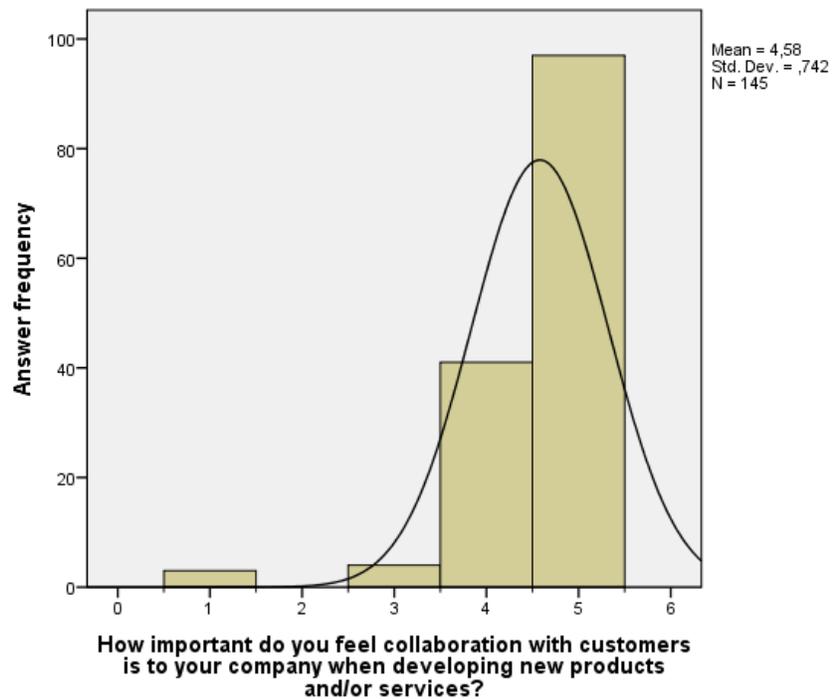


Figure #11. Managers' views about the importance of customer co-creation. Number 3 represents neutral value.

As is evident, managers within this sample have clearly recognized the importance of customer co-creation and hold it in very high regard. Over 93 % of respondents thought of customer collaboration as being either important or very important for their new product and service development efforts. The statistical significance of this result is proven via a Kolmogorov-Smirnov test (see appendix V for statistical significance tests). Additionally, almost 90 % managers thought that their firm's product or service development efforts could benefit from more collaboration with customers (see Appendix IV for details).

The results of the bivariate analyses in table 5 already suggested that firm size does not hold explanatory power for managers' views about the

importance of customer co-creation. The correlation was slightly negative at -0.080, but at over 30 % significance level the correlation has to be discarded. Instead, the results seem to show that the amount of customers the firm collaborates with has strong explanatory power for this variable at a correlation coefficient of 0.198 at a significance level below 2 %. When the explaining variables are considered individually, there is no support for the hypothesis.

A multiple linear regression analysis was conducted to further explain the effect of the two aforementioned variables on managers' views about customer co-creation.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	4,544	,135		33,558	,000
Number of customer collaboration (log)	,123	,042	,250	2,911	,004
Number of employees (log)	-,097	,049	-,170	-1,983	,049

a. Dependent Variable: How important do you feel collaboration with customers is to your company when developing new products and/or services?

Table #6. Multiple linear regression analysis of case variables.

As the analysis shows, the number of customers the firm collaborates with remains a very significant explanatory variable when it is considered simultaneously with firm size. Interestingly, the firm size itself also emerges as an important factor in the multiple linear regression analysis. The correlation is negative, suggesting that in a more real-world situation an increased number of employees actually results in managers holding

collaborative efforts in lower regard. The R-square values of the linear regression analysis are not high enough to endow this model any significant explanatory power in the larger scheme of things (see Appendix VI for details). However, even though there is no support for the actual hypothesis, the results strongly suggest that managers collaborate with higher numbers of customers as their opinion of customer co-creation becomes more positive. What's more, the strong negative correlation between employee amount and managers' opinions about co-creation in the multiple linear regression analysis is interesting.

5.3. Customer Idea Usage and Customers' Freedom to Innovate

According to theory, the particular points in the new product and/or service development process where customer knowledge is implemented are a factor by which customer co-creation relationships can be classified. The same also goes for the degrees of freedom the customer is allowed when asked to provide input to those processes. The purpose of this section is to empirically show in which points ideas are used and whether or not customers are allowed large or small degrees of freedom in innovating within this particular sample of firms. Two hypotheses were created to reflect assumptions about the state of the issues, the first one regarding the point of customer idea use.

H2a. Managers use customers' ideas evenly in the early and late stages of new solution development.

The table below demonstrates how managers use customers' ideas in new product and service development processes. Idea generation and concept development are considered as points in the early stages of developing new solutions, while product/service design and testing are points in the late stages. Survey respondents were allowed to select multiple points where they felt it was appropriate.

Product or service development stage	Customer idea use point	Frequency
Early stage	Idea generation	60
	Concept development	79
Late stage	Product/service design	67
	Product/service testing	69
	Unknown to manager	3

Table #7. *Customer idea usage in different stages of the new product/service development process.*

The results offer strong support for the first hypothesis. It seems that customers' ideas are used fairly evenly across the various points in new product and service development processes. The early and late stage idea usage totals amount to 139 and 136 respectively. The minor disparity between idea generation and concept development in the early stage suggests that firms may prefer to generate their own ideas and then ask their customers how they would see the idea conceptualized.

In the next table, the various product classifications the managers associated their firms with are cross-tabulated with a new variable, customer knowledge use scope. Customer knowledge use scope was derived from the points where managers used customers' ideas. The points are not considered in order from early to late stages, but rather simply reflect increasing customer knowledge use with values from 1 to 4 independent from which point or points were actually in question.

		Customer knowledge use scope				Total
		1,00	2,00	3,00	4,00	
Would you describe your firm as one that develops products and/or services that are fully customized to your customers' needs, or one that develops products and/or services that are standardized to a higher degree?	Customized products/services	23	14	4	3	44
	Standardized products/services	13	13	5	9	40
	Both	25	16	10	4	55
	Neither	1	1	0	1	3
Total		62	44	19	17	142

Table #8. *Firms' product types cross-tabulated with customer knowledge use scope.*

This table illustrates something interesting: firms that produce standardized products and services were the ones that used customer knowledge most comprehensively in all stages of new product or service development. The table also shows that most firms use customer knowledge in only one or two points along the new product or service development cycle.

H2b. Managers issue their customers equal numbers of predefined and open tasks.

The surveyed managers were asked whether or not they issue their customers simple tasks with little freedom to elaborate or open tasks with more freedom, with the assumption being that the number of those tasks would be close to equal. The results are as follows:



Figure #12. *The issuance of simple and open tasks to customers regarding new product and service development collaboration.*

The surprising outcome is that managers mostly issue their customers open tasks when they are looking for their input into new product- and service development. This suggests that managers rely on their customers' ability to innovate more than expected, and prompts the abandoning of hypothesis H2b. The results prove statistically significant (see Appendix V).

5.4. Managers' Reluctance to Engage in Customer Co-Creation

A number of reasons as to why managers can be reluctant to engage in customer co-creation activities are listed in the literature. The most important ones are the difficulties involved in estimating the financial gains and losses associated with customer co-creation, concerns about customers becoming competitors or eroding the supplying firm's competitive advantage, and issues regarding intellectual property rights. This part of the empirical section will

show how the sample firms relate to these issues and which of the three is regarded as the most prominent issue. To facilitate statistical testing, a hypothesis was created where the assumption is that firms experience the intellectual property rights issues involved with customer co-creation as the most influential deterrent.

H3. Managers' uncertainties about issues related to intellectual property rights are the most important factor discouraging them from engaging in customer co-creation.

To begin the analysis, bivariate correlation analyses were run to see if an increase in firm size or the amount of customers co-created with had an effect on firms' views about the difficulties of estimating the financial gains and losses involved in customer co-creation. No significant correlations were found, suggesting that SMEs of all sizes and customer amounts find evaluating the financial aspects equally easy or difficult. A similar analysis was run with a variable reflecting firms' concerns about customers becoming their future competitors as the dependent variable, once again with no significant correlations found. For details of these analyses, see appendix VI.

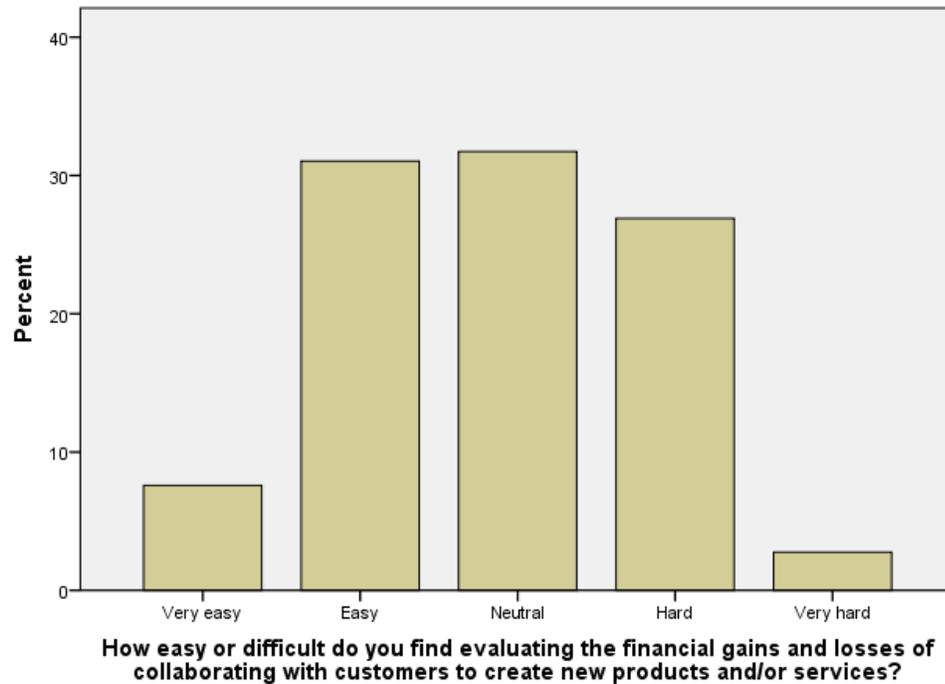


Figure #13. Managers' perceptions about the difficulty of evaluating financial gains and losses associated with customer co-creation.

The above figure shows that managers actually relate fairly neutrally to the difficulties associated with evaluating the financial aspects of co-creation. 38.6 % of managers thought that evaluating financial gains and losses was very easy or easy. On the other hand, 29.7 % thought of those evaluations as hard or very hard, suggesting that it's fair to say that most managers actually are fairly neutral about the difficulties involved or in fact don't see them as an issue. Furthermore, an overwhelming 99.3 % of managers said that they feel collaborating with customers to create new products and services does not generate a financial burden that is not offset by the benefits the collaboration brings (see Appendix IV). These two results prove statistically significant (see Appendix V). With the financial aspect of customer co-creation shown to be quite well handled by managers on average, it remains to look whether or not

competitive advantage-related concerns and IP issues have an effect on participation in co-creation.

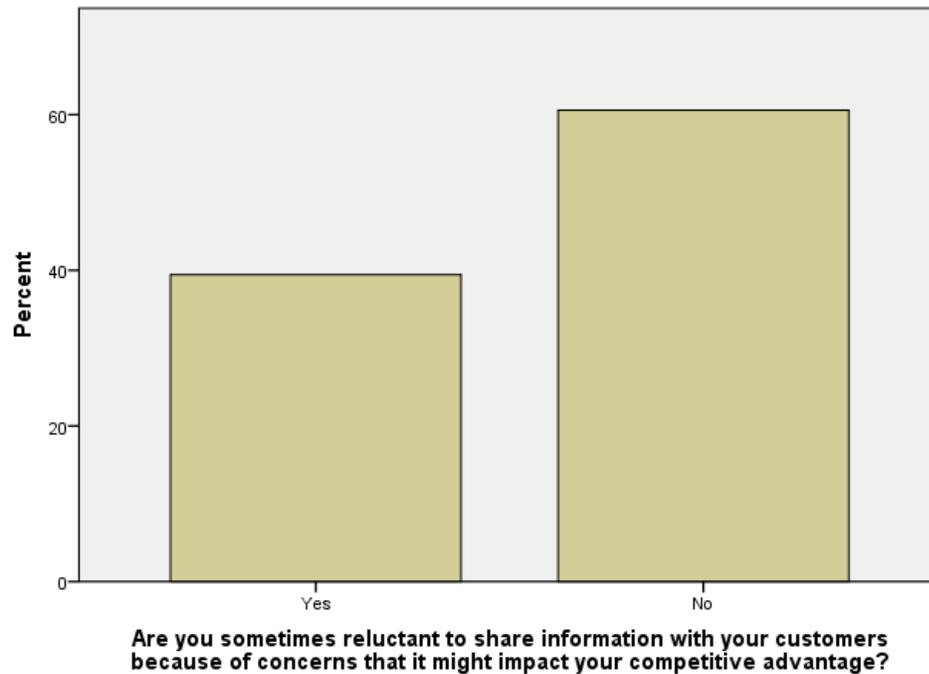


Figure #14. Managers' views on customer co-creation's effects on competitive advantage.

It appears that the majority of managers aren't worried about information sharing with customers negatively affecting their competitive advantage. Still, approximately 40 % of respondents did feel that those concerns do sometimes affect their information sharing practices, and such a large group should not be ignored when considering customer co-creation and manager practices. When asked how concerned the managers were about customers one day becoming their competitors, 72.4 % of respondents were unworried or not at all worried. Only 9 % were worried, and no one expressed significant concern over the issue. It appears that while concerns about competitive advantage have some kind of an effect on information sharing practices in customer co-creation, not a whole lot of managers are concerned about

customers rising to compete with them in the future. This data proves statistically significant (for detailed data and analyses, see Appendix V).

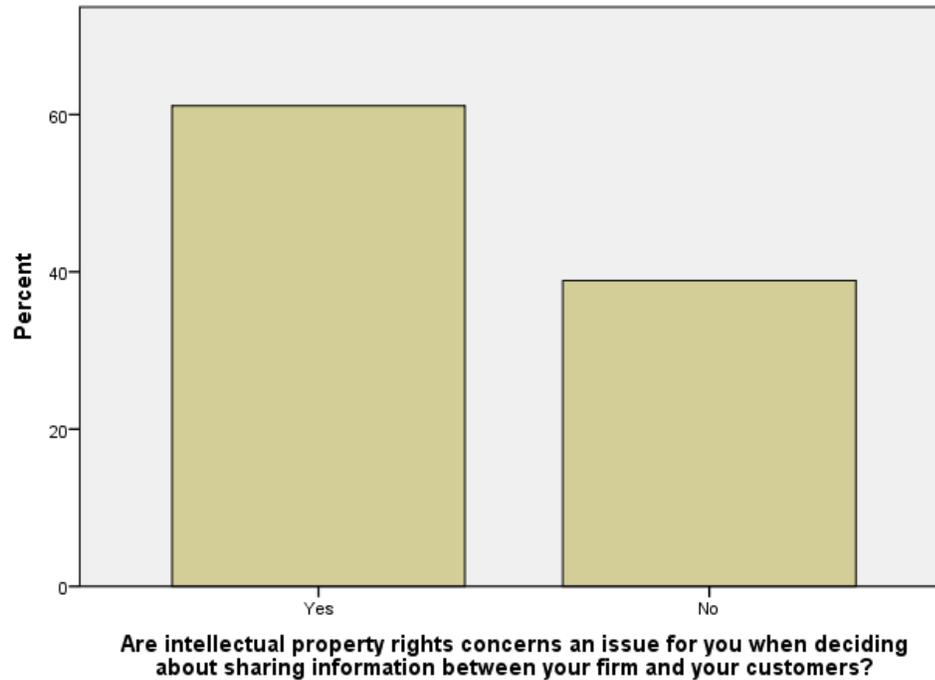


Figure #15. *Managers' views about intellectual property rights and information sharing with customers.*

A majority, 61.1 % of managers, responded that they are concerned about intellectual property rights issues when deciding about sharing information with their customers. This result is statistically significant (see Appendix V for details) and suggests that IP rights issues in particular are more important to managers than general competitive advantage issues in customer co-creation situations. The gathered data provides evidence in support of the hypothesis. Even though about one third of managers find it hard to evaluate the financial aspects of customer co-creation, nearly all of them find that co-creation is worth the resources, thus implying that they are not deterred by financial concerns. Intellectual property rights concerns arise as the most prominent

detering factor, suggesting that the large host of literature regarding it is well justified.

5.5. Issues in the Fuzzy Front-end of New Product and Service Development

A number of researchers have suggested that open innovation related activities may complicate decision-making in the already challenging fuzzy front-end of product development. The fuzzy front-end is a critical phase in product and service development where good initiatives should be differentiated from the bad. To reflect the current understanding and assumptions about how customer co-creation activities relate to the fuzzy front-end of product and service development, a hypothesis was created:

- H4.** Managers' feel the fuzzy front-end of new product/service development becomes more complicated with increasing customer co-creation activities.

In the following table, customer co-creation activities are measured with a variable that shows how many customers firms co-create with. This variable along with the size of the firm are included in a bivariate correlation analysis together with managers' opinions about how easy or difficult they find managing their customers' input in the fuzzy front-end of their product or service development efforts. For detailed data on the latter variable, see Appendix IV.

	Number of employees (log)	Number of customer collaboration (log)	How easy or difficult is it difficult to keep track of customers' ideas and concepts in the early stages of product or service development?
Number of employees (log)	1	,302	,189*
		,000	,023
	145	143	145
Number of customer collaboration (log)	,302	1	,144
	,000		,087
	143	143	143

Table #9. Bivariate correlation analysis of case variables.

The correlation analysis suggests that there are indeed some dependencies between the variables. It seems that managers feel that it becomes harder to keep track of their customers' ideas in the early stages of product or service development as the firm's size increases. This correlation is significant at the 5 % level. There is less support for the assumption that the more collaboration with customers the firm exercises, the more complicated keeping track of those ideas would be. However, the correlation between the number of co-creation customers and keeping track of ideas is significant at the 10 % level, suggesting that a minor relationship between the variables exists. Nevertheless, the support for the hypothesis is very limited.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2,196	,169		13,017	,000
Number of employees (log)	,114	,061	,162	1,867	,064
Number of customer collaboration (log)	,058	,053	,095	1,095	,275

Table #10. Multiple linear regression analysis of case variables.

A multiple linear regression analysis of the same variables suggests that firm size maintains its positive correlation to managers' opinions about the difficulty of keeping track of customers' ideas (see Appendix VI for the full analysis). It must be noted that the significance of the correlation slightly exceeds the 5 % level, but there nevertheless seems to be a degree of dependence between the variables. The number of co-creation customers, on the other hand, falls off as an explanatory variable when it is considered simultaneously with firm size. It seems that firm size, instead of the number of co-creation customers, should be considered a factor that significantly influences the fuzzy front-end of product development in firms that practice customer co-creation.

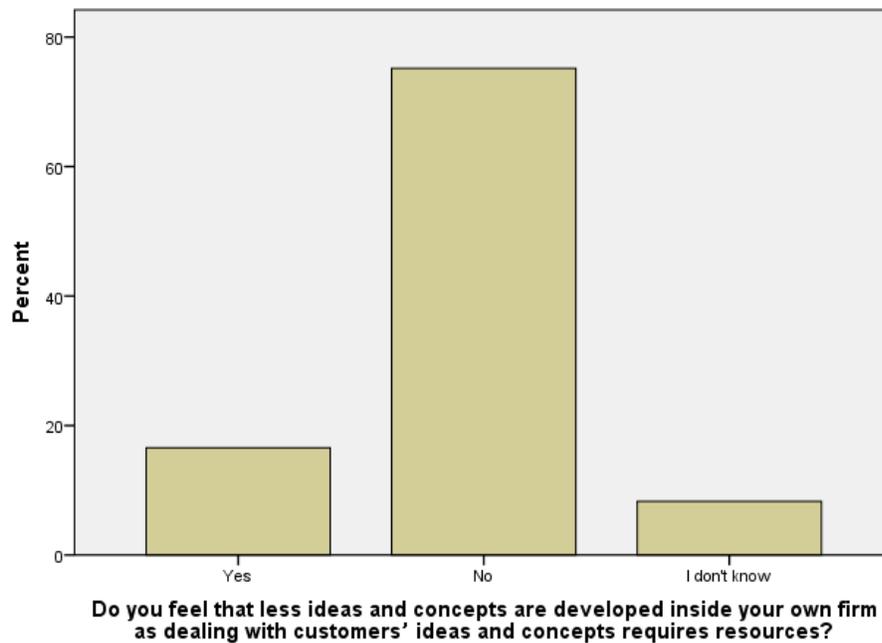


Figure #16. *Managers' views about the effect of customer-generated ideas and concepts on the ability of their own firm to generate ideas and concepts.*

For more insights into the fuzzy front-end of product and service development in firms that practice customer co-creation, managers were asked if they feel that dealing with their customers' ideas and concepts took away from their own capacity to innovate. Again, the data provides only limited support for the hypothesis. Here, 75.1 % of managers did not feel that managing their customers' input took a toll on their own firm's ability to innovate (see Appendix V for statistical significance test). Almost half of managers considered it easy or very easy to keep track of their customers' innovations, while only 14.5 % thought of it as hard or very hard (see Appendix IV for detailed graph). To sum it up, it seems that managers generally think that customer-generated innovations are fairly easy to manage and don't usually carry negative implications for their firms. Additionally, firm size, instead of the amount of collaborative customers, emerges as the factor that most

significantly complicates the fuzzy front-end of product and service development.

5.6. Identifying and Collaborating with Lead Customers

Lead users are an important part of the distributed innovation paradigm and are also related to customer co-creation. In this study, managers were asked questions about their potential lead customers to see what information could be uncovered about the relationship of lead customers and firms that practice customer co-creation. A hypothesis was created on the basis of current assumptions derived from the literature:

H5. Managers know who their lead customers are.

A series of questions was asked to see what managers thought about lead customers. First, the managers were asked whether or not they have customers fitting a description of lead customers. If they did, they were asked whether or not they had taken steps to deepen their cooperation with those customers. Finally, the managers were asked whether or not their firm made a conscious effort to find customers fitting a description of lead customers. The results were as follows:

Does your firm have one or more key customers that are able to provide more advanced ideas and input into your product or service development efforts than others?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	98	67,6	72,1	72,1
	No	38	26,2	27,9	100,0
	Total	136	93,8	100,0	
Missing	System	9	6,2		
Total		145	100,0		

If yes, have you taken steps to deepen your collaboration with those customers?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	96	66,2	87,3	87,3
	No	14	9,7	12,7	100,0
	Total	110	75,9	100,0	
Missing	System	35	24,1		
Total		145	100,0		

Does your company actively seek customers that seem to have more potential in providing ideas and input for your product or service development efforts than the average customer?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	70	48,3	50,4	50,4
	No	69	47,6	49,6	100,0
	Total	139	95,9	100,0	
Missing	System	6	4,1		
Total		145	100,0		

Tables #11-13. Manager perceptions about lead customers.

The results suggest that over 70 % of the respondents have identified their firms' lead customers, supporting the hypothesis. The result is encouraging, considering the fact that not all of the firms necessarily even have lead customers as such. Even more encouraging is the state of the second variable, which shows that almost 90 % of managers had taken steps to deepen their collaboration with their lead customers where they had identified them. This result suggests that managers have identified the potential for increased value creation in lead customer collaboration, providing further evidence of the value of the lead user paradigm. Interestingly, the results of the third variable show that only half of the responding managers' companies actively take steps to identify potential lead customers. In the following table, data from the first and third variables are cross-tabulated to see whether or not it pays off to actively seek lead customers.

		Does your firm have one or more key customers that are able to provide more advanced ideas and input into your product or service development efforts than others?		Total
		Yes	No	
Does your company actively seek customers that seem to have more potential in providing ideas and input for your product or service development efforts than the average customer?	Yes	53	13	66
	No	42	24	66
Total		95	37	132

Table #14. Cross-tabulation of the first and third variables regarding lead customers.

This table shows some interesting results. First of all, about 80 % of the firms that actively searched for lead customers had been able to find at least one. On the other hand, the firms that didn't look for lead customers had at least one in about 64 % of cases. The implication is that a conscious effort on the firms' part to find lead customers does indeed pay off, at least in terms of the amount of found lead customers. Another implication is that firms are likely to find lead customers "accidentally" whether they try to or not.

6. Discussion and Conclusions

The purpose of this chapter is to collect all the evidence gathered in the empirical results and analysis section, and present it in a way that enables further discussion and conclusions to be drawn from it. These include responses to the research questions, as well as considerations as for the theoretical and managerial contributions of the results. Furthermore, the limitations of this study will be considered and some possible further research directions presented.

6.1. Responses to the Research Questions

To clarify research issues and results, the research sub-questions and hypotheses will be gathered in table 15 along with the main related findings, as well as some additional findings.

RSQ1	Do customer co-creation activities become more important for management as the size of the firm increases?
H1	Customer co-creation activities become more important for managers as the firm's size increases.
<i>Results:</i> <i>H1 unsupported</i>	When considered individually, no significant bivariate Pearson's R correlation was found between firm size and managers' positions on the importance of co-creation. A multiple linear regression analysis showed that a significant negative correlation between the variables exists when the amount of co-creation customers is taken into account simultaneously.

RSQ2	Do managers prefer to incorporate customers' innovations in the early or late stage of developing solutions, and how much freedom do they allow for the innovating customer?
H2a	Managers use their customers' ideas evenly in the early and late stages of new solution development.
<i>Results: H2a supported</i>	The managers' answers indicated that customers' ideas are in fact used in a very uniform way across the early and late stages of new solution development.
H2b	Managers issue their customers equal numbers of predefined and open tasks.
<i>Results: H2b unsupported</i>	The results indicated that managers leaned heavily on issuing their customers open tasks when they wanted their input. Managers usually issued their customers open tasks in about 70 % of cases.
RSQ3	Why are some managers reluctant to involve customers in the innovation process?
H3	Managers' uncertainties about issues related to intellectual property rights are the most important factor discouraging them from engaging in customer co-creation.
<i>Results: H3 supported</i>	The results of the survey indicated that intellectual property rights were the most prominent issue discouraging managers from co-creation. A majority, over 60 % of managers saw IP rights issues as a concern when deciding about information sharing with customers.
RSQ4	Do managers feel increased pressure in the fuzzy front-end of product/service development because of customer co-creation activities?
H4	Managers feel the fuzzy front-end of new product/service development becomes more complicated with increasing customer co-creation activities.
<i>Results: H4 partially supported</i>	The results showed some limited support for this hypothesis. In a bivariate analysis, increasing co-creation activities influenced managers' opinions about the difficulties involved with the fuzzy front-end with a p-value of 0,087, suggesting the correlation is not entirely insignificant. Furthermore, about 15% of managers felt that less ideas and concepts were developed inside their firms because of resources spent dealing with those of their customers.
RSQ5	Are managers conscious of their firms' lead customers?
H5	Managers know who their lead customers are.
<i>Results: H5 supported</i>	The hypothesis received strong support on the basis of the data. Over 70 % of managers could identify at least one lead customer when asked about customers with lead customer characteristics.
Additional findings	<ul style="list-style-type: none"> - Increases in the amount of customers firms collaborate with seem to have a strong correlation with managers' opinions about customer co-creation. The more customers the firm co-creates with, the stronger are managers' positive views about co-creation (and vice versa). - Managers tend to use less customer-generated input for idea generation than for concept development, suggesting that in the early stages of developing solutions, firms lean towards generating their own ideas and then asking their customers input on conceptualizing them. - Firms that develop standardized products and services seem to use customer-generated knowledge most comprehensively in all stages of new solution development.

	<ul style="list-style-type: none"> - Managers are not worried about their customers becoming their competitors, but competitive advantage erosion via customer collaboration is an issue for many. - Managers think they are getting their money's worth in collaborating with customers to create new products and services, but estimating the costs involved is not always easy. - Growing firm size makes managers' decision making in the fuzzy front-end of product and service development more difficult. - Managers are very active in deepening their collaboration with the lead customers they have identified. - Only half of managers reported that their firm actively seeks lead customers. - Firms that did and did not seek lead customers had one or more in 80 % and 64 % of cases, respectively, suggesting that actively searching for lead customers is not wasted time.
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Table #15. *Research findings.*

Answering the research sub-questions is relatively straightforward with the corresponding hypotheses and their related evidence at hand.

- **RSQ1.** According to the evidence, managers do not feel any increase in the importance of customer co-creation activities as their firm grows in size.
- **RSQ2.** The evidence shows that managers use their customers' input and knowledge fairly evenly in the early and late stages of developing new solutions. Additionally, they prefer to let their customers innovate and allow them a lot of freedom when issuing tasks related to new solution development.
- **RSQ3.** Most of managers' reluctance to engage in co-creation with customers stems from intellectual property rights related issues. General competitive advantage erosion related concerns also exist, while financial deterrents are less pronounced.
- **RSQ4.** According to the data, there is some evidence that an increase in customer co-creation activities puts more pressure on managers making decisions in the fuzzy front-end of product and service

development. However, the evidence is vague and more research should be undertaken.

- **RSQ5.** Managers are quite conscious about their firms' lead customers and very actively pursue increased collaboration with them.

Finally, what remains is to consider an answer for the main research question: how are customer co-creation activities managed in Finnish high-tech SMEs? The question is a complex one, and does not have a simple answer. As far as the details of managers' perceptions and beliefs on managing it are concerned, much of the answer can be found in the data analysis and the results of the research sub-questions.

In general it seems that Finnish high-tech SMEs are, perhaps exceptionally, aware of the potential value that can be extracted by innovating together with customers. A specific concern when crafting the self-administered survey was that managers might not exactly understand what was meant by the used choices of wording. The challenge was to describe customer co-creation as accurately as possible without actually using the words, so that managers could understand the essence of what was meant without necessarily knowing a thing about customer co-creation as it exists as part of innovation management theory. A survey completion rate close to 9 % is a testament to the fact that the wording was successful, and more importantly, to the fact that managers were able to identify with concepts related to customer co-creation and provide meaningful insights. This is an important part of the answer to the main research question. Finnish high-tech SME managers are aware of the importance of customer collaboration and are also able to actively manage it, effectively pursuing increased mutual value in the process. A part of this fact is no doubt a result of the high levels of clustering found within the Finnish knowledge economy: collaboration and co-competition has been important for many firms operating in the Finnish ICT sector for a long time.

6.2. Theoretical Contributions

The results of this study contribute some interesting additions to current theory. As mentioned, most of the research gaps focused on were gaps that are characterized by the lack of empirical evidence in particular issues. These results should provide a valuable empirical view to some of the themes that were investigated.

Recall that the relationship between firm size and customer co-creation efforts are an ongoing subject for debate. Large firms were found to use advanced online co-creation tools and practice a lot of open innovation (Prandelli *et al.* 2006, Lichtenthaler 2006). Others (Faems *et al.* 2005, van der Meer (2007) found negative relationships between firm size and open innovation as well as collaborative efforts. This study found a significant negative relationship between managers' perceptions of co-creation and firm size, when firm size and the number of customers co-created with were considered simultaneously. The results and theory seem to imply that while micro-sized enterprises find collaborating with their key customers very important, this enthusiasm fades as firms grow towards the outer limits of the SME classification and experience a significant increase in customer amounts. When SMEs turn into large enterprises, theory would seem to suggest that the firms once again come to rely more on customer collaboration to differentiate themselves, perhaps due to pressure because their competition becomes global. However, this collaboration may be better described with open innovation models instead of the customer co-creation paradigm.

A very interesting finding of this study was that firms that develop standardized products and services use their customers' knowledge more extensively in all stages of the product or service development process than their customized product/service counterparts. Some ideas as to why this may be can be gathered from NPD literature. Most researchers of the field find that involving

large, closely associated customers with collaborative experience into the NPD process will yield superior products. Bonner & Walker (2004) have found that the gained advantage is especially large for companies that produce incremental products, i.e. standardized products that are developed via incremental innovation. If and when these companies recognize the potential advantages, it would make sense for them to use more customer input in all stages of their product and service development processes. Additionally, as many such firms produce products for multiple customers with slightly different demands, it is rational to modularize their product architecture. Sanchez & Mahoney (1996) argue that modularization helps firms to reduce the costs involved with adaptive coordination and leads to more effective knowledge management. It seems rational to assume that using customer knowledge in all stages of the product development process would contribute towards an effective modularization strategy for products.

The research results pertaining to the barriers that discourage managers from engaging in co-creation with their customers did not yield any particularly significant revelations to theory. The results mainly help confirm the idea that intellectual property issues are indeed the most important barrier between free-flowing communication of innovative ideas between the supplying company and its customers. The barrier is definitely there, and the wide body of literature regarding it seems well justified. Academics should not yield in their efforts to design theory for intellectual property rights regimes that would enable free economic flows of innovations between corporations and institutions, but at the same time allowing them to maintain appropriability where necessary. A tough but necessary task as the innovation practices of companies continue to move towards a more open direction, while appropriability regimes are still rigid and government-maintained. Meanwhile, an easier nut to crack might be to develop models which would help companies manage the financial aspects of customer co-creation. Although IP rights issues seemed the most significant barrier to

co-creation, quite a number of managers reported having difficulties assessing the financial costs and risks associated with it.

The results provide some interesting suggestions about what factors might influence the difficulty of keeping track of projects in the fuzzy front-end of product and service development. Although there was only a weak link between the amount of collaborative customers and managers' opinions about the difficulty of handling ideas and concepts, it is something that warrants consideration. More interestingly, a strong link was found between firm size and issues with customers' ideas and concepts in the fuzzy front-end. This finding may be considered an addition to current theory as something to be considered in further tests. Verworn & Herstatt (2000) found no links between firm size and the success indicators of the fuzzy front-end, but this study suggests that a connection may be found between firm size and some management- and decision-making related negative aspects such as increased uncertainty about and reluctance to discard the bad ideas and concepts of customers.

The lead customer section of this thesis' empirical results can be considered a valuable empirical addition to the theory of lead user identification. The results show that a vast majority of managers within the sample have identified lead users. Not only that, but also that they are very active in increasing their cooperation with them. These findings contribute to the pool of existing large-scale empirical studies about whether or not companies have identified lead users, which is limited at best. Another important finding was that companies that actively seek lead customers found them at a 16 % increased margin to those who did not. As theory shows that customer-generated knowledge, and especially input from lead users is very valuable in developing superior products and services, this information can contribute to existing lead user identification models. As mentioned, the sample firms operate in an industry

which is quite clustered and where collaboration is widespread. Further observing the lead user collaboration practices of firms like these can yield even more contributions to lead user theory.

6.3. Managerial Implications

Some useful managerial recommendations can be gathered on the basis of the research results. With customer co-creation being a relatively new field of study, managerial recommendations that are supported with empirical data may prove of value to firms that want to practice more customer co-creation and do it effectively.

The empirical data provides some clues as to what steps should be taken by top level management if the firm finds itself in a position where more collaborative innovation with customers is desirable. This study finds a strong link between the amount of customers that firms collaborate with and managers' perceptions about the importance of customer co-creation. This implies that unless managers are aware of the potential value and benefits collaboration entails, the collaborative actions may remain lackluster. Influencing a change in managers' opinions about customer co-creation via expert seminars and workshops might prove a valuable tool in gearing a company towards a more customer co-creation oriented mindset.

The results suggest that about 75 % of managers use customer-generated knowledge and ideas in only one or two points of the total four along the new product/service development cycle. This suggests that there is still a lot of room to increase the scope of customer knowledge use. There is already a lot of customer co-creation happening within the sample, but managers should not be satisfied with the current state of collaborative actions. Instead, they should actively pursue new avenues for increased value creation along all points of the new product/service development cycle to explore the limits of customer

co-creation. As the Finnish economy continues to struggle to find growth, renewing competitive advantage in the high-tech sector through becoming the world's forerunners in customer knowledge implementation could be part of the solution. The fact that 70 % of managers issue their customers open tasks when they look for new ideas to implement in their solutions implies that the open mindset necessary for increased co-creation activities is already there.

As far as the difficulties of estimating the financial gains and losses involved with customer co-creation are concerned, there are likely steps that companies can take to mitigate some of them. One way to do so could be to integrate customer co-creation activities as a new module into enterprise resource planning systems. Customer co-creation activities should be viewed as investments that have an expected return just as any other investment. To streamline the costs involved, it is of course necessary to evaluate the risk level involved with co-creation initiatives. All of this should contribute towards an effective system that can be used to evaluate co-creation initiatives and promptly pursue the promising ones while discarding the rest. This way, the problem can be tackled in a fashion that resembles project management, which is already familiar to many firms. Intellectual property rights-related issues are harder for firms to solve by themselves, as they are not acting alone but in collaboration with their customers. Meanwhile, appropriability regimes are controlled by government institutions. There is little else managers can do but to try to evaluate their relationships with co-creation customers rationally and try to decide if sharing sensitive information with them is worth the risk. In some situations managers may want to consider using covenants and non-compete clauses that prevent their co-creation partners from utilizing critical information that they must be made privy to.

This study found that managers find it harder to keep track of their customers' ideas and concepts in the early stages of product- and service development as

their firm size increases. It seems reasonable to assume that this might be an organizational issue: as the amount of employees increases, it becomes less clear who is responsible for maintaining a big picture understanding of customer co-creation activities in the fuzzy front-end of product and service development, or, that big picture simply becomes too big to handle. Firms should take steps to implement more effective project management systems and to train their personnel to use them. If the fuzzy front-end of developing new solutions becomes too hard to handle, it may make sense to employ project management consulting services. Effective communication with co-creation customers is vitally important, but simultaneously managers must be conscious about where their responsibilities lie and also communicate effectively within their own firm.

As far as lead customers go, the recommendation based on the empirical results is simple: firms should make a conscious effort to find them. Only half of managers looked for lead customers actively, and those managers' firms had one or more lead customers significantly more likely than those whose firms did not. This is an important area where managers should become more active and look to take their collaborative efforts further, as the potential for increased value creation with lead customers is largely undisputed. Judging by the data, the likely reason why half of managers do not actively search for lead customers is that they will probably have one anyway (in 64 % of cases). However, there is no reason why firms should not try to find more lead customers when there is a clear incentive and possibility to do so. As shown in the theory section, there is a number of lead user identification techniques that managers could learn from and possibly implement in their business.

6.4. Study Limitations

There are some inherent limitations with this research which should not go unaccounted for. The most significant external validity limitations are

geographical and regarding industry types and firm sizes. As already mentioned, the Finnish high-tech and especially the ICT sectors are somewhat clustered in comparison to many other areas. This may create a bias towards more pronounced customer co-creation activities than may be found to be the case in an average situation found in other developed countries' high-tech sectors. The same limitation applies when considering generalizability to other industries in addition to the fact that results may not be comparable simply due to industry heterogeneity. These results are also likely not generalizable to large firms that exceed the SME classification by a large margin. Most likely, this research can contribute best to understanding how customer co-creation is managed in high-tech sectors that are similarly developed and clustered as in Finland. It should also be noted that this study does not differentiate between products and services when asking managers about new solution development processes.

Because the research was undertaken as a communication study, there are some measurement validity and reliability concerns that are always part of gathering data via self-administered surveys. Measurement validity, or how accurately the used instruments measured the research issues in question, can be considered the main concern. An attempt was made to mitigate this concern by testing and re-testing the survey on industry and consulting service professionals. As for measurement reliability, there is no reason to assume that the survey measures would produce different results if the sample of firms was re-tested.

6.5. Further Research Directions

The first priority for further research should be to create a comprehensive understanding about how firms of different sizes relate to customer co-creation. This study found out that managers in micro-sized enterprises are more likely to hold customer co-creation in higher regard than larger SMEs. On the other

hand, theory suggests that very large enterprises are active co-creators. These results call for developing a framework that explains how companies' perceptions about customer co-creation change as they grow, as well as simply understanding the difference in mindsets that micro-sized, medium, large, and very large enterprises seem to have. Perhaps the differences in approaches and mindsets are something that stem from varying pressure of competition faced by firms of different sizes.

The second priority for further research would be to undertake studies that aim to understand the differences in customer co-creation practices and the ways customer knowledge is used in firms that create standardized products and services versus firms that create customized ones. This study suggested that customer knowledge use in various points of the new solution development process could be something that differs between the firm types, implying a link to how customer co-creation activities are managed in them. A larger study should be undertaken to better understand these differences.

Finally, academics should confirm or refute the suggestion put forward by this study that keeping track of customers' concepts and ideas may become more complicated as firm size grows. No matter the end result, it could imply changes to new product development models for firms that practice customer co-creation.

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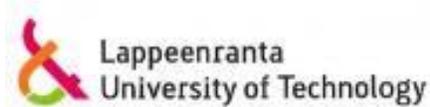
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APPENDICES

Appendix I. Survey Questionnaire



Thank you very much for choosing to take this survey. The results will be used as data for a master's thesis research paper for the Lappeenranta University of Technology. This survey consists of five short parts, and will only take about 3 minutes to complete.

Kiitos, että päätit osallistua tähän kyselytutkimukseen. Kyselytutkimuksen tuloksia käytetään osana pro gradu-tutkielmaa Lappeenrannan teknilliselle yliopistolle. Kysely koostuu viidestä lyhyestä osiosta, ja siihen vastaaminen kestää noin 3 minuuttia.

Would you like to take this survey in English or in Finnish? Haluaisitko vastata tähän kyselyyn suomeksi vai englanniksi?

English Version

Block 1

Approximately how many employees does your company have?

Approximately how many customers does your company collaborate with to develop products and/or services at any given time?

Would you describe your firm as one that develops products and/or services that are fully customized to your customers' needs, or one that develops products and/or services that are standardized to a higher degree?

Customized products/services	Standardized products/services	Both	Neither
---------------------------------	-----------------------------------	------	---------

How important do you feel collaboration with customers is to your company when developing new products and/or services?

Very unimportant Unimportant Neutral Important Very important

Block 2

In your company, are customers' ideas used more in the early stage of product or service development (idea generation, concept development) or in the late stage (product design, testing)? You can pick multiple choices.

Idea generation	Concept development	Product/service design	Product/service testing	I don't know
-----------------	------------------------	---------------------------	----------------------------	--------------

When you wish for your customers' input into your product or service development process, do you generally issue your customers simple tasks or queries with little freedom to elaborate, or open tasks with more freedom?

Simple tasks Open tasks I don't know

Block 3

How easy or difficult do you find evaluating the financial gains and losses of collaborating with customers to create new products and/or services?

Very easy Easy Neutral Difficult Very difficult

Do you feel like collaborating with customers to create new products and/or services is a financial burden that is not offset by the benefits it provides?

Yes No I don't know

Are you sometimes reluctant to share information with your customers because of concerns that it might impact your competitive advantage?

Yes No I don't know

How concerned are you that your customers might one day become your competitors?

Very unconcerned Unconcerned Neutral Concerned Very concerned

Are intellectual property rights concerns an issue for you when deciding about sharing information between your firm and your customers?

Yes No I don't know

Block 4

How easy or difficult is it difficult to keep track of customers' ideas and concepts in the early stages of product or service development?

Very easy Easy Neutral Difficult Very difficult

Do you feel that less ideas and concepts are developed inside your own firm as dealing with customers' ideas and concepts requires resources?

Yes No I don't know

Block 5

Does your firm have one or more key customers that are able to provide more advanced ideas and input into your product or service development efforts than others?

Yes No I don't know

If yes, have you taken steps to deepen your collaboration with those customers?

Yes No I don't know

Does your company actively seek customers that seem to have more potential in providing ideas and input for your product or service development efforts than the average customer?

Yes No I don't know

In general, do you feel that your firm's product and/or service development efforts could benefit from engaging in more collaboration with customers?

Yes No I don't know

If you would like to receive the full research results upon their completion, please add your e-mail address to the field below. Your e-mail address will not be associated with your responses, and your anonymity will be protected at all times.

Suomenkielinen versio**(Finnish Version)****Block 1**

Kuinka monta työntekijää yrityksenne työllistää (arvio riittää)?

Kuinka monen asiakkaan kanssa yrityksenne normaalisti tekee palvelu/tuotekehitysyhteistyötä (arvio riittää)?

Kuvailisitteko yritystänne firmana joka kehittää tuotteita ja/tai palveluita jotka ovat kustomoitu asiakkaidenne tarpeisiin, vai firmana joka kehittää tuotteita ja/tai palveluita jotka ovat suuremmassa määrin standardoituja?

Kustomoidut	Standardisoidut		
tuotteet/palvelut	tuotteet/palvelut	Molemmat	Ei kumpikaan

Kuinka tärkeänä näette yhteistyön asiakkaiden kanssa uusia tuotteita ja/tai palveluita kehittäessänne?

Ei lainkaan tärkeänä Ei tärkeänä Neutraali Tärkeänä Erittäin tärkeänä

Block 2

Käytättekö asiakkaidenne ideoita enemmän tuote- tai palvelukehitysyhteistyön alkuvaiheessa (ideanmuodostus, konseptien kehitys) vai myöhäisessä vaiheessa (tuotedesign, testaus)? Voitte valita useampia vaihtoehtoja.

Ideanmuodostus	Konseptien kehitys	Tuote/palveludesign	Tuote/palvelutestaus	En tiedä
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Kun kaipaatte asiakkaidenne ideoita tuote- tai palvelukehitykseenne, annatteko yleensä asiakkaillenne yksinkertaisia tehtäviä tai tiedusteluita vähällä valinnanvapaudella, vai avoimia tehtäviä joissa asiakkaanne ovat vapaampia kuvailemaan tarpeitaan?

Yksinkertaisia tehtäviä Avoimia tehtäviä En tiedä

Block 3

Kuinka vaikeaa on mielestänne arvioida taloudellisia hyötyjä ja haittoja joita koituu tuote- tai palvelukehitysyhteistyösuhteista asiakkaidenne kanssa?

Erittäin helppoa Helppoa Neutraali Vaikeaa Erittäin vaikeaa

Ovatko tuote- tai palvelukehitysyhteistyösuhteet asiakkaidenne kanssa mielestänne taloudellinen taakka jonka hyödyt eivät voita haittoja?

Kyllä Ei En tiedä

Oletteko toisinaan haluton jakamaan tietoa asiakkaidenne kanssa koska olette huolissanne tiedonjaon vaikutuksista kilpailuetuunne?

Kyllä En En tiedä

Kuinka huolissanne olette, että asiakkaistanne tulisi tulevaisuudessa kilpailijoitanne?

En lainkaan En huolissani Neutraali Huolissani Erittäin huolissani

Ovatko tekijänoikeus- ja patenttikysymykset relevantteja teille kun päätätte tiedonjaosta yrityksenne ja asiakkaidenne välillä?

Kyllä Ei En tiedä

Block 4

Kuinka helppoa tai vaikeata mielestänne on pitää kirjaa asiakkaidenne ideoista ja konsepteista tuote- tai palvelukehityksen alkuvaiheessa?

Erittäin helppoa Helppoa Neutraali Vaikeaa Erittäin vaikeaa

Tuntuuko teistä siltä, että oman yrityksenne sisällä kehitetään vähemmän ideoita ja konsepteja koska asiakkaidenne ideoiden ja konseptien johtaminen vaatii resursseja?

Kyllä Ei En tiedä

Block 5

Onko yrityksellänne yksi tai useampi asiakas joka pystyy tuottamaan parempia ideoita ja sisältöä tuote- tai palvelukehityspyrkimyksiinne kuin muut?

Kyllä Ei En tiedä

Jos vastasitte edelliseen kyllä, oletteko pyrkineet syventämään yhteistyötänne näiden asiakkaiden kanssa?

Kyllä Ei En tiedä

Etsiikö yrityksenne aktiivisesti asiakkaita joilla on keskimääräistä asiakasta enemmän potentiaalia tuote- tai palvelukehitystänne hyödyttävien ideoiden ja sisällön tuottamiseen?

Kyllä Ei En tiedä

Yleisesti ottaen, tuntuuko teistä siltä että tuote- ja/tai palvelukehityspyrkimyksenne voisivat hyötyä lisätystä yhteistyöstä asiakkaidenne kanssa?

Kyllä Ei En tiedä

Jos haluatte valmistuneen tutkimuksen tulokset käyttöönnne, lisätkää sähköpostinne alla olevaan kenttään. Sähköpostiosoitetta ei yhdistetä vastauksiinne eikä käytetä mihinkään muuhun tarkoitukseen.

Appendix II. Industries within Firm Dataset

Primary Industry	Sub-Industry
ICT Mobile Telecommunications	Mobile Devices & Accessories Mobile Solutions & Software Mobile Enterprise Telco Middleware Mobile Applications E-Learning Healthcare IT Web-Based Services
ICT Software	Enterprise Software & Infrastructure Web-Based Services Entertainment & Media Applications & Software E-Learning Development Tools Miscellaneous
ICT Hardware & Semiconductors	Network Infrastructure Components Miscellaneous Vide & Imaging Processors Devices
Clean Tech	Environmental Protection and Management Water and Air Related Technologies Energy Miscellaneous Transportation and Logistics Recycling & Waste Management Materials and Green Building
Industrial	Laser and Optical Solutions Robotics Quality Monitoring & Testing Machinery & Automation Appliances

	Materials & Chemicals
Life Sciences	Biotechnology Medical Devices & Equipment Pharmaceuticals Healthcare Services Nutrition Healthcare IT Miscellaneous
Nano Technology	Nanomaterials & Nanodevices Progressive Miniaturization

Appendix III. Synthesis of Co-creation Frameworks

This framework is presented as seen in Greer & Lei (2012).

Driving and restraining forces

Demand for customization (Etgar 2008)

Technology related (Etgar 2008, Ojanen and Hallikas 2009; Payne *et al.* 2008)

 Technological change (Etgar 2008; Ojanen and Hallikas 2009)

 Product modularity (Baldwin and Clark 1999; Salvador 2007)

Individual, consumer or customer level (Etgar 2008; Ojanen and Hallikas 2009)

 Expertise and depth of knowledge (Etgar 2008)

 Motivation for collaboration (Etgar 2008; Ojanen and Hallikas 2009)

Strategic and structural (Ojanen and Hallikas 2009)

 Strategy (Ojanen and Hallikas 2009)

 Networks (Etgar 2008)

Organizational (Ojanen and Hallikas 2009)

 Cultural views of collaboration (Etgar 2008; Ojanen and Hallikas 2009)

 Availability of time (Etgar 2008; Ojanen and Hallikas 2009)

 Presence or absence of trust (Etgar 2008; Ojanen and Hallikas 2009)

 Presence or absence of empathy (Etgar, 2008)

Feasibility

Assessment of costs and benefits (Etgar 2008)

Processes for customer integration (Ojanen and Hallikas 2009)

Implementation

Indicators of collaborative potential (Bilgram *et al.* 2008; Fuller *et al.* 2007)

Learning and knowledge transfer (Ojanen and Hallikas 2009; Payne *et al.* 2008)

Lead user collaboration (von Hippel 2005; von Krogh 2006; Lettl *et al.* 2006)

Participative design (Buur and Matthews 2008; Pals *et al.* 2008)

Further development

Mutual learning (Ojanen and Hallikas 2009; Payne *et al.* 2008)

Mutual innovation processes (Ojanen and Hallikas 2009; Payne *et al.* 2008)

Measurement and feedback

Appendix IV. Assorted Dataset Statistics and Variables

Amounts of employees and customers co-created with:

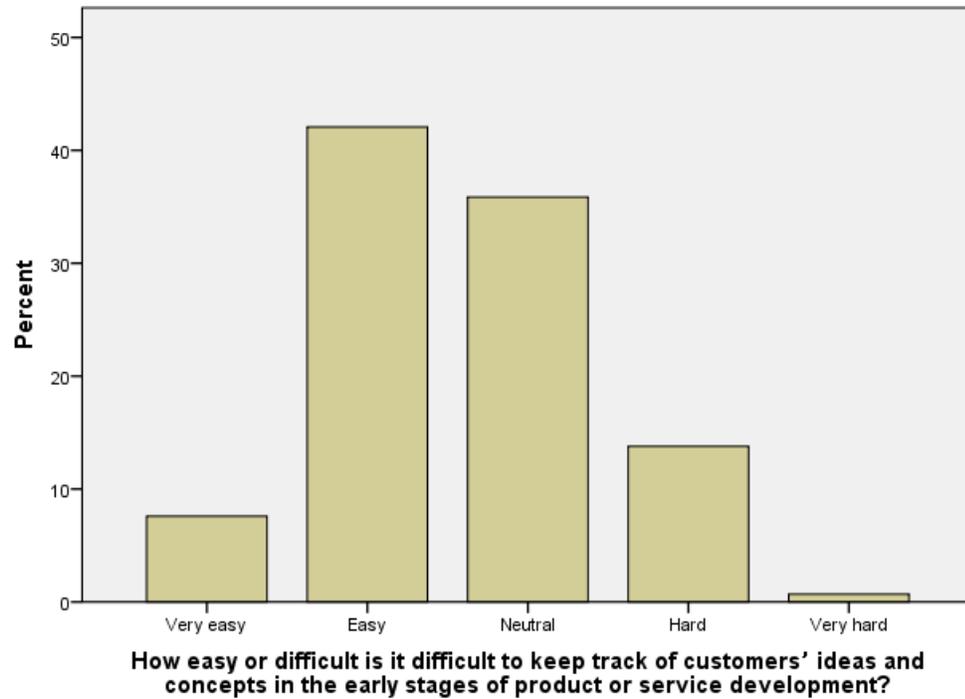
Employee amounts

N	Valid	145
	Missing	0
Mean		19,76
Skewness		2,774
Std. Error of Skewness		,201
Kurtosis		8,852
Std. Error of Kurtosis		,400

Amounts of customers cooperated with

N	Valid	144
	Missing	1
Mean		33,19
Skewness		4,253
Std. Error of Skewness		,202
Kurtosis		20,185
Std. Error of Kurtosis		,401

Challenges in keeping track of customers' ideas and concepts in the fuzzy front-end:



Manager opinions about the benefits of increased customer co-creation:

In general, do you feel that your firm's product and/or service development efforts could benefit from engaging in more collaboration with customers?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	130	89,7	89,7	89,7
No	8	5,5	5,5	95,2
I don't know	7	4,8	4,8	100,0
Total	145	100,0	100,0	

Appendix V. Statistical Significance Tests of Assorted Variables

Statistical significance test (Kolmogorov-Smirnov) of the customer collaboration importance variable (H1):

One-Sample Kolmogorov-Smirnov Test

		How important do you feel collaboration with customers is to your company when developing new products and/or services?
N		145
Normal Parameters ^{a,b}	Mean	4,58
	Std. Deviation	,742
Most Extreme Differences	Absolute	,384
	Positive	,285
	Negative	-,384
Test Statistic		,384
Asymp. Sig. (2-tailed)		,000 ^c

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Statistical significance test (χ^2) of the customer input variable (H2b):

When you wish for your customers' input into your product or service development process, do you generally issue your customers simple tasks or queries with little freedom to elaborate, or open tasks with more freedom?

	Observed N	Expected N	Residual
Simple tasks	39	66,0	-27,0
Open tasks	93	66,0	27,0
Total	132		

Test Statistics

	When you wish for your customers' input into your product or service development process, do you generally issue your customers simple tasks or queries with little freedom to elaborate, or open tasks with more freedom?
Chi-Square	22,091 ^a
df	1
Asymp. Sig.	,000

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 66,0.

Statistical significance test (Kolmogorov-Smirnov) of the evaluating financial gains and losses of co-creation variable (H3):

		How easy or difficult do you find evaluating the financial gains and losses of collaborating with customers to create new products and/or services?
N		145
Normal Parameters ^{a,b}	Mean	2,86
	Std. Deviation	,990
Most Extreme Differences	Absolute	,194
	Positive	,194
	Negative	-,171
Test Statistic		,194
Asymp. Sig. (2-tailed)		,000 ^c

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Statistical significance test (χ^2) of the financial burden of customer co-creation variable (H3):

Do you feel like collaborating with customers to create new products and/or services is a financial burden that is not offset by the benefits it provides?

	Observed N	Expected N	Residual
Yes	1	67,5	-66,5
No	134	67,5	66,5
Total	135		

Test Statistics

	Do you feel like collaborating with customers to create new products and/or services is a financial burden that is not offset by the benefits it provides?
Chi-Square	131,030 ^a
df	1
Asymp. Sig.	,000

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 67,5.

Statistical significance test (χ^2) of the information sharing reluctance and competitive advantage variable (H3):

**Are you sometimes reluctant to share
information with your customers because of
concerns that it might impact your competitive
advantage?**

	Observed N	Expected N	Residual
Yes	56	71,0	-15,0
No	86	71,0	15,0
Total	142		

Test Statistics

	Are you sometimes reluctant to share information with your customers because of concerns that it might impact your competitive advantage?
Chi-Square	6,338 ^a
df	1
Asymp. Sig.	,012

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 71,0.

Statistical significance test (Kolmogorov-Smirnov) of the customers becoming competitors variable (H3):

One-Sample Kolmogorov-Smirnov Test

		How concerned are you that your customers might one day become your competitors?
N		145
Normal Parameters ^{a,b}	Mean	2,10
	Std. Deviation	,895
Most Extreme Differences	Absolute	,270
	Positive	,270
	Negative	-,192
Test Statistic		,270
Asymp. Sig. (2-tailed)		,000 ^c

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Statistical significance test (x2) of the IP rights issues and information sharing variable (H3):

**Are intellectual property rights concerns an
issue for you when deciding about sharing
information between your firm and your
customers?**

	Observed N	Expected N	Residual
Yes	88	72,0	16,0
No	56	72,0	-16,0
Total	144		

Test Statistics

	Are intellectual property rights concerns an issue for you when deciding about sharing information between your firm and your customers?
Chi-Square	7,111 ^a
df	1
Asymp. Sig.	,008

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 72,0.

Statistical significance test (χ^2) of the ideas and concepts of the firm versus ideas and concepts of the customer variable (H4):

Do you feel that less ideas and concepts are developed inside your own firm as dealing with customers' ideas and concepts requires resources?

	Observed N	Expected N	Residual
Yes	24	66,5	-42,5
No	109	66,5	42,5
Total	133		

Test Statistics

	Do you feel that less ideas and concepts are developed inside your own firm as dealing with customers' ideas and concepts requires resources?
Chi-Square	54,323 ^a
df	1
Asymp. Sig.	,000

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 66,5.

Appendix VI. Bivariate and Multiple Linear Regression Analyses

Hypothesis H1 multiple linear regression analysis table:

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,256 ^a	,065	,052	,665

a. Predictors: (Constant), Number of employees (log), Number of customer collaboration (log)

b. Dependent Variable: How important do you feel collaboration with customers is to your company when developing new products and/or services?

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4,341	2	2,171	4,906	,009 ^b
	Residual	61,939	140	,442		
	Total	66,280	142			

a. Dependent Variable: How important do you feel collaboration with customers is to your company when developing new products and/or services?

b. Predictors: (Constant), Number of employees (log), Number of customer collaboration (log)

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,544	,135		33,558	,000
	Number of customer collaboration (log)	,123	,042	,250	2,911	,004
	Number of employees (log)	-,097	,049	-,170	-1,983	,049

a. Dependent Variable: How important do you feel collaboration with customers is to your company when developing new products and/or services?

Hypothesis H3 bivariate correlation table:

Correlations

	Number of employees (log)	Number of customer collaboration (log)	How easy or difficult do you find evaluating the financial gains and losses of collaborating with customers to create new products and/or services?	How concerned are you that your customers might one day become your competitors?
Number of employees (log)	1	,302 ,000 145	,036 ,668 145	-,015 ,861 145
Number of customer collaboration (log)	,302 ,000 143	1	-,137 ,102 143	-,049 ,560 143

Hypothesis H4 multiple regression analysis:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,211 ^a	,044	,031	,829

a. Predictors: (Constant), Number of customer collaboration (log),
Number of employees (log)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4,475	2	2,238	3,257	,041 ^b
	Residual	96,182	140	,687		
	Total	100,657	142			

a. Dependent Variable: How easy or difficult is it difficult to keep track of customers' ideas and concepts in the early stages of product or service development?

b. Predictors: (Constant), Number of customer collaboration (log), Number of employees (log)

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,196	,169		13,017	,000
	Number of employees (log)	,114	,061	,162	1,867	,064
	Number of customer collaboration (log)	,058	,053	,095	1,095	,275

a. Dependent Variable: How easy or difficult is it difficult to keep track of customers' ideas and concepts in the early stages of product or service development?