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CUSTOMER NEEDS IN INNOVATION AND R&D STRATEGY DEVELOPMENT

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ABSTRACT

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The company in the focus of this study opened an innovation center in late 2015. The first goal of the thesis is to study how customer needs can be found in the innovation center. The second goal is to find out how customer needs can be included in the innovation and R&D strategy. A comprehensive process for customer need assessment is presented. The process is fine-tuned to suit the company by utilizing the information gathered from a survey conducted for customers. Company's product managers were interviewed in order to get their insights about customer need assessment and how the customer needs could be incorporated in the innovation and R&D strategy. According to the results, a suitable method for customer need assessment in the innovation center would be creative group interview. Also GDSS based workshops would help in overcoming several problems faced in meetings and workshops. It was found out in the research that the major development directions and the most important needs should be included into the innovation and R&D strategy. Suitable ways for doing this would be by utilizing roadmaps and scenarios, as well as innovation fields and customer need tables.

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Tutkimuksen kohteena oleva yritys avasi innovaatiokeskuksen 2015 vuoden loppupuolella. Tutkimuksen tavoite on tutkia keinoja löytää asiakastarpeita innovaatiokeskuksessa sekä selvittää, kuinka asiakastarpeet sisällytetään innovaatio- ja tuotekehitysstrategiaan. Kattava prosessi asiakastarvekartoituksesta esitellään ja prosessi säädetään yritykselle sopivaksi asiakkaille tehdyn kyselyn tulosten mukaan. Lisäksi yrityksen tuotepäälliköille järjestettiin haastattelu, jotta heidän näkemyksiään asiakastarvekartoituksen kehittämisestä ja tarpeiden lisäämisestä strategiaan päästiin myös hyödyntämään. Asiakastarpeiden kartoittamiseen soveltuvaksi menetelmäksi löydettiin ryhmätyömalliin perustuva menetelmä, jossa tarpeita kerätään innovaatiokeskuksessa. Lisäksi tietokoneita hyödyntävä GDSS-kokous auttaa välttämään useita yleisiä kokousten ongelmia. Tutkimuksen mukaan asiakastarpeiden suuret kehityslinjat ja kaikista tärkeimmät tarpeet voidaan lisätä strategiaan hyödyntämällä innovaatiokenttiä, skenaarioita ja roadmappeja sekä asiakastarvetaulukkoja.

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Tattista!

In Lappeenranta, 7.8.2016
Teemu Salinto

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LIST OF SYMBOLS AND ABBREVIATIONS

CIC	Collaborative Innovation with Customers
CKM	Customer Knowledge Management
CRM	Customer Relationship Management
GDSS	Group Decision Support System
IRD	Innovation and R&D
NDA	Non-Disclosure Agreement
NPD	New Product Development
NSD	New Service Development
QFD	Quality Function Deployment
R&D	Research & Development
SBU	Strategic Business Unit

1 INTRODUCTION

Innovations have key role in helping companies survive in increasingly competitive markets (Kärkkäinen et al., 2001). Today collaboration is almost mandatory in order to be truly innovative (Dodgson, 2014, p. 462) and open innovation is a great mean for this. In the end, customer is the one which defines the value of the innovation because it decides whether to buy the product or not. This is why customers are great partners for open innovation.

In order to create products that the customer values, companies have to know what they need. This is vital as it has been found out that most successful innovations are often results from successful customer need assessment (Elfvengren et al. 2004). Companies that understand the customer needs are able to provide higher quality products and services from the customer's point of view (Prahalad & Ramaswamy, 2004), faster development times (Iansiti & MacCormack, 1997), cost savings, and better image of the company in the marketplace (Wikström, 1996). Customers' hidden and future needs are even more valuable than present needs as they enable the company to meet customers' expectations proactively (Kärkkäinen et al., 2001). Innovations based on just new technological opportunities, on the other hand, are less likely to succeed (Rothwell, 1992). This is why it is nowadays common that customers have key roles in companies' external innovation networks helping to create new and innovative products (Chatterji & Fabrizio, 2012). As a consequence, understanding customer needs when developing new products and services significantly affects the companies' success.

Innovation centers can be used in finding customer needs but it appears that there has not been any research on this area. The innovation center of the company in focus of this thesis is built to foster cooperation between the company and customers, and it provides excellent setting for finding out customer needs. The importance of customer needs for the companies and the lack of research in the area of finding customer needs in innovation centers emphasize the importance of the subject both in the theoretical and managerial points of view.

Customer needs must direct product development so that new products will meet customers' needs and expectations. This is why customer needs have to be included into the company's innovation and R&D (IRD) strategy. Innovation strategy determines the direction of innovation in a company and creating an innovation strategy requires detailed information about the business environment (Hittmar et al., 2014). A well-prepared innovation strategy is essential for companies as it for example provides guidelines for different kinds of strategic issues such as which markets to enter and skills to develop (Lester 1998). Innovation strategy helps in combining technology

push and demand pull in order to enable successful long-term innovation activities (Hamel & Prahalad, 1994). And as Cambra-Fierro et al. (2011) found out that market orientation, innovation and performance are connected together and they are moderated by strategy. Furthermore, strategic planning affects the firm performance in positive way and it is even more important in turbulent environments (Miller & Cardinal, 1994). This is why this thesis identifies ways to include customer needs into the IRD strategy.

1.1 Background

The company in the focus of this thesis operates in global business-to-business environment within the forestry product industry. The business-to-business markets are different from those of consumer industry for example with larger buyers, close relationships between customer and producer and on average more complex products (Kotler 1991; Griffin 1997 according to Kärkkäinen et. al. 2001). The forestry product industry is going through major changes as the demand for traditional products is decreasing and the companies are adjusting their production and finding new ways to make business (Anttila & Silvennoinen, 2014). It is vital for the company to focus on the customers' changing needs and prevent the business from decreasing, which is why studying the subject is important. As Miller and Cardinal (1994) argued that when uncertainty of the environment is high, companies need to plan more in order to manage the uncertainty.

A great amount of companies are opening innovation centers, but research regarding those has been limited. Innovation centers can be very different as others are more like showrooms and meeting rooms, and others full-on research and development centers with laboratories and scientists working in them full time. The company in the focus of this thesis recently opened its innovation center in its headquarters, operating as a collaborative space with group work possibilities as well as showroom and a design laboratory. One of the basic ideas of the center is to keep contact with the main stakeholders, customers being the most important ones, and to find out their needs regarding new products and services. Currently the customer need assessment process is not very organized, as often is the situation in other companies as well (Hanna et al., 1995). Also the newly opened innovation center does not yet have clear process and methods specifically for customer need assessment.

Another part of this thesis is to study how customer needs should shape the IRD strategy as the company is implementing a more market oriented strategy. IRD strategy should provide guidelines for the development efforts based on the customer needs and their development. The objective is to present various methods for implementing customer needs into the strategy.

1.2 Objectives and outlines for research

The objective of the work is to go through different methods and tools for utilizing innovation center in finding out customer needs, and finding out how to incorporate those into innovation and R&D strategy. This leads to research questions 1 and 2:

Research Question 1: How to find out customer's needs utilizing the innovation center?

Research Question 2: How to incorporate these needs into innovation and R&D strategy?

Customer needs can also be assessed from other sources than customers, but since customers have the best knowledge of their needs and they are the ones buying the products and services, this research is focused on customers rather than partners, competitors or market studies. The customers can innovate by themselves and companies can then buy these innovations, which would also give information about customer needs, but this kind of user innovation is not part of this thesis. Innovation center is also used for other stakeholders and other activities than customer need assessment, but these aspects are also not in the scope of this thesis.

1.3 Research methodology

Information for the first research question is gathered from relevant literature in order to find out the best practices and key aspects to consider in customer need assessment in the innovation center. A literature review is used to draw a summary of the subject from different sources and to help in analyzing and interpreting the results (Rowley & Slack, 2016). To focus more specifically on the case, a semi-structured email survey was conducted to a group of company's customers that have participated in innovation workshops or shared their needs with the company. Email surveys are great for qualitative research as they are quick and convenient when there is limited time, limited resources or geographical constraints (Meho, 2006). The participants represented different functions, companies and countries. Questions were mostly open, but there were also a couple of questions where participants were asked to rate the importance of certain things. A semi-structured survey worked well for finding out improvement ideas and best practices for customer need assessment process as customers had lots of insights about how the process could be improved to allow them to best describe their needs. Open questions helped to understand the problems and best practices of the customers better than quantitative methods.

The second research question is also studied as a literature review to find out possible ways for incorporating customer needs into the IRD strategy. In addition, semi-structured interviews were conducted for company's product managers to get their insights about how the customer needs

should be accounted in the strategy. Semi-structured interviews were chosen as they give flexibility to the interview and they can help in noticing new aspects that have not been considered beforehand (Kurkela, 2016). Product managers were also shortly asked about how they think that the customer need assessment could be improved.

1.4 Structure of the work

The structure of the work is illustrated in the following figure 1 below.

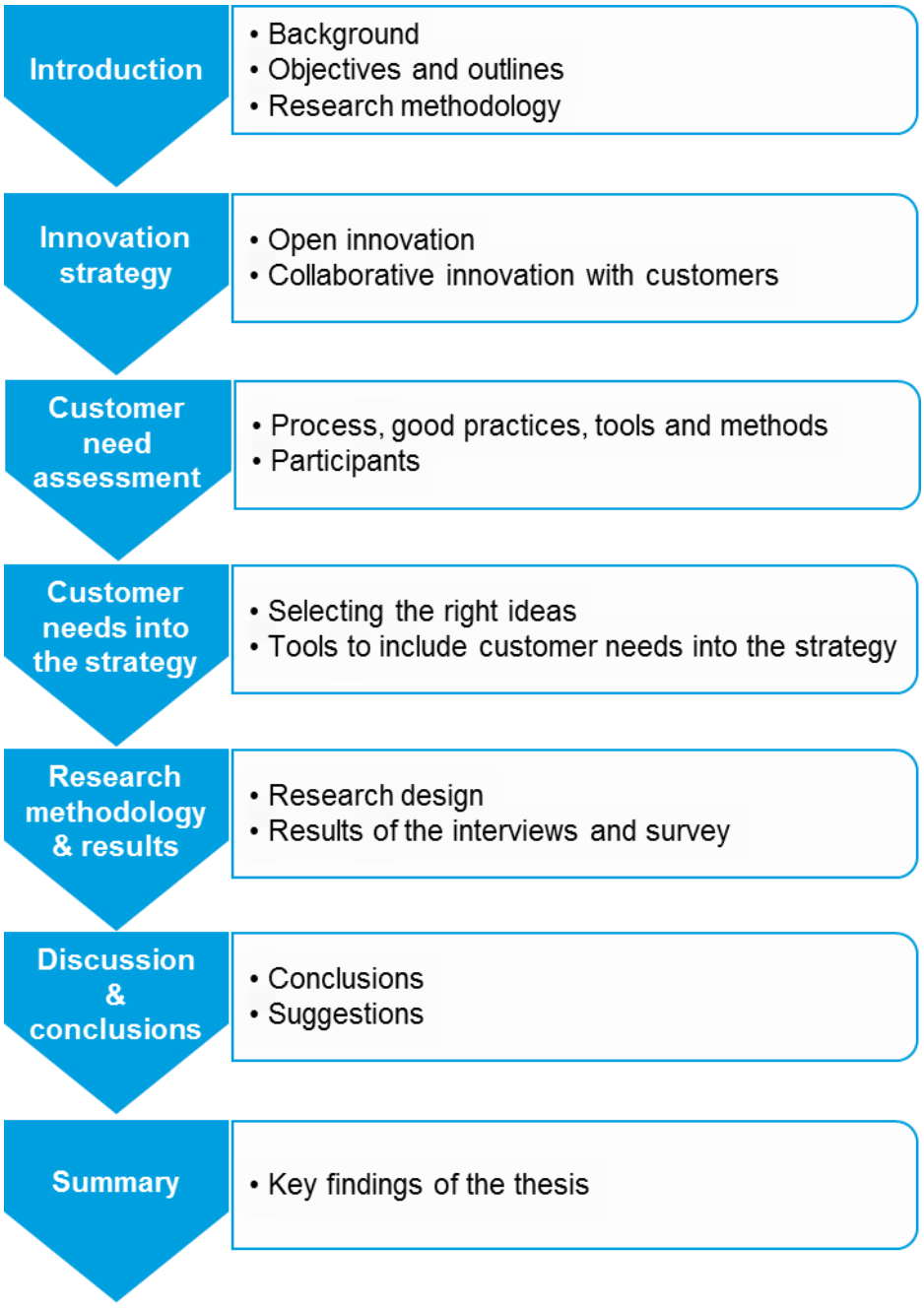

Figure 1. Structure of the thesis

First, in the introduction, the background of the thesis is presented followed by the objectives with research questions and outlines of the thesis. Then the research methodology is presented. Next the literature review section of the thesis begins with innovation strategy literature, open innovation and one branch of open innovation in particular: collaborative innovation with customers. In the following chapter the process, best practices, tools and methods for customer need assessment are studied, along with assessing which customers and participants would be the most suitable for the customer need assessment activities. Then the thesis focuses on literature related to selecting and including the right ideas into the innovation and R&D strategy. This concludes the theoretical part of the thesis and starts the empirical section where the research design is first presented, followed by the results of the interviews and the survey analyzed together with the insights from the literature. After this conclusions are drawn from the thesis- Finally the key findings are presented in the summary.

2 INNOVATION STRATEGY

The ultimate goal of a company's strategy is to be able to understand how it can create sustainable competitive advantage. Often, however, in today's highly competitive and innovative environment, competitive advantages can disappear quickly. In order to be able to survive in competition, it's essential to involve innovation aspects into strategic management. (McGrath & Kim, 2014, p. 397)

Nowadays companies are more involved in sectors with services and products with short life cycles. These are often more vulnerable to competition because of lower entry barriers and higher risk of substitution. One of the most important factors in order to remain competitive will be the ability to create innovations systematically. It is also important to abandon and exit exhausted opportunities so that resources can be re-purposed for other innovation opportunities. (McGrath & Kim, 2014, p. 403, 408)

Companies can be focused on technology or market forces (Morgan et al., 2009). The resource-based view sees that a company consists of portfolios of specific assets and its strategy is driven by these assets. Market-based view, on the other hand, focuses on market opportunities that require a company to adjust its strategy according to market developments. Often companies tend to focus on one of these rather than focusing on a more balanced strategy of utilizing both. However, it seems that companies that balance both technology and market forces equally, are achieving higher innovative results, since their technologically driven innovations are targeting clear markets with enough potential. (Lattuch et al., 2013; Leker et al., 2007, p.198-199)

Companies have to be able to innovate and offer customers exactly what they want (Kumar & Phrommathed, 2005, p.130). Innovation cannot be developed without the understanding of market behavior and its response (Santos-Vijande, et al., 2013). For long-term prosperity, in addition to meeting today's customers' needs, a company has to innovate to create new customers and the means to satisfy their future needs (Berthon et al., 1999). According to O'Cass & Ngo (2007) innovativeness is an antecedent and not a consequence of market orientation.

An explicit innovation strategy is important for a company for several reasons. It provides guidelines for strategic issues such as which markets to enter and skills to develop (Lester 1998). By strategically planning the projects, a company will be able to benefit from synergies between parallel innovation projects, optimize the use of resources and improve competitive position (Hall & Nauda, 1990). Learning-by-doing helps companies to benefit from the previous innovations that have been successful along with their skills that result from them (Rothwell 1992; Aagaard, 2012).

Portfolio management is an important aspect of innovation strategy and management. It assesses R&D projects or activities or even whole business units to balance between risks and returns, as well as stability and growth. (Igartua et al., 2010) Companies that pursue market exploration, seeking new information and new markets, are taking more risks than those focusing on market exploitation, seeking market information that matches with current market experiences (Kim and Atuahene-Gima 2010). The right balance depends on the company's ambitions, competence, vision and culture (Igartua et al., 2010). When company's innovation strategy focuses on both incremental and radical innovation, the profits from the former finance the latter (Zirger 1997). Project portfolio planning has been proven to add the skills of R&D teams, since the teams involved in several projects simultaneously have been more successful than the teams that have been involved in only one project at a time (Kleinschmidt and Cooper 1995 according to Aagaard, 2012). (Aagaard, 2012)

In turbulent markets where customers, their preferences and competitors change often, it can be wise to develop part of the new product portfolio that is different to company's core business. This way company is ready with several alternatives if the markets change or cease to exist. Taking a broader perspective to innovation might also help to notice and prepare for the entry of new competitors. (Leker et al., 2007, p. 92, 94) However, focusing on just the most essential projects and having clear strategic goals helps employees to act in a creatively and innovative manner (Martins & Terblanche 2003).

Innovation takes a lot of resources and it is unpredictable and uncertain by nature. It has been recognized that innovation rarely happens in isolation and the roles of actors in today's competitive business environment are becoming more dynamic. Companies can regard their customers as being key contributors to their R&D strategy. (Greer & Lei, 2012) Searching and adapting new knowledge from outside the company has always been an important strategic activity for innovative companies, but in recent years the focus of innovation has changed from inside the firm to the network of actors outside the company (March 1991; Kogut & Zander, 1992; Chesbrough, 2003, p. 10). The main reasons that have contributed to the locus of innovation moving outside the company are that the knowledge required for innovation is more and more complex and also the speed required to implement has accelerated significantly. Required speed and knowledge are usually out of reach of internal capabilities of even the most innovative firms. It is also often too costly to maintain in-house expertise in all relevant fields. As studies have shown, radical innovations are more likely to emerge when professionals from distant branches of science are brought together (Hargadon & Sutton, 1997). Networks provide the flexibility and

speed required for success and this is why innovation strategies are adopting inter-organizational focus. (McGrath & Kim, 2014, p. 408-410)

2.1 Open innovation

Chesbrough introduced the term open innovation in 2003 and since then it has been widely adopted and used in academia and by companies. Innovation capabilities are not restricted by the boundaries of the organizations, but open innovation extends to other stakeholders as a whole. In open innovation, projects may enter or exit at various points and in various ways of the innovation process. The projects can originate from internal or external sources and they can also be launched from either of these sources. (Chesbrough, 2012)

Open innovation can be seen as a search process. It is possible to utilize various sources of knowledge as different sources provide different information. More search channels lead to more innovative companies, but it is important to spread the attention wide enough to perform well. (Laursen & Salter, 2006) The likelihood of new inventions increases even more if there are knowledge flows between companies with different, but related knowledge (Alexy & Dahlander, 2014, p. 452). Oftentimes the source of innovation is not the company itself, but the user or supplier. (Alexy & Dahlander, 2014,p.449, 445-446)

Many or even most of radical innovations are made by individual inventors, start-ups, university researchers, or as a part of government programs. Established companies are more often focused on improving their existing technologies. Often companies don't have the skill to focus on both radical and incremental innovation, especially simultaneously. Open innovation can be a useful way to explore new technologies for established companies to create both incremental and radical innovations (Dodgson, et al., 2006), since it helps companies to focus on new areas which would otherwise be too uncertain to focus (Dodgson, 2014, p. 466). (Alexy & Dahlander, 2014, p. 452-453)

2.1.1 Types of openness

The type of openness varies among actors utilizing open innovation. Dahlander & Gann (2010) created a matrix, which is presented in the figure 2 below, that categorizes the flow of knowledge and type of exchange. (Alexy & Dahlander, 2014, p. 444)

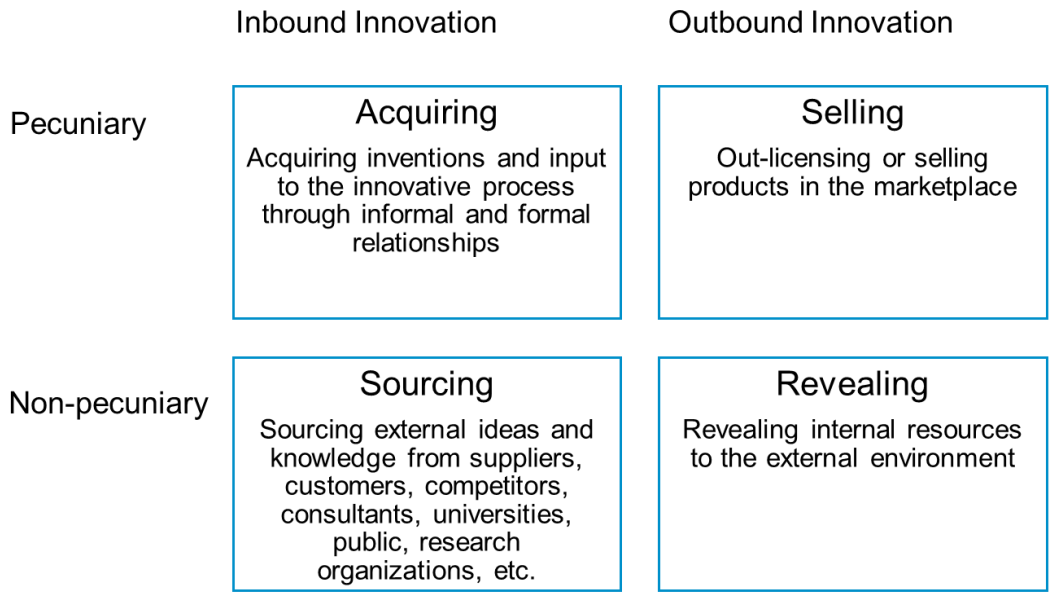

Figure 2. Overview of types of openness (Dahlander and Gann, 2010; Alexy & Dahlander, 2014, p. 455)

Acquiring is about buying inputs to the innovation process from the outside of the company. The difficult part is to find out how to use acquired knowledge with internal expertise to search and then review potential inputs. (Alexy & Dahlander, 2014, p. 445) Sometimes it is cheaper to license or buy technology from outside than to develop it in-house (Arora et al., 2001 according to Alexy & Dahlander, 2014, p. 445).

Sourcing is about how companies scan and use their external environment in searching inputs for the innovation process. A lack of assets like skilled employees, cash, or machines and equipment can reduce options for a company to choose (Chesbrough, 2003 according to Alexy & Dahlander, 2014, p. 445-446). Laursen & Salter (2006) stated that both too much and too little openness can be harmful for the company. (Alexy & Dahlander, 2014, p. 445-446)

Selling is the type of openness where a company sells or licenses their technologies and inventions to external actors. Companies can have valuable inventions unused and other more suitable companies might be willing to pay for those. (Alexy & Dahlander, 2014, p. 446)

Revealing proprietary knowledge is beneficial when diffusion creates more value (von Hippel, 1988). A company needs to evaluate when it is advantageous to reveal information and when it is not (Henkel, 2006). Company can reveal some information while still gain competitive advantage using other parts of their business (Chesbrough, 2006 according to Alexy & Dahlander, 2014, p.

446-447). Sharing information can lead to generation of standards which in turn might increase the size of the market (von Hippel, 1988, p. 88). (Alexy & Dahlander, 2014, p. 446-447)

Above listed types of openness are often combined in use, e.g. a company is often revealing and sourcing ideas from the environment. Exchanging knowledge in the network of actors allows organizations to benefit from the other's improvements which leads to faster product development and higher success rates. (von Hippel, 1988; Dalle and Jullien, 2003; Alexy & Dahlander, 2014, p. 447) In this research, the focus is on sourcing, and more specifically sourcing from the customers.

2.1.2 Challenges in open innovation

There are also challenges associated with open innovation. Some of them are internal and some external to the firm. Perhaps the best recognized challenge is the 'not invented here' syndrome, where employees reject innovations from the outside because they challenge the ideas inside the company (Katz & Allen, 1982). The syndrome is often a result of repeated failures with external collaboration (Alexy et al., 2012). The syndrome is also caused by fear that working with external partners will make employees look bad and even risk their jobs. It has been found out that less-skilled employees are often more against open innovation than better-skilled ones, who have better ability to recognize and work with external knowledge. (Alexy et al., 2013; Alexy & Dahlander, 2014, p. 448)

Especially companies that are leaders in a technology often find it hard to find partners that can add value to their innovation process. Also, identifying suitable partners in rapidly changing technology environment and companies that have matching knowledge for the problems a company is facing can often be difficult. Company has to identify what is the best place to search for partners and solutions. For some problems it can be one specific company and for other kinds of problems a large crowd. (Alexy & Dahlander, 2014, p. 448-453)

One big challenge in open innovation is the management of connection process to external parties (von Stamm, 2004), since coordinating external people with different interests and who are beyond hierarchical reach is a challenging task. It is important to have a deep understanding of each other's needs in order to reach and maintain agreements with partners. (Alexy & Dahlander, 2014, p. 454-455)

Legal aspects are important to consider in open innovation. Usually it's easier to exchange innovation when there are strong legal mechanisms in place to define ownership of intellectual

property (Alexy & Dahlander, 2014, p. 451-452). Otherwise companies might be very cautious about who to share their knowledge with. However, openness is crucial if companies are to benefit from open innovation. (Yström et al., 2015)

It is not beneficial for the company to rely too much on open innovation and external partners because this way the innovation performance can become too dependent on them. (Alexy & Dahlander, 2014, p. 455)

2.2 Collaborative innovation with customers

Only very few companies today can innovate without collaboration of any sort (Dodgson, 2014, p. 462). Customers are important sources of information in the innovation process and this was confirmed in Eurostat's innovation statistics, where 26 % of the companies thought that customers' value is high, only 12 % thought that competitors' importance is high as a source of information for innovation. Universities' or other high educational institutes' importance was considered high by only 6 % of the respondents and only 4 % thought that government's and public or private research institutes' importance was high. (Eurostat 2015)

There are also always risks and uncertainties associated with innovation activities. (Dodgson, 2014, p. 462) von Stamm (2004) stated that innovators collaborate to share risk and cost which are often directly linked to each other. The more risky and innovative the project is, the more open companies are for collaboration in innovation process. Collaboration can even reduce risks and uncertainties since it can help making sense of rapid changes and in building shared expectations and approaches to innovation challenges. Developing for example shared technology standards reduces the risk that company's products are not compatible with emerging platform structures. Selecting the right partners to collaborate with when developing new standards, however, is an important decision. (Dodgson, 2014, p. 466, 470)

Collaborative Innovation with Customers (CIC) falls into one stream of open innovation (Gianiodis et at., 2010). It is not as comprehensive as open innovation, since it involves the processes by which firms and customers engage in mutual innovation, but it doesn't involve broader open innovation issues of acquisitions or divestitures. (Greer & Lei, 2012)

Customers can be great help in product development and they will also be more likely to commit fully to product when they are allowed to make changes to it (von Hippel, 2001; Jeppesen & Fredriksen, 2006). Knowledge co-created with customer appears to create most value through its customization to specific project tasks and its moderate originality. This kind of knowledge is

often useful in the development of products that are familiar for the company rather than in radically new products. (Greer & Lei, 2012) However, co-creating with customer can work as promoter and tester during the commercialization of products, and companies can benefit from practical, hands-on knowledge to ensure a timely and successful launch for the product (Nambisan & Nambisan, 2008). CIC is even more important in business-to-business markets than business-to-consumer markets (Santos-Vijande et al., 2013). Collaboration is a great way to tap into complementary knowledge that is not written down in documents, but is tacit within individuals (Mowery & Grodal, 2005; Dodgson, 2014, p. 465). Collaboration with customers and openness to innovation are essential for a company to gain knowledge about customers which will in turn lead to improved performance and competitive advantage (Fidel et al., 2015). Furthermore, Santos-Vijande et al. (2013) showed that customer participation improves loyalty, customer satisfaction and added value, which have positive effect on business results like sales and market share. Payne et al. (2008) noted however that the ability to learn from customers and to engage in CIC depends on the quality of customer relationships.

Processes are needed in order to integrate customer in CIC. Processes for information acquisition help to overcome challenges, such as customers' inability to express their needs and problems encountered with a product, and limiting effects of their real-world experience. (Franke & Piller, 2004; von Hippel, 1988, p.102; Greer & Lei, 2012).

2.2.1 Successful innovation collaboration with customers

First step in successful collaboration is to establish a clear need or benefit for the collaboration. Next step is to define a vision or goal to indicate what the collaboration should achieve. Win-win deal for all parties is the best initiative for whole-hearted participation in collaboration. These aspects ensure real buy-in and commitment for the collaboration. Management and reporting structures, resources and responsibilities must be well-defined to help in managing expectations and avoiding conflicts. How intellectual property is treated should be decided to avoid conflicts. The timeframe to indicate if the collaboration is for the duration of a project or a certain period of time is important to define. It is also reasonable to prepare exit scenarios for example about what happens to people involved in collaboration after it has finished, and what to do with the assets if the collaboration ends in divorce. (von Stamm, 2004)

Senior management has to support collaboration in order for it to be considered serious and that it attracts the best people. The focus in collaboration must be in the people and not in the technology since the trust of all participants must be won and maintained, and everyone should

be convinced of the mutual benefits. (von Stamm, 2004) Successful collaboration requires (von Stamm, 2004): trust, empathy (Greer & Lei, 2012), respect, support, clarity and, fairness.

Mutual trust is important in any collaboration and it is considered to be critical for innovation with customers (Brockhoff, 2003). Working with customers with whom there is mutual trust, for example long-time partners, can be helpful in managing risks of CIC (Enkel et al., 2005). In order to create innovations, continuous personal interactions are often needed in knowledge transfer (Alexy & Dahlander, 2014, p. 456). Often, the collaboration starts between individuals, and over time, inter-personal trust has to evolve into inter-organizational trust so that the collaboration is not dependent only on individuals who might move to a different company and thus end the relationship. Building trust also improves learning from partners and protects against opportunistic behavior (Kale et al., 2000). (Dodgson, 2014, p. 474; Greer & Lei, 2012) Sometimes a confidentiality agreement can help in forming trust with the customer (Kärkkäinen et al., 1995, B2 p.4-5).

Empathy, as seen as organizational values of caring and helpfulness, is important for sustainable collaboration with customers (Etgar, 2008; Kelley et al., 1990). Empathy is reflected at the organizational level when highly personal relationships are focused on identifying and satisfying customers' individual needs (Lei & Greer, 2003). Empathy and understanding how customers feel help companies gain deeper understanding as well as enables them to gain knowledge about customers' experiences about products or services (Lei & Greer, 2003). (Greer & Lei, 2012)

2.2.2 Selecting the right customers for collaboration

Selecting the right partners is critical in achieving benefits from customer collaboration in new product development (Campbell & Cooper, 1999). The objective of the collaboration determines which actors are the most suitable partners. Although in almost every collaboration, it's beneficial to have complementary cultures. In partner selection it's important to consider partner's resources, capabilities, and their culture and traditions, as well as their record as a collaborator. (Dodgson, 2014, p. 473-474)

Companies should use different customers in co-creating activities. One key question in innovation management is about having a small amount of deep collaborations compared to a large number of shallow ones. The challenge is to find the right balance between building cohesive, long-term partnerships, and being open to new ones. (Dodgson, 2014, p.471) Granovetter (1973) argues that strong ties often communicate information with limited value, and weak ties are more likely to provide useful novel knowledge. Regarding product

development, it has been noted that weak ties help in searching for innovation opportunities and strong ties help in the transfer of complex knowledge (Hansen, 1999). It has been noted that people with diverse set of weak ties are better prepared to create radical innovations (Elfring & Hulsink, 2007). On the other hand, weak ties are less useful for mobilizing resources and transferring tacit knowledge. Strong ties that have trust overcome these disadvantages, but they sometimes suffer from inertia and lock-in (Maurer & Ebers, 2006). Mahr et al. (2014) found out that close relationship between the company and customer fosters the creation of relevant knowledge at low cost, but it doesn't appear to have a significant effect on novelty. Often companies favor long-time customers because of mutual trust and easy access to them (Alam, 2002). Rosenkopf et al. (2001) noted that informal collaborations often filter and lead to more formal ones over time.

Having access to a wide group of external partners is beneficial when companies can focus on a few of them (Alexy & Dahlander, 2014, 456). Usually more partnerships lead to more knowledge and potential innovation (McGrath & Kim, 2014, p. 412). Furthermore, a broader network of partners that don't offer obvious direct economic benefits can lead to even bigger network, and greater diversity in company's partners will enhance company's absorptive capacity and it's capability to adapt in new environments. Mahr et al. (2014) suggests that to benefit from trustworthy relationships and customers' innovativeness, companies should not seek one customer with both qualities, but multiple customers with either of these qualities. Chesbrough & Appleyard (2007) noted that large networks are expensive to maintain and that expanding the size of the innovation network will only increase innovativeness up to a certain point. (Dodgson, 2014, 469, 470-472; Zahra & George, 2002)

Establishing and maintaining the right relationships and alliances is the key for a company to be able to stay in competition. One important question is what kinds of partners a company should have in its network to create competitive advantage. Selecting partners in mature technologies, though, is relatively easy (Alexy & Dahlander, 2014, p. 452). Generally companies should seek for partners with skills that compensate the lack of knowledge in own organization. Innovations made with prominent and highly reputed companies are perceived favorably within the company's network (Podolny & Stuart 1995) and because of this, more high-status partners want to join the network. This suggests that a high number of partners is not necessarily a strategic advantage and it can even harm the perception of an innovation, if they reflect low quality to other actors in the network. (McGrath & Kim, 2014, p. 412; Alexy & Dahlander, 2014, p. 453) Sometimes a company

looking for partners may have to invest in internal R&D before it is allowed into a collaboration network (Nelson, 1991; Alexy & Dahlander, 453).

Abrell et al. (2016) found out in their research about the role of users and customers in digital innovation in business-to-business markets that customer knowledge is an important source for short-term and incremental innovations, but not as much for long-term and radical innovations. They suggest that users are better sources for future needs which can lead to radical innovations (Abrell et al., 2016). Users can help to create unexpected and innovative products, but they are also a valuable source of feedback and ideas for the company (McGrath & Kim, 2014, p. 410-411). According to Chatterji & Fabrizio (2012) in medical device industry, inventions that utilized user knowledge were better diffused and had greater impact.

2.2.3 Communication channels in collaborative innovation

Managers should be able to select adequate communication channels for different situations since the outcomes of communication process greatly depend on the communication channel used. The channel can alter the meaning of the message and influence the results of the communication. (Moenaert & Souder, 1996) Communication channels have at least two key abilities: richness to transfer the message comprehensively, and reach to reduce geographical and temporal constraints. Knowledge creation requires the use of nonverbal cues, for example facial expressions and body language, and opportunities for immediate feedback (Daft & Lengel, 1986). For this reason communication is more comprehensive through personal and ad hoc discussions, and this also reduces misunderstandings that can be usual during innovation process because of the novel knowledge (Moenaert & Souder, 1996). Tacit knowledge is best delivered in personal and rich face-to-face channels of communication, for example in personal meetings, interviews, and workshops, since it's difficult to articulate and codify into text format (Ganesan et al., 2005). Face-to-face communications have positive effect on novelty of co-created knowledge. But they can also accentuate familiarity of the customer's and company's relationship to an extent that it inhibits the creation of unexpected insights. (Mahr et al., 2014)

It may sometimes be beneficial to select communication channels that allow the sender and receiver to be in different locations and communicate at different times (Ganesan et al., 2005). These kinds of bit-to-bit channels, for example email, reduce temporal and monetary efforts that are needed for setting up meetings, harmonizing the schedules of participants, and travelling especially with close customers (Mahr et al., 2014). Bit-to-bit channels have high reach, but they lack in richness. They cannot transfer complex messages, which are ordinary especially with lead

users, very well, and it can evoke misunderstandings which take time to resolve (Ganesan et al., 2005; von Hippel, 1986). However, close customers can have a shared language, trust and goodwill which help in the correct understanding. Voice-to-voice channels are in between of face-to-face and bit-to-bit channels as they offer immediate feedback, but do not transfer nonverbal cues. Phone calls are often used to obtain details that complement company's own knowledge (Alam, 2002).

All of the channels have their advantages and disadvantages in the creation of knowledge. Face-to-face is the most suitable to support creative, complex, and iterative process of creating novel knowledge. Bit-to-bit communication channels are cheap and efficient to use. Voice-to-voice communications are useful for example when project members have to clarify some rather simple things. Different communication channels are used with different customers and situations since it affects the relevance, novelty and cost of the information created. (Mahr et al., 2014)

2.2.4 Challenges in collaborative innovation with customers

There are some known issues occurring during the interaction process of collaborative innovation with customers. Listening to customers too closely can lead to over-customization of new products and services. If a product or service is too much customized to one customer's specifications and if that customer won't buy it in the end, the new product or service might fail. (Alam, 2002; Alam, 2013) Lead users have high expectations of the benefits of new innovations, and when such expectations are not present, customers are not likely to attend CIC again (Enkel et al., 2005; Franke et al., 2006). It can even be dangerous to be too customer-led, since customers are normally notoriously lacking in foresight in producing new technologies and products (Hamel & Prahalad, 1994). Also, focusing only on own customers can lead to missed opportunities to gain new customer bases with other technologies if the needs are different than the current customers' needs (Abrell et al., 2016). (Kärkkäinen et al., 2001)

Other problems that can be faced in CIC are that the customer's ideas are not always feasible (Magnusson et al., 2003), they do not always know what they really want (Simonson, 1993), companies lack ways to interact with the customers, customers do not have enough time and knowledge (Ulwick, 2002), input is not practical or it is far from the organization's capabilities (Alam, 2002) and the results might just increase costs, but not the competitiveness (Campbell and Cooper, 1999). Unrealistic expectations are the main reason why knowledge creation with customers fail and this is why managers have to be aware of its opportunities and challenges (Greer & Lei, 2012). Intense relationships between the supplier and the customer (Cova & Salle,

2008) and excellent communication during the development process (Bettencourt et al., 2002) help to overcome these problems and create higher innovation rates and added value.

Managing collaboration sets challenges for a company since it can be unstable and troublesome, and the ownership of the results might spark disputes. Confidentiality is a major issue since customer interaction includes transparency in part of the firms (Alam, 2002; Alam, 2013). This is why managing collaboration greatly affects its success. In general, the more different the two companies are, the more difficult and costly will transferring ideas, practices and structures be (Phillips, 2014, p. 495).

It is not rare that collaborations face tensions and disruptions. Lokshin et al., (2011) stated that 30-50 % of the collaborations fail and some of the failures can even lead to recriminations between partners. Three conflicting forces have been identified by Das & Teng (2000) to develop in collaborations: cooperation versus competition, rigidity versus flexibility, and short-term versus long-term orientation. Lokshin et al., (2011) found out that there tend to be less problems in collaboration when the aim is to develop new products, new markets or improving product quality, than when focus is on jointly exploiting cost efficiencies. (Dodgson, 2014, p. 470)

3 CUSTOMER NEED ASSESSMENT

Successful innovations fulfill customer needs and create value, but the challenge is to identify and understand these needs (Kärkkäinen et al., 2001). Customer need assessment refers to the gathering, structuring and analysis of useful information on customer needs (Kärkkäinen et al., 2001b). The information is useful when it's in a form that can be easily communicated, and persons who need and use it consider it useful and trustworthy (Adams et al., 1998; Kärkkäinen et al., 2001). A thorough understanding of customers' real needs and early assessment of hidden and future needs is essential for successful new product development (Kärkkäinen et al., 2001). Several studies have shown that product development projects are more likely to succeed if they are based on carefully defined customer needs rather than just on new technological opportunities (Rothwell, 1992). Working directly with customers greatly helps in creating innovative products and services (Hohmann, 2007, p. 15). Effective fulfilling of also customers' unrecognized needs is a way to significantly improve customer satisfaction, which in turn leads to higher level of customer loyalty and increased market shares (Kärkkäinen et al., 2001).

Customer needs have hierarchical structure as among the general needs are more specific needs. General needs provide directions for strategic product development whereas more specific needs give more precise targets for development teams. (Takai & Ishii, 2010) According to Kärkkäinen et al., (2001) Holt et al (1984) divided needs into existing and future needs. Existing needs are easy to assess since they are of conscious nature. However, they can also include unarticulated needs, which have not been recognized by the customer itself. These latent or hidden needs are according to Ulrich & Eppinger (1995 according to Kärkkäinen et al., 2001) needs that many customers see important in the final product, but do not or are not able to communicate in advance. These kinds of needs can be assessed by gaining deep insights into potential classes of customer benefits (Kärkkäinen et al., 2001). Future needs do not exist at present, but will exist in the future. These are particularly important in long product development projects where origination to market introduction takes several years. Asking the customer in a straightforward manner about their future needs is not always an easy way of assessing those needs. It is common that customers are not able to clearly express what they need and they might often demand technical features and solutions in which they are seldom experts. Users' insights into new product needs and solutions are also limited by their previous experiences and their opinions are bound to products they already know which means that users steeped in the present are not likely to create new and extraordinary product concepts (von Hippel, 1988). It is also common

that customers highlight their short-term problems instead of their long-term needs (Kärkkäinen et al., 2001; Holt et al., 1984).

3.1 Need assessment process

Kärkkäinen et al., (2001b) presented a need assessment process which consists of six phases. At first, a company has to define their starting situation and the goals of the need assessment in order to be able to select the right tools and the right extent for the need assessment operations. Next step is to collect customer need data from various sources. The data is often not very precise and in clear form, so it must be structured illustratively and then analyzed. In addition to customer data, also data about the competitive situation has to be collected as competition affects the competitive advantage (Hakanen, 2004, p. 104-105). With all this information, it is possible for a company to set development targets for product concepts and attributes. These targets have to align with the company's own objectives and strategies. The last phase is to manage product development so that the targets will be achieved. (Kärkkäinen et al., 2001b)

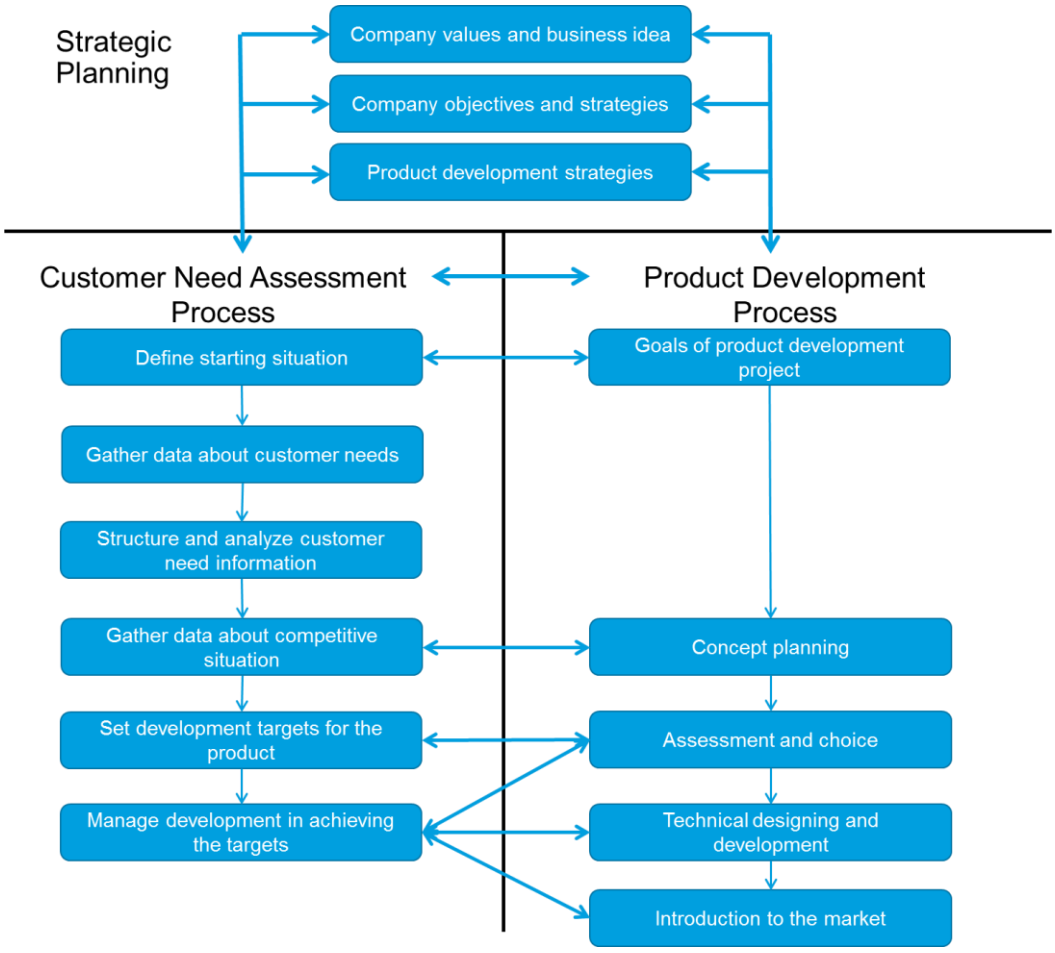

Figure 3. The links between customer need assessment, product development and strategic planning (Kärkkäinen et al., 2001b)

In practice, customer need assessment is not as linear as it is pictured here in the figure 3 and sometimes some of the phases don't have to be used, some phases might be used multiple times, phases might be used in different order, or the phases might be used at the same time. The figure 3 above illustrates the connections between customer need assessment, strategic planning and product development processes, as well as the phases in these processes. (Kärkkäinen et al., 2001b) In the following chapters, the phases of the need assessment process are being described in more detail.

3.1.1 Defining the starting situation

At the beginning of the need assessment process, a company should define the starting position by finding out (Kärkkäinen et al., 1995, B1 p.4):

1. Who are the customers?
    a. Whose needs are taken into account?
2. Who are the competitors?
3. What are the company's competitive means?
    a. Quality or price?
4. What is the scale of the development process?
    a. New product or improvement of the old one?
    b. Resources, schedule?
5. What customer needs and competitor information are already known and what more has to be known?
6. Which tools are used to gather the missing information?

The answers for the first four questions are defined in strategic planning when product development goals are being set. However, these are useful to go through at the beginning of customer need assessment process. Strategic planning and the goals of product development steer the customer need assessment process. For example, when a company is developing a completely new product, they should carry out a wide customer need assessment which looks also into customers' new needs. But when they are developing an existing product, it might be best to focus on customers' problems and customer satisfaction. (Kärkkäinen et al., 1995, B1 p.4)

When the starting situation is defined well, it is possible to plan customer need assessment in line with the goals of product development and the state of the present knowledge. The objective is to get a clear understanding about the starting position for customer need assessment and its objectives by collecting all the relevant information the company has about the customer needs and presenting it in a clear format. This also includes a description about the markets and the most important customers. Defining starting situation guides to do the right things in customer need assessment. (Kärkkäinen et al., 2001b; Kärkkäinen et al., 1995, B1 p.8, 17)

3.1.2 Collecting customer need information

The customer need collection process should be able to listen to customer and guide the customer to give information about the things that affect customer satisfaction (Kärkkäinen et al., 1995, A2 p.5). The objective is to collect need information for both short-term product development to increase customer satisfaction and long-term product development to increase competitiveness (Kärkkäinen et al., 2001b). It should also be clear what questions to ask and what will be done with the answers in order to be committed for next steps when the answers for required questions are provided (Hohmann, 2007, p. 10).

Customer needs can be collected in workshops with customers (Hohmann, 2007, p. 10). Having direct contacts to customers is important in order to understand the customer and to clarify the specific needs (Majava et al., 2013). Many customer needs are similar which means that they can be grouped in order to reduce the needs into small amount of representative needs (Takai & Ishii, 2010). This helps in aligning product development with customer needs. The collection of customer needs should be conducted in a positive manner while not allowing direct criticism (Kärkkäinen et al., 2001b). A team taking part in the workshops should consist of selected customers or users and company representatives. It is essential to work efficiently in groups, since group work is a great way of promoting common understanding, communication and commitment. A group understands problems and catch errors better than individuals, group has more knowledge than any individual and a group can combine that knowledge and create new knowledge (Turban & Aronson, 1998 according to Elfvengren et al., 2004). Group work can also promote communication of need information both within the company and with the customers. Carrying out customer need assessment in a group that consists of representatives from different functions of the company and the customers that are participating in defining the product, developing them, or are affected by them leads to fast and direct connections between product development and customer need assessment, and great usefulness of the results of the need assessment. (Parkinson, 1982; Alam, 2002; Kärkkäinen et al., 2001b) Having close interaction between the experts of both needs and solutions can effectively help in achieving innovative results. (Kärkkäinen et al., 2001b) The more people are participating and interacting, the more committed they will be to decisions, which in turn leads to improved results. (Elfvengren et al., 2004; Kärkkäinen et al., 2001b) Everyone's opinions should be brought out democratically as also this commits them to achieved results (Kärkkäinen et al., 2001b).

Customers must be encouraged to describe, organize and select their most important requirements, and customer need analysts should not select and interpret customers' comments,

ideas or requirements to suit their own ways of thinking, which is, however, quite usual (Kärkkäinen et al., 2001b). This way the selection of less important signals and misunderstandings can be avoided and it also minimizes the chance of information changing inside the company (Majava et al., 2013). It should also be ensured that there is a common language between the companies, so that different persons in different companies understand the same terms and words in the same way. This promotes communication inside the company and with the customers. (Kärkkäinen et al., 2001b)

It is important to be able to systematically handle information or expertise that is qualitative and even intuitive, because a great part of need-related information is not very explicit, especially the information about trends, future needs and competitors. Qualitative information promotes understanding whereas statistical data is not always very helpful in understanding real customer needs and their backgrounds. (Kärkkäinen et al., 2001b) Qualitative methods also help in strengthening customer relationships and building empathy (Hohmann, 2007, p. 10).

People carrying out need assessment should be able to carefully listen to the customers, since this helps in taking into account and to understand customers' backgrounds, values, business problems and opportunities, and to notice unspoken concerns. (Flores, 1993 according to Kärkkäinen et al., 2001b) The facilitator should help all the customers participate in the workshops in order to get feedback from everyone. The facilitator also follows the time usage of the meeting. (Hohmann, 2007, p.31) Customers' requests should not be responded during the workshops as this might decrease the quality of the information collected in the workshops and the plans can easily change later which is not easy to explain to customers. Reporting of the workshop is done after the meeting and the results are then distributed to the participants. (Hohmann, 2007, p.19) The most important thing is to let customers know that they have been heard, their input is valuable and action will be taken according to the information gathered (Hohmann, 2007, p.40).

Asking for and collecting also new and wild ideas might help in discovering new and hidden needs (Kärkkäinen et al., 2001b). Latent customer needs can also be obtained by involving customers more in the innovation process for example by presenting partial solutions to them Kristensson et al., 2008; Kärkkäinen et al., 1995, A2 p. 12). This way the concept can also be adjusted according to customers' opinions. Especially in service innovation, where patenting ideas or concepts is difficult, presenting concepts to a customer requires relationship based on trust. Also, involving customers in the implementation phase of new service is used very much, because this motivates

customers to explain their wishes and needs, and innovation can be adjusted accordingly before implementation. Testing the service allows companies to monitor how customers use the service, why they use it, and what problems occur during the service. (Kärkkäinen et al., 1995, A2 p. 12)

It is important that the need assessment process ensures that all important information on customer needs will be assessed by the customers themselves and inside the company. This is why systematic and competent methods and tools are required in need assessment. (Elfvengren et al., 2004; Kärkkäinen et al., 2001) Customer needs should be structured after they have been gathered in order to be better able to focus on essential matters and avoid collecting lots of scattered information (Kärkkäinen et al., 1995, A2 p.5).

3.1.3 Methods for customer need assessment

There are several methods for assessing customer needs in the workshops with customers and each have their own benefits. Creative methods and principles of creativity can help to question both the customers' and the company's present, traditional ways of thinking and this way assist in bringing up new ideas and customer needs (Hall, 1996; Kärkkäinen et al., 2001). In the research by Kärkkäinen et al. (2001) about the assessment of hidden and future customer needs they found out that important sources of new customer information were co-operation with lead customers and lead users, free-form customer contacts, analysis of customers' customers and other customers' stakeholders, company's own participation in standardization instances, and predicting changes in different laws and regulations. The methods that were in regular use in the assessment of new customer needs in the companies taking part in the research were statistical marketing research, brainstorming and scenario methods. Companies that were familiar with and had utilized the methods seemed generally very satisfied with the methods in the assessment of new customer needs.

New types of systematic methods, such as lead user analysis, and practical tools like Group Decision Support Systems (GDSS), as described in the next chapter, are essential in customer need assessment and new product development (NPD) of industrial products. (Elfvengren et al., 2004; Kärkkäinen et al., 2001b) It is often so that if customers are asked what they want, they are likely to ask for everything. (Alam, 2013) This is why it is more beneficial to try and understand what the customers value and what outcomes they would like to achieve or problems to solve (Ulwick, 2002).

Lead users

In rapidly changing new technologies customers might not be able to envision radically new products and therefore it is hard for the company to clarify new customer needs. Lead user analysis can be a suitable method for identifying customer needs when those are difficult or essential to clarify. The lead user method is based on an idea that just a few users have the richest understanding of new products and services for which there is demand (Herstatt & von Hippel, 1991). Lead users are a small group of people whose present needs will become commonplace in the future markets. They can have a lot of useful information on future customer needs and also solutions for those. Lead users face more extreme conditions and that is why they require, and help in creating, breakthrough solutions and products. (Lilien et al., 2002) Satisfying the needs of lead users can bring significant benefits for them (Urban & von Hippel, 1988). (Elfvengren et al., 2004) Kärkkäinen et al. (2001) found out in their research that lead customers and lead users are very important sources of new customer information for companies in business-to-business environment.

Involving customers with lead user characteristics is a way to increase the novelty and relevance of co-created knowledge (Mehr et al., 2014). von Hippel (2005, p.139-140) found out in his research conducted for 3M, which compared product development success between concepts that involved lead users and concepts that did not, that product concepts created with lead users were significantly more novel and successful than the ones created with non-lead user methods. The product concepts were also addressing more original and newer customer needs, had significantly bigger market share, had greater potential to be developed into a new product line, and be more strategically important. Furthermore, the concepts developed with lead users had 8 times bigger projected sales estimation in 5 years than the concepts created with non-lead user methods. Lead user involved methods created major new product lines whereas non lead user methods created mainly incremental product improvements.

Companies can tap into this information by maintaining close cooperation with lead users. However, lead users are rare and tracking them requires a lot of work and often only a few of them can be involved in innovation process at the same time because of coordination constraints (da Mota Pedrosa, 2012). von Hippel (2005) suggested that because lead users have typically no reason to contact the manufacturer that might benefit from their innovation, companies should seek lead users also outside of their customer list. And there is also a risk if a lead user cooperates with the company for a long time, it may assimilate which might increase knowledge overlap and decrease the probability of very novel ideas occurring (Mehr et al., 2014).

Mahr et al. (2014) found out that involving lead users into customer co-creation of knowledge does not increase the cost of the information created. They also found out that the costs of finding lead users and benefits gained from them follow a curvilinear graph, meaning that a medium level of lead user characteristics appear to invoke the highest costs. If lead user's or customer's and company's relationship is close, it fosters the creation of knowledge that suits project activities well and that is achieved with low costs.

Customers in different regions can have different needs which makes it difficult to take everyone's needs into account. Customers might be in different regional or national contexts and even on different stages of technological development, but they still expect innovations that are perfectly suitable for them. The lead market approach suggests focusing customer interaction on those areas which are likely to be ahead of international demand trends. It has been noted that technical designs preferred by lead markets becomes later the globally dominant design. (Cleff et al., 2008)

Group decision support systems

A GDSS facilitates formulation and solution of problems by a group of people combining communication, computers and decision support technologies (DeSanctis & Gallupe, 1987). In practice, GDSS is a network of computers in face-to-face environment and software which allows participants to exchange comments and votes (Aiken et al., 1994; Kraemer & King, 1988 according to Elfvengren et al., 2004). GDSS supports group decision making by eliminating communication barriers, offering the group various tools, and managing time usage and by systematic handling of meeting items (DeSanctis & Gallupe, 1987). GDSS improves the productivity of decision-making process and improves the quality of the resulting decisions (Ellis et al., 1991). It also reduces process losses associated with regular group decision making by reducing disorganized and unfocused activity, the dominance of one or a few members of a group, and the consequent inhibition of other members and social pressures (Finlay & Marples, 1992; DeSanctis & Gallupe, 1987 according to Elfvengren et al., 2004). GDSS is far more usable in promoting cooperation and effectiveness than regular meetings because it (Elfvengren et al., 2004):

- enables parallel communication among participants,
- helps in eliminating domination of participants and offers equal and anonymous opportunities to share ideas and opinions, which assists in collecting in-depth knowledge from all participants,
- enables to quickly find out which opinions are supported by group members and which are not,
- helps in managing meeting's schedule and agenda,

- provides effective automatic electronic documentation which speeds up the distribution of information to the participating organizations a lot and makes it much easier to carry out further actions based on the results achieved in the session,
- increases commitment to rapid solving of problems discussed in the meeting.

In a study by Elfvengren et al., (2004) they found out that GDSS is very suitable for assessing customer needs. They also found out that combining lead user approach with GDSS process can be very promising method for customer need assessment. GDSS helped the lead users to consider the future perspective of customer needs and it can also help in gaining in-depth understanding of customer needs. By rating the customer needs, participants can see which needs are the most important for the customers and discussion can be focused on those. Standard deviation can illustrate if there are major opinion differences within the opinions of the group. (Elfvengren et al., 2004)

The following chapter presents a workshop model for customer need assessment utilizing GDSS. The group participating can consist of lead customers or other customers and a group of company's representatives.

A GDSS meeting can be organized in multiple different ways, but Elfvengren et al. (2004) described a useful process for the workshop in their work. The meeting has to be planned carefully before the actual meeting and it is also good to ask some of the participants to take part in the planning phase. The goals and agenda for the meeting, how the session will go and what tools need to be used have to be determined in the planning phase. The actual workshop starts with an introduction of the participants, tools, agenda and activating the participants. This phase can take around an hour. Next up is the idea brainstorming phase where the goal is to create customer need information, ideas, problems and development requirements with the participants. Time needed for this phase is around 15-30 minutes. Next the ideas are clarified and specified which helps in getting mutual understanding about the ideas and creates a list of ideas in well-specified and clear form. Here the participants can comment and clarify the ideas they have shared. This phase is over in 90-120 minutes. Then ideas are categorized so that similar ideas are grouped together. In this phase the participants can express their opinions and arguments about the ideas. This phase should take around 30 minutes. Next the ideas are evaluated and their benefits are explored. This takes roughly 60 minutes. After this the ideas are prioritized by voting which creates a prioritized list of categorized ideas according to specified criteria. Time needed for this is around 45-60 minutes. Finally participants can be asked to evaluate the workshop, its benefits, problems and development needs. The overall duration of

the meeting is around seven hours. After the workshop the results have to be analyzed and delivered to the selected managers. In the figure 4 below, the general process of the workshop is illustrated.

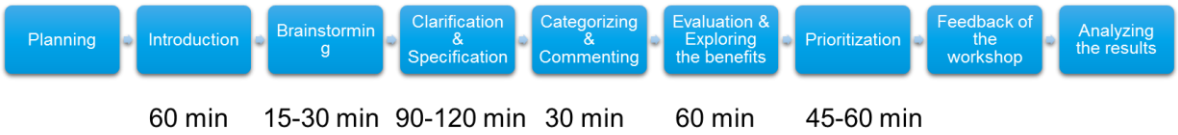

Figure 4. GDSS workshop model for customer need assessment

The customer company's representatives, or lead users, that are most suitable for GDSS session are expected to have (adopted from Elfvengren et al., 2004):

- profound knowledge and understanding of their industry
- strong influence on the company's investment decisions
- understanding of the possibilities in the industry
- capability for creative thinking

GDSS workshops are more time-efficient than normal workshops, like the creative group interview presented in the following chapter, because ideas are entered directly into the system instead of writing them down and moving to a wall (Ackermann & Eden, 2001). Elfvengren et al. (2004) found out that the focused discussion on the important customer needs and on the major opinion differences were regarded as very useful and interesting by the GDSS session participants. It is also a good way to ensure that the customer needs are understood in the same way by different persons and it also produces deeper common understanding of customer needs. They noted that the quality of the results of a GDSS session depend greatly on the roles and the experience of the GDSS facilitator (technical) and a session chairman (non-technical, problem-owner). (Elfvengren et al., 2004)

There are also some limitations in GDSS which should be considered before a meeting. A GDSS is often used for groups bigger than seven members and for tasks that involve information sharing (Aiken et al., 1994). Too small groups do not benefit sufficiently from GDSS and too large groups may face challenges in handling of large quantities of data (Dennis & Gallupe, 1993). A group should also practice verbal discussion, since body language and other forms in verbal meetings are not present in written text (Aiken et al., 1994). Ackermann & Eden (2001) noticed that pairing the participants for computer work had positive benefits in the form of social communications. It is also good to note that typing is often slower than speaking, which makes communication speed per person lower than in ordinary meeting. (Elfvengren et al., 2004)

It can often be challenging to arrange a session where both customer and company representatives from different functions are present and participate for several hours. The process should be time-efficient and it should consume as little time as possible, this way all key persons are more likely to stay committed to provide the needed information. Many participants involved in the study of Elfvengren et al. (2004), however, were pleased to see that GDSS sessions brought significant time-savings in the customer need assessment. GDSS sessions can also save time, since they focus strictly on issues at hand. In ordinary meetings, commenting other's opinions can lead to long conversations and delays whereas in GDSS commenting is organized in writing electronically which often helps to avoid delays. (Elfvengren et al., 2004)

Creative group interview

In creative group interview, a group of company's and customer's representatives from different departments cooperate in order to reach a common, broad-structured view of the customer's needs and demands. It requires a lot of people and time so it's usually possible to use only with the most important customers. Creative group interview combines group work and creative problem solving to find out customer's improvement needs. Based on these needs, the group will figure out the requirements that the customer places for the company. One great benefit of this tool is that it opens up direct communication to the customer, and often to many representatives of the customer company. The conversation should be directed to deal with the aspects that are important regarding the customer's needs. (Kärkkäinen et al., 2001b; Kärkkäinen et al., 1995, p.8-9)

Facilitator should preferably be a person who is not dealing with that customer a lot so that the facilitator is not leading the participants to a certain direction. There should be participants from different functions of both companies and the meeting should last for about three hours. (Kärkkäinen et al., 1995, B2 p.4-5)

The workshop starts by having everyone think development targets and problems that the customer has and the focus should be in the future, for example 5 years into the future. Everyone should come up with at least 5 ideas in around 3-4 minutes time. Next step is to form pairs where in each pair there is one person from each company. Then the pairs are asked to go through their ideas and choose 3 most important things and each of those are written to an A4 paper which will be placed on a wall. Every pair should then present their chosen ideas and explain why they chose those. Next the pairs should choose 3 most important things among all of the ideas presented by marking a plus on the paper and only one of the selected ones can be their own. The pairs should

explain their selections to other pairs. Next similar improvement ideas and problems are grouped together with the ones that have the most plus marks on the top. All of this should be done in 45 minutes. (Kärkkäinen et al., 1995, B2 p.6-8)

Then everyone is asked to individually think about the requirements that the customer has especially in the future. Everyone should come up with at least 10 ideas in 5 minutes. Participants should link the requirements to the improvement ideas from the previous phase. Giving participants more time helps getting more and more novel ideas and at the end participants will be asked to come up with at least one wild idea that might not be even possible to create with current technology. These wild ideas are the ones that might help in creating something totally new. (Kärkkäinen et al., 1995, B2 p.8)

Next pairs are formed again and pairs choose 5 most important requirements with at least one that is wild one. These requirements are written on A4 papers and listed on the same wall as improvement ideas and problems in the earlier phase that are moved to side. Requirements can be only once on the wall and if another pair places the same requirement on the wall first, the other pair has to choose another one. Next each pair chooses 2 best requirements from their own ones and marks plus on those. Then pairs have to present and explain their requirements and how those connect to the earlier improvement needs and problems. After this, pairs are asked to choose three best requirements from other's requirements and mark those with plus marks and then explain the reasons for these selections and how they connect to improvement needs. Finally pairs get to give one extra plus to one requirement that has not got enough attention. This phase should take 40 minutes. (Kärkkäinen et al., 1995, B2 p.8-9)

Next similar requirements are grouped together. The grouping should be started from the requirements that got the most plusses. These requirements can be put as headlines for groups and other ideas will be place under these. Then the group should think, at least about the headlines, what are the needs behind the expressed requirements. This helps in gaining deeper understanding about the customer. This takes around 30 minutes of time and after this phase it might be good to take a little break. (Kärkkäinen et al., 1995, B2 p.10)

Participants should check if they have some good ideas in their idea list, but which are not on the wall. Next pairs are formed again so that everyone gets a new pair and the pairs will go through the ideas and decide which both think that should be on the wall. Then facilitator asks if there are any new ideas for first group of ideas on the wall and so forth, and pairs present their ideas and other pairs get to think which group would be the best for the idea and if the idea should be on

the wall at all. There might be need to create new groups during this phase. Next participants are asked to go through the grouping and discuss about the possible errors. Then pairs get to give stars from 1 to 3 to highlight the importance of the groups that they think are the most important. This phase is over in 35 minutes. After this the wall is ready and it is time to plan the following actions that take place after the workshop. There should be at least a couple of actions to be decided right after the workshop and also the schedule for following actions should be decided. Persons in charge should be named from both companies that can work on the results of the workshop. The results should be documented and delivered to all participants quickly after the workshop so that everything is still fresh on everyone's heads. (Kärkkäinen et al., 1995, B2 p.10-12)

Affinity diagram

Affinity diagram is one of the most widely used grouping methods among product development teams as they try to identify representative customer needs from large amount of customer needs for new products and services (Takai & Ishii, 2010). Affinity diagram and other group support methods can actively involve the persons who possess customer need information and help in forming a common picture of important customer needs, and to foster communication about and commitment to results (Kärkkäinen et al., 1997; Kärkkäinen et al., 1999 according to Kärkkäinen et al., 1995, C2, p.3-5). Affinity Diagram, which is also called KJ method, helps in creating and grouping ideas or facts, and in customer need assessment, it can be used in collecting and structuring customer need information (Kärkkäinen et al., 1995, C2, p.3-5). It is also useful in mapping already known customer needs at the start of the customer need assessment process. In a workshop, the first task is to define the problem and then participants are asked to write down facts, opinions or ideas on small pieces of paper. When there is enough ideas, papers with similar ideas are collected into groups. This makes participants think how ideas relate to bigger picture. Then these groups are named so that it describes their contents. It is wise to think the causations of the groups because it helps in focusing the efforts on the right problems. Next the participants get to rate the most important groups which will then be taken into closer examination. Affinity diagram can also be used for just grouping the ideas or needs which can be helpful in clarifying large and complex issues. (Kärkkäinen et al., 1995, C2, p.3-5) Here the needs are placed on a wall and if the need is similar to the needs on the wall, it will be placed near that and otherwise it will be placed apart. This way similar needs will get grouped together and the groups will be named after a representative need. (Takai & Ishii, 2010)

Other methods

Problem detection studies, where data is collected from customers about the problems they have with current products, help in quantifying problems in a category or area, and this can lead to big product innovations. It's easier for the customer to identify the problems that need to be solved rather than offer solutions to those problems because they are not good at expressing their needs (Ulwick, 2002; Alam, 2013).

Structural studies examine the benefits and product characteristics that the customers want. Consumers can be asked to rate the current benefits they get from the product and the characteristics they desire. (Chay 1989)

One approach to customer interaction is called an outcome-based approach. Under this approach, customers are asked to suggest benefits and outcomes that the product or service would bring rather than focus on ultimate solutions. After the outcomes have been collected, they should be categorized into groups according to the steps of the process that the customer needs to do with the product or service. Then the customers should rate the importance of the outcomes and how well the outcomes are currently satisfied. The outcome-based approach can also identify customers' latent and unarticulated needs because it encourages customers to suggest ideas that are extraordinary (Ulwick, 2002).

Consumer idealized design means involving customers in the design of new goods or services (Cincianntelli & Magdison, 1993 according to Kaulio, 1998). The idea is to get customers creative and to forget existing products and ignore the feasibility of the designs. This results in a new design, list of requirements, and a record of reasons for design choices. Facilitator guides participants towards their ideal solutions and away from their perceived obstacles. Customers' job is to identify and articulate their basic requirements and to actively find solutions to their own problems and requirements. (Kaulio, 1998)

Observation of customers and their behavior might be better way to identify their needs and choices than interviewing them, since customers can be less reliable in face-to-face interviews. This is also a way to identify unstated and unspoken customer needs and predict differences between what customers say and what they do. (Alam, 2013)

In service innovation, front-line employees are part of customer interaction and thus they can provide important inputs for the innovation process (Cadwaller et al., 2010). Front-line employees are able to proactively collect, analyze, disseminate and act on information about the customer.

Alam (2013) found out that front-line employees, such as tellers, who have close relationships and regular contacts with customers, can even point out the customers that would be the best fit for interaction. There should be a culture of idea hunting and front-line employees should be motivated to search for new ideas among customers. (Alam, 2013; Chan et al., 2010)

3.1.4 Structuring and analyzing customer need information

Customer need assessment creates and collects a large amount of data and the company must be able to analyze it correctly (Goffin & Lemke, 2004). Collected customer need information can be in different forms and it can contain partly separated pieces of knowledge, and for this reason the customer need information has to be structured and analyzed. Structuring customer need information focuses in finding the relevant bits from the collected information, finding out connections between the issues, and emphasizing the essential pieces of knowledge. (Kärkkäinen et al., 1995, p.5) This can lead to factors behind the needs, to customers' hidden needs and to radical innovations (Goffin & Lemke, 2004; Kärkkäinen et al., 1995, p.5). The analysis about customer needs should focus on requirements of usage rather than product features that could solve a specific problem (Kaulio, 1998). This is an important phase since customers are rarely able to articulate all the needs directly, but they might give hints about them with their attitudes, wishes, opinions, beliefs, values and strategies. If possible, structuring and analyzing the customer need information should be done together with the customer. (Kärkkäinen et al., 1995, p.5)

The trace matrix for business chains assists in describing complex business chains and tracing back requirements for the company also from the remote customer's stakeholders and trends. This can be used after customer need information has been gathered by using for example creative group interview or interviews. The voice of customer interpretation table assists in analyzing customer's demands, opinions, attitudes, values and strategies in order to find the actual needs behind them and consider the criteria that the customer uses to evaluate suppliers. This is a useful tool because industrial customers often articulate their requirements in technical terms, but this helps to discuss and clarify the real requirements that lie behind. Customer's comments are collected to the table as they express them an then those are converted into customer needs (Mazur, 2015). (Kärkkäinen et al., 2001b; Kärkkäinen el al., 1995, B4 p.3; Mazur, 2015)

Trace matrix for business chains is a table that has different stakeholders on the diagonal and stakeholder's dependencies of each other are illustrated on the other squares. Stakeholders are placed on the diagonal so that the material flow goes from bottom left towards the top right corner of the table. Special attention should be placed on defining stakeholders since they are not

always very obvious. If there are some stakeholders that are not part of the actual business chain, those will be placed after the participating parties on the right. When there is something coming from the stakeholder, it will be placed on the horizontal line of that stakeholder. And things that are coming to a specific stakeholder will be place on the vertical line of that stakeholder. This means that the area on top of the diagonal has the needs coming from the end of the business chain and the area below the diagonal is the area for properties that the company is offering to its customers. The below area will be filled as new properties that are useful for the customer are found and developed during product development. In addition, outside area of the table can also be utilized. In the figure 5 below an example of the trace matrix for business chains is illustrated. (Kärkkäinen el al., 1995, B4 p.3-7)

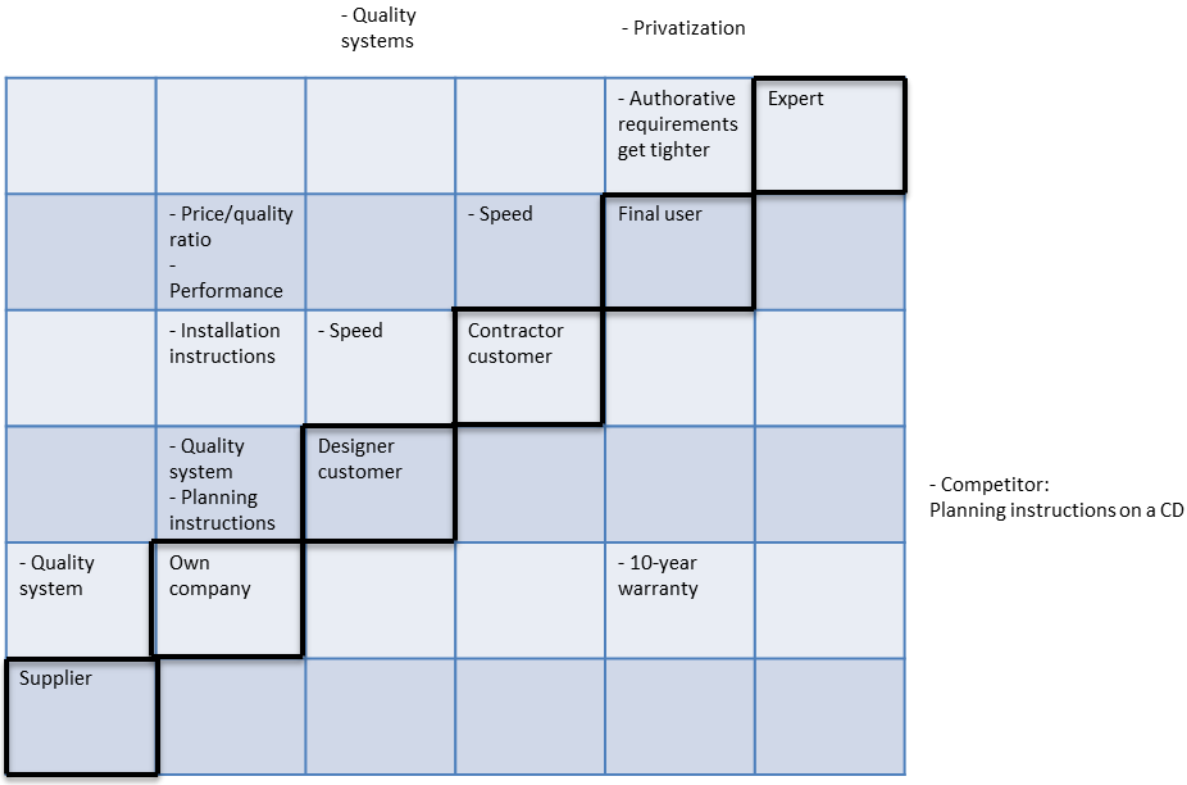

Figure 5. Simplified example of the trace matrix for business chains (Kärkkäinen el al., 1995, B4 p.3)

The useful information regarding to different stakeholders' needs, requirements, problems, trends or development needs are then listed on the matrix. Especially important is to focus on the things that affect the company or the products that are going to be developed, and to focus on the future aspects. The factors that affect the stakeholders, but are not clearly originating from other mentioned stakeholders are marked on top of the table, on top of the stakeholder affected.

Trends for example can be marked here. The factors that are coming from other stakeholders than in the table are marked to the right from the table. These are mainly customer needs, demands and problems from other stakeholders. These are marked on the same row as the stakeholders, where these originate. To make the matrix more visual, different colors can be used for customer needs, problems, trends and development objectives. Only the most important things are marked to the matrix and as the matrix gets filled, the least important things can be dropped off. (Kärkkäinen el al., 1995, B4 p.8-9)

3.1.5 Gathering data about the competitive situation

The current competitive situation has a great impact on target setting for fulfilling customer needs and development goals of new products so innovation and R&D activities are steered also according to competition (Hall & Nauda, 1990). Customer is the best expert of the competitive situation so it's wise to combine information gathering about customer needs and competitive situation. The most important factors about the competitive situation are the most important competitors, the importance of all the customer needs, and company's position compared to competitors when considering the most important customer needs and the development goals set for these needs. All of these answers should be collected from customers to ensure a reliable image of the competitive situation and to set realistic goals for product development because customers might see things differently than the company itself. (Kärkkäinen et al., 1995, p.6; Kärkkäinen et al., 2001b)

3.2 Continuous customer need assessment

Customer needs are dynamic, which means that they change over time. This makes product development difficult because if customer needs are studied in the beginning of innovation process and the process takes for example three months, the customer might prefer other things than at the beginning. Ideally the development of new products should be based on customer's needs at the market introduction and during product consumption. For this reason collecting customer need information should be continuous and systematic activity (Kärkkäinen et al., 1995, A2 p.5; Chong & Chen, 2010). This way the need information is accumulated gradually and it helps in getting right and unbiased information about customer needs as fast as possible. Iterative process also enables to challenge, question and clarify customer input and requirements until they make sense and successful services and products can be developed (Joshi & Sharma, 2004; Lynn et al., 1996). (Kärkkäinen et al., 2001b) On the other hand, a study by da Mota Pedrosa (2012) states that companies should not involve customers in the development phase of innovation process for successful innovation performance. A possible explanation for this is that

already at development stage companies tend to know the current customer needs and searching for more creates only additional costs (da Mota Pedrosa, 2012).

If customer need assessment and product development are conducted at the same time and in connection to each other, customer information is less likely to get lost, and it serves the product development better (Kärkkäinen et al., 2001b). The voice of customer should be continuously delivered into manufacturing decisions (Griffin & Hauser, 1993). However, the main focus of the customer need assessment should be in the beginning of the product development process because this way product development can focus on the essential things from the beginning (Kärkkäinen et al., 2001b).

After the launch, it is important to follow how the goals set for the product for example market share, customer satisfaction and customer loyalty are reached in order to stay on track what the customers are thinking about the products and services and if they stand out from the competitors' products and services and to further develop the product (Hakanen, 2004, p. 122; Kärkkäinen et al., 1995, A2 p. 12). Companies should continuously follow how the targets are achieved in the market to be able to improve and develop the product immediately. It is also a way to learn more about the customer and improve customer need assessment process. The results of customer need assessment from every phase should be documented and in the end companies should think what went well and what areas could be improved next time. (Kärkkäinen et al., 1995, A2 p.7-8)

3.3 Need assessment in business-to-business environment

Need assessment tends to be different whether the product is for industrial or consumer markets (Holt et al., 1984 according to Elfvengren et al., 2004). For example, in industrial markets, there are often strong relationships between manufacturers and customers, and direct personal contacts with key customers are important sources of information about customer needs. Because of the small number of customers and the complexity of the products, the statistical methods that are commonly used for analyzing consumer markets are usually not the most useful for need assessment in industrial markets or assessing hidden or future needs. Industrial companies often pursue close cooperation with their customers in order to gain profound knowledge of the customer needs. All the available information about existing and future customer needs should be collected from various sources, and from several persons and functions, e.g. production, product development, marketing and quality, as well as functions that are often overlooked e.g. sales, marketing, R&D and aftersales, within the customer. In large

organizations, needs of the departments and functions often differ from each other. All of these have to be clarified and considered in product development, but usually it's challenging and often for example buyer's opinions may dominate. (Kärkkäinen et al., 2001b; Elfvengren et al., 2004; Leppälä 2014, p. 172)

In business-to-business industries the chains of customers, customers' customers and other stakeholders can be very complex, and everyone's opinions and needs should be considered in product development. Customers' needs can originate from distant customers' stakeholders' needs and stakeholder-affecting trends by different long and complex ways and patterns. New trends may raise needs that have not yet been recognized by the customer (Chay 1989). When the company understands the background for the customer's needs, they are able to understand and predict changes in needs and requirements more easily. Customer needs and requirements can be identified by carefully and systematically analyzing such trends and their impacts. (Kärkkäinen et al., 2001; Kärkkäinen et al., 2001b; Chay, 1989)

Industrial customers may have very general needs, like improving productivity, and when the customer realizes that the supplier may be able to help in achieving this, new customer needs may be created. Customer can be helped to realize that the supplier can help it by studying and questioning the customer's ways of thinking its business and by providing information about new technological opportunities. (Virkkala et al., 1994, p.28-13) (Kärkkäinen et al., 2001)

3.4 Challenges in customer need assessment

Common need assessment problems are that companies have too few contacts between the company and the customer, and difficulties in spreading the information about the customer inside the company (Kärkkäinen et al., 2001b). Also individuals with strong personalities or persons in higher positions can affect the product specification process too much which leads to less useful product specification and it will often cause specification changes later in NPD. It is difficult to find customers' future needs and if the time-horizon of need information is too short, it can cause specification changes. (Kärkkäinen & Elfvengren, 2002)

Customer needs can be assessed from sales and marketing, but this information is often too short-term and it may also lack information about important unrecognized needs. It is common that new requirements are brought up after product specifications have been fixed which causes extensions in the duration of projects. And during the extended time, new changes may occur, which leads to self-reinforcing loops and even longer projects. Careful and systematic assessment of customer needs, especially hidden and future needs, can be very effective in early-phase

management of R&D. It can reduce or eliminate the described self-reinforcing loops and it might also affect a large number of common problems in management of product development. (Kärkkäinen et al., 2001)

Emerging technologies set challenges for innovation, since it's difficult to understand the nature and extent of customer needs for new products that are possible to make with new technologies (Elfvengren et al., 2004). Mullins and Sutherland (1998) stated that there are three levels of uncertainties in rapidly changing markets:

1. It's difficult for customers to articulate needs that new technology might fulfill, which makes NPD managers uncertain about new technology's market opportunities.
2. NPD managers are uncertain about how to use new technologies in products to meet customer needs.
3. Senior management is uncertain about when and how much capital to invest in pursuit of quickly changing markets. (Elfvengren et al., 2004)

The persons assessing needs in the company are usually restricted by their own personal characteristics, background and mental models, which have a strong effect on their ability to recognize hidden needs, demands and new opportunities, and to utilize the collected information in new product development. The tendency in organizations to rely on established understanding about important aspects in product development and the utilization of market information only if it suits the prior expectations can create barriers hindering the learning of market needs (Adams et al., 1998). Also, in large companies, the gap between those perceiving the needs and those recognizing technological opportunities can be long which leads to changes of need information and even parts of it disappearing in the process, and fusion between user needs and technological opportunities might be ineffective (Kärkkäinen et al., 2001; Kärkkäinen et al., 2001b).

4 CUSTOMER NEEDS IN THE INNOVATION AND R&D STRATEGY

In addition to identifying customer needs and detecting changes in them, the company needs to have mechanisms to quickly react to them. Information about customer needs and their changes should be distributed to a broad group of product development, and preferably to whole organization in illustrative form. This allows each function to monitor changing pulses in customers and adjust product development in a coordinated manner. However, proper communication of customer need information is challenging between different departments of a company. (Chong & Chen, 2010; Kärkkäinen et al., 2001b; Kärkkäinen et al., 1995, C4 p.4) Incorporating customer needs into the Innovation and R&D (IRD) strategy is a way to communicate customer need information inside the company and to guide product development activities into the desired direction.

If a market need is predicted far enough in the future, the need can be fulfilled with particular innovation. Also, a technology that is already in development can be steered to a direction that its market appeal is redirected or broadened. The role of a company is to create links between innovation and markets. (Sloane, 2011, p. 62) It should be considered which customer needs and corresponding projects would support the idea that the strategy should exploit business strengths and neutralize weaknesses as well as exploit competitors' weaknesses and neutralize their strengths. The best case is to play in a healthy growing industry with a strategy that is based on company's strengths which are hard for competitors to acquire or neutralize. (Aaker, 1995, p.146)

Strategy should be updated when new relevant information is available (Leppälä, 2014, p.132). Situations change and it is not possible to be prepared for all of them in advance. Companies should monitor predictions about the customers' future needs as the time passes because it is not certain that the needs will eventually go that way, and if changing needs are observed early enough, the strategy can be revised according to new information. (Taylor & Sparkas, 1977, p.98-100) Systematic ways of working and effective co-operation between product management, R&D and other internal stakeholders is needed to turn the needs into the right requirements and product features. (Majava et al., 2013)

4.1 Connecting strategic planning, customer need assessment and product development

The connections between customer need assessment, product development and strategic planning need to be understood in order to be able to operate successfully (Kärkkäinen et al., 2001b). The information gained in need assessment can form a basis for goals of development

projects, and concrete development targets and the targets set by customers and the competitive situation should steer concept planning and evaluation. Company's own goals, strategies, special skills, and working methods affect the targets for new products. Targets for product attributes direct the company to work with the right things especially in product development. (Kärkkäinen et al., 1995, p.6-8) Moreover, selection of the concepts should be systematically based on the information gathered in the customer need assessment. (Kärkkäinen et al., 2001b) It is important that all the relevant knowledge gained in customer need assessment is distributed inside the company (Kärkkäinen et al., 1995, p.7-8).

According to Kärkkäinen et al. (2001b) strategic planning should direct the implementation of both customer need assessment and product development. Also, the possibilities and challenges noticed in product development and customer need assessment have to be considered in strategic planning. The specific goals like schedules, available resources, and extent of developmental activities for product development projects are based on the strategies and they form a basis for the project and also define the starting situation of the customer need assessment. Clear goals must be known before starting the customer need assessment and product development in order to execute right activities. It is important that everyone involved in the development activities understand the goals clearly and similarly and that they keep them in mind during the entire development process. (Kärkkäinen et al., 2001b) Strategic planning should ensure that people do the right things in customer need assessment and product development (Kärkkäinen et al., 1995, p.10-11).

Having deep knowledge about customers' preferences helps the company to create innovations especially in highly dynamic market environments (Leker et al., 2007, p. 92-94). When technologies are changing, customer needs help in choosing and exploiting emerging technologies by linking the technologies and customers' future needs (Danneels & Sethi, 2005, p.17 according to Leker et al., 2007, p. 92).

4.2 Grouping and prioritizing the customers

It is clear that some customers' needs are more important than others'. Grouping of the customers can help in focusing the development efforts to the right opportunities. A usual way to segment customers is to create segments based on their needs, buying behavior and field of business (Hakanen, 2004, p. 42). In addition to segmenting of the customers, they should be prioritized. According to Hannus (2004, p. 140-141) it is important to be able to group customers according to their value for the company. This can be done for example by monitoring the volume

and sales. However, it is also wise to pay attention to potential customers which are not customers at all yet, or are very small customers, but could use company's products a lot. In the figure 6 below is an example of customer grouping based on realized and potential customer sales. It is important to note, however, that sales are not the whole picture of the customer relationship's value. For example profitability is often even more important than just sales.

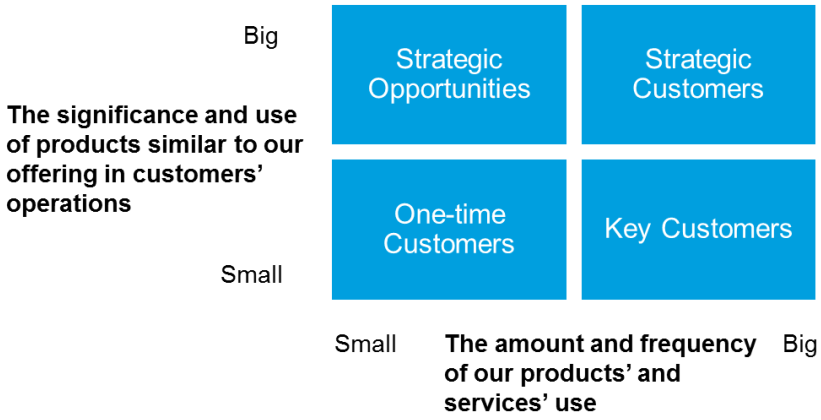

Figure 6. Customer grouping (Hannus 2004, p. 140-141)

Companies need to recognize those customer relationships that are not valuable for them neither in the short nor long term and then somehow turn those to profitable. If those customer relationships cannot be made profitable, then it is better to end the relationship and focus efforts to somewhere else. It is also possible to group customers based on how strategically important that relationship is and how easy the relationship is to replace. (Hakanen, 2004, p. 141, 192)

After grouping, the customers can be given different priorities. With strategic customers, companies need to have extensive plans about how to work with them and these should be monitored and updated continuously. Key customers should have compact plans. Strategic opportunities need to be monitored depending on their potential. Working with one-time customers should be cost efficient. This helps in recognizing the most important customers and customers with best opportunities to grow which in turn helps in focusing the efforts. (Hannus, 2004, p. 142)

4.3 Selecting the right ideas

It can be challenging to select the right ideas for development. The most important customer needs and representative customer needs can be found utilizing for example affinity diagram. These needs should be behind the ideas that are selected to move forward. (Takai & Ishii, 2010)

The ideas that promise knowledge if they fail and value if they succeed are ones worth investing in. Even if the innovation fails eventually, if the project was selected right, it still provides information about a particular business model or sector, about new technologies, and an opportunity to learn to avoid costly mistakes in the future. Innovation strategy should work as a platform for building this information that can be continuously developed. Failures are also an opportunity to recalibrate the innovation strategy so that it remains relevant to the customer needs. (Sloane, 2011, p. 172, 177) Also prioritization of development projects is important to be based on company's strategy (Hannus, 2004, p. 228). For example importance and urgency of the customer's needs are good ways to prioritize projects (Hakanen, 2004, p. 137). And after product development projects have been prioritized, go/no-go decision can be taken on focusing on customer benefit (Kumar & Phrommathed, 2005, p.136).

Companies can set strategical objectives, for example a new product for certain segment by the end of the year. However, different people within the organization might have different opinions about what are the critical things that the company must succeed in doing. The focus should be set on the most important things and the list should not extend too long. Company should not have too many objectives and it has been noted that around ten is suitable amount. (Hakanen, 2004, p. 125-130)

4.4 Roadmaps and scenarios

Roadmapping identifies relationships between products/services and markets/customers (An et al., 2016). It is one of the most widely used management techniques for innovation and strategy (Phaal & Muller, 2009) in order to integrate market and technology strategies (Vishnevskiy et al., 2015). The main advantage that roadmapping brings is in the analysis of market and product drivers and in forming a comprehensive picture of the links between technologies and products (Vishnevskiy et al., 2015). Innovation and R&D projects can be roadmapped to help in aligning research efforts with sector trends (Phaal & Muller, 2009) and in market entry timing of new products (Simonse et al., 2014). It also helps in visually supporting the dialogue and communication that is needed in developing and deploying the strategy (Phaal & Muller, 2009).

There are two main types of roadmaps: the market-driven and technology-driven. Market-driven approach places the market demand as a primary driver for R&D whereas technology-driven approach begins with technologies and then defines market needs that could be fulfilled with these technologies. (Vishnevskiy et al., 2015) Basic examples of market-driven and technology-driven roadmaps are presented in the figure 7 below.

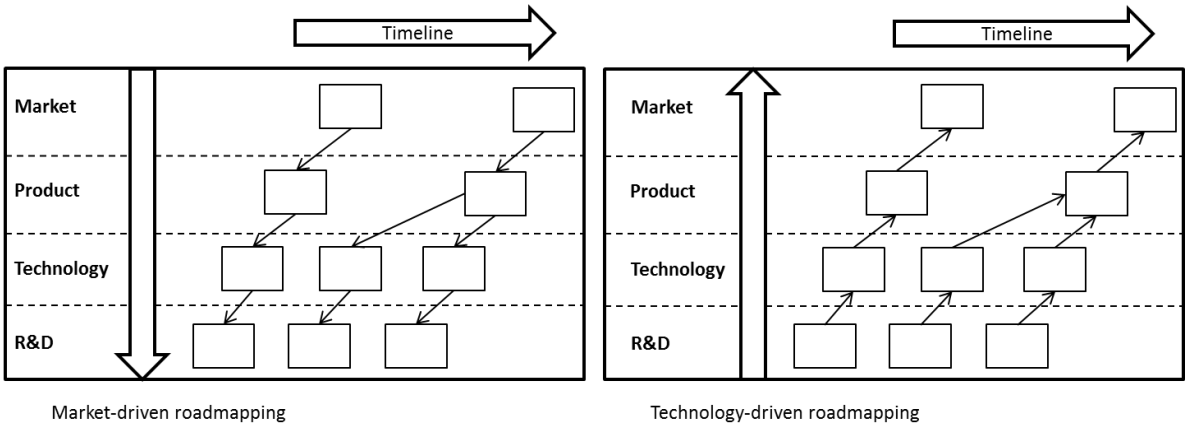

Figure 7. Market-driven and technology-driven roadmaps (Lee et al., 2009)

The market-driven roadmap can help in finding out the most promising market segments and in figuring out what kind of products should be designed in R&D. Roadmaps can basically provide the most preferred directions for innovations. (Vishnevskiy et al., 2015) And roadmapping offers the greatest help in the front-end of the strategy or innovation process (Phaal & Muller, 2009).

More specifically roadmaps can take many forms, but usually they are visual time-based and multi-layered charts which enable alignment of various functions and perspectives of an organization. They also help in figuring out three key questions: “Where do we want to go?” “Where are we now?” and “How can we get there?” (Phaal & Muller, 2009) Figure 8 presents an example of more specific roadmap like this. Phaal & Muller (2009) had an excellent example which represents the planning with roadmaps: “Key trends A, B and C will create a market opportunity D in the medium term and E in the long term, which will require the development of product F and service G, together with manufacturing system H, which means that we will need to invest in technology I and develop a strategic partnership with J”. This could represent one possible scenario that is roadmapped.

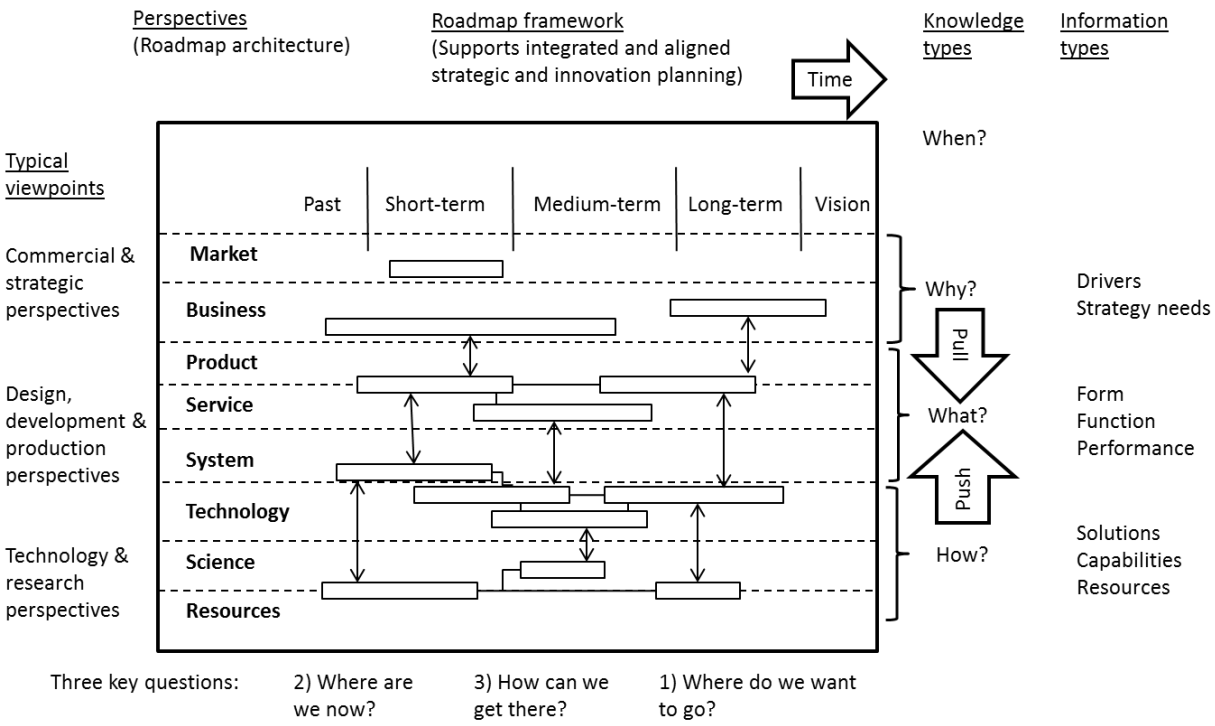

Figure 8. Schematic roadmap example (Phaal & Muller, 2009)

Figure 9 below illustrates how strategic planning takes into account different possible scenarios depending on different situations and developments in the market and technology. This kind of a roadmap is very general level illustration, but same kinds of roadmaps can be built on specific technologies, industries or even products. (Leppälä 2014, p. 141)

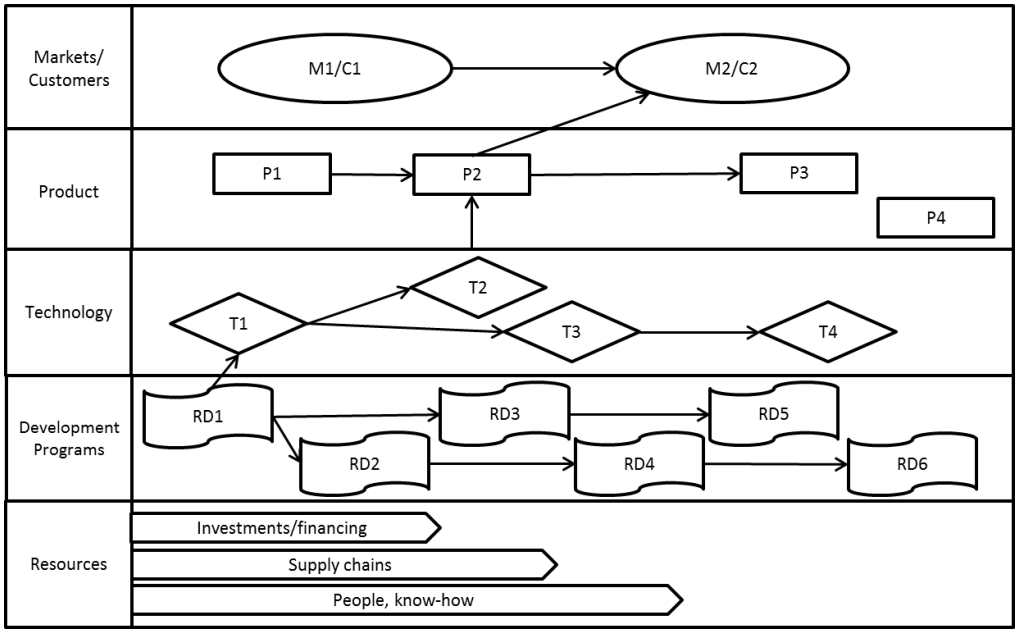

Figure 9. Strategy roadmap (Leppälä 2014, p. 141 who used Albright 2009)

The timeframe might include short-, medium-, and long-term perspectives and also aspirations or vision, but for many companies, a timeframe of 10 years is appropriate (Phaal & Muller, 2009). A great roadmap needs a group of employees in the development in order to get different perspectives (Phaal & Muller, 2009). Furthermore, a group of employees should be responsible for keeping the roadmap up to date (Gerdsri et al., 2010). Roadmapping can be integrated in annual strategic planning or even as a part of stage gates in innovation process. Roadmaps should be compatible with company's segments, but sometimes it might encourage new ways of thinking if the structure of the roadmap is different than company's other structures. (Phaal & Muller, 2009)

Future-oriented methods like scenario methods assist in the evaluation of future customer needs (Kärkkäinen et al. 2001). Companies can use scenarios to determine directions for innovation and to balance long and short term objectives (Abrell et al., 2016; Simone et al., 2014). Scenarios describe future use cases and ongoing trends to present users and to a bigger audience, they are also used to set long-term development goals for innovations. Scenarios are a way to predict in which direction customers' needs are developing in the long-term even if the customers themselves are not able to express their needs that far. (Abrell et al., 2016) Scenarios are especially suitable for analyzing those dynamics which have high importance or great uncertainty. They are not supposed to predict the future, but to analyze how different scenarios can affect. This helps to better understand uncertainties and define actions in different situations. When creating scenarios, first the dynamics of the operating environment are recognized and analyzed how important these are. Then it is possible to create and describe different scenarios. And finally, companies need to recognize different strategic options and test those in different scenarios. (Hannus, 2004, p. 211-212)

4.5 Innovation fields and other ways

One way to update company's innovation strategy and to incorporate customer needs into innovation strategy is to translate future megatrends into action fields that consist of specific areas where customer needs will be matched to different product concepts. These action fields are then used to identify innovation fields, which will be used as a background for product ideas that are developed in promising strategic areas. (Ebert et al., 2008, p.5)

Innovation fields help companies to focus their innovation efforts on pre-defined fields. An innovation field includes several innovation projects that are related under a common theme which can be based on different aspects e.g. customer need, customer group or technology. A key

benefit of the innovation fields for the company is that they bring synergies, like economies of scope, economies of scale and knowledge spillovers between related innovation projects. In addition to considering customer aspects and technologies, companies should consider their own competencies when defining innovation fields. By considering also company's own competencies, innovation fields have a much greater contribution on company's performance. Innovation fields need to have a number of large projects in order to bring good benefits. (Henderson & Cockburn 1996, p.35; Leker et al., 2007, p. 126-128, 187-189)

Customer needs can also be collected into a requirement lists and if a single customer is large enough, innovation projects can be launched based on just its needs. (Abrell et al., 2016) Studying the importance and frequency of customer needs can help in recognizing the most valuable needs for the lists (Kurtadikar & Stone, 2003).

5 RESEARCH METHODOLOGY AND RESULTS

In addition to the literature review, the improvement of customer need assessment was also studied by conducting a qualitative research in order to understand the situation and improvement needs better. A semi-structured survey was conducted for customers who have been part of product development, have participated in innovation workshops or whose needs have been utilized in product development. Suitable customers were contacted by key account managers via email and asked whether they would be willing to take part in the survey. Extensive searching of suitable customers provided seven contacts. The questionnaire, which can be found in the appendix 1, was sent to all of these seven customers and four responses were received. One respondent could not respond because of legal issues and other two did not respond to any emails. Respondents were from different positions and different companies. All of the companies operated internationally, one was a smaller company and three were large or very large in size, with revenues between 4 and 100 billion. This was a great representation of customers since the largest customers are very large and their needs are for this reason often more important than smaller companies' needs. But smaller customers can be important too, as they can for example help in creating radical innovations if they possess lead user characteristics. It was also good to have respondents from different positions and functions as they can have different kinds of insights to the subject. The questionnaire had ten questions, seven of which were open questions, in two questions respondents were asked to rate importance and explain their answers, and in one question, respondents had to rate their knowledge and describe their selection.

With the relatively low number of respondents, it is not possible to make generalizations out of the results. However, in qualitative research it is not intended to use statistical or quantitative methods, but to describe and understand a particular phenomenon (Kananen, 2014, s. 21). All of the respondents provided valuable information and insights about what they feel is important in customer need assessment process which, together with the literature review, allowed to get a direction for development of the process. Respondents had different opinions on some of the questions, but there were also things that all of them agreed or thought the same.

The respondents had different backgrounds and they had participated in different kinds of meetings with the company. One respondent had participated in an innovation workshop in the new innovation center, one had participated in technical meetings, but not workshops and one in meetings in the production site with people from different functions.

After the survey had been conducted, three of the company's product managers were interviewed to get insights to the second research question about how customer needs should affect innovation and R&D strategy. In addition, also the product managers were asked to give their insights about how to improve customer need assessment. Product managers are heavily involved in product development and all of the interviewed product managers had connections with multiple customers. This is why they have plenty of knowledge on both of these aspects and insights about how customer needs as well as innovation and research & development activities should connect in the innovation and R&D strategy.

One interview was held via Lync call whereas two others were face-to-face interviews. Face-to-face interviews were recorded so that it was easier for the interviewer to focus on the discussion. The recordings were later transcribed, compiled together and organized in logical order and groups according to subjects for analyzes. The basic structure of the interview was the same for all the product managers, but some specific and defining questions varied according to the discussion. This way the results are reliable and comparable with each other.

Also the head of new product development was interviewed at the beginning of the research discussing the basic facts about the innovation center. The business division head's insights about the innovation center were also utilized in the insights about the company's innovation center.

5.1 Company's innovation and R&D strategy

The company's Innovation and R&D Strategy is a relatively new document and has recently gone through a major updating process. At the moment, it does not directly take customer needs into account. They might be included for example in development projects, but the needs are not described in the strategy at the moment.

The innovation strategy should follow the company's vision and mission by guiding to build the project portfolio with projects that are both customer led and technologically advanced. The company's strategic orientation is leaning a lot on both customer needs and new technological opportunities.

5.2 Innovation center

The company recently opened an innovation center in its headquarters. There has been a great amount of visitors already in the center and the customers' interest has been high. The head of new product development commented that the main focus is on customers, even though other stakeholders, like universities, research organizations are also invited to visit. Innovation center is

expected to bring several benefits to the company including increased sales, partnerships, marketing benefits and new knowledge. With the help of the center, customers are expected to gain added value from the products since those are developed in cooperation during long-term product development projects. This will also make customers more attached to the company.

The head of the business division commented that the innovation center will bring opportunities to engage with key customers. The center is a collaboration space that will help in creating new ideas and customer led innovations. It also shows and strengthens customer centricity through innovation and consumer insight. According to the head of new product development, one of the main benefits of the center is that it also improves communication between different functions inside the company because people get together in the innovation center quite often. This also improves relationships both between employees, and employees and customer's representatives. Also, it is expected to significantly reduce product development times, since people from different functions are working together and everyone knows what others are working on. Furthermore, it helps to understand the customer better when the contact is face-to-face rather than email or phone calls. The head of new business development expects that the benefits gained from the innovation center will increase over time as people learn to utilize the center more effectively.

The innovation center fosters innovation by utilizing state-of-the-art equipment, and new equipment and methods will be incorporated when available to keep the space inspiring and modern. It is a lively environment where people and groups work together on new ideas. The equipment include for example a large intelligent touch screen where group work can be directed, another big screen and multiple smaller ones, multiple spots for groups with tables and chairs if a group needs to be divided into smaller groups, showcases of products, a cardboard cutter to create mockups, and also the auditorium is available for innovation center use.

Working in the innovation center is open innovation and often more specifically collaborative innovation with customers as the focus is on customers. The current innovation workshop model in the innovation center is focused to get ideas and solutions from the customers. In the workshop meetings, there are representatives from different functions both from the company and the customer.

5.3 Customer need assessment in the innovation center

New customer needs are found in innovation center in innovation workshops. However, the current method focuses more on finding ideas and solutions rather than customer needs. This is not the most efficient way of helping to create new customer-oriented innovations, since

customer is rarely an expert about new technologies and possible solutions (Ulwick, 2002) and they might be stuck in the past with their ideas which limits the value of the ideas (von Hippel, 1988). However, new customer needs might also be found in these workshops if special attention is paid in finding which features are the most important in the new concepts and what problems do these concepts solve (Ulwick, 2002; Alam, 2013; Kaulio, 1998). Though, a better model for finding new customer needs would be to utilize methods and tools designed especially for customer need assessment. And this way customers' lack of expertise does not have a negative effect on results (Kristensson et al., 2008).

In the following chapters a comprehensive picture of the customer need assessment process is given supported with information from customer survey and product manager interviews. Inviting the right companies as well as their participants and selecting the company's own representatives is the starting point. Then preconditions for successful customer need assessment are discussed. After that, the chapter is about working methods that can be utilized in workshops for customer need assessment. This is followed by a chapter stating that customer need assessment is not a one-time job, but that it should be continued throughout the product development process.

5.3.1 Customer awareness

Customers' knowledge about the new possibilities was studied by asking product managers about how much customers have been inquiring totally new kinds of products and if they have been interested about new products when those have been presented to them. According to product managers, customers have not been active in asking about radical new products, but they sometimes ask in general what the company has to offer and new ideas are presented to them. In some segments these kinds of ideas have been presented to the customers and they have been interested, but the interest depends greatly on the price of the product. These ideas have also been introduced to other segments, but they have generally not shown much interest as they have the entire infrastructure developed so well for the current products that they are unwilling to make any changes to it. This is why the required improvements for them are often quite small and product development is very closely connected to the customer. According to product managers, there could be some opportunities for these kinds of new types of products for example in smaller segments, but then the volumes would be too small for the company to provide. Customers often show interest towards these products when those are presented to them, but there are still some limitations that prevent them from adopting these kinds of new technologies just yet, the price being often the problem according to product managers. The fact that the customers have not been asking about radical new products, but they have been

generally interested in them when the possibilities are presented to them can indicate that they do not know what is possible to make with modern technology. This means that their new ideas are limited with their lacking knowledge (von Hippel, 1988).

In the survey for customers, the respondents were asked to rate their awareness regarding the possibilities and limitations of current packaging technology. The answers were varying greatly, presumably because the respondents were in different positions and functions in the companies. Two rated their awareness to be 4 or 5, but their awareness was limited to their business, industry or region. The other two rated their awareness to be 2 or 3 and the other said that she has solid basic knowledge, but would like to get more knowledge from the supplier and the other noted that they need to stay aware of the development trends to be able to respond to their customers' needs.

5.3.2 Selecting the customers

Selection of the customers which are invited to the innovation center for workshops has a great impact on the results of the need assessment. Diversity of the customers improves the ability to find valuable information from the outside sources and create innovations, but the most intense work should be focused on just a few key partners in order to keep the work manageable and effective (Alexy & Dahlander, 2014, 456; McGrath & Kim, 2014, p. 412).

Prioritization of the customers is needed in order to be able to select the key partners for the workshops. Product managers have prioritized their customers so that they can focus more on the most important ones. Some customers can be much larger in size than others and size is a big deciding factor in the prioritization which is why their needs are more important as they represent a large part of the sales. For example for one product manager one customer represents 40 % of the sales, which makes it a very valuable customer. For one product manager, large customers have also been more active in giving out their needs and asking whether it would be possible to develop their ideas. Furthermore, large customers are also good for testing the products and great partners because of the large sales possibilities.

Lead users and customers are often the most important sources of customer information that leads to novel and successful innovations (Mehr et al., 2014; von Hippel 2005, p.139-140). Two project managers had identified lead customers in their customer base. Lead customers should also be searched outside the company's customer list, since they do not necessarily need to contact companies (von Hippel, 2005). Maintaining close relationships with lead users helps in getting information from them, but cooperating too long with the same lead customer might

reduce the novelty of ideas created (Mehr et al., 2014). According to product managers, lead customers are also higher in the priority when considering product development, since they can help in finding future directions for major development directions of customer needs and they are also willing to try out new things which allows the company to get answers faster and make things move forward faster. Lead users expect high quality results and when these are not delivered, they are less likely to take part in product development again (Enkel et al., 2005; Franke et al., 2006). For this reason, special attention should be paid when working with lead customers as finding more of them can be difficult and expensive (Mahr et al. 2014). Also, product managers have identified strategic customers for example for increasing sales in a certain area, and in these situations, also other deciding factors than sales need to be considered carefully. These kinds of customers are also valuable for the company for strategic reasons.

It is important to invite both new and old customers as weak ties help in searching for new innovation opportunities and strong ties help in the transfer of complex knowledge at low cost (Mahr et al. 2014; Hansen, 1999). When new or possible customers are invited, it is a good chance to seek for new opportunities for innovations. Old customers however are great help especially in incremental product development and cooperation with them is easy. Close relationships with key customers help in achieving profound knowledge about their needs in a cost effective way (Mahr et al. 2014).

Also customers' customers and other parts of the supply chain should be invited to visit the innovation center as for example users have been noted to be even better source than customers for future needs which can be a way to radical innovations (Abrell et al., 2016). Two of the product managers noted in the interviews that they collect needs from the entire supply chain until the end user. This is important in order to understand where the needs are originating from, and to get as complete picture of the needs as possible. It also helps in understanding the background of customer needs which assists in recognizing new trends that might not be recognized by the customer and helps in predicting changes in needs and requirements (Kärkkäinen et al., 2001; Kärkkäinen et al., 2001b; Chay 1989). One product manager noted that it is important to get customer needs from the entire chain, because customer's customer might have needs that the company's customer is not able to fulfill, but the company might can, but the customer would not tell the company about those needs. Continuous interaction and having contact points to multiple steps in the supply chain and to several functions within the companies was seen important by product managers in getting comprehensive information about customer needs. Having meetings and workshops with customer's customers and end users will provide

valuable information regarding to customers' most important needs and real consumer expectations.

5.3.3 Participants for the workshop

After selecting the customers for workshops, the company has to guide them to bring the right participants for the workshop in order to achieve the best results. The results of customer need assessment are more useful when it is carried out in a group consisting of representatives from different functions of the company and the customers (Parkinson, 1982; Alam, 2002; Kärkkäinen et al., 2001b). In the survey for customers, respondents thought that it is important or very important that there are people from multiple different functions participating the workshops from both companies. Respondents thought that having people from different functions helps participants to understand the processes and what is possible and what is not. Different people were seen as important to participate because one cannot represent all the aspects alone and different people have different knowledge and experience. Respondents noted that having participants from different functions also helped to consider both technical and commercial issues which can often be quite conflicting in the development of new board grades. Especially in large companies, the needs regarding to new products can be quite different between different functions which is why it is important to have participants from multiple different functions to be able to form a complete picture of the needs (Kärkkäinen et al., 2001b; Elfvengren et al., 2004). Important functions are for example production, product development, marketing, sales and R&D (Elfvengren et al., 2004).

In the survey for customers, one respondent thought that the best way to express their needs would be to have direct personal contact with sales staff while other respondent described that direct personal contact with technical and commercial key accounts would be best. This is in line with the findings of Elfvengren et al. (2004) that these are important functions to have in the workshops. When there are a lot of people participating, it also helps in making people committed to the project as they are involved from the beginning and they have had a chance to contribute with their own thoughts (Kärkkäinen et al., 2001b). All the respondents selected the same importance for having people from various functions of their own organization, and from the organizing company. This indicates that these customers think that it is equally important that the company has their own functions well represented in the workshops as it is to have the customer's functions participating. A respondent thought that it is important to be able to ask questions from their perspective and get direct feedback from the experts. This also suggests that there must be participants from different functions as this way customers are able to ask the right

questions and the company will be able to provide answers from the specialists. This assists in all phases of the project, speeds up the process after the workshop and leads to improved results. The speed of the process increases because there is no need to wait for the responses from the specialists if they are present in the meeting.

A respondent also noted that internal and external interaction boosts innovation. Connecting people with different knowledge is a well-known promoter for innovation (Hargadon & Sutton, 1997). Groups have more and different knowledge than individuals and having people from different functions participating the meetings and workshops leads to better workshop results (Tung & Turban, 1998). A respondent thought that it is not important to have people from different functions participating the workshops, but he still agreed that all the people relevant to the subject and first steps implementation are good to have in the meetings. In customer need assessment, multiple different functions are always relevant to the subject as the needs can be different and they must be taken into account.

Respondents thought that having had previous contacts with the people participating in the workshop makes it easier for the people to express their needs. Participants are forming personal relationships and building trust between each other which has been seen as a base for building trust and better relationships between the companies which in turn leads to more open discussion and more knowledge flows between the companies (Kale et al., 2000; Dodgson, 2014, p. 474; Greer & Lei, 2012). It was also noted by respondents that it takes some time to get tuned among the participants, to get a feeling what participants want to express and how different individuals do it. If the participants are already familiar with each other, the meeting will get going more quickly than if all participants are new to each other and they have to get to know each other and how they act. This way having people that are familiar with each other might speed up the meetings.

5.3.4 Prerequisites for the workshop and collaboration

Customers noted in the survey that it is easier for them to express their needs in the workshops if there is a Non-Disclosure Agreement (NDA) in place, participants are briefed in advance and that the needs are identified in advance so the workshop can even be based on these needs. They also noted that in order for the meetings to be successful, the participants should be prepared well for the meeting. Preparing the customers in advance has been seen to speed up the meetings and improve the results (Kärkkäinen et al., 2001b; Kärkkäinen et al., 1995, B1 p.8, 17). Collaboration between the companies is easier if they are in good relationship with each other. NDA helps in

building trust between companies which is essential in customer need assessment so that the customer opens up its needs (Kärkkäinen et al., 1995, B2 p.4-5). If there is no trust, the customer will not be able to express its needs thoroughly. Trust and good relationships were also seen as important factors that help customers in expressing their needs by product managers. Both sides must agree at the beginning of the collaboration who is responsible for what, what is the schedule and expectations for the project or collaboration, confidentiality issues and whether or not the confidentiality agreement has to be signed. Collaboration between a company and its customers must have clear needs, benefits and vision about the things that will be achieved through the collaboration. It must be clear to everyone that the benefits of the collaboration are mutual so that everyone feels like it is important to succeed. When these are considered beforehand and the benefits are mutual, the collaboration has got a good chance to succeed. (von Stamm, 2004)

5.3.5 Working methods in the workshop

It is essential that the tools and methods for assessing customer needs work efficiently in groups, since group work is a great way of promoting common understanding, communication and commitment. Group work also leads to better communication of need information both within the company and with the customers. (Elfvengren et al., 2004; Kärkkäinen et al., 2001) Also customers very clearly expressed that it is good that there are a group of participants in the meetings. The tools and methods should allow customers to describe, organize and select their most important requirements (Kärkkäinen et al., 2001b).

In the survey for customers all the respondents were unanimous, even though there were no pre-defined answers, that the best way to give input about their needs was personal meetings. One respondent noted that email would be the second best way. When the respondents were asked about the keys in better anticipating and identifying their future needs for new products and services speaking with the people, having regular personal meetings with customer representatives, keeping close contact and maintaining personal contacts throughout different functions between the companies were seen as the best practices. It came also clear in product manager interviews that regular live meeting is the best way to gain customer need information. Personal meetings are the best for transferring knowledge since there is a lot of useful information for example in body language and expressions that would be missed in other communication channels like email and phone calls (Daft & Lengel, 1986; Ganesan et al., 2005). Having meetings regularly helps to quickly recognize needs as they appear and continuously follow if there are changes in the needs after, during or before product development (Chong & Chen, 2010). Regular meetings also help in building trust between the companies.

In the survey for customers, presenting company's own inventions was seen as a good starting point for workshop. This was seen important by all of the product managers in the interviews. They noted that it works as a great start for discussions with the customer if there is something concrete that they can touch and feel. Customers thought that using the final products to communicate consumers' feelings and what is needed to fulfill their expectations is a good practice for the meetings. It also makes them feel important and helps building trust which is essential in the relationship. Furthermore, presenting partial solutions to the customers can help in finding latent customer needs and it also makes possible to adjust the concept according to customer's opinions (da Mota Pedrosa, 2012).

Open communication was seen as an important success factor for the meetings in the survey for customers. A respondent expressed that a friendly atmosphere and good social relationships form the base for inspiring and productive work environment and that he has had "mostly sufficient opportunities to contribute in the workshops". The respondents liked simple communication process in the meeting instead of a model where a presentation is held first and then the participants get to ask questions. Simple and easy communication allows people to participate and to get everyone's opinions, but the facilitator should still guide the conversation so that the discussion stays in topic and the meeting does not extend too long. Criticism is not good for the meetings (Kärkkäinen et al., 2001b) so it should not be allowed and an open atmosphere allows everyone to share their opinions and thoughts about the subject.

Discussing about the company's own future plans with the customers was seen as useful for anticipating customers' needs by customers' point of view. This would help them to be better prepared for the future. This point was also recognized by product managers. But the problem was that the customers are often very interested in the company's development directions, but they are very preserved to share their own. It would be helpful for the company to be aware of the development directions that the customer is taking in order to better prepare for their future needs. One product manager considered that close cooperation with customer's management would help to overcome these issues and to get more insights about customers' future directions and that there should be meetings for both top management and in operative level for R&D people.

5.3.6 Benchmarking to customers

In the survey for customers, the respondents were also asked to describe how their company tries to identify needs far away in the future to possibly find out good ideas and practices from the

customer companies. Respondents expressed that they use internal workshops, brainstorming sessions, scenarios, get ideas from the suppliers, keep contact with customers, follow market trends and global material development trends when they are trying to identify needs far away in the future. Also different functions sharing information between each other in monthly reports, individual meetings, direct contacts with the customers, market research studies, evaluation of supplier's capabilities and strategic supplier cooperation were used in helping to find future customer needs. Scenarios provide a great way to prepare for the future by considering how the customer needs could evolve. Market trends and global material development trends help in anticipating future development of customer needs so noticing these trends from the customers in workshops is very important.

5.3.7 Problems in the workshops

People who are not willing to listen to others, have limited imagination or who do not believe that new solutions will work were seen as problems in the workshops in the survey for customers. One respondent had experienced a situation where someone was dominating a meeting with his/her opinion. As also the respondent noted, a skilled and experienced moderator can resolve these kinds of situations. Also, having a GDSS meeting instead of a regular one will help to avoid these kinds of regular meeting problems (Finlay & Marples, 1992 according to Elfvengren et al., 2004). Facilitator was seen as an important person to capture discussion points, but the facilitator should not dominate the meeting. If possible, the facilitator should be a person who is quite new to the customer so that the real needs are found and the facilitator is not leading the customer to a specific direction (Kärkkäinen et al., 1995, B2 p.4-5). Participants with limitations like budgets and due dates were also seen to be creating possible problems in the workshops.

The respondents expressed that it is not easy to differentiate real consumer expectations from marketing expectations. And one noted that there are no problems in expressing their needs, but the problem is more often that the counterpart is not able to respond to those needs either for technical or commercial reasons. This might be because the customer's ideas are not possible to make as is sometimes the situation because customers are not experts in the field (Kärkkäinen et al., 2001). Other than that, the customers did not recognize challenges that hindered them from expressing their needs in the workshops. According to Leppälä (2014, p. 174) close cooperation with the customer's functions helps in recognizing the most important needs and real consumer expectations.

One customer noted that sometimes there are situations that the company is not able to respond in the customer needs either for technical or commercial reasons. Open innovation can help to overcome the obstacles. By sourcing ideas and technologies outside, a solution might come up for a certain customer need, and it can be cheaper and faster to find those outside than to develop in-house Alexy & Dahlander, 2014, p. 445; Laursen & Salter, 2006).

5.3.8 Location for the workshop

Even though the focus of the thesis is on finding customer needs in the innovation center, it should also be taken into account that other places like the research centers and the mills could be very exciting and mind-opening places for customers to visit for an innovation or customer need assessment workshop. One product manager noted that customers like to visit the innovation center because it is logistically easier to reach than factories or research centers. She also told that customers often want to see the mills, but since those are remotely located and customers have busy schedules, it's not always possible to visit them. According to product managers, customers seem to have tight schedules and cost pressures nowadays which is why regular meetings are more difficult to have. She had not heard that customers would prefer any location over others and noted that the innovation center is a good option if customers cannot come to mills. Other two product managers, however, were very clear that customers definitely like to visit research center and the mills much more than the innovation center. One product manager told that the research center is by far the favorite place for customers to visit and customers have been extremely impressed after a tour in the research center. Some customers have not seen the mills and for them those are impressive places to see. Customers have also been taken to tours starting from forest going all the way through the mills and into the research center, and customers have liked these tours a lot. These are very good opportunities to build trust and form relationships with the customers. One product manager noted that even for an innovation workshop, the customers would rather come to the research center than the innovation center because the research center is that exciting for the customers.

5.4 Including customer needs into innovation and R&D strategy

Innovation and R&D Strategy is a living document which is updated whenever new information is available. Customers express their new needs quite regularly according to company's product managers that were interviewed. One product manager noted that big and important things must be incorporated to the strategy immediately as they arise so that the people can get working on them as quickly as possible. As the collection of customer needs is continuous, so should the strategy work be, too. By continuously updating the strategy, most important needs are guiding

innovation activities to the right direction and the opportunities will not be missed by acting too slowly. New customer needs can for example mean shifting focus to projects which are addressing the needs best. Product managers also noted in the interviews that it is important that innovation and R&D activities are going into the same direction as customer needs. In the following chapters methods for incorporating customer needs into the IRD strategy is presented.

5.4.1 Structuring and analyzing the customer need information

The collected data about customer needs is often not very precise and in clear form, so it must be structured illustratively and then analyzed (Kärkkäinen et al., 1995, p.5) so that it can be utilized in strategy work. Affinity diagram can be utilized in structuring customer need information. It can help both in extracting customer needs from ideas created in workshop and in grouping similar customer needs into bigger groups which assists in finding bigger themes for needs and weak signals and finding causations between different customer needs (Kärkkäinen et al., 1995, C2, p.3-5). Also customer voice table can help in finding the essential customer needs that lie behind what the customers say and express. Customer's comments are collected as customers say them into the table and then the team translates those into customer needs. (Mazur, 2015) The trace matrix for business chains helps in studying business chains as often the needs of the customers originate from complex business chains (Kärkkäinen et al., 2001b; Kärkkäinen el al., 1995, B4 p.3).

Customer needs can be structured in multiple ways in the strategy and one way is to present them according to the segments, since customers within a segment have similar needs according to product managers. Customers are segmented according to product segments and it was studied in the product manager interviews whether there is a need for more specific segmenting of the customers. It became clear in the interviews that customers with whom a certain product manager is working with within a segment have very similar needs regarding to products and services. There are only minor differences in the needs depending on the final product. For example one product manager had differences in the materials between almost all the customers even though the end use was nearly the same, but still the main needs regarding the product were similar. Here the kind of products and colors the customers wanted affected the material chosen for them. Another product manager's customers had very similar needs when considering the most important requirements, but the needs were weighted differently between countries, markets and customers.

5.4.2 Selecting the most important needs

It's not necessary to list all the customer needs in the strategy, but according to product managers, the biggest development directions and customers' future expectations needs that would direct innovation and R&D activities into right direction are valuable information for the strategy. Close and long-term strategic cooperation with customers together with the top management was seen important in getting long-term strategic information about the major development directions of customer needs.

Selecting the most important needs is an important activity which is also affected by the importance of the customer. Customers and their needs can be important in different ways and some customers are more important than the others, some segments are more important than the others, some customers are identified as lead customers, and some as strategic customers and it should be clear which needs are the ones which will be included into the strategy.

According to a product manager the most important customers', which are biggest customers, lead customers and strategic customers, needs are often the most important. One clear indicator is the sales or profitability, but it is also worth considering if there are other important aspects, like lead user characteristics, which can help in creating radical innovations, affecting the selection. But according to product managers, in a tight situation, profitability is still more important deciding factor than new interesting possibilities with lead users. A product manager noted that in tight capacity situations it is important to speak with the customers to find solutions together.

Needs that will create loss of business if those are not fulfilled and interesting needs from even smaller customers which fits the development of market trends are placed higher on the priority noted the product managers. A product manager told, however, that product development is not done exclusively to very small customers because large customers are several times bigger.

One way of finding the most important needs for the strategy is by looking at the frequency and importance of the needs customers present (Kurtadikar & Stone, 2003). If the same need arises from multiple customers, then it indicates that it can be a larger phenomenon and should receive more attention.

At the moment, product managers have customer needs in their product strategies. One product manager told that competitive projects based on customer needs, and needs of the important

customers are mentioned in the strategy. These are the most important needs that are known already which can be utilized in the strategy.

5.4.3 Incorporating customer needs into the strategy

After customer needs have been identified, structured and analyzed, they are ready to be implemented into the innovation and R&D strategy so that product development and innovation activities are guided by the real customer needs.

One way for incorporating customer needs into the strategy is to use a roadmap where customer needs, development programs, technologies and product scenarios are joined together to serve different markets and customers. Roadmap in the figure 10 is developed combining the ideas of roadmaps p resented earlier in the thesis.

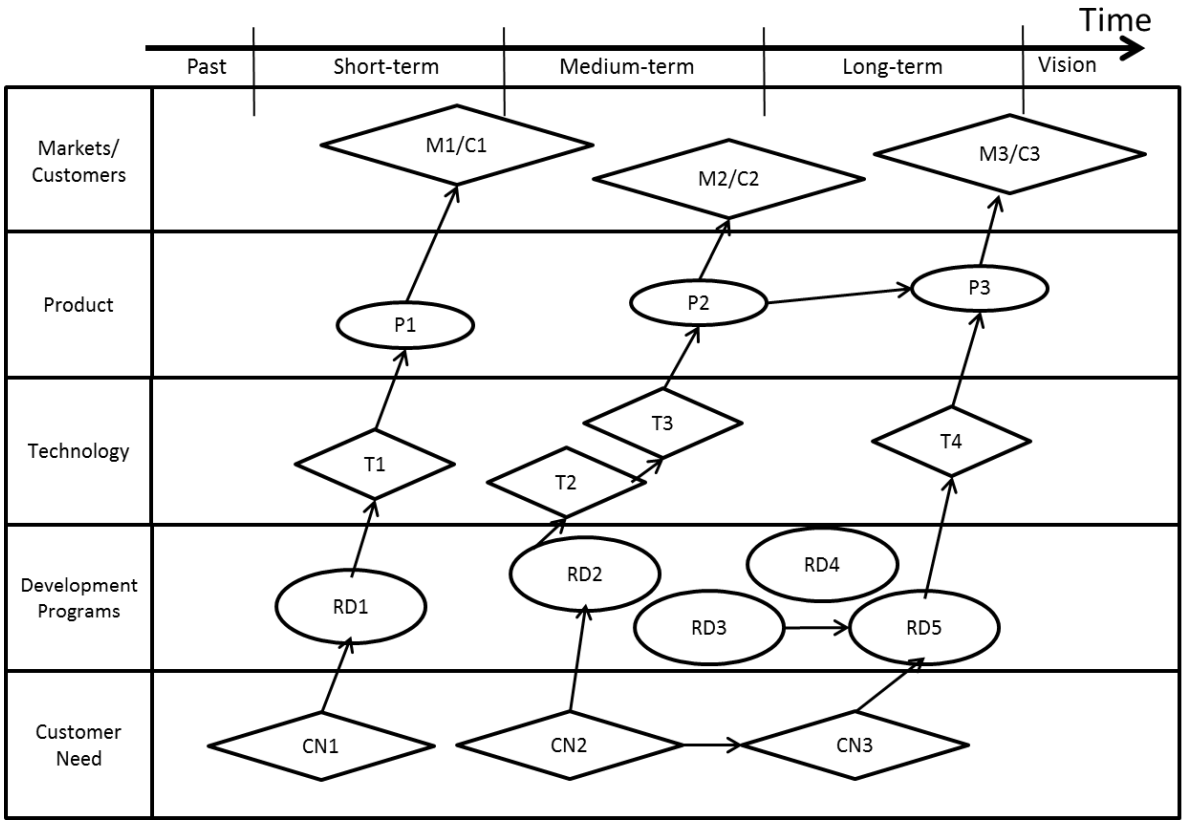

Figure 10. Strategy roadmap

In this model, customer needs are steering product development and innovation activities, thus making it a market-driven roadmap. These roadmaps can be created for all segments separately to keep them compact. New important customer needs, development programs and technologies are updated to the roadmaps whenever they are noticed or started. The roadmap helps in innovation management as it illustrates the most important customer needs and guides new

product development according to those. For example the size of the figure around a specific customer need could illustrate the importance of the need. This would help in prioritizing and focusing the efforts to the most important customer needs. The roadmap should be kept updated to see how certain customer needs are being solved and where they are progressing. The above roadmap assists in planning ahead how customer needs can be fulfilled and keeps the customer needs in the central part of the innovation and R&D work. Furthermore, the roadmap helps in selecting the best development programs and technologies to develop by analyzing how many and how important different customer needs can be satisfied with different projects. Roadmaps also help in strategic planning to take into account different situations that are possible and depend on the developments in the market and technology (An et al., 2016).

Product managers thought that roadmaps could be helpful in joining customer needs into the product development and strategy. Currently only one product manager had roadmaps for basic products, but not yet for the innovative products since those products' development is hard to predict. When product managers were asked whether it would be good to utilize scenarios in predicting possible futures for customer needs, all of them thought that it would be a good idea and a project manager noted that they are trying to pay more and more attention into the future directions. Product managers told that information is collected from various sources including customers, brand owners and end users, but conflicting information makes predicting the future harder. But when information is collected continuously, it is possible to form a vision about the future. A product manager also noted that scenarios can be hard to get right because customers are not revealing their strategies concerning their new products. She noted that getting closer to customer to have this information would help a lot in building more accurate scenarios. According to a product manager the issue is that the customers do not fully trust the company and will not tell about their future needs and even NDAs do not help customers to open up. The basic idea of scenarios is not to predict the future, but to help in preparing for different scenarios by thinking about the actions in different possible and probable situations. Even if the customers are not able to express or the company is not able to predict their future needs, scenarios are still helpful as they are especially suitable when dynamics have great uncertainty (Hannus, 2004, p. 211-212). Of course more accurate roadmaps and scenarios can be built with better information from the markets and customers. When different scenarios have been created, it is important to recognize different strategic options for them to help prepare for different scenarios (Hannus, 2004, p. 211-212).

Another way of incorporating customer needs into the innovation and R&D strategy is to draw tables of customer needs for every segment. Customers within a segment have similar needs which are, however, different compared to other segments. These kinds of tables help in forming a comprehensive picture about the needs that customers have in different segments and focus innovation and R&D efforts to the right things on all of company's segments. It also helps in noticing the differences and similarities in customer needs between the segments, focusing innovation and development activities in the most important areas within the segments and finding the major overall lines of customer needs. This is very basic, but still informative way of illustrating the most important customer needs for future products and services. Table 1 below illustrates the idea of the Customer Need Table.

Table 1. Customer Need Table

Key directions for customer needs	
	NEED 1
	NEED 2
Segment 1	
	NEED 1
	NEED 2
Segment 2	
	NEED 1
	NEED 2

Innovation fields are helpful in focusing innovation efforts according to megatrends and customer needs into larger groups of similar development projects and noticing which fields would be the most valuable ones to focus. This would lead into economies of scope and scale as well as knowledge spillovers and synergies. (Ebert et al., 2008, p.5; Henderson & Cockburn 1996, p.35; Leker et al., 2007, p. 126-128, 187-189)

5.4.4 Customer needs directing innovation and R&D activities

According to product managers, the product development process starts often from the customer need. Product managers noted that there is always a customer need behind development projects and development of own ideas is very limited. These customer needs often remain the same for long periods of time focusing on rather general aspects the product manager noted. The

company must be able to rationally select the most important projects to execute based on the information created so far.

Product manager is the first gate who selects new innovation and R&D projects to be presented for the portfolio team which then decides which projects to start. There are several aspects that the product managers consider when selecting the projects to execute, for example business potential, sales, volume, time-to-market, is the project possible to go through with current technology, does it require investments and how important the customer is.

Sometimes there sparks up a good idea inside the company and it is developed if it is known that it would help the customer and later the solution is offered to the customer. One product manager noted, however, that they have so many customer needs and requests that they barely have any time to develop anything else which is harmful for the development of the company's own ideas. Especially large customers, who are great for testing new products, do not want to take new products to test all the time since it reduces their production time. This is why it would be beneficial for the customer if the products were sometimes developed a little further before tests in the customer's facilities one product manager thought.

It is wise to have a customer need behind every product development project. This does not necessarily mean that the solutions come from the customer, instead the needs should be clear and then it is product development's mission to find the best possible ways to fulfill these needs. And even though the customer needs might be quite general in some segments, the company still needs to be active in searching ways to meet them and improve customer value (Virkkala et al., 1994, p. 28-32; Kärkkäinen et al., 2001) as these are often the representative customer needs which provide directions for strategic product development (Takai & Ishii, 2010). A product manager noted that if customer clearly indicates that the need is especially important for them or that they need it quickly, it can be developed faster and before other needs. One product manager noted that urgency of the needs is also relative, and it is often easier for bigger companies to understand that some things take time whereas smaller companies can sometimes think that the schedules can be very short.

6 DISCUSSION AND CONCLUSIONS

Below in the figure 11 is the summary of findings and suggestions of this thesis. The right side of the figure illustrates the main aspects to consider in finding customer needs in the innovation center and the left side is about including them into the innovation and R&D strategy.

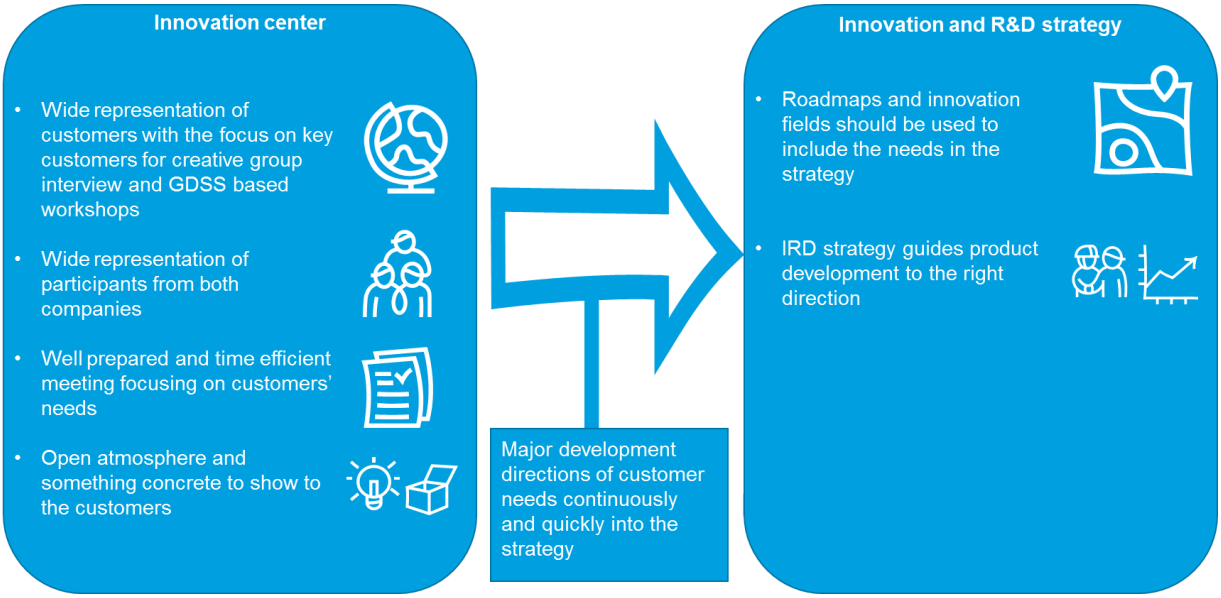

Figure 11. Findings and suggestions

Finding customer needs and especially future needs is not a simple task. In order to make it continuous, the company needs to have clear processes, tools and methods for customer need assessment, and also systems to collect need information, take the needs into account in the strategy and share them to everyone who needs that information. By having clear understanding of customer needs it is possible to notice improvement opportunities for existing products and services or to come up with ideas for completely new ones.

In the following chapters the answers for the research questions and suggestions for actions are presented. The structure follows the figure 11 above.

6.1 Finding out customer needs in innovation center

The first objective of this thesis was to find out suitable ways for finding out customer needs in the innovation center. The research provided a process and several methods and tools for this and the findings are discussed below.

The innovation center is a great place for assessing customer needs directly from the customers as it offers an inspiring space and modern equipment to support the customer need assessment

process. A broad range of customers should be invited to visit the innovation center since great diversity of partners improves the ability to absorb valuable information from outside sources. However, the most intense work should focus on just a few key partners in order to keep the work effective and efficient. Expanding the innovation network will increase innovativeness only up to a certain point so it should not be expanded too large. Product managers have prioritized their customers, and this prioritization should be utilized in order to find the key customers for the innovation workshops. There are large customers that create more sales than the others and they are great for testing new products, lead customers, which have advanced needs, and strategic customers, which are useful for example in expanding to new markets. These key customers should be invited regularly to the innovation center as this enables to quickly recognize new needs and follow the changes in needs after, during and before product development. Regular meetings also improve the relationship between the companies which fosters trust and easy communication. Old customers should be utilized in the innovation center as they are easy to work with and they provide excellent opportunities for incremental innovation. In addition, it is vital to invite also new customers to gain new insights as those are useful in creating radical innovations and finding new customers, lead customers and markets. Special attention should be paid on lead customers and users, since these are often the most important sources for future needs as well as novel and successful innovations. However, long cooperation with the same lead customer might reduce the novelty of the ideas which is why new lead customers have to be identified from time to time. Sometimes even end users should be utilized in the innovation center as they are better sources of radical innovations and they might come up with needs that the company's direct customers are not expressing to the company because of their own limitations. Especially in new service development, the front line employees are useful in pointing out the most suitable participants for the workshops among customers and users. They have a lot of valuable information about customers so they should also participate in the workshops. Also other parts of the supply chain should be utilized in the innovation center as this helps in creating an understanding about the origins of customer needs which assists in seeing coming changes in them.

A wide range of customers' and the company's representatives from different functions should be invited to the workshops as this way customer's needs will be assessed more thoroughly and the results of the workshops will be better as things are considered from different perspectives. Connecting people with different knowledge is also a great way to foster innovation. Participants should be open for new ideas, have knowledge about their industry and capability for creative

thinking. It is also important that at least some of the participants have influence on their company's decisions. People who participate in the workshops are more committed to the project as they have had a change to contribute to it from the beginning so having more people in the workshop leads to bigger group of committed people.

In addition, the overall duration of the customer need assessment is shortened when all the important people are present in the workshop, and there is no need to wait for the answers from email or other ways. Emails and phone calls can be utilized with close customers when there is a common language and understanding for example to obtain some details or other smaller things to utilize the cost and reach advantages and time savings of the email and phone calls. These two channels can be utilized regularly during product development to ensure that customer's changing needs are also captured. It has to be noted that these channels are not best for innovation activities, since they do not transfer complex messages very well as they do not allow nonverbal cues. Also it's easier to have misunderstandings with these communication channels. Having continuous interaction with customers helps in avoiding conflicts and problems and in reaching better innovation performance.

Having people familiar with each other in the workshops can make it easier for the participants to share their needs as they are forming personal relationships and trust which leads to more open discussion. Lack of trust prevents the customer from expressing their needs and long-time development targets which is why it is vital to have good relationships with the customers. Having people familiar with each other might also speed up the workshops as people know each other and how they act so they don't have to spend time on getting familiar with each other. Furthermore, confidentiality agreement should be done with the customers when needed since this can help customers to openly express their needs in the workshops.

The workshops should be as time efficient as possible so that the participants do not feel like they are wasting time which would make them less interested in the workshop. Participants should be briefed and prepared in advance before the meetings as this leads to shorter meeting times and improved results. They should know what is the objective of the workshop, how they should prepare and what to think before the actual workshop.

At the beginning of the workshop, collaboration schedule and expectations should be clarified with the customer and it is important that the benefits are mutual in order for the collaboration to be successful. If for example limitations like budgets and due dates are not expressed at the beginning, they can create problems for the collaboration later.

There should be something concrete and new to show to the customers at the beginning of the workshop in order to get them excited and show them what is possible to do with modern technology. It also works as a good start for the workshop to get the customer into open discussion. Customers can also share their thoughts about the products, and concepts can be adjusted according to the customer's input. The company should also inform customers about newly released products and present new development ideas to hear comments about those from the customers and to keep the customers updated about the new products.

The facilitator of the meeting should be experienced since this has a huge effect on the quality of the results. The facilitator should guide the meeting, keep an eye on the schedule, make sure that the discussion stays on topic and that no one is dominating with their opinions. The participation should be made as easy as possible and the atmosphere should be open. Everyone should be made clear that criticism should be avoided in the workshops as this kills creativity. The facilitator should not take too big role in the meeting and he/she should not direct the participants' opinions to any direction. Special attention should also be taken that the notes of the meeting are as complete and unchanged as possible.

Both companies' future development plans should be discussed in the workshops as it would prepare both better for the future. Close cooperation with customer's management would possibly help in gaining deeper knowledge about their future plans and for this reason, also people from both company's and customers' management should participate in the workshops from time to time.

Creative group interview and GDSS based workshops for customer need assessment are very suitable methods for assessing customer needs and those should be utilized in the innovation center. They support group work and facilitate the customer need assessment process very well and GDSS has been proven to be an excellent method in business-to-business environment. A GDSS helps in overcoming some of the traditional issues of conventional meetings and workshops, like strong personalities dominating with their opinions, everyone does not dare to express their ideas, time management problems and reporting difficulties. When everyone has an equal opportunity to participate, more knowledge will be collected from all participants. Automatic documentation makes distribution of results to participants faster and helps in carrying out further actions. GDSS meetings should be arranged mainly for the most important customers and lead customers as they take a full day of time and require extensive planning. But there is also use for other customers as well since GDSS meetings offer multiple benefits compared to normal

meetings. Also some of the good practices of creative group interview could be utilized in GDSS workshops like giving extra time to think about new ideas and asking also wild ideas.

Customers can also be asked to describe the problems they have with the current products, what kinds of benefits they want and requirements for the new products. These methods can identify customers' hidden and future needs. Also observing customers while they use the product or service can lead to finding out new customer needs.

After workshops the customer needs should be structured and analyzed in order to find out the real needs behind what the customer is able to express. Voice of customer table is an excellent tool for this job as it allows to thoroughly go through what the customer has said and to figure out the needs that lie behind the most obvious. This can lead to great innovations as future and hidden customer needs can be met with new products. The trace matrix for business chains is a helpful tool in clarifying and analyzing the requirements of the whole business chain.

Customers are often very interested and impressed to see the research centers and they are a lot more willing to visit those than the innovation center in Helsinki even for just a workshop. Mills are also interesting places to see for the customers at least for those who have never visited them. However, innovation center in Helsinki is a lot easier to visit than the research centers or mills because of its location, so it is faster for the customers with increasingly tight schedules. And as long as there is impressive and modern equipment and products to show for the customers, it is also a great place to host customer need assessment workshops. It must still be considered to have customers visit also other locations.

Innovations are seen as important aspect in the company, but exploring customer needs should be made everyone's job. Weak signals or customer needs can be found in multiple instances if employees are aware of that and pay attention to it. The culture should foster open innovation and finding out customer needs as this would improve the results significantly because employees would see these as important aspects of their work.

6.2 Including customer needs in the IRD strategy

The second objective of the thesis was to find ways to include customer needs into the innovation and R&D strategy. Below the conclusions based on the research are discussed.

Customer needs should be visible in the innovation and R&D strategy, since they should be guiding the innovation and R&D activities. All of the customer needs cannot and should not be mentioned in the IRD strategy as this would make the list unnecessarily long and out of focus.

Small improvement requests from small customers do not provide much additional information about where the customer needs might be developing in the future or where the company should be focusing its efforts. The major development directions and the most important customer needs are the ones that are worth mentioning in the strategy. In order to get new customer needs into the IRD strategy, anyone who finds new customer needs that are important for the strategy will inform innovation management about the need. Then innovation management will consider whether it will be included into the strategy or not. Product managers and innovation center manager are often the first ones to find and screen the customer needs and they have great responsibility when figuring out which needs would be the most important for the strategy. They have the deepest knowledge of customer needs and market development directions so they are the best able to select the most important needs, that can be for example needs of a big customer, lead customer or strategic customer or needs that are coming from multiple customers and possibly indicating a trend. Strategy should be updated whenever there is new information about customer needs available. Customers are quite active in expressing their needs and this is why product managers and innovation center manager should be fast to react so that the opportunities are not missed by moving too slowly. Customer needs listed in the product strategies should also be utilized in the IRD strategy.

The current segmentation in different product segments seems to be suitable also for separating customer needs in the strategy because the main needs of the customers within a segment are very similar. This ensures that the needs and development directions are big enough that they should be mentioned in the strategy to divide different customer needs and to help in finding major guidelines for innovation activities.

Innovation fields based on megatrends and customer needs are great ways to focus innovation efforts into the most promising projects which are supported by the biggest megatrends and most important customer needs. Innovation fields can be helpful in forming groups of customer needs under the same theme. Also affinity diagram is a great help in creating representative needs of single customer needs by grouping them. Innovation fields could be used to form groups of similar development projects according to customer needs in order to gain synergies between the projects. These major customer needs can then be utilized when building roadmaps. Roadmaps and scenarios are great ways for including customer needs into the innovation and R&D strategy. Customer needs are the starting position in these tools and they direct development programs, technologies used and the products that are launched to different markets and customers. There should be own roadmaps for each of the segments to keep them compact. The roadmaps should

be kept updated so that they have the latest customer needs and show where the development projects are going and help in planning ahead how the customer needs can be fulfilled. Scenarios can be utilized in preparing for the different possible situations in the future, for example how the customer needs might evolve. Scenarios and roadmaps will be more accurate with better information from the customers, but they are still valuable even though the information is not always complete as they help in preparing for different situations in the market.

Other suitable way for including customer needs into the innovation and R&D strategy is to have tables of customer needs according to segments. Only the most important needs are placed on the tables in order to keep them focused and the needs are to be placed in the order of their importance so that the table highlights which needs require the most attention. The tables should also be compared to each other and if there are similar needs between the segments, those can be the ones which need the most focus.

The above mentioned tools help in noticing where the product development resources need to be directed by highlighting the most important needs that have to be met. If there is a technology that could help in solving multiple important customer needs, it can be selected as a flagship project to highlight its importance. Also the projects that support each other are wise to be developed simultaneously and it is beneficial for the employees' capabilities too to be part of different projects at the same time.

6.3 Topics for future research

A respondent in the customer survey noted that there are situations where the counterpart is not able to respond to the customer's needs. This challenge can be assessed by utilizing open innovation. Sourcing new ideas from the outside of the company can provide solutions to the customers' problems and even with less time and cost than if solutions are developed in-house. Wider application of open innovation would require further in-detail studies but open innovation with customers can work as a game opener for wider use of open innovation.

7 SUMMARY

Collaboration is one of the key factors in improving companies' innovation capabilities. Furthermore, including customers into the innovation activities can help in understanding customers' needs, which is vital for the company's success. This enables creating successful innovations that are needed by the customers which leads to competitive advantage. According to other studies and the survey conducted in this thesis, customers often do not have enough knowledge and expertise to be able to ideate the best solutions for their problems. Instead of focusing on finding solutions and ideas in the innovation center, the workshops should focus on finding customer needs and their long-term development directions. A thorough understanding about customers' needs helps also in noticing and preparing for the changes in their needs.

Creative group interview and GDSS workshops are suitable ways for finding out customer needs in the innovation center. They utilize group work which improves the results of the customer need assessment process. And GDSS workshops will help in avoiding common meeting problems. Also good practices from other methods can be utilized in customer need assessment workshops like asking customers for wild ideas, what benefits they would like to have with their products and what problems they have with the current products. Both old and new customers should be utilized in the workshops in finding new customer needs. Old customers are usually good for incremental innovations whereas new customers can be valuable sources of radical innovations. Also users and lead customers can help in creating radical innovations.

Customer needs must be addressed in the innovation and R&D strategy since they can for example start or end, or increase or decrease research on some areas of product development. This way new product development is directed according to innovation strategy in order to provide the most value and to help the company to move into desired direction for the future.

A suitable method for including customer needs into the IRD strategy would be to utilize roadmaps. They are good in uncertain environment and they also help in visualizing how the solutions to the needs are progressing. Also innovation fields and customer need tables can be utilized to fit customer needs into the IRD strategy. Innovation fields are great in grouping innovations under a certain theme and noticing representative needs. Whereas customer need tables can help in noticing differences and similarities in customer needs between segments.

REFERENCES

Aagaard, A. 2012. The Contribution of Innovation Strategy Development and Implementation in Active Facilitation of Pharmaceutical Front End Innovation. *Syst Pract Action Res.* no. 25. pp.457–477.

Aagaard, A. 2012. The Contribution of Innovation Strategy Development and Implementation in Active Facilitation of Pharmaceutical Front End Innovation. *Syst Pract Action Res* no. 25 pp. 457–477.

Aaker, D. 1995. Developing Business Strategies. John Wiley & Sons, Inc. USA. ISBN: 0-471-11814-1. 379p.

Abrell, T., Pihlajamaa, M., Kanto, L., vom Brocke, J. & Uebernickel, F. 2016. The role of users and customers in digital innovation: Insights from B2B manufacturing firms. Information & Management.

Adams, M., Day, G. & Dougherty, D. 1998. Enhancing new product development performance: an organizational learning perspective. *Journal of Product Innovation Management.* Vol. 15. pp. 403-422.

Aieken, M., Hawley, D. & Zhang, W. 1994. Increasing meeting efficiency with a GDSS. *Industrial Management & Data Systems.* Vol. 94. no. 8. pp. 13-16.

Alam, I. 2002, An exploratory investigation of user involvement in new service development, *Journal of the Academy of the Marketing Science*, Vol. 30.

Alam, I. 2013, Customer interaction in service innovation: evidence from India, *International Journal of Emerging Markets*, Vol. 8 Iss 1 p. 41 – 64.

Alexy, O. & Dahlander, L. 2014. Managing Open Innovation. The Oxford Handbook of Innovation Management. Oxford University Press. Oxford.

Alexy, O., Criscuolo, P. & Salter, A. 2012. No Soliciting: Managing unsolicited ideas for R&D. *California Management Review.* Vol. 53. no. 3. pp. 116-139.

Alexy, O., Henkel, J. & Wallin, M. 2013. From closed to open: Job role changes, individual predispositions, and the adoption of commercial open source software development. *Research Policy.* Vol. 42. pp. 1325-1340.

An, Y., Lee, S. & Park, Y. 2008. Development of an integrated product-service roadmap with QFD. *International Journal of Service Industry Management*. Vol. 19 Iss 5. pp. 621-638.

Anttila, S. & Silvennoinen, A. 2014. Metsäteollisuus murroksessa - mitä vielä on edessä? *Boardview.* Vol. 1. pp. 14-17.

Arora, A., Fosfuri, A. & Gambardella, A. 2001. Markets for Technology. Cambridge, MA: MIT Press.

Berthon, P., Hulbert, J. M. & Pitt L. F. 1999. To Serve or Create? Strategic Orientations Toward Customers and Innovation. *California Management Review.* Vol. 42. no. 1. pp.37-58.

Bettencourt, L., Ostrom, A., Brown, S. & Roundtree, R. 2002. Client co-production in knowledge intensive business services. *California Management Review*. Vol. 44. pp. 100–128.

Börjesson, S. & Dahlsten, F. 2004. Management action in developing market orientation: a report from a customer knowledge project at Volvo Cars. *Journal of Change Management.* Vol. 4, no. 2. pp. 141-154.

Brockhoff, K. 2003. Customers' perspectives of involvement in new product development. *International Journal of Technology Management. Vol.* 26. pp. 464–481.

Cadwallader, S., Jarvis, C., Bitner, M. & Ostrom, A. 2010. Frontline employee motivation to participate in service innovation implementation. *Journal of the Academy of Marketing Science.* Vol. 38. no. 2. pp. 219-239.

Cambra-Fierro, J., Hart, S., Mur, A. & Redondo, Y. 2011. Looking for performance: How innovation and strategy may affect market orientation models. *Innovation: Management, policy & practice*. Vol. 13. pp. 154–172.

Chan, K., Yim, C. & Lam, S. 2010. Is customer participation in value creation a double edged sword? Evidence from professional financial services across cultures. *Journal of Marketing.* Vol. 74. no. 3. pp. 48-64.

Chatterji, A. & Fabrizio, K. 2012. How Do Product Users Influence Corporate Invention?. Organization Science. Vol. 23. no. 4. pp. 971-987.

Chay, R. F. 1989. Discovering unrecognized customer needs with consumer research. *Research Technology Management. Vol.* 32. no. 2. p. 36-39.

Chesbrough, H. & Appleyard, M. 2007. Open Innovation and Strategy. *California Management Review*. Vol. 50 no. 1. pp. 57-74.

Chesbrough, H. 2003. Open Innovation: The new imperative for creating and profiting from technology. Boston. Harward Business Press.

Chesbrough, H. 2006. Open Business Models: How to Thrive in the New Innovation Landscape. Boston, MA: Harvard Business School Press.

Chesbrough, H. 2012. Open Innovation – Where We've Been and Where We're Going. *Research-Technology Management*. July-August. pp. 20-27.

Chong, Y. T. & Chen, C-H. 2010. Customer needs as moving targets of product development: a review. *Int J Adv Manuf Technol.* 48. p. 395-406.

Cicianntelli, S. & Magdison, J. 1993. From experience: consumer idealized design: involving consumers in the product development process. *Journal of Product Innovation Management*. Vol. 10. pp. 341-347.

Cleff, T., Grimpe, C. & Rammer, C. 2009. Demand-oriented innovation strategy in the European energy production sector. *International Journal of Energy Sector Management*. Vol. 3 Iss 2 pp. 108-130.

Cova, B. & Salle, R. 2008. The industrial/consumer marketing dichotomy revisited: a case of outdated justification? *Journal of Business & Industrial Marketing.* Vol. 23. no. 1. pp. 3-11.

da Mota Pedrosa, A. 2012. Customer Integration during Innovation Development: An Exploratory Study in the Logistics Service Industry. *Creativity & Innovation Management,* Vol. 21 N. 3. p. 263-276.

Daft, R. & Lengel, R. 1986. Organizational information requirements, media richness and structural design. Management Science. Vol. 32. no. 5. pp. 554–571.

Dahlander, L & Gann, D. 2010. How open is innovation?. *Research Policy.* Vol 39. pp. 699-709.

Dalle, J. & Jullien, M. 2003. "Libre" Software: Turning Fads into Institutions? *Research Policy.* Vol. 32. no. 1. pp. 1-11.

Danneels, E. & Sethi, R. 2005. Explorative new products and their organizational antecedents, Working Paper, Worcester Polytechnic Institute and Clarkson University.

Das, T & Teng, B.-S. 2000. Instabilities of strategic alliances: An internal tensions perspective. *Organization Science.* Vol. 11. no.1. pp. 77-101.

Dennis, A. & Gallupe, B. 1993. A history of group support systems empirical research: Lessons learned and future directions. In: Jessup, L., Valacich, J. (Eds.), Group Support Systems: New Perspectives. MacMillan Publishing Company, New York.

DeSanctis, G. & Gallupe B. 1987. A foundation for the study of group decision support systems. *Management Science.* Vol. 33. No. 5. pp. 589-609.

Dodgson, M. 2014. Collaboration and innovation management. The Oxford Handbook of Innovation Management. Oxford University Press. Oxford.

Dodgson, M., Gann, D. & Salter, A. 2006. The role of technology in the shift towards open innovation: the case of Procter & Gamble. *R&D Management.* Vol. 36. no. 3. pp. 333-346.

Ebert, J., Chandra, S. & Liedtke, A. 2008. Innovation Management – Strategies for success and leadership. A. T. Kearney Inc.

Elfring, T. & Hulsink, W. 2007. Networking by Entrepreneurs: Patterns of Tie–Formation in Emerging Organizations. Organization Studies. Vol. 28. no. 12. pp.1849-1872.

Elfvengren, K., Kärkkäinen, H., Torkkeli, M. & Tuominen, M. 2004. A GDSS based approach for the assessment of customer needs in industrial markets. *International Journal of Production Economics.* Vol. 89. pp. 275 - 292.

Ellis, C., Gibbs, S. & Rein, G. 1991. Groupware: Some issues and experiences. *Communications of the ACM*. Vol. 34 no. 1. pp. 38–58.

Enkel, E., Kausch, C. & Gassmann, O. 2005. Managing the risk of customer integration. *European Management Journal.* Vol. 23. pp. 203–213.

Enkel, E., Kausch, C. & Gassmann, O. 2005. Managing the risk of customer integration. *European Management Journal.* Vol. 23. pp. 203–213.

Etgar, M. 2008. A descriptive model of the consumer co-production process. *Journal of the Academic Marketing Science.* Vol. 36. pp. 97-108.

Eurostat. 2015. Innovation Statistics. [Www document] [referred 2.3.2016] Address: http://ec.europa.eu/eurostat/statistics-explained/index.php/Innovation_statistics

Fidel, P., Schesinger, W. & Cervera, A. 2015. Collaborating to innovate: Effects on customer knowledge management and performance. *Journal of Business Research.* vol. 68. p. 1426–1428

Finlay, P. & Marples, C. 1992. Strategic group decision support systems—a guide for the unwary. *Long Range Planning.* Vol. 25. no. 3. pp. 98–107.

Franke, N. & Piller N. 2004. Value Creation by Toolkits for User Innovation and Design:The Case of the Watch Market. *Journal of Product Innovation Management.* Vol. 21. pp. 401-415.

Franke, N., von Hippel, E. & Schreier, M. 2006. Finding commercially attractive user innovations: a test of leaduser theory. *Journal of Product Innovation Management.* Vol. 23. pp. 301–315.

Ganesan, S., Malter, A. & Rindfleisch, A. 2005. Does distance still matter? Geographic proximity and new product development. Journal of Marketing. Vol. 69. no. 4. pp. 44–60.

Gerdsri, N., Assakul, P. & Vatananan, R. 2010. An activity guideline for technology roadmapping implementation. *Technology Analysis & Strategic Management.* Vol. 22 no. 2. pp. 229-242.

Gianiodis, P., Ellis, S. & Secchi, E. 2010. Advancing a typology of open innovation. *International Journal of Innovation Management*. Vol. 14. pp. 1–42.

Goffin, K. & Lemke, F. 2004. Uncovering your customers' hidden need. *European Business Forum*. Vol. 18. pp. 45-47.

Granovetter, M. 1973. The Strength of Weak Ties: A Network Theory Revisited. Sociological Theory. Vol. 1. pp. 201-233.

Greer, C. R. & Lei, D. 2012. Collaborative Innovation with Customers: A Review of the Literature and Suggestions for Future Research. *International Journal of Management Reviews*, Vol. 14, p. 63–84.

Griffin, A. 1997. Drivers of NPD success. The 1997 PDMA Report Chicago: Product Development and Management Association.

Hakanen, M. 2004. PK-yrityksen strategiatyö - Menestystikijöinä tieto, luovuus ja oppiminen. Multiprint Oy. Helsinki. ISBN 952-468-041-6. 217p.

Hall, D. & Nauda, A. 1990. An interactive approach for selecting IR&D projects. *IEEE Transactions on Engineering Management*. Vol. 37 pp. 126–133.

Hall, D. 1996. The role of creativity within best practice manufacturing. *Technovation.* Vol. 16. no. 3. pp. 115-121.

Hamel, G. & Prahalad, C. 1994. Competing for the Future. Harward Business School Press.

Hanna, N., Ayers, D., Ridnour, R. & Gordon, G. 1995. New product development practices in consumer versus business products organizations. *Journal of Product & Brand Management.* Vol. 4. no. 1. pp. 33-55.

Hannus, J. 2004. Strategisen menestyksen avaimet – Tehokkaat strategiat, kyvykkyydet ja toimintamallit. Protalent Oy. Jyväskylä. ISBN 952-99293-1-5. 397p.

Hansen, M. 1999. The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. Administrative Science Quarterly. Vol. 44. no. 1. pp. 82-111.

Hargadon, A. & Sutton, R. 1997. Technology brokering and innovation in a product development firm. *Administrative Science Quarterly.* Vol. 42. no. 4. pp. 716-749.

Henderson, R. & Cockburn, I. 1996. Scale, scope and spillovers: The determinants of research productivity in drug discovery, *The Rand Journal of Economics.* Vol. 27 no. 1. pp.32-59.

Henkel, J. 2006. Selective revealing in open innovation processes: The case of embedded Linux. *Research Policy.* Vol. 35. pp. 953-969.

Herstatt, C., von Hippel, E. 1991. An implementation of the lead user market research method in a ‘‘low tech’’ product area: Pipe hangers. Working paper, Alfred P. Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

Hittmár, S., Varmus, M. & Lendel, V. 2014. Proposal of model for effective implementation of innovation strategy to business. *Procedia - Social and Behavioral Sciences* 109. pp. 1194 – 1198.

Hohmann, L. 2007. Innovation Games - Creating breakthrough products through collaborative play. Pearson Education, Inc. USA.

Holt, K., Geschka, H. & Peterlongo, G. 1984. Need Assessment, A Key to User-Oriented Product Innovation. Wiley, Chichester, UK.

Iansiti, M. & MacCormack, A. 1997. Developing Products on Internet Time. *Harwad Business Review.* September-October.

Igartua, J. I., Garrigós, J. A. & Hervas-Oliver, J. L. 2010. How innovation management technologies support an open innovation strategy. *Research Technology Management.* May-June.

Jeppesen, L. & Frederiksen, L. 2006. Why Do Users Contribute to Firm-hosted User Communities? The Case of Computer-controlled Music Instruments. *Organization Science.* Vol. 17. no. 1. pp. 45-63.

Jeppesen, L. & Lakhani, K. 2006. Marginality and Problem solving Effectiveness in Broadcast Search. *Organization Science.* Vol. 21. no. 5. pp. 1016-1033.

Joshi & Sharma. 2004. Customer Knowledge Development: Antecedents and Impact on New Product Performance. *Journal of Marketing.* Vol. 68. pp. 47-59.

Kale, P., Singh, H. & Perlmutter, H. 2000. Learning and Protection of Proprietary Assets in Strategic Alliances: Building Relational Capital. *Strategic Management Journal.* Vol. 21. pp. 217-237.

Kananen, J. 2014. Toimintatutkimus kehittämistutkimuksen muotona – miten kirjoitan toimintatutkimuksen opinnäytetyönä? Jyväskylän ammattikorkeakoulun julkaisuja. Jyväskylä. 179p.

Katz, R. & Allen, T. 1982. Investigating the Not Invented Here (NIH) svndrome: A look at the performance, tenure, and communication patterns of 50 R & D Project Groups. *R&D Management.* Vol. 12. no. 1. pp. 7-19.

Kaulio, M. A. 1998. Customer, consumer and user involvement in product development: A framework and a review of selected methods. *Total Quality Management*, Vol 9, no. 1. p. 141-149.

Kelley, S. Donnelly, J. & Skinner, S. 1990. Customer Participation in Service Production and Delivery. *Journal of Retailing.* Vol 66. no. 3. pp. 315-335.

Kim, N., & Atuahene-Gima, K. 2010. Using exploratory and exploitative market learning for new product development. *Journal of Product Innovation Management.* Vol. 27 no. 4. pp. 519–536.

Kleinschmidt, EJ, & Cooper, RG. 1995. The relative importance of new product success determinants: perception versus reality. *R&D Management*. Vol. 25. no. 3. pp. 281–297.

Kogut, B. & Zander, U. 1992. Knowledge of the firm, combinative capabilities and the replication of technology. *Organization Science.* Vol. 3. pp. 383-397.

Kotler, P. 1991. Marketing Management - Analysis, planning, implementation and control. 7th ed. London. Prentice-Hall International Limited.

Kraemer, K. & King, J. 1988. Computer-based systems for cooperative work and group decision making. *ACM Computing Surveys.* Vol. 20. no. 2. pp. 115–146.

Kristensson, P., Matthing, J. & Johansson, N. 2008. Key strategies for the successful involvement of customers in the co-creation of new technology-based services. *International Journal of Service Industry Management.* Vol. 19. no. 4. pp. 474-491.

Kumar, S. & Phrommathed, P. 2005. New Product Development: An Empirical Study of the Effects of Innovation Strategy, Organization Learning, and Market Conditions. Springer Science+Business Media, Inc. USA. ISBN 0-387-23273-7 (eBook). 199p.

Kurkela, R. 2016. Tilastokeskus – Tilastollinen tiedonkeruu. [WWW document] [Used June 27th 2016] Address: https://www.stat.fi/virsta/tkeruu/04/02/

Kurtadikar, R. & Stone, R. 2003. Investigation of customer needs frequency vs. weight in product platform planning. *Proceedings of IMECHE 2003 ASME International Mechanical Engineering Congress and R & D Expo November 15-21, 2003 – Washington, D.C.*

Kärkkäinen, H. & Elfvengren, K. 2002. Role of careful customer need assessment in product innovation management - empirical analysis. *Int. J. Production Economics.* 80 p. 85–103.

Kärkkäinen, H., Piippo, P & Tuominen, M. 2001b. Ten tools for customer-driven product development in industrial companies. *Int. J. Production Economics.* 69. p. 161-176.

Kärkkäinen, H., Piippo, P., Puumalainen, K & Tuominen M. 2001. Assessment of hidden and future customer needs in Finnish business-to-business companies. *R&D Management,* 31, 4. p. 391-407.

Kärkkäinen, H., Elfvengren, K., Piippo, P. & Tuominen, M. 1999. A tool for systematic assessment of customer needs in industrial markets, Proceedings of ISPIM99 Conference, Tokyo, Japan, 26, 29 September, 1999.

Kärkkäinen, H., Piippo, P. & Tuominen, M. 1997 A creative groupwork tool for customer need assessment of industrial products, Proceedings of the R&D Management Conference: Managing R&D into the 21st Century, The Manchester Conference Center, Manchester, UK, 14-16 July, 1997.

Lattuch, F., Pech, R., Riemenschneider, F. & Weigert, M. 2013. Market and technology drivers: shaping an innovation strategy. *Journal of Business Strategy*. Vol. 34 Iss 5 pp. 4 – 11.

Laursen, K & Salter, A. 2006. Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal.* Vol. 27. pp. 131-150.

Lee, S., Yoon, B., Lee, C. & Park, J. 2009. Business planning based on technological capabilities: patent analysis for technology-driven roadmapping. *Technological Forecasting & Social Change.* Vol. 76. no. 6. pp. 769–786.

Lei, D & Greer, C. 2003. The Empathetic Organization. *Organizational Dynamics.* Vol 32. No. 2. pp. 142-164.

Leker, J., Salomo, S. & Schewe, G. 2007. Innovation Strategy and Firm Performance – An empirical study of publicly listed firms. Gabler. Germany. ISBN 978-3-8349-1755-3. 242p.

Lester, D. 1998. Critical Success Factors for New Product Development. *Research Technology Management.* Vol. 41. no. 1. pp. 36-43.

Lilien, G., Morrison, P., Searls, K., Sonnack, M. & von Hippel, E. 2002. Performance Assessment of the Lead User Generation Process for New Product Development. *Management Science.* Vol. 48. pp. 1042–1059.

Lokshin, B., Hagedoorn, J. & Letterie, W. 2011. The Bumpy Road of Technology Partnerships: Understanding Causes and Consequences of Partnership Mal-functioning. *Research Policy.* Vol. 40. no. 2. pp. 297-308.

Lynn, G., Morone, J. & Paulson, A. 1996. Marketing and discontinuous innovation: The probe and learn process. *California Management Review.* Vol. 38. no. 3. pp. 8-37.

Magnusson, P., Matthing, J. & Kristensson, P. 2003. Managing User Involvement in Service Innovation – Experiments With Innovating End Users. *Journal of Service Research.* Vol. 6. no. 2. pp. 111-124.

Mahr, D., Lievens, A. & Blazevic, V. 2014. The Value of Customer Cocreated Knowledge during the Innovation Process. *J Prod Innova Manag.* vol 31. no. 3. pp. 599-615.

Majava, J., Nuottila, J., Haapasalo, H. & Law, K. 2013. Customer Needs in Market-Driven Product Development: Product Management and R&D Standpoints. *Technology and Investment.* No. 5. pp. 16-25.

March, J. 1991. Exploration and exploitation in organizational learning. *Organization Science.* Vol. 2. no. 1. pp. 71-87.

Martins, E. & Terblanche, F. Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management.* Vol. 6. no. 1. pp. 64-74.

Maurer, I. & Ebers, M. 2006. Dynamics of Social Capital and Their Performance Implications: Lessons from Biotechnology Start-Ups.

Mazur, H. 2015. Quality Function Deployment - Voice of Customer Meets Voice of Process. *The Journal for Quality and Participation.* Vol. 37 no. 4. pp. 24-29.

McGrath, R. & Kim, J. 2014. Innovation, strategy and hypercompetition. The Oxford Handbook of Innovation Management. Oxford University Press. Oxford.

Meho, L. 2006. E-Mail Interviewing in Qualitative Research: A Methodological Discussion. *Journal of the American Society for Information Science and Technology.* Vol. 57. No. 10. pp. 1284-1295.

Miller, C. & Cardinal, L. 1994. Strategic planning and firm performance: A synthesis of more than two decades of research. *Academy of Management Journal.* Vol. 37. no. 6. pp. 1649-1665.

Miller, C. & Cardinal, L. 1994. Strategic Planning and Firm Performance: A Synthesis of More Than Two Decades of Research. *Academy of Management Journal*. Vol. 37. no. 6. pp. 1649-1665.

Moenaert, R. & Souder, W. 1996. Context and antecedents of information utility at the R&D/marketing interface. Management Science. Vol. 42. no. 11. pp. 1592–610.

Morgan, N., Vorhies, D. & Mason, C. 2009. Market Orientation, Marketing Capabilities and Firm Performance. *Strategic Management Journal.* Vol. 30. pp. 909-920.

Mowery, D. & Grodal, S. 2005. Networks of Innovators. The Oxford Handbook of Innovation. Oxford. Oxford University Press.

Mullins, J. & Sutherland, D. 1998. New product development in rapidly changing markets: An exploratory study. *Journal of Product Innovation Management.* Vol. 15. no. 3. pp. 224–236.

Nambisan, S. & Nambisan, P. 2008. How to Profit From a Better Virtual Customer Environment. *MIT Sloan Management Review.* Spring. pp. 53-61.

O'Cass, A. & Ngo, L. 2007. Market orientation versus innovative culture: two routes to superior brand performance. *European Journal of Marketing*. Vol. 41 No. 7/8. pp. 868-887.

Parkinson, S. 1982. The Role of the User in Successful New Product Development. *R&D Management.* Vol. 12. no. 3. pp. 123-131.

Parkinson, S. 1982. The role of the user in successful new product development. *R&D Management.* Vol 12. no. 3. pp. 123-131.

Payne, A., Storbacka, K., Frow, P. & Knox, S. 2008. Co-Creating Brands: Diagnosing and Designing the Relationship Experience. *Journal of Business Research.* Vol. 62. no. 3. pp. 379-389.

Phaal, R. & Muller, G. 2009. An Architectural framework for roadmapping: Towards visual strategy. *Technological Forecasting & Social Change.*Vol. 76. pp. 39-49.

Phillips, N. 2014. Organizing Innovation. The Oxford Handbook of Innovation Management. Oxford University Press. Oxford.

Podolny, J. & Stuart T. 1995. A Role-Based Ecology of Technological Change. American Journal of Sociology.Vol. 100. no. 5. pp. 1224-1260.

Prahalad, C. & Ramaswamy, V. 2004. Co-Creation Experiences: The Next Practice in Value Creation. *Journal of Intreractive Marketing*. Vol 18. no. 3. pp. 5-14.

Rollins, M. & Halinen, A. 2005. Customer knowledge management compentence: towards a theoretical framework. Paper presented at The 38th Hawaii International Conference on System Sciences, Hawaii.

Rosenkopf,L., Metiu, A. & George, V. 2001. From the Bottom Up? Technical Committee Activity and Alliance Formation. Administrative Science Quarterly. Vol. 46. pp. 748-772.

Rothwell, R. 1992. Successful industrial innovation: critical factors for the 1990s. *R&D Management.* Vol. 22. no. 3. pp. 221-239.

Rowley, J. & Slack, F. 2004. Conducting a literature review. *Management Research News*. Vol. 27 no. 6. pp. 31-39.

Santos-Vijande, M., González-Mieres, C., & López-Sánchez, J. 2013. An assessment of innovativeness in KIBS: Implications on KIBS'co-creation culture, innovation capability, and performance. *Journal of Business & Industrial Marketing.* Vol. 28 no. 2. pp. 86–102.

Simonse, L., Hultink, E. & Buijs, J. 2014. Innovation Roadmapping: Building Concepts from Practitioner's Insights. *Journal of Product Innovation Management.* Vol 32. no. 6. pp. 904-924.

Simonson, I. 1993. Get closer to your customers by understanding how they make choices. *California Management Review.* Vol. 35. no. 4. pp. 68-84.

Sloane, P. 2011. A guide to open innovation and crowd sourcing – Advice from leading experts. Great Britain & the United States. Kogan Page Ltd. p. 217.

Takai, S. & Ishii, K. 2010. A Use of Subjective Clustering to Support Affinity Diagram Results in Customer Needs Analysis. *Concurrent Engineering.* Vol. 18. no. 2. pp. 101-109.

Taylor, B. & Sparkes, J. 1977. Corporate Strategy and Planning. The Pitman Press. Great Britain. SBN 434 91911 X. 402p.

Tung, L-L. & Turban, E. 1998. A proposed research framework for distributed group decision support systems. *Decision Support Systems.* Vol. 23. pp. 175-188.

Turban, E. & Aronson, J., 1998. Decision Support Systems and Intelligent Systems, 5th Edition. Prentice Hall, Englewood Cliffs, NJ.

Tushman, M. & Scanlan, T. 1981. Boundary Spanning Individuals: Their Role in Information Transfer and their Antecedents. *Academy of Management Journal.* Vol. 24. no. 2. pp.289-305.

Ulrich, K. & Eppinger, S. 1995. Product development and Design, New York: McGraw-Hill, Inc.

Ulwick, A. & Bettencourt L. 2008. Giving Customers a Fair Hearing. *MITSloan Management Review.* Vol 49. no. 3. pp. 61-69.

Ulwick, A. 2002. Turn customer input into innovation. *Harvard Business Review.* Vol. 81. no. 1. pp. 91-97.

Virkkala, V. 1994. Luova ongelmanratkaisu. 3rd ed. Insinööritieto Oy. Helsinki. 282p.

von Hippel, E. 1986. Lead users: A source of novel product concepts. Management Science. Vol. 32. No. 7. pp. 791–805.

von Hippel, E. 1988. The sources of innovation. New York, Oxford University Press. 218p.

von Hippel, E. 2001. User Toolkits for Innovation. *Journal of Product Innovation Management.* Vol. 18. no. 4. pp. 247-257.

von Hippel, E. 2005. Democratizing Innovation. Cambridge, MA. The MIT Press. 204p.

von Stamm, B. 2004, Collaboration with other firms and customers: innovation's secret weapon, *Strategy & Leadership*, Vol. 32 Iss 3 p. 16 – 20.

Wikström, S. 1996.The customer as co-producer. *European Journal of Marketing*. Vol. 30 no. 4 pp. 6-19.

Yström, A. Aspenberg, H. & Kulim, A. 2015. Exploring the creative climate in an open innovation arena. *European Journal of Innovation Management.* Vol. 18. iss. 1. pp. 70-85.

Zirger, B. 1997. The influence of development experience and product innovativeness on product outcome. *Technology Analysis & Strategic Management. Vol. 9. no. 3. pp. 287-297.*

APPENDIXES

APPENDIX 1: Questionnaire for the customers

When answering the questions, think about the previous times you have worked with the company around innovation and product development activities in workshops or other instances. If you have not participated in any activities of this type, please answer the questions based on how you would like such a session to be. Please type your answers in the boxes below the questions.

1. Have you participated in an innovation or product development workshop with the company? YES/NO

2. Would you say that having people from various functions of your organization participating in the workshops is: (1) Not at all important (2) Not important (3) Neutral (4) Important (5) Very important.

Why?

3. Would you say that having people from various functions of the company participating in the workshops is: (1) Not at all important (2) Not important (3) Neutral (4) Important (5) Very important.

Why?

4. In the workshops that you have participated in, what were the good practices that helped you express your company's needs regarding products and services? What were the key challenges that hindered you from expressing these needs?

5. In the workshops that you have participated in, how were the opportunities to express your company's needs regarding products and services? How could the workshop be improved so that you could express the needs better?

6. In the workshops that you have participated in, did everyone have an equal chance to share their thoughts or did someone dominate the session with his/her opinions? Describe the situation in your answer.

7. How could the company identify and anticipate your company's future needs for products and services better?

8. What methods does your company use to identify the product or service needs really far away in the future (far beyond the horizon)?

9. Would you say that your awareness regarding the possibilities and limitations of current packaging technology is: (1) Poor (2) Fair (3) Good (4) Very good (5) Excellent. Please describe why.

10. Describe your most preferred way to give input about your needs regarding the company's products and services.

Thank you for responding!