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CHALLENGES OF USER-DRIVEN INNOVATIONS ON LATE STAGES OF INNOVATION PROCESS: EVIDENCE FROM ICT COMPANIES

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ABSTRACT

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The goal of this thesis is to study user-driven innovations and user involvement throughout the innovation process in context of B2B companies. Significant emphasis in the analysis put onto the late stages of innovation process and commercialization of innovations. Thesis includes detailed review of theoretical concepts and underlying frameworks of innovation process, lead users and user-driven innovations.

The empirical part of the thesis consist of interviews of the four companies from ICT industry, followed by the comprehensive analysis and comparison of the results. The presented findings indicate common challenges, which ICT companies face, when shifting towards innovation by users paradigm.

Linkages and connections among current situation and theoretical frameworks presented in the discussion part of the thesis allow to draw practical managerial implications. The results of the research emphasize valuable insights and challenges of user interactions within innovation process as well as output and participation related benefits for the companies and users. The research points out current state of the user involvement techniques and tools used for user interactions as well as suggests the possibilities for improvement in the future.

Acknowledgements

Hello, me from the future!

I am sure this message is often read only by authors themselves, therefore I would like to address myself and remind me what did it take to write this thesis. I sure hope that someday in the future I would open this file again to relive some of those memories and reflect on my achievements.

However, I would like to start on the serious note. My deepest gratitude goes towards both of my supervisors Paavo Ritala and Irina Fiegenbaum for helping me throughout this daunting task of conducting my own research and writing my master thesis. This work would not be complete without your help and advice. Furthermore, I want to thank all of the researchers at LUT Kouvola unit for being a great team and friendly colleagues. The ITEA Accelerate project, which I became a part of, was a great opportunity for me to show myself and achieve first results. I am forever grateful for the chance to publish my first conference paper based on this research.

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Sincerely yours,

Alexander Grun

Helsinki, August 2015

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List of Abbreviations

UDI	–	User-driven innovation
OI	–	Open innovation
ICT	–	Information and communications technology
R&D	–	Research and development
MAP	–	Manufacturer-active paradigm
CAP	–	Customer-active paradigm
SME	–	Small and medium-sized enterprises
MNC	–	Multinational corporation
IPR	–	Intellectual property rights
B2C	–	Business-to-consumer
B2B	–	Business-to-business
SOA	–	Service Oriented Architecture

1. INTRODUCTION

Innovation and innovation management became current agenda for both companies and academics in the recent decades. Today almost every company in technology-related industry has R&D departments responsible for producing big and small changes in technologies, products and services called innovations. They called innovations rather than inventions mainly because they could be commercialized, because customers on the markets are willing to pay for the changes and discoveries achieved by the companies and engineers. This paradigm shift happened not long ago in the middle of 20th century, when capitalism and free markets developed to the point when products were not sold by itself. Competition and world trade made it possible for countries with comparative economic advantages in product making to trade their goods in the developed western markets. Western companies faced challenges on the home markets and were forced to invent new or radically change existing technologies and strategies in order to survive rising competition. Right at this moment the difference between innovation and invention occurred. It happened because of two reasons 1) not every single invention has to have customers that are willing to buy it and 2) not every single invention even though potentially popular among customers would be successfully introduced to the market. Therefore, term commercialization occurred; commercialization describes the process of introducing new service or product to the market. Hence, successfully commercialized inventions become innovations. Nowadays companies are aimed not only to produce technological breakthroughs and enhance existing offers, but also to commercialize own achievements and launch them on the market.

The process of creating new or modify existing technology, strategy or product was always associated with different costs for the businesses. It required time, finance, people and knowledge put together in particular proportion in order to produce invention and later commercialize it. However, in some cases single person or small group of experts create something ingenious, which could

easily become popular on the market without substantial contributions from the innovators. One of the most popular examples of this situation is commonly known invention of bubble wrap packaging, which was discovered by incident in process of creating 3D wallpapers. Obviously, this solution would have been invented eventually, however it would probably took R&D department and significant budget of warehouse or transporting company to succeed. This concept lies in the foundation of user-driven innovations on par with lead user theory (von Hippel, 1988), open innovation (Chesbrough, 2003) and many other spheres of knowledge contributing to UDI phenomenon.

User-driven innovation in its core represents the idea of bringing to the market inventions inspired or created by customers themselves. This ideas and inventions are likely to have higher market success than regular product because of practical nature of the inventions as well as initial client base, since they are most likely inspired by the community of users. Thus, utilization of users as sources of innovations facilitate not only speed and cost-reduction of innovation process, but also brings the initial customers and helps the innovation diffusion process. Although the idea looks viable and easy to implement on paper, the reality shows that there are challenges on the path of user-driven innovations. UDI requires certain degree of openness from the company; it increases the risks of informational leakages from the company. Business model and strategic orientations of the company are likely to be changed in order to achieve successful results from UDI. Finally, not every industry is suited for utilization of users in development process and these are only few arguments to consider when talking about UDI.

Another important aspect is innovation process and its stages. Researchers and practitioners agree on the fact that user involvement in innovation process is relatively easier on early stages, while on the late stages users have fewer opportunities to affect innovation process. Thus, challenges arise from the complexity of innovation process and ability to involve users on late stages. These challenges might hurdle the commercialization of the newly developed product or service and undermine its market success.

Furthermore, this study is focused on the user-driven innovation and user involvement in Finnish ICT companies. Finnish market was chosen, due to the fact that Finnish economy is ranked highly on innovation and competitiveness index. According to Global Competitiveness Report 2014-2015 (World Economic Forum, 2014) Finland is ranked 4th in the world in terms of competitiveness of economy, while being ranked 2nd in Europe. Moreover Finland's economy ranks 1st in the world in the innovation performance index, making Finnish ICT companies appropriate choice for studying user-driven innovations.

1.1. Background

User-driven innovations is rather popular topic in innovation related literature. It was initially studied by Eric von Hippel in late 1970s and became widely known in 1990s-2000s with boom of ICT companies and development of technologies. There are number of case studies proving the existence of phenomena, however the research gap lies in user involvement. Researchers agree on the fact that there are substantial amount of lead users and technology enthusiasts, which could positively contribute to innovation development and commercialization, however most companies nowadays struggle to utilize this potential.

The main contributor to the user-driven innovation research is Eric von Hippel – professor of MIT Sloan School of Management. Von Hippel started in early 1970s by formulating manufacturer-active and customer-active production paradigms, which were used to distinguish between different approached to ideation inside companies. In his findings, researcher highlighted that unlike mainstream practices of product development initiated by internal idea generation process; there are successful examples on the market of products, which were suggested to the company by its active clients.

Later von Hippel developed Lead User theory, which described those active

clients as autonomous innovators with special needs and proactive vision. These enthusiasts shaped market trends before they occurred on the mass market and benefited from their own innovation and ideas. Therefore, companies willing to collaborate with those enthusiasts received potentially successful product idea in exchange for their production capabilities.

Later studies proved von Hippel's earlier findings and developed innovation diffusion theory, user involvement techniques and mechanisms as well as types of user involvement and stages innovation process. The nexus of different theoretical findings lead to the development of user-driven innovation phenomenon.

Currently academic literature is focused on the particular cases of UDI implementation as well as challenges of innovation process and user involvement. Recent works devoted to the IPR issues related to UDI, utilization of UDI in different market conditions as well as different geographical regions.

This research is aimed to investigate current situation with user involvement in innovation process and product development and to provide practical recommendations on how to increase user involvement and boost commercialization of new products.

1.2. Research gap, objectives and questions

As previously mentioned the research gap of this research lies in peculiarities of user involvement in innovation process. The main component of user-driven innovation is users and their ideas, therefore the greatest challenge occurs in the involvement techniques. Currently there is lack of theoretical evidence of the successful user involvement in B2B context due to limited access to the end users. Paasi et al (2014) investigated challenges in open innovation process in B2B markets; however, this article does not contribute to the UDI domain, since the focus was put onto the cooperation with business partners rather than users.

Researchers currently possess fragmented knowledge on the user involvement in B2B context. Moreover, user-driven innovations differs between various industries. For instance, early researches on UDI and lead users were primarily conducted in extreme sports (Baldwin et al., 2006; Franke et al., 2006) and medical (von Hippel, 1976) industries.

Currently there are no relevant studies done on the user driven-innovation and user involvement in B2B context. Furthermore, limited amount studies focused on ICT companies. Finally, as mentioned by Bråtå et al. (2009) late stages of innovation process have fewer opportunities for users to participate in development and testing. Therefore, aforementioned arguments lead to the research gap of this research.

The main objective of the study is to identify user involvement techniques used by the ICT companies on late stages of innovation process and analyze user-driven innovation activities in B2B context. This research is conducted with LUT Kouvola research unit and is part of ITEA2 Accelerate project, which is focused on commercialization of innovation produced by ICT companies and technology acceleration.

Based on the review of the theoretical concepts presented in the existing academic literature and the research gap discussed in this section, the following research questions were formulated.

The main research question:

- *How user-driven innovations are utilized on different stages of innovation process?*

To support this research question, following sub-questions were formed. Research sub-questions:

- How ICT companies involve users on late stages of the development?

- What are the challenges of user involvement for ICT companies in B2B segment?
- What tools and approaches are used to engage users in B2B context?

These research questions combine the set of issues stated in the research gap and helps to achieve research objective of this thesis. This study contributes to the academic literature on user-driven innovation and user involvement by offering new insights on user involvement in B2B context by ICT companies with focus on late stages of innovation process. The research provides practical managerial contributions on the user involvement techniques for managers of ICT companies operating in B2B segments of the market.

1.3. Theoretical framework & methodology

Theoretical framework of this thesis includes relevant academic theories on user driven-innovations, innovation process and user involvement. These fundamental concepts formed the framework of the conducted research. Based on the reviewed academic literature, several models, paradigms and structures were selected to include into further analysis. These independent phenomena do not form a systematic framework; however, they provide in-depth description and tie together such factors as innovation process, user involvement techniques, lead users, benefits from innovation process and others.

According to the literature on user involvement, there are three main domains, in which companies could operate (Figure 1). The last one – innovation by user representing user-driven innovations, while the first type – innovation for user representing closed innovation process defined by von Hippel as Manufacture-active paradigm. In this paradigm, companies innovate themselves without any influence from customers. Innovation with users representing the transitional stage between closed and open innovation.

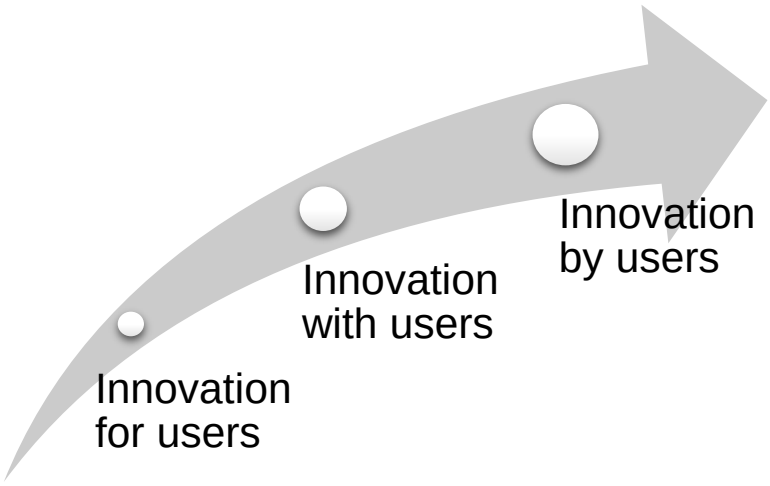


Figure 1.Types of user involvement
Source: adopted from Schuurman, Baccarne & Mechant, 2013

More detailed description of theoretical framework and most important models, on which this research is based, are presented in the fourth chapter of this thesis.

In order to research the aforementioned topic and answer research questions, the research was designed as a multiple inductive explanatory case study. The research design is presented of on the Figure 2. Inductive approach to the case study allows to put close attention to similarities and challenges in user involvement process.

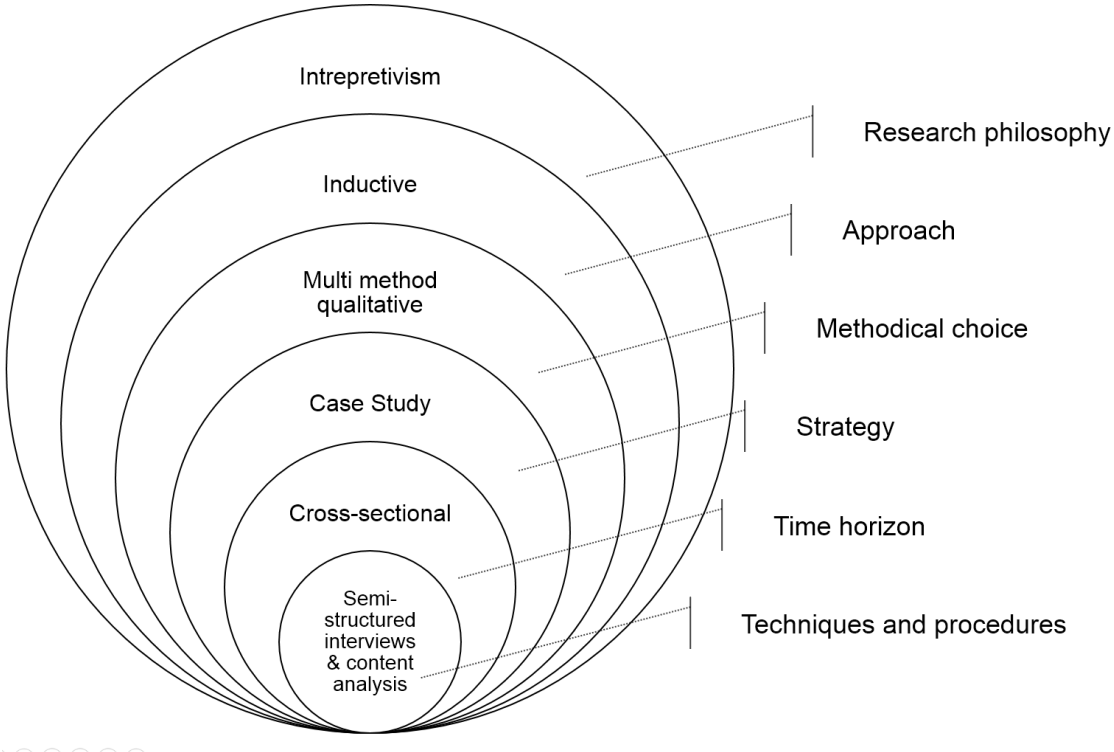


Figure 2. Research design
Source: Adapted from Saunders et al. (2012)

For the purposes of this research, four Finnish companies operating in ICT sector were selected. All of those companies have B2B orientation, while some of them also operate in B2C segment of the market. Six semi-structured interview with employees responsible for innovation and development were conducted and transcribed in order to analyze current situation inside those companies.

The cross-case analysis and comparison of the companies is presented in the discussion part of this thesis. The conducted research allowed to reach research objectives and answer research question as well as formulate managerial implications.

1.4. Limitations

The scope of the thesis includes the analysis of ICT companies operating in B2B context. Research and conclusions would focus on user involvement and commercialization of innovations created with, for or by users. The scope of the

study only limits data collection process in terms of case company selection. However, the case study approach itself is aimed towards open approach to data collection with semi-structured interviews. Thus, any additional relevant information that might occur during the interviews could be incorporated into the study.

Since the study focuses on user-driven innovations, the closed innovation process conducted by companies would not be considered relevant to the scope of this research. Moreover, user involvement activities related to the B2C businesses of the interviewed companies would not be studied with the same degree of attention as B2B approaches. Finally, because the case company choice is done from Finnish ICT companies operating in B2B markets, the results may not be fully generalizable to the other markets and industries. However, main peculiarities and country-specific factors are stressed in the discussion section of the thesis.

1.5. Structure of the thesis

The thesis is divided into two greater parts: theoretical and practical. The theoretical part includes introduction as well as theoretical discussion and literature review with comprehensive overview of the following phenomena: user-driven innovation, user involvement, commercialization of innovation. Throughout chapters 2-4, the detailed description of relevant literature and academic articles is presented. Chapter 4 contains the theoretical framework of the empirical study and brief recap of the most important theories. Chapter 5 presents the description and explanation of research methods and data collection. Visualized structure of the thesis is presented on following figure.

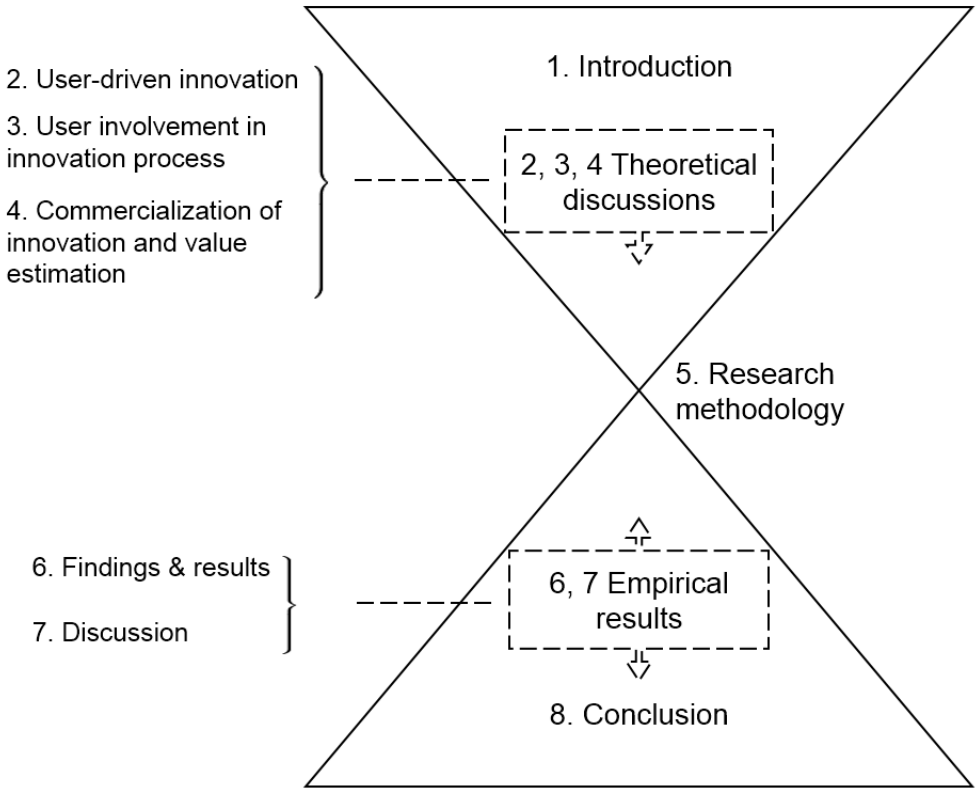


Figure 3. Structure of the thesis

The empirical part of the thesis consists of chapters 6, 7 and 8 with empirical findings, analysis of the results and discussion as well as conclusion and managerial implications of the conducted research.

2. USER-DRIVEN INNOVATION

2.1. Innovation by users

The importance of users in technology development and innovation process have been emphasized by various authors. A number of empirical studies suggest that most successful new products were initiated by information about user needs, often referred to as “need pull” (Baker, Siegman & Rubinstein, 1967; Utterback, 1971; Robertson, 1973). In many cases, technical improvements were realized during the diffusion phase by user feedback or re-invention by users (Rogers, 1995). Ornetzeder & Rohrache’s (2006) studies of user innovations show how the users can be involved in the design and dissemination of technologies at different levels of intensity. For example, early adopters among users could start completely new technologies and design new products. They could find and try new applications of existing products as well appropriate unconventional technology development and design solutions in the course of collective decision-making process inside user communities.

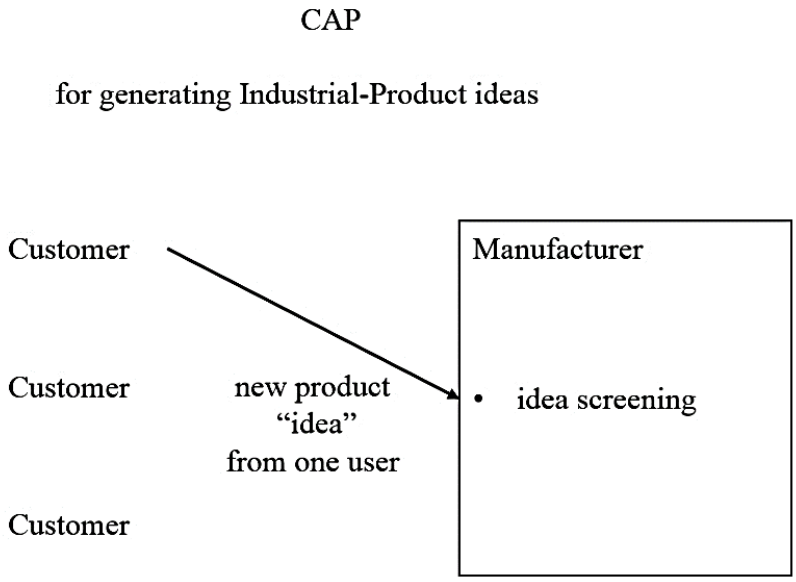
However, as the analysis of literature reveals, the role of users in innovation processes is much broader than simple direct user participation. Even without active user involvement, designers are still able to represent the needs and expectations of future users and match it with the design of a product trough imagination about future uses and users or through the experiences of designers or producers as users. Users may also try to change or re-design technologies, or block their usage (Ornetzeder & Rohrache, 2006).

The term “user-driven innovation” (UDI) is commonly mistaken with another academic term ‘open innovation” (OI). Despite open innovation and user-driven innovation share certain key precepts, they differ in key values and assumptions, as well as in the phenomena they study. Open innovation is a firm-centric paradigm that is primarily concerned with leveraging external knowledge to improve internal innovation and thus the firm‘s economic performance, while user innovation is mainly about individuals using innovation

to address their own (often unique) needs, without regard to firm success and often as part of a socially embedded community (Piller & West, 2014).

2.1.1. Manufacturer-active and customer-active paradigms

The idea of user innovation in the form of a new customer-active paradigm was firstly proposed by Eric von Hippel (1978). Prior to von Hippel, the generation of consumer-product ideas used to be “manufacturer active” (for example the manufacturer played an active role), rather than “customer active”. Customers/users, as to define the term, are firms or individual consumers that expect to benefit from using a design, a product or a service suggested by customers. In contrast, manufacturers/producers expect to benefit from selling a design, a product, or a service (Baldwin & von Hippel, 2009).



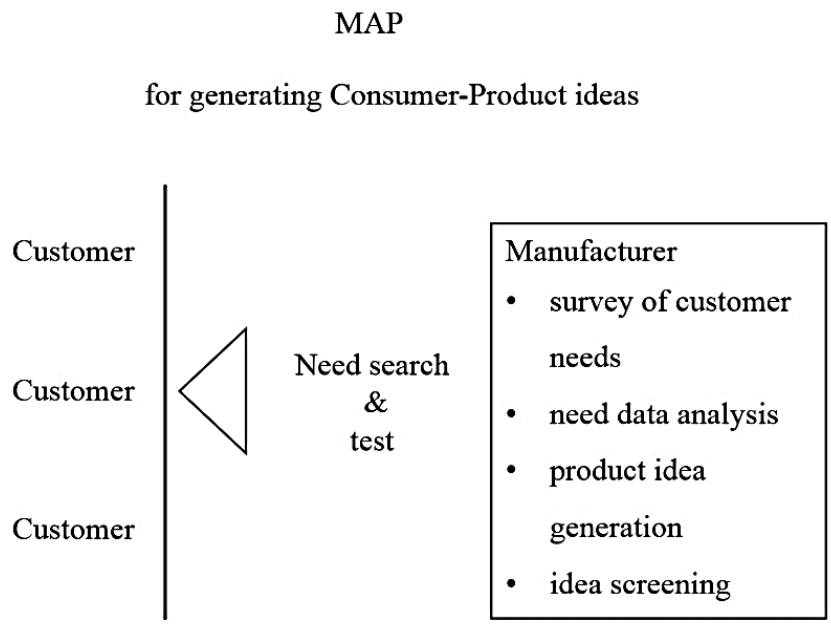


Figure 4. Manufacturer-Active Paradigm (MAP) vs. Customer-Active Paradigm (CAP)
Source: von Hippel, 1978, p. 40

According to von Hippel (1978), the manufacturer-active paradigm (MAP) made a poor fit with conditions under which ideas for most new industrial products must be generated; von Hippel had developed a new “customer-active” paradigm (CAP), which further appeared better suited.

The key difference between these two paradigms (Figure 4) is that in the MAP, the role of the manufacturer is to select and survey a group of customers to obtain information about needs for new products or modification of existing products then analyze the data and create a responsive product idea. Therefore, the MAP lies on the principle where customers could ‘speak only when spoken to’. In contrast, in the CAP, it is the role of the potential customer to develop the idea for a new product. The role of the manufacture is to attract and wait for a potential customer to submit a request, to screen the ideas and to select the most promising ones for development (von Hippel, 1978)

It should be noted that although von Hippel proved that the hypothesized CAP fits more closely with industrial product-idea generation practice than does the conventionally assumed MAP, the CAP can only be applied in situations where the potential customer is aware of his new product need.

2.1.2. Lead users

The early user innovation literature clearly focused on the lead user as the focal actor who is innovating autonomously to solve his/her own need (von Hippel, 1988).

In order to discuss “lead users” further, the definition should be given. According to von Hippel (1988), "lead users" of a new or enhanced product, process or service are defined as those who display two characteristics with respect to the product:

- Lead users face needs that will be general in a market place - but face them months or years before the bulk of that marketplace encounters them, and
- Lead users are positioned to benefit significantly by obtaining a solution to those needs.

In sum, lead users are users whose current strong needs will become prevalent on market months or years in the future. The shape of a market trend and the role of lead users in it can be illustrated by the Lead User Curve (von Hippel, Thomke & Sonnack, 1999):

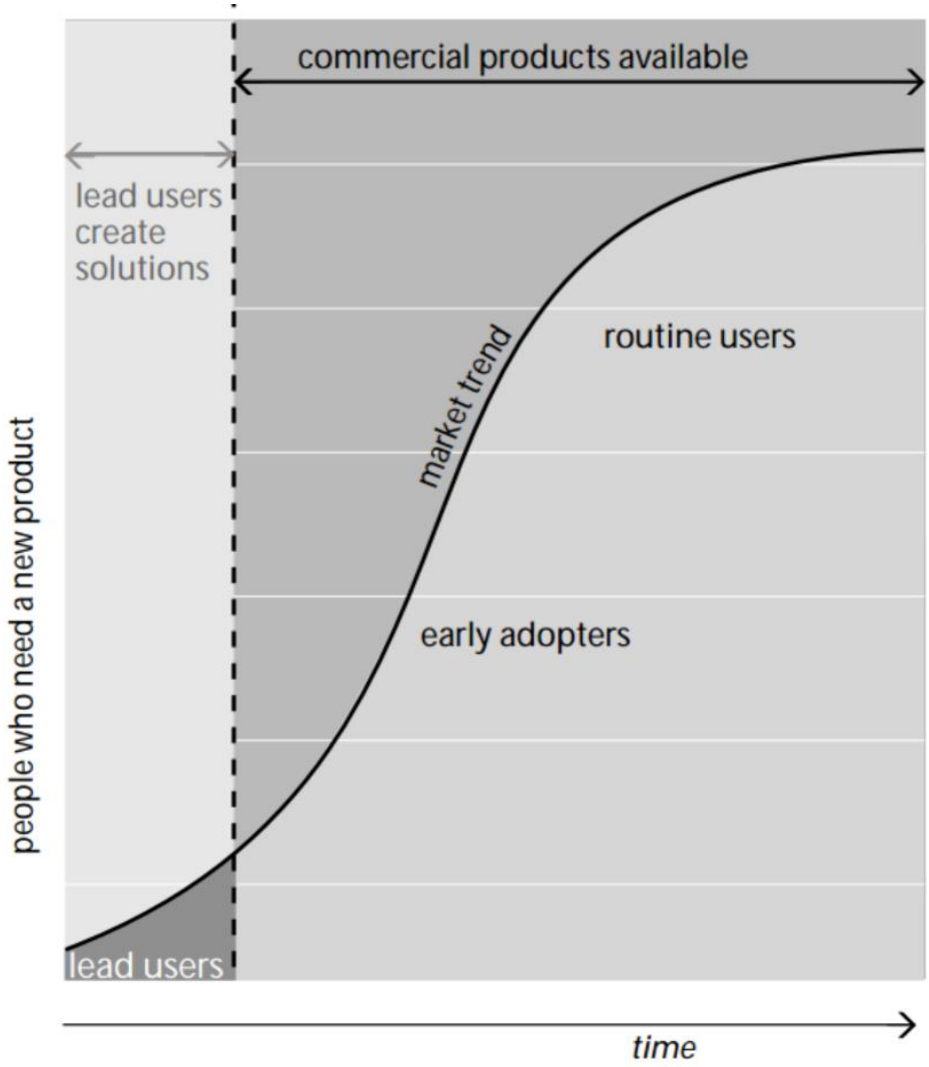


Figure 5. The Lead User Curve
Source: von Hippel, Thomke & Sonnack, 1999

Thus, the curve (see Figure 5) illustrates the outline of the market trend. Lead users reperesent needs that are significantly ahead of the trend: over time, more and more people would acquire the same need. A range of findings presented previously (e.g. von Hippel, 1988; Pavitt, 1994; Shah, 2000) support the proposition that user innovations are later adopted by other individuals and/or commercial firms.

Research had shown that some of the most important and new products, services and processes have been developed by lead-users. For instance, von Hippel (1988) found that about 80 percent of the most important scientific instrument innovations were developed by practitioners and users, the same

stands true for the most of the major innovations in semiconductor processing industry. Pavitt (1984) adds that many inventions by British firms were for in-house use. Moreover, Shah (2000) found that the most commercially important equipment innovations in sports industry were again developed by individual users or lead user communitites.

In addition, several published studies have also reported success in new product idea generation experiments with a lead user-centered approach. Two of such studies have compared using quantitative methods the outputs of lead user idea generation studies with the outputs of traditional “voice of the customer” studies that focus on target market customers (Griffin 1997). These articles conclude that the ideas generated by or with significant inputs from lead users have much higher commercial attractiveness (Urban & von Hippel 1988, Lilien et al. 2002). Lilien et al. (2002) also found that lead users capable of systematically generating ideas for “breakthrough” or radical innovations, where radical or breakthrough were defined as new product lines providing new sales representing over 20% of total existing sales of the entity (a corporate division) developing them.

Overall, apart from the obvious benefits in terms of creation of both new products and solutions, there are other benefits for firms, for instance, von Hippel (1986) had contributed to the analysis of need and solution data from "lead users". He found that lead user cooperation could potentially improve the productivity of new product development in fields characterized by rapid change in technologies.

2.1.3. Diffusion of user-driven innovations

Von Hippel (2005) emphasized, “If user-innovators do not somehow also diffuse what they have done, multiple users with very similar needs will have to independently develop very similar innovations – a poor use of resources from the viewpoint of social welfare” (p.9). The diffusion paths of user innovations have been explored by de Jong et. al (2014) – see Figure 5.

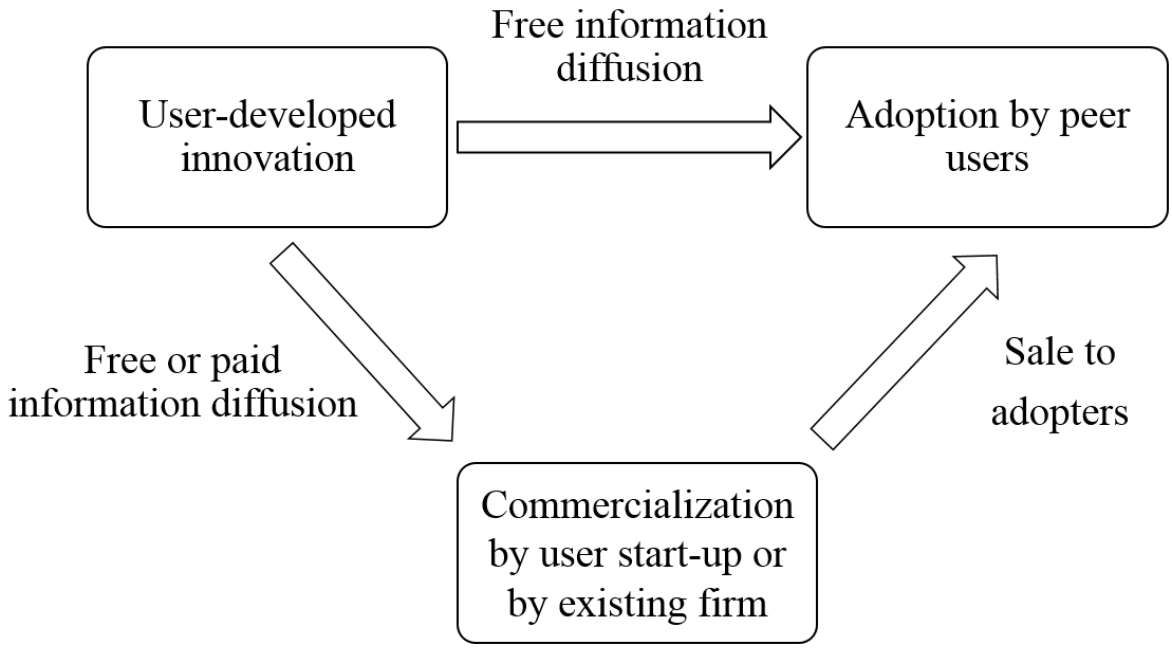


Figure 6. Pathways via which user-developed innovations diffuse
Source: de Jong et. al., 2014

The top of Figure 6 shows that users who innovate may choose to reveal information regarding their innovations freely to other users (peers) interested in adopting them. Free revealing is defined to exist when the information is provided without any restriction upon or charge for the information itself. It implies that user innovators voluntarily give up their potential intellectual property rights and share the details of their innovation with anyone interested, so that the information becomes a public good (Harhoff, Henkel and von Hippel, 2003). This does not mean, however, that potential adopters will not have to spend money and/or an effort to acquire that information.

Diffusion can also be accomplished less directly, with producers obtaining information from user innovators so that they can adopt the innovation (and further develop it if needed) and then offer it to a broad audience for general sale. As can be seen at the left side of Figure 6, the information may be freely revealed to the producers on the same terms as it is revealed to adopting users: freely revealed information has no restrictions upon who may access it. Alternatively, some user innovators may choose to not freely reveal their

innovation-related information but instead demand some kind of compensation (e.g., pay, royalties, favors).

Regardless, the transfer of innovations from user-innovators to producers can take several different directions. Licensing or sale of user-developed intellectual property related to processes is often done in chemistry-related fields (Enos 1962, Freeman 1968). While in open source software development and other ICT industries peer to peer transfer without monetary benefits is a popular trend according to Benkler (2006). User-innovators also do sometimes result in newly developed startups or spin-offs from existing companies companies to produce commercially what they initially designed for their own use; in recent years, this tendency grew in popularity among researchers of user-driven innovations.

Multiple evidence from academic literature suggest that many users innovate and that lead user communities are common, the evidence on the role of user-innovators in the commercialization of their innovations is mixed. According to some researchers such as von Hippel (1988), individual scientists who had developed important scientific instrument innovations seldom founded firms to exploit these. On the other hand, Shah (2000) found that, in the field of sporting equipment, lead users who developed significant equipment innovations often did become user-manufacturers, producing small volumes of their innovative equipment for purchasers. Therefore proving von Hippel's early theory about applicability of MAP and CAP paradigms. Shah and Tripsas (2004) explore when user-innovators are likely to start firms, and compare the competitive advantages of user-startups with established manufacturers. They found out that the likelihood that users will start companies is affected by their opportunity costs as well as initial customer needs.

In any of these commercial pathways, the innovation ends up being offered for general sale, so that adoption by peer users is accomplished and social welfare is enhanced.

2.2. User-driven innovations research timeline

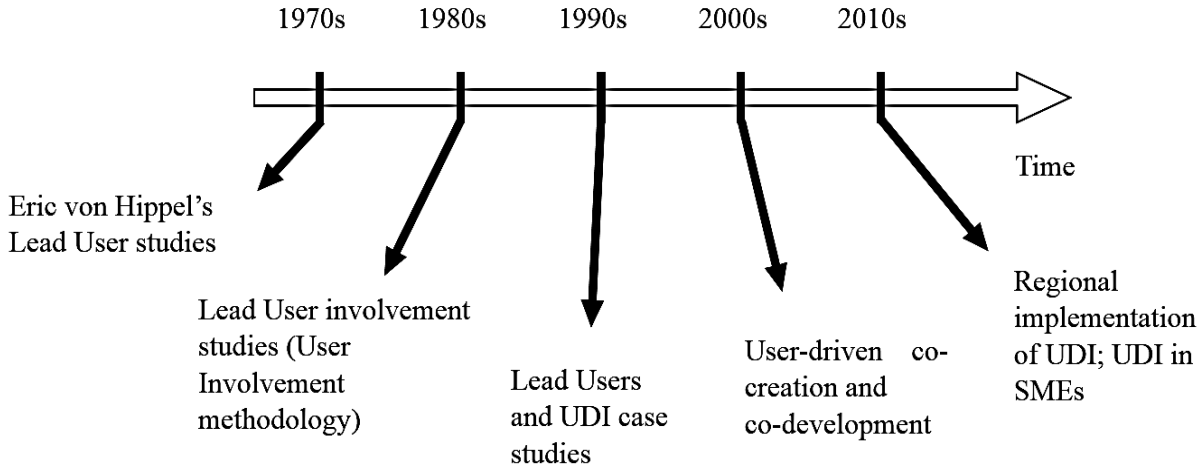


Figure 7 User-driven innovations research timeline

All the research and literature devoted to user-driven innovation could be outlined in a timeline divided by decades. UDI as a term was created in 1970s when Eric von Hippel wrote his first articles on Lead Users and role of lead users in product development (von Hippel 1976, 1977). Prior to that, most of the literature operated with only traditional product development paradigm, where manufacturer played the main role (See Figure 7). Later, researches based on data obtained from both customers and firms proved that Customer-As-Innovator approach (see Figure 8) could significantly improve new product development process by addressing users' needs directly. Moreover, traditional approach to new product development proved to be cost and time inefficient compared to user-driven innovation approach. According to von Hippel, despite obvious benefits, new approach to product development does not suits every company. In fact, mainly technological companies with complex products could capitalize upon new product development paradigm.

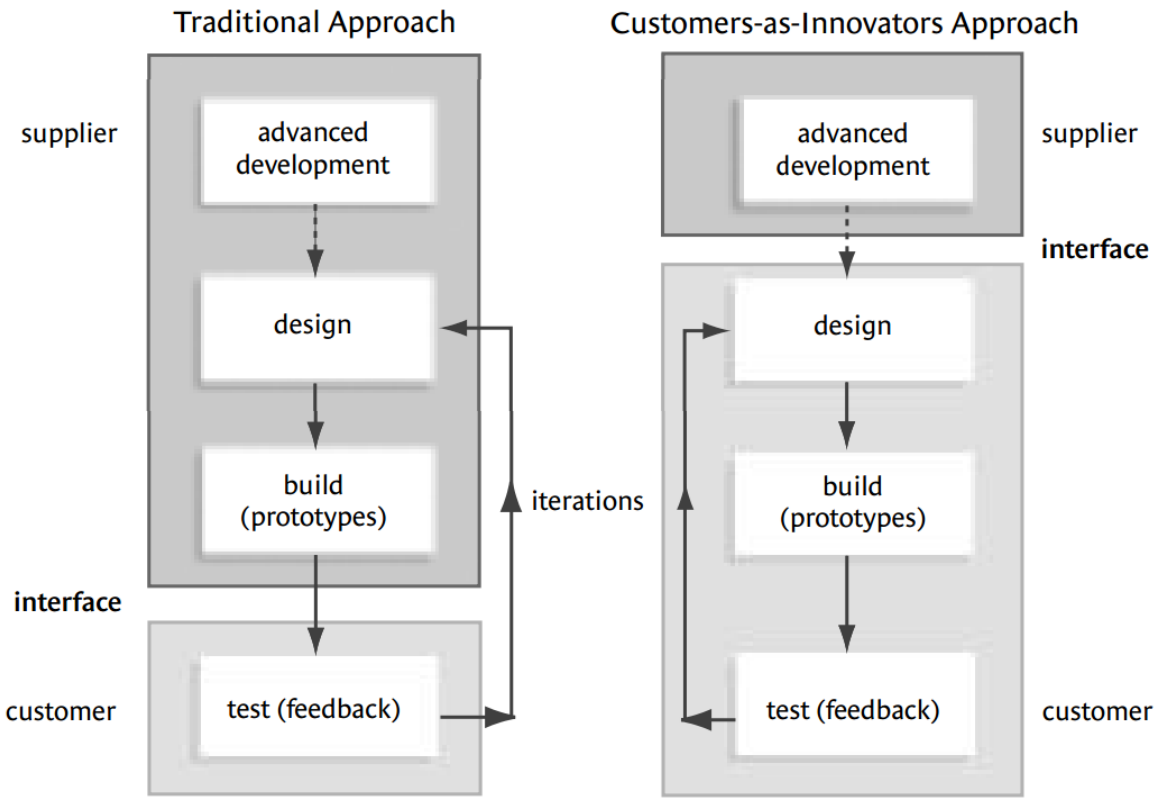


Figure 8. Traditional and new product development paradigms.
Source: Thomke, S. & von Hippel, E. 2002

The idea of innovations by users grew in popularity not only among academic community, but also among business practitioners. Therefore, due to the growing interest of practical implementation of lead user's knowledge in 1980s von Hippel and other researchers developed User Involvement Methodology (Urban & von Hippel 1986). The methodology itself consisted of four main aspects:

1. Specify Lead User Indicators;
2. Identify Lead User Group;
3. Generate Concept (Product) with Lead Users;
4. Test Lead User Concept (Product).

Many researchers afterwards built onto this methodology. At the same time, large companies started to suffer from the declining profits in the late 1980s due to disparity between investments into new product development and outcome from sales. These factors resulted in industry transformation, which led to

growing influence of customers on product development.

In 1990s, multinational companies such as 3M and P&G started to apply knowledge of UDI and lead users in practice, hence substantial amount of research had been focused on case studies as well as successful examples of UDI implementation (Herstatt & von Hippel 1992, Riggs & von Hippel 1994, von Hippel, Thomke, Sonnack 1999). Another trend in academic literature of 1990s was the increase of researches devoted to open innovation and interactions among different stakeholders. Customers as innovators allowed companies to provide exacts solutions to needs and meet most demanding expectations, therefore increasing perceived value of the product for customers. In case of 3M, for instance, on average, more than 30% of commercially important innovations were developed by users rather than by the company itself. In fields of Scientific Instruments and Semiconductors first commercial prototypes in 100% of cases came from users (von Hippel, Thomke, Sonnack 1999).

At the same time, in late 1990s - early 2000s, the term Open Innovation emerged in academic literature. According to Henry Chesbrough (2003) Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ones, and internal and external paths to market, as the firms look to advance their technology. Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model. Apparently, for the most companies main source of external ideas to stimulate open innovation process is close collaboration with customers.

Open innovation process, as Chesbrough (2003) hypothesized, requires inflow of external ideas on research stage. These ideas in case of user-driven innovation approach come from lead users and regular customers. The main goal of the manufacturers shifts from design and idea generation to idea capturing and idea-validation. Most radical customer’s suggestions that could not be adopted by the conventional businesses result in spin-off or even create new market niches.

Open innovation research base gave a push to another trend of 2000s - co-creation and co-development with lead users. Development of the ICT and spread of broadband Internet connection allowed online communities of users to emerge. This led to enormous possibilities of co-creation and co-development with users based on ideas created in online communities. Extreme sports, computer games, medical equipment are among industries with most active utilization of co-creation of new products. Kite surfing is one of the example of industries, which arise due to the development of online communities and co-development of equipment with users. Eric von Hippel et al. (2006) reported that approximately 10-40% users of kite surfs modified or developed a new product. Further development of Internet collaboration in product development resulted in creation of startups solely devoted to niche markets based on cooperation with lead user and ideas driven by uses of the product.

Starting from 2010s, latest trends in UDI research are practicalities of regional development and implementation of UDI as well as research of UDI in SMEs and startups. There are several overviews and surveys of the UDI implementation by countries such as UK, the Netherlands, Finland, and Denmark (Rosted 2005; de Jong, J.P.J. & von Hippel E. 2009; Flowers et al. 2010; Niemi & Kuusisto 2013). Most of the surveys show that approximately from 5% to 20% of the companies are involved in the UDI depending on country; in almost 50% of the cases users gave their ideas away freely without any compensation.

Overall, UDI research timeline gives a clear overview of the term UDI. The phenomenon that started in 1970s with von Hippel's lead user theory has become popular since 1990s with the increase of its adoption among MNEs. UDI proved to be a multidisciplinary field of study combining different approaches and theories. The development of information technology and global spread of the Internet made the user-driven co-creation and idea sharing commonly used not only by MNEs, but also by SMEs and startups.

3. USER INVOLVEMENT IN INNOVATION PROCESS

Despite the transition in the customer's role from passive participants into active ones, customers still play a limited role in the development of new products and services in most of industries. Among limiting factors are information gap between customers and producers, poor connectivity and lack of cooperation. Furthermore, one of the key reasons explaining customers' limited role in new product development is lack of motivation. Only a small portion of lead users show willingness to be involved in generating ideas for new products and in co-creating these ideas with companies. However, given rapid development of technologies and online innovation communities, it is clear that lead users can become a key part of the innovation process. Therefore, there is a need for increasing users' involvement.

3.1. Involvement of users

Previously, it had been considered that the only people involved in innovation process were R&D personnel (Jensen, Johnson, Lorenz, & Lundval, 2007). However, in nowadays business environment, innovation activities are rarely carried out within a single organization (Still et. al, 2011). Rather, companies often gather and incorporate required knowledge and other resources from multiple sources, which include networks, co-creation with customers and end users, etc. (Still et. al, 2011). In addition, in current conditions, users have better incentives, opportunities, capabilities and oftentimes more willingness to participate actively in innovation, and initiate innovation processes.

Barki and Hartwick (1989) conclude that psychology, organizational behaviour, and marketing have converged to a definition of involvement "...as a subjective psychological state, reflecting the importance and personal relevance of an object or event" (p. 61). Therefore, the term user involvement, according to the

authors, reflects a psychological state connecting the importance and personal relevance of a new system to the user. It also should be noted that user participation and user involvement are two different terms.

User (customer) participation refers to “the degree to which the customer is involved in producing and delivering the service” (Dabholkar, 1990, p. 484). Users seen as participants of the innovation process when they take part in, or contribute to, the innovation being developed. Participation can be assessed by measuring the specific inputs, activities, and behaviours that users perform during the innovation development process. (Barki and Hartwick, 1994). Regardless, this distinction between the 'participation' and 'involvement' terms is not considered important for this study. Therefore, the term 'involvement' would mean both physical and psychological involvement of users in various stages of the innovation process.

There are various opportunities for users to participate in product or service development. Different kinds of contributions by users have been recognized, for example quality improvement, customization of existing products, refinements and niche-targeted variety, or breakthrough innovative ideas. Some of the authors, nevertheless, believe that users do not play a part in the ideation process; users are only contacted after the company has developed a new solution to evaluate it, for example focus groups (McQuarrie & McIntyre, 1986). However, von Hippel has stated that users can be perceived as sources of new ideas or inventions (von Hippel, 1977, 1978, 1982, 1988). Today, von Hippel’s vision is prevalent on the market as well as in academic literature, since users play significant role in ideation process.

Direct contact between users and developing companies has been found to be a crucial element in user involvement (Howe, 2008). Therefore, one of the dimensions on which user involvement can differ is the degree of freedom of the user-collaborator relationships. Kaulio (1998) distinguished three degree of such relationships: design for users, design with users and design by users.

Design for users denotes a product development approach where products designed on behalf of the customers. This type of user involvement coincides with the 'market pull' paradigm, as the user remains a passive stakeholder in terms of input to the innovation development (Schuurman, Baccarne & Mechant, 2013).

Design with users refers to a product development approach that focuses on the customer and utilizes data on users' preferences and their needs and requirements. In addition, this also includes presenting different concepts to users, so they can react to different proposed design solutions (Schuurman, Baccarne & Mechant, 2013).

Design by users allows for the highest degree of end-user freedom. End-users are actually developing the products themselves or in close collaborations with companies. (Schuurman, Baccarne & Mechant, 2013).

Another dimension of user involvement in open innovation relates to the nature of involvement. Jespersen (2008) defines five possible user roles that differ in terms of interaction control as well as task/social orientation:

- user as a resource (unstructured interaction and task oriented);
- user as a co-creator (structured interaction and task oriented);
- user as a product (unstructured interaction and socially oriented);
- user as a buyer (structured interaction and socially oriented) and;
- user as a 'user' (in the middle of both dimensions).

Although these roles often appear in combination and are not mutually exclusive, they provide insight for structuring user involvement in open innovation.

The combined framework for types/methods of user involvement in open innovation (see Figure 9) is based on the framework presented in the study conducted by Schuurman, Baccarne & Mechant (2013) with major modifications

in types of user involvement.

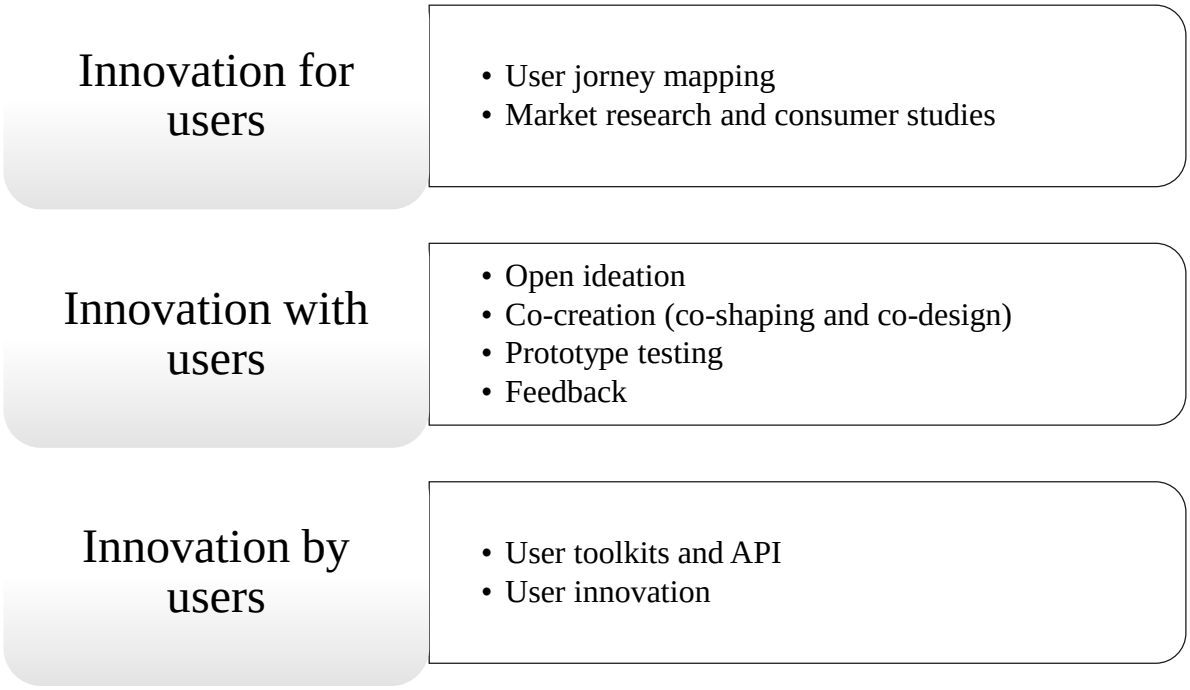


Figure 9. Types of user involvement
Source: adopted from Schuurman, Baccarne & Mechant, 2013

- User Journey Mapping – the method that helps determine the functions of services that need to be improved and the potential obstacles which users might encounter when they are using those services (Advocac Unit, HSE, 2010).
- 'Market research' instruments refer to practices associated with the market pull paradigm. In this approach, users serve as passive respondents, and do not actively participate in the innovation process.
- Open ideation approach helps to gather user ideas by means of different methods and techniques (comments, ratings, new ideas, selection by voting). This approach is most appropriate in the early stages of the new product development process.
- Co-creation - involving users in the innovation and development process in the forms of co-shaping and co-design.
- Prototype testing - the method that is designed for testing the developing services (products) through observing the interaction between users by

putting prototyped services (products) in a situation that will occur in the future.

- Feedback – chat sessions, bug reports, discussion with developers.
- User toolkits and API - all the elements or building blocks are well-defined but the user can configure them the way he wants.
- User innovation refers to the users taking complete control of the innovation process. Users can fully utilize their creativity and turn this into concrete products or services, tailored to their own needs and wants.

All in all, the framework shows that it is important to distinguish between whether the users are directly or indirectly involved in the innovation process. In addition, it is also crucial to distinguish between acknowledged needs and undiscovered potential needs, which might occur in the future. User motivation for participation in innovation process will be discussed in Chapter 4.

3.2. Stages of innovation process

In academic literature there could be found a variety of approaches to the description of innovation process, however if structuring them all, one could see that in fact most of the authors use two main constructions, when talking about innovation process.

First is the Stage-gate (sometimes Phase-gate) model (see Figure 10), which originates from project management. This model assumes that each stage or phase of any process is separated by gates, while at every gate decision-making body decides whether to continue process or not.

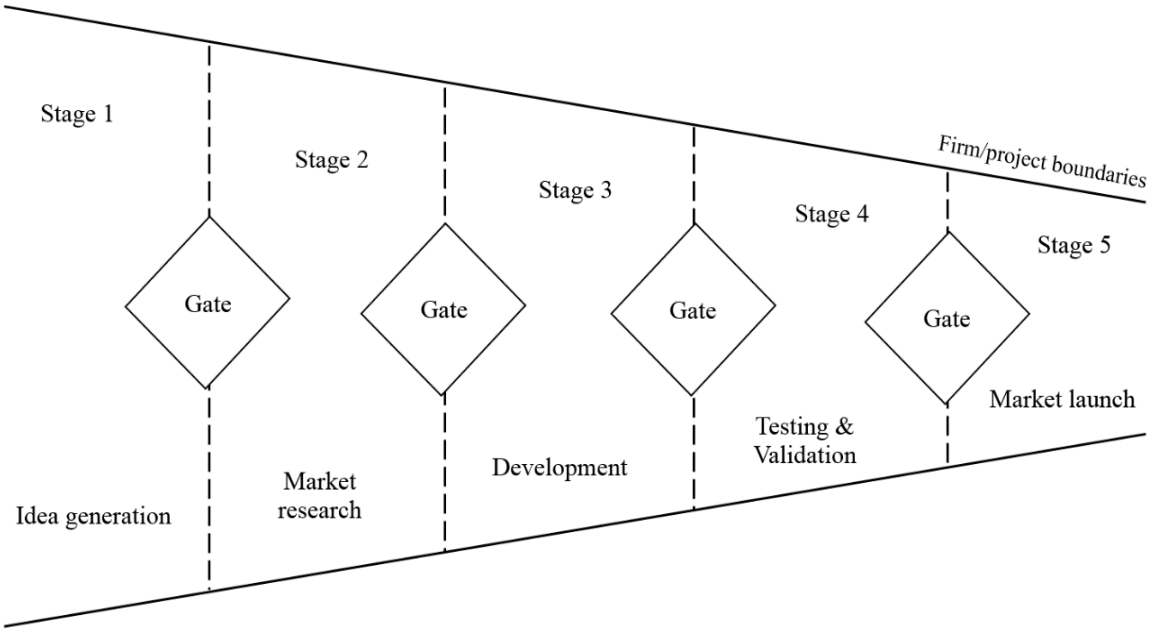


Figure 10. Stage-gate model of innovation process
Source: Stage-Gate International, 2014

Model was developed in the middle of 20th century and had been used primarily for the support of the investment decision-making in project management. Later, when innovation management separated from project management this model was tailored to the needs of innovation management. Nowadays, stage-gate model commonly depicted as the innovation funnel (funnel-shaped graph) in order to highlight the fact that on each stage number of viable projects or innovations reduced. This happens due to the numerous reasons, earlier stages could represent many projects that are impossible to implement because of the lack of technology on the market. Late stages eliminate ideas according to scope of the company or the availability of resources.

The second model of the innovation process came from the producers of innovations (see Figure 11). Conventional R&D process in a production company starts not from the idea generation, but rather from the research of the market and customers' needs. Then, as in the stage-gate model, follows development and production and, finally, market launch and commercialization of the product, in other terms diffusion of the innovation. This model refers to a classical technology-push approach, where manufacturer offers a product,

which he think has a market potential and demand according to market research conducted by the manufacturer.

Figure 11. Producer innovation process model
Source: Eric von Hippel 2005

In this research, we would orient on the combination of both of this models. Open innovation process (see Figure 12) proposed by the Chesbrough (2003) combines innovation funnel and stage-gate model as well as incorporating producer innovation process model, while also making boundaries of the firm open. Open boundaries highlight the open flow of the idea in and out of the innovation process, which allow collaboration with users as well as spin-off creation based on the same innovation.

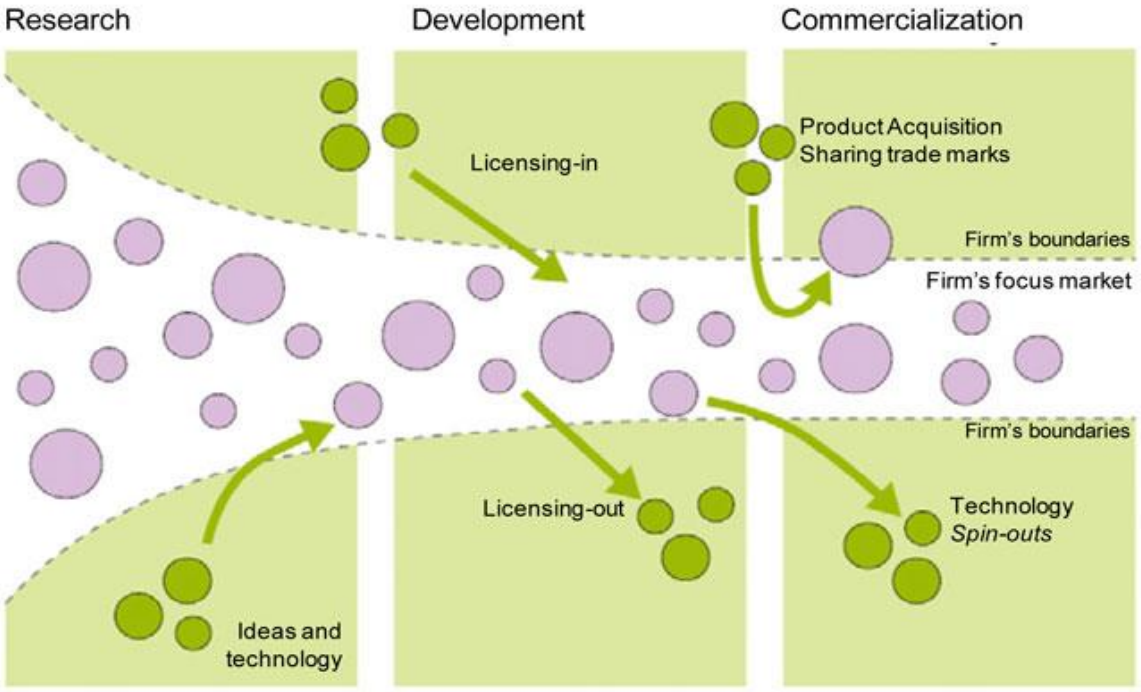


Figure 12. Open innovation process
Source: adopted from Chesbrough, 2003

This model suits user-driven innovation process well, as it show that inflows of the ideas into the firm from the outside could occur on every stage of the innovation process. In addition, model takes into the account possibilities of the spin-offs of the ideas on the commercialization stage.

Overall, for the purposes of this thesis there are three main stages of innovation process that include research, development and commercialization stages.

3.2.1. Research stage

Research stage of the innovation process is the first stage; this stage includes idea generation by companies as well as by users, market research and investigation of the viability of the idea and the definition of the project. On this stage, company works with the variety of the ideas from different sources. In case of user-driven innovations, company filters ideas, assessing whether the idea fit into the scope of the company and/or have the market potential to succeed. After the screening of the ideas, a company finalizes which project to continue with and prepares preliminary project plan.

This stage is the widest part of the innovation funnel with the highest number of potential projects and ideas, which means that most of the projects would be sorted out here before going onto the next stage. However, it is wrong to assume that most of the ideas on that stage are unimportant or irrelevant, since this stage define the volume of the idea-flow, which would go into the innovation funnel further. This means that strict rules could potentially scare off some radical ideas, which could put at risk al the innovation process in future.

On this stage of innovation process, company should seek balance between estimated potential of the idea and production possibilities of the company in order to stay into the limits of company’s business scope.

3.2.2. Development stage

After final selection of the ideas and projects on the research stage, comes development stage of the innovation process. This stage consists of resource evaluation, concept development and licensing of the successful ideas. Testing and validation committed after the concept development in order to investigate existing flows of the product and eliminate them before launching into the market.

Development stage requires detailed investigation of available and necessary resources from the producer's side in order to ensure successful concept development. Innovation projects often associate with human resources and knowledge and, therefore different intellectual property (IPR) rights procedures such as patenting and licensing. This means that companies should not only create new knowledge themselves, but also find the right patents from the existing ones. IPR-related matters could significantly hinder the innovation process. According to von Hippel (2005), present-day intellectual property regimes are far from the expectations of theorists and policy makers, and since user-driven innovation is often associated with free reveal of the inventions by users, both firms and society could benefit form that.

In case of MNC's, mergers and acquisitions could happen on the development stage due to the fact that it is cheaper to acquire patent and know-how holder than developing the technology from the scratch. Another tendency of the development stage of innovation process is a spin-offs creation. Some radical ideas or projects that does not fit firm's boundaries well could get a new life in the start-ups or other companies. Chesbrough (2003) in his book on open innovation analyses the case of PARC (Palo Alto Research Center) created by Xerox to show that around 20 years after the start of the project cumulative market value of the spin-offs was higher that Xerox itself. This case illustrates the importance and possibilities that innovation development opens for a firm.

Another important part of the development stage is testing and validation phase

that helps to minimize risks of failure of the innovation on the market after launch. Role of users and testers on this phase is vital; therefore, companies should not cut costs on this stage as it may affect the whole project. It should be noted that testing procedures should include not only lead users and enthusiasts, but also control groups of the common users and so-called technological conservatives, laggards or sceptics. The response from latters sometimes is the most important one, since diffusion of innovation and commercial success comes from the mass adoption of the innovation by majority of the users. Many practitioners agree on the fact that lead users or technology enthusiasts or visionaries account only for 5-10% of the whole number of users (von Hippel 1988, 2005), which make testing and validation by common users a key to successful innovation diffusion.

3.2.3. Commercialization stage

The last stage of innovation process is called “commercialization” or “market launch”; on this stage, product or service going to the mass market and company expects to capture value from it. Commercialization stage covers most of the diffusion of innovation, which starts on the late development stage, where only small portion of the users is acquainted with the product. User acquisition, word of mouth and other marketing techniques are among the most important factors of success of the innovation on this stage. Hence, user involvement on previous stages of innovation process helps to establish user base, which would account for the initial customer pool for the new product.

However, it should be mentioned that in case of user-driven innovation promoted by users themselves, commercialization stage represents the process of offering the product made by the company for lead user to his peers among the professional community. Examples of such commercialization by lead users could be found in medical equipment or some extreme sports industries, where user develops a prototype himself and the company plays a role of contract manufacturer (Franke et al., 2006; Rosted, 2005).

3.3. User involvement on each stage of innovation process

According to Bråtå et al. (2009) “there are a number of opportunities for users to participate in product development. Typically, there are more opportunities in early stages of product development, but it might then be difficult for users to participate because the product being developed is difficult to depict. The case is the opposite at latter stages of product development.” The author suggests a scheme that shows opportunities for users to participate in the innovation process (See Figure 13)

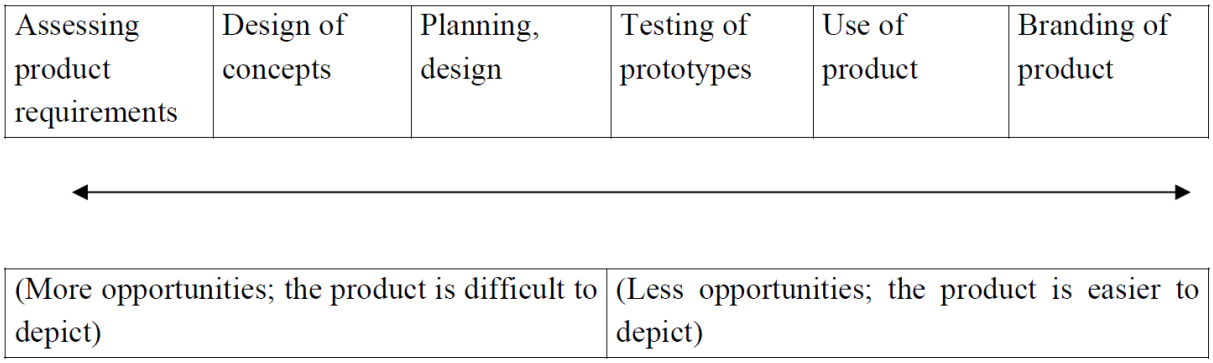


Figure 13. User’s opportunities to affect the innovation process
Source: Bråtå et al., 2009

Literature overview shows that in most cases, related to user-driven innovation, companies tried to attract users to participate in idea development and initial product requirements assessment, rather than on late stages, where users could test and validate the product before market launch. Active user involvement and participation on each stage of innovation process could positively affect commercialization of the new product, given that users ensure utility and usability of the developing product.

Degree of user involvement on each stage of innovation process should differ depending on particular goals of the project. However, there are some common approaches, which could be utilized on each of the three stages of innovation process. Initially, on the research stage companies could collect and screen

inbound ideas from users or encourage existing customers to share their ideas for the new product. Developing first prototypes or drawing schemes of the future product or service is crucially important on this stage, since it helps users to depict the image of the future product and simulate its characteristics.

Development stage of innovation process requires as much user attention as research stage does, given that first working prototypes emerge on this stage. Users should play main role in a process of testing and evaluating first prototypes in order to share their insights and first impressions. Most of the flaws of the future product could be avoided on this stage by considerable amount of testing. Another important thing to mention here is that lead users and enthusiasts, which participate in preliminary tests, could help to build the image of the product for mass market and spread the word of mouth about upcoming innovation.

User involvement on late stages of innovation process could be illustrated by case of Oculus VR. Oculus VR is a technological company developing head-mounted display for virtual reality. Their first product called Oculus Rift is currently under development and expected to be release sometimes in 2015. The idea of the product came from one of the online communities of 3D enthusiasts, where founder of the company saw the discussion on the virtual reality head-mounted devices. Oculus involve some of the experts from game development and graphics design to create its first prototype of the Oculus Rift. Company sent first developer kit to the number of supporters from crowdfunding campaign in order to receive first impression and feedback. Device got primarily positive feedback and became highly discussed among gamers and technology enthusiasts, which helped project to became popular and receive publicity and funding even before first product launch. Later in March 2014, Facebook acquired Oculus VR for US$2 billion (The Guardian, 2014). Recently company release second version of the developers' kit with improved characteristics and build quality based on the feedback from the first prototype. The Oculus VR case is a practical example of how company could involve users and extract value from the user involvement on the development stage of innovation

process. Public testing allowed company to get customer base, recognition and even additional financial resources for future development, before going into market launch. Experts predict big market potential for the upcoming product and several well-known game developers agreed to collaborate in software creation process with Oculus VR (Forbes, 2013; Oculus VR, 2014).

On a commercialization stage of the innovation process, when the image and prototypes of the product are available to users, there are fewer possibilities to contribute to product development. However, consistent user involvement on first stages of innovation process helps to utilize established customer base on the late stages. Reviews of the product on the popular web sites as well as early access to the product samples increase innovation diffusion among wide masses of the customers. Another important thing to consider on the commercialization stage is a future product development and utilization of the established community for the future purposes.

As an example of successful work with the community and product modernization after market launch, could be the case of Electronic Arts' Digital Illusions CE (EA DICE or DICE). DICE is a game developing studio owned by Electronic Arts, which is mostly known for development of Battlefield series of video games. One of the innovative products in DICE's portfolio is Frostbite game engine, which is used to create video games. With the release of their latest product on the Frostbite engine – Battlefield 4 at the end of 2013, DICE faced many technical issues, which resulted in malfunctions of the product (DICE, 2014). DICE decided to utilize community of gamers in order to tweak and fix the game. In April 2014, DICE released stand alone version of the Battlefield 4 called CTE (Community Test Environment), which enabled users to test and design new features for the game. As a result of the experiment, DICE was able to fix most of the issues with current product as well as gather ideas for the next games to come. CTE provided a platform, where developers and gamers could play and create at the same time. Successful ideas and fixes were transferred to the main product, therefore improving stability of the game for all the customers (International Business Times, 2014). Such initiative by

DICE shows the importance of user involvement on late stages of the innovation process, especially after market launch of the product, since the results and ideas would not only help to improve current product, but also support future product development (DICE, 2014).

Overall, there are different techniques and approaches to user involvement on different stages of the innovation process. Companies could start collaboration with users from the idea generation and continue interaction even after market launch of the product. Examples of Oculus VR and DICE reflect some methods of utilization of online communities for mutual advantages of users and company on various stages of innovation process.

3.4. User involvement in ICT sector

According to academic literature, information and communications technology (ICT) sector could significantly benefit from user involvement in product development (Mahmood, Hall & Swanberg, 2001; Jespersen & Buck, 2010). Nowadays, more and more IT companies include feedback from users into new product development; whereas any software developing company as integral part of new product development commonly uses software testing by users (beta testing). However, the degree of user involvement in innovation process in ICT still has some room for improvement, since most of the companies generate the ideas themselves rather than incorporating user ideas.

Rapid development of technologies and broadband connection in last decades enabled independent developers to create their own projects and commercialize them without help from corporate sector. Online marketplaces for the mobile application as well as crowdfunding platforms opened new opportunities for innovation development in ICT (Miles, R. E., Miles, G., & Snow, C. C., 2005).

However, business models of larger software developing companies resemble traditional manufacturers with internal idea generation and closed R&D

processes. Recently, traditional approach to software development started to put additional limitations on the new products on the commercialization stages of innovation process, since user-driven solution sometimes better tailored to customer needs (Jespersen K.R. & Buck N., 2010).

Therefore, some of the user involvement techniques for ICT sector emerge in academic literature. Researchers distinguish between individual and corporate clients, when talking about user involvement in ICT, due to the difference in customers' needs and scopes between B2C and B2B clients. Figure 14 incorporates most of the commonly used user involvement approaches.

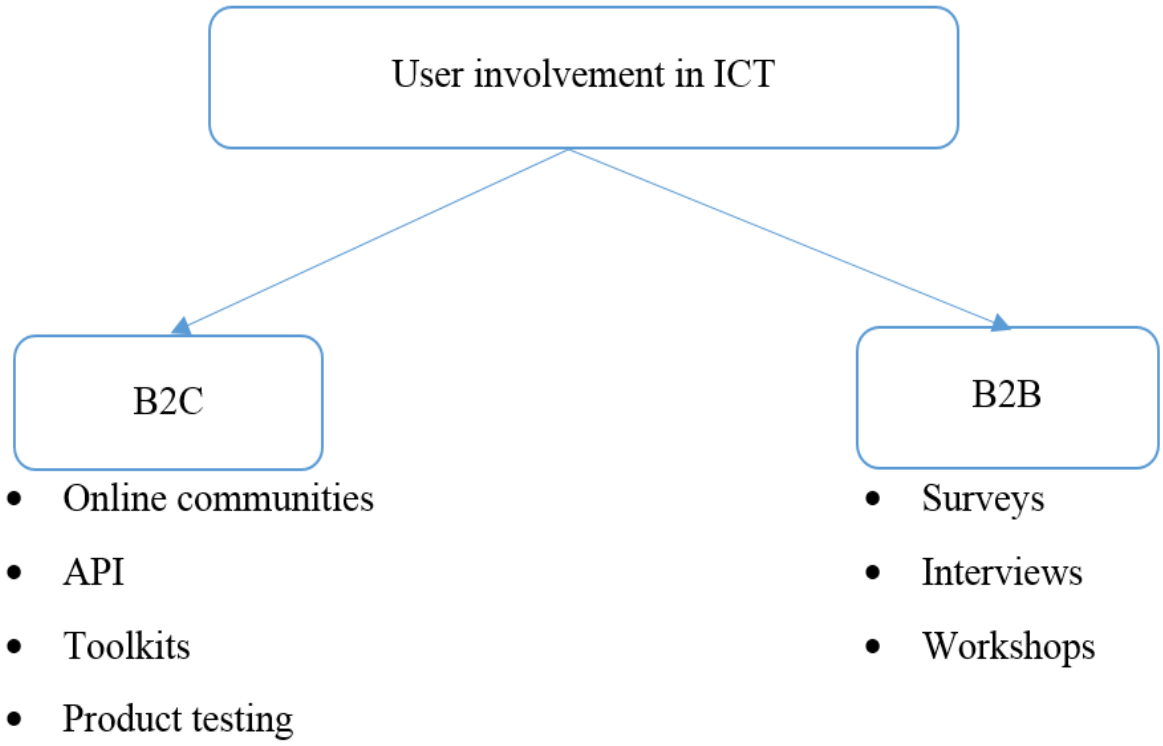


Figure 14. User involvement in ICT
Source: adopted from Dubelaar, Sohal & Savic, 2005; Jespersen & Buck, 2010

Individual users are much more flexible in terms of participation, therefore companies, working for B2C sector, use such user involvement methods as online communities, application programming interfaces (APIs), various toolkits and public product testing. Online communities foster idea generation phase of

the innovation development. API and toolkits help users to generate content and modify software for their specific needs. While product testing allows companies to make trial run of the newly developed products (Sawheny, Verona & Prandelli, 2005). All of these methods generate unique information about user preferences, which could be utilized during innovation development process (Dubelaar, Sohal & Savic, 2005).

Corporate users, on the other hand, require personal approach, in order to satisfy specific requirements. Hence, surveys, interviews and workshops are suitable tools for user involvement on the different stages of innovation process. Personalized approach to user involvement not only helps to obtain valuable feedback, but also increase rate of innovation diffusion and product adoption among corporate users, which are vital for seamless business operations (Dubelaar, Sohal & Savic, 2005; Jespersen & Buck, 2010).

In sum, user participation in ICT involves traditional as well as specific approaches to user involvement. Companies use different methods, when working with either individual or corporate clients. User involvement in innovation process in ICT sector provides valuable feedback, which could enhance processes of product development and innovation diffusion.

4. COMMERCIALIZATION OF INNOVATION AND THEORETICAL FRAMEWORK

4.1. Commercialization of innovation

Commercialization is the process of conversion of ideas, projects or prototypes into tangible products offered to the mass market (Franke, von Hippel & Schreier, 2006). From the manufacturer point of view commercialization means formulation of the production plan as well as implementation of such plan with the lowest costs. When speaking about commercialization of innovation, it is important to mention time to market measure, which defines the speed of

innovation diffusion and adoption by the users.

In case of user-driven innovation, time to market could be reduced compared to conventional R&D process at the same time collaboration with users provide initial customer base for future product. As a result, researchers (Thomke & von Hippel, 2002) state that user-driven innovations tend to have less hinders at the start of commercialization stage, since users are already familiar with the product or service. In addition, ideas suggested by users helps to significantly reduce time to market and reduce costs on R&D for manufacturers.

However, practice shows that companies still struggle to manage user-driven innovations effectively due to lack of regulations and policies. Only a few companies admit to have experience in innovation commercialization. According to McKinsey's (2010) survey on innovation and commercialization, only 39% of responding companies said that they are good at commercializing new products or services. While around 40% of respondents selected commercialization of innovations as the biggest challenge for the company. Another major issue in commercialization process is lack of formal regulations, which was chosen by 23% of respondents. Survey also shows that almost 40% of the companies see the customers' ideas as a way to improve their performance in innovation management (McKinsey & Company, 2010).

Lack of policies and experience could be one of the biggest issues in commercialization, since most of the MNC's rely on well-developed principles in their business operations. Von Hippel (2005) emphasizes the fact that policy-making and regulations are among top priorities of the countries, which aim at enhancing their innovation productivity. In fact, only few countries develop innovation related policies nowadays. The US and Scandinavian countries were the first to address the issue innovation commercialization on the country-level, nowadays rest of the EU and BRIC countries also start developing innovation policy that would help companies and encourage users to collaborate in innovation development and commercialization (Ministry of Employment and the Economy of Finland, 2010).

Users' perspective of innovation commercialization involves not only participation in development with companies and idea generation, but also implies creating spin-offs or startups upon new technologies. Attitude towards spin-off creation by users in academic literature differs, as ones see the future of technological advancement in startups, while others show skepticism pointing out higher risks and slower diffusion of innovations in that case.

Those in favor of commercialization by users primarily highlight benefits from using the product itself. In other words, new era of mass customization made it possible for users to find a solution for existing problem themselves due to the fact that customers became more educated and adopted to new technologies. Closely related to this, there is another argument for spin-off type commercialization – deeper customization of the product to tailor specific needs of the users. Cases of extreme sports (Baldwin et al., 2006; Franke et al., 2006) show that using toolkits provided by companies and unique experience, people we able to create product, which made completely new industries in sports. Which lead to another strong point of user commercialization – development of niche markets. Sometimes bigger companies unable to satisfy needs of various customers by offering limited solutions on the market, which leave part of the niches unfilled. Here user-driven innovation thrives with its custom solutions and flexible approach.

Another positive perspective of commercialization by user could be opportunity for the most radical ideas to see the life on the mass market. Individual entrepreneurs could manage to take bigger risks than established, risk-averse companies do, since for user-innovator it is sometimes more important to use his idea himself and share it with peers than to make it financially successful. This may also have a positive effect on the economy by developing entrepreneurial skills and abilities of lead users. Chesbrough (2003) points out that PARC (Palo Alto Research Center) provided Xerox and the ICT sector with the technologies and ideas for decades as well as created spin-offs, which became successful independently.

On the other hand, more skeptical researchers argue that in most cases users' attempts to create something viable on their own fail to succeed due to lack of the different resources such as financial, organizational or entrepreneurial. Indeed, even well-established producers with big R&D budgets struggle to successfully commercialize innovative products (Bleda & del Río, 2013). For instance, in early 1990s Sony presented new data-storage device called MiniDisk, which supposed to revolutionize market of optical storage devices. Despite huge investments and strong brand name of the manufacturer, MiniDisk technology lost to its main competitor CD format and became obsolete without any significant success (Forbes, 1998).

Another concern towards user-driven commercialization is focus on the specific solution, which might not be so attractive to wider audience. Some of the specific solutions fail to diffuse into mass market due to indirect competition with bigger companies with well-known brands and broad customer bases. In addition, most cases reveal that even successful spin-offs by users often fail to produce something new after the first success and end up being one-time sparks. The last skeptical argument against user commercialization is longer time required to create and diffuse new product compared with innovation by companies.

Overall, both only company-driven and only user-driven innovation have flaws when it comes to commercialization, therefore balance should be found. Cooperation with users by companies on different stages of the innovation process brings the most effective results and helps to enhance process of commercialization of innovation.

4.2. Estimating value of user innovation

Value of user innovation is a vague term that could relate to many different topics around user-driven innovation. First, it is important to differentiate between value perceived by companies and companies, since those have its

unique motives to participate in innovation process. Figure 15 reflects most of the benefits and values that companies or individuals expect to gain from innovation process.

Benefits from innovation process

Company	Innovator/user
• Output-related benefits o Expected profit from selling the innovation o Expected benefits from created patents and knowledge • Participation-related benefits o Free source of new ideas o Reduction of R&D costs o Acceleration of innovation diffusion o Initial customer base o Higher level of user loyalty and satisfaction • Other benefits	• Output-related benefits o Expected benefits from using the innovation o Expected profit from selling the innovation • Participation-related benefits o Enjoyment from creating the innovation o Learning from creating the innovation o To help others (altruism) • Other benefits

Figure 15. Benefits from innovation process
Source: modified from Gales & Mansour-Cole, 1995; Raasch & von Hippel, 2013

When it comes to estimation of the value of innovation most economists and innovation practitioners tend to think primarily about economic value of the outcome of the innovation process. However, researchers suggest that apart from monetary benefits there are also benefits from participation in a development (Raasch & von Hippel, 2013). In some cases participation-related benefits could represent much more when converted to monetary equivalent since it is very hard to gain, for instance, initial customer base or customer loyalty. However, here lies another issue with value of innovation – it is almost impossible to calculate this value using conventional methods or find the right money equivalent.

Companies involved in user-driven innovation process could monitor their cost over time and see the reduction in R&D costs, which could be associated to each particular project. Another measurable indicator of innovation is sales of created product or service, which could be calculated after the market launch of the product. Value of the participation-related benefits as well as patents and knowledge, created during the innovation process depends on each particular company and in each particular case. There are examples of user-driven innovation cases, which was conducted only to attract customers and accelerate innovation diffusion, without any immediate financial results.

Long-term orientation could be the main requirement for the companies interested in user-driven innovation process, because value of the benefits gained in process could only be fully extracted over the time. This is what makes innovation process and user-driven innovations in particular so appealing to well-established MNCs rather than SMEs, however SMEs could also gain a thing or two from collaboration with users.

Looking from the perspective of individual user/innovator, there are also output-related benefits such as benefits from using the innovation and profit from selling idea to the company. However, researchers found out that such things as enjoyment from the creation and learning in process are among the top motivating forces that drives users to create new ideas and share them with others. Survey of Finnish citizens developing product innovations (de Jong et al. 2013) showed that 51% of respondents expect to benefit from the new product itself, while only for 3% profit from selling the innovation was a motive to create or share. This corresponds with other survey and cases (de Jong & von Hippel, 2009; von Hippel. & Oliveira, 2009), which conclude that users in most cases share their ideas free without expecting compensation.

Substantial amount of users in Finland find motivation in enjoyment from creating the innovation, helping other and learning from creation process, these motives together accounts for almost 45% (de Jong et al. 2013) and show that participation-related benefits as important for users as output-related ones.

To sum up, user-driven innovation creates value for both companies and users involved in development process. This value could bring output-related as well as participation-related benefits, which differs for companies and users. Participation-related benefits are hard to measure, but they could bring value and motivation for users in a long-term. Innovation value estimation is a complicated process, which is unique in each particular case.

4.3. Theoretical framework

Although there are tremendous amount of models and theoretical concepts related to user-driven innovations and user involvement, literature review revealed that throughout the history of user-driven innovation there are several key theoretical insights. These fundamental concepts formed the framework of the conducted research. Based on the reviewed academic literature, several models, paradigms and structures were selected to include into further analysis. These independent phenomena do not form a systematic framework; however, they provide in-depth description and tie together such factors as innovation process, user involvement techniques, lead users, benefits from innovation process and others.

One of the most important models related to user-driven innovation is MAP and CAP comparison by von Hippel (1978). This model helps to distinguish between fundamentally different approaches to the development process inside the companies. This model lead to another important part of theoretical framework – types of user involvement described by Schuurman, Baccarne & Mechant (2013).

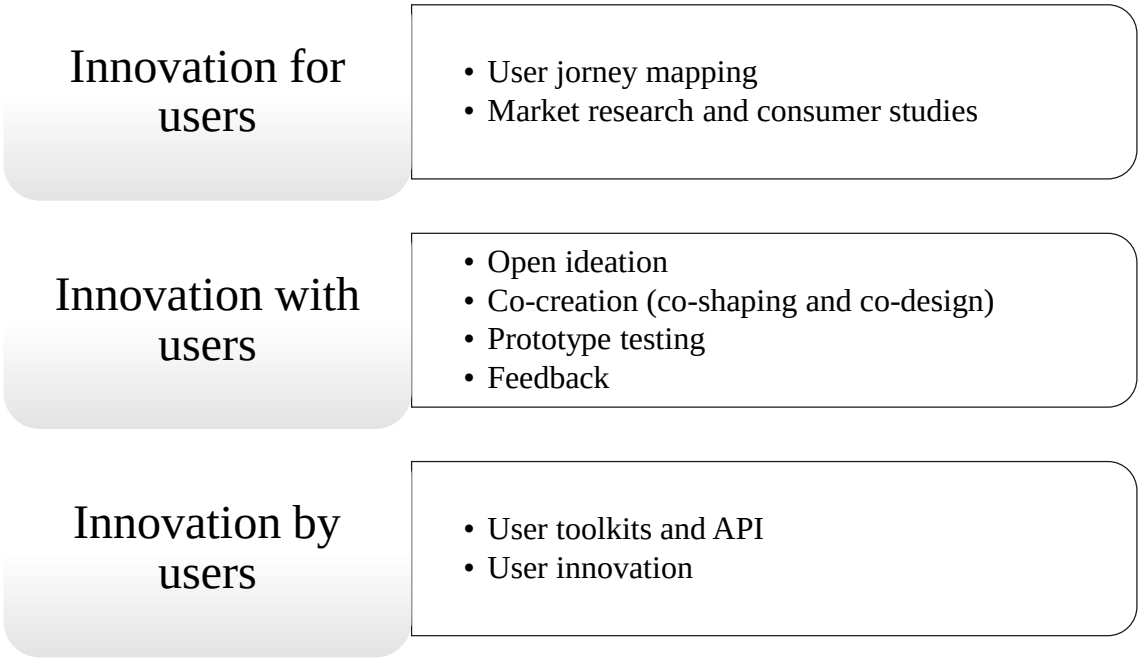


Figure 16. Types of user involvement
Source: adopted from Schuurman, Baccarne & Mechant, 2013

Aforementioned model used to identify the stage on which each company is located currently, what tools does each company utilize and whether the involvement of users into innovation process is direct or indirect.

As for the innovation process, for the purposes of this research, the innovation process would be divided into 4 stages: Ideation, Development, Testing and Commercialization and after. These stages were chosen to analyze the user involvement activity on each of them and compare the results.

Finally, the findings would be analyzed in regards to the benefits from innovation process both for companies and innovators. According to Raasch & von Hippel (2013), structure of these benefits include output-related as well as participation-related advantages. Taking into account presented theoretical assumptions; each company in the further research would be studied according the chosen models and theoretical concepts. User involvement on different stages of innovation process in interviewed companies would be analysed in detail in the following chapters of this thesis.

5. RESEARCH METHODOLOGY

This research aimed to investigate how ICT companies utilize user-driven innovation and involve users in innovation process on different stages. The purpose of this chapter is to describe how the study was carried out, what methods were used and how data was collected. The last section of this chapter outlines the reliability and validity of the research. The empirical part of this study was conducted with middle and large sized ICT companies operating on B2B and B2C markets.

5.1. Research approach

The research is carried out as a multiple case study of companies in ICT sector. The research therefore was conducted as a *multiple inductive explanatory case study* (Baxter & Jack, 2008). This type of research methodology was chosen according to Yin (2009) case study design, since the main research question is seeking the answer on “how” question. The research is aimed at covering the contextual peculiarities of the innovation process and user involvement among ICT companies. Hence, ICT industry acts as a distinguishing factor and delimiting context for choosing the companies included into the research.

Rationale behind choosing a multiple case study rather than single case study could be explained by the different techniques and methodologies utilized by companies. The research focuses on finding differences in approaches of interviewed companies, as well as similarities in current state of user involvement and development in order to propose meaningful, implications. Moreover, according to Yin (2009) the reasons to choose multiple case study research design are theory testing, typical conditions and revelatory character. This research cover all of the three aforementioned criteria; case studies test the theoretical implications from UDI and lead users theories, combines the typical companies from ICT sector as well as presents a revelatory insights on the UDI theory from the ICT industry point of view.

Explanatory type of case study according to Yin (2009) allows the researcher to examine phenomenon on deeper level. It helps to form a theory or practical implications. Explanatory type of case study is the basis of generalization and explanation; it builds explanations as well as provides the answers to “why” and “how” types of research questions.

Finally, inductive approach was chosen since the research itself was initially set around the data collection and literature review with close attention to patterns and similarities. Thus, this research does not provide and test any hypothesis drawn from theory. Inductive method usually associated with the qualitative data and deep understanding of the context of the research.

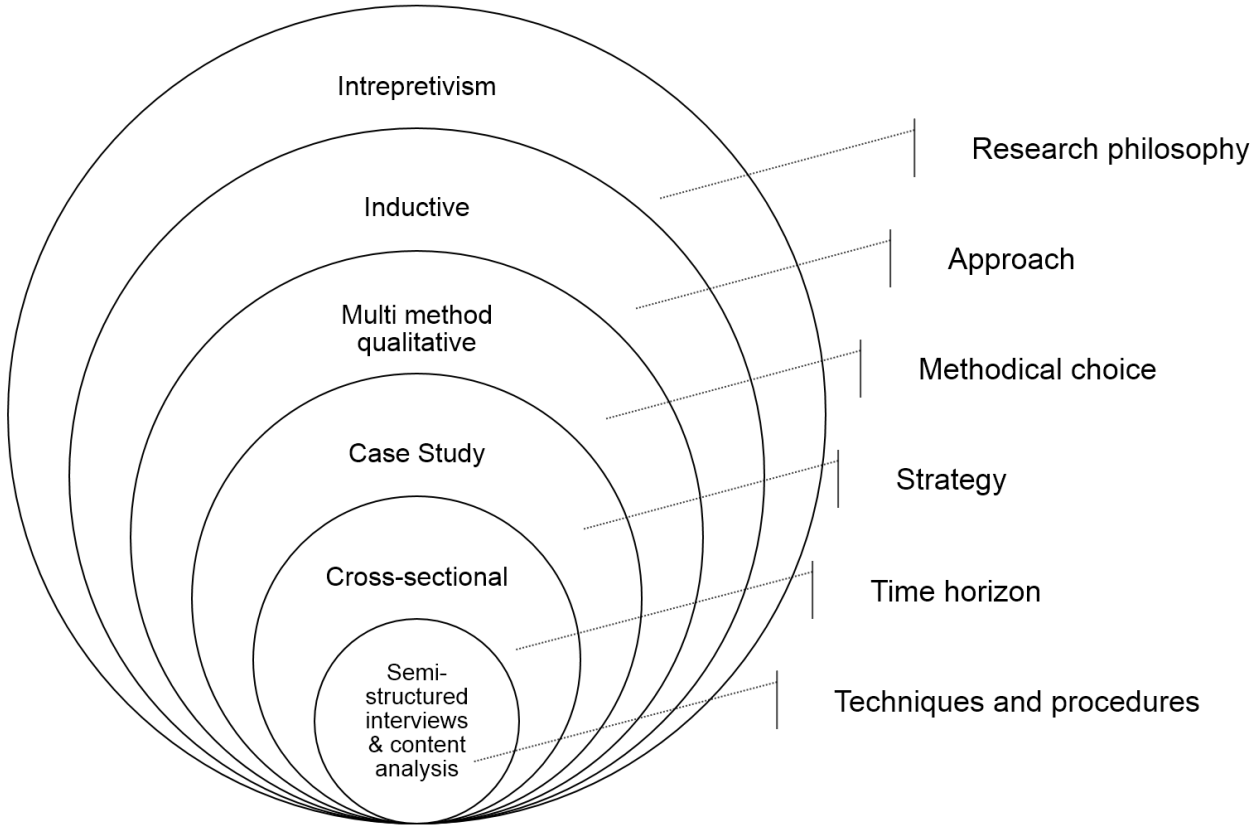


Figure 17. The research onion
Source: Adapted from Saunders et al. (2012)

The research methodology could be also described by the model proposed by Saunders et al. (2009). Figure 17 represents the research onion, which has five layers. These layers illustrate research design from research philosophy to techniques and procedures.

The research philosophy is the top layer of the model, which represents how researcher views and understands the research question and the context of the research. In this thesis, the main research philosophy is interpretivism. This philosophy focuses on studying phenomena in the natural environment. Data collection and analysis in terms of interpretivism, therefore, likely to involve qualitative data from in-depth investigations with small samples Saunders et al. (2009).

The next layer of the research model is methodological choice. This choice determines type of data as well as method – qualitative or quantitative. In this research, multi qualitative method was chosen, representing multiple qualitative case study.

Strategy of the research reveals the approach to the data collection and representation. This research utilizes case study research strategy in order to accumulate data collected by the interviews.

Time horizon shows whether research is longitudinal or cross-sectional. This research is a cross-sectional research, in order to establish “snapshot” of the studied phenomena, from different sources of information at the same time. This research does not cover the history of the user-driven innovation development, rather it is aimed at establishing current situation in the ICT companies according to the theoretical background presented in the literature review.

5.2. Research techniques and procedures

A review of the literature was followed by an inductive and explanatory multiple-case study on user involvement. The empirical context of this study is the Finnish ICT industry, and specifically companies operating on B2B market. The research aims at addressing the questions: how ICT companies utilize user's inputs in innovation process? and what are the corporate challenges in integrating users in innovation process? This question is illustrated with case studies of IT companies in Finland. The multiple case study approach was selected in order to allow analyzing the context of industry where companies operate. 4 out of 3 companies are in B2B segment, only one is present also at B2C market. This allows us to look at the particularities of their business practices related to their innovation process and the user involvement practices. All of the companies are headquartered in Finland, but in their nature, they are also global.

Choice of the companies was initially set among those operating in the ICT industry. Company should have operations in B2B or B2C context as well as be medium to large size. Startups were excluded from the scope of this research due to lack of significant R&D and innovation budgets and lack of establish innovation practices.

In order to create questioner for the semi-structured interviews, theoretical background was used. Among the issues, which were assessed for each particular company during the interviews were innovation process and its stages, user involvement techniques, openness of the company, current projects and user inputs utilization.

5.3. Data collection

The data was gathered with semi-structured interviews in 2014-2015. The duration of the interviews varied from 60 to 90 minutes. The interview guide is presented at the appendix of this research. During the interview, the informants

were first asked to provide background information of themselves, about their company's innovation process and B2B or B2C orientation. Second, the informants were asked to describe their general attitudes and practices of working with customers and users. Third, questions about each separate step of innovation process and user engagement in each of them were asked.

Interview was divided in two parts in order to establish general situation around innovation process and user involvement and specific peculiarities and progress achieved by each interviewed company. Interviewees were mainly responsible for the R&D or innovation process directly and had a significant experience working for each particular company. The interviewees were informed beforehand that the interview were recorded and that interviews would relate to a Master's thesis and would be a public document.

The interviews were recorded and transcribed verbatim, and later analyzed with content analysis method and with the help of NVivo 10 software. In this research, the companies' anonymity is preserved; therefore, case companies' names are not revealed. However, the details of each interview are provided in the Appendix section of this thesis. Overall, 6 interviews were held, two biggest companies were presented with two interview sessions while medium sized companies with one.

5.4. Reliability and Validity

The reliability of this study is proven by the contents and saturation of the interviews. According to Eisenhardt (1989) the qualitative research is considered relatively valid and reliable if several interviewees report the same information. To increase the reliability of results, each interview was transcribed and analyzed in order to compare the meaning and contexts. The research is easily reproduced for the other industries and companies, since the interview question and methodology is presented in this chapter as well as in appendix of this thesis.

Another significant point supporting the reliability of the conducted research could be the fact that interviewed companies' representatives were informed before the interview that names of the companies would be disclosed in the final version of the work. Therefore, there is no stimulus for interviewees to somehow modify the insight that they share. Anonymity helps to exclude overly positive or negative opinions on innovation process and methods, which companies use. The results could not be traced back to the companies, since their descriptions are modified.

Throughout the interviews and transcription of the results process, it could be seen that interviewees shared different opinions on different matters; representative from the same companies often did not express similar opinions on the same subject. Most of the interviewees admitted minor flaws in innovation strategy executions as well as gave credit to the significant achievements in innovations process, where it was due.

The supervisor of the thesis also participated in most of the interviews and had access to the recordings and transcripts of the interviews, therefore representing the outside observer of the data collection. Overall, the research design was carefully planned using benchmark of the best practices of the academic literature presented in the literature review in order to provide sufficient levels of reliability and validity of the results.

6. FINDINGS & RESULTS

In this section presented the results and findings of the conducted research as well as description of the companies included into case study. The analysis of the findings presented in this section includes cross-company comparison of existing practices and future ideas in context of innovation process and user involvement. The results of the each interview is summarized and analyzed according to theoretical conceptions reviewed in the first part of this thesis. The

investigation further followed by the cumulative table with significant results linked to each stage of innovation process.

6.1. Description of case companies

6.1.1. *Company 1*

Company 1 is a software service provider in the field of data security and storage; it operates in the Americas, Europe and Asia Pacific regions. It is headquartered in Helsinki, Finland and employs around 1000 people through 20 offices around the world. The company offers security services, storage services and content solutions for operators. Currently company is trying to involve end-users to share their feedback and ideas for improvement of its products and services and go out of own comfort zone with the new product offerings. Recently the company launched an online community for all their users, where it encourages users to share opinions and propose new features for the company. Company plans to gather lead users of its services in its community to extract potential value of user knowledge.

> "We are doing surprisingly well in terms of user involvement and interviews on the early stages of development. I think it is notable for Company 1, since we traditionally create features and then try to sell them to users"
>
> Source: Interview 1, Senior Manager (External Research Collaboration)

Currently innovation process and user involvement in Company 1 looks the following way. On Ideation stage, Company 1 uses feedback collection tools and marketing agencies in order to collect large number of data from different geographical markets. It also utilizes market researches and predictions from third parties in order to establish market potential of future products.

> *"Within the business lines there are innovations based on the*

> *competitors and feedback from the users and metrics that we collect from various analytics tools."*
> Source: Interview 1, Senior Manager (External Research Collaboration)

Company 1 already had some successful examples of collaborations with users, their latest product for the consumer market found its place on the market due to collaboration with users and extensive feedback on all of the stages of development. Interviewee admitted that company got the initial idea from customers too. However, this example is merely an exception, since more than 80% of revenues comes from the conventional development and closed innovation process. Only small portion of the Company 1's business lines subject to the changes in user involvement techniques.

In future company 1 wants to shift the idea collection responsibilities to its growing online community and develop products and services suggested by users. However currently there is significant amount of skepticism from top management and board of directors, due to stable revenue streams from conventional business model. In spite of that middle management and developers inside the company fully committed to the idea of openness and collaborations with users.

> *"Today we have all the ideas coming from employees, we want to include students and Universities, but we have so much IPR and legal issues, it makes things impossible right now."*
> Source: Interview 5, R&D and Innovations Manager

The main issue occurs when multiple user start to collaborate on the same project, it is impossible to distinguish who own the idea at the end, since in most cases it is a combination of many ideas by many users and employees. Company 1 representatives were surprised to discover that some of the users willing to share their ideas and contributions without output-related benefits. Pure participation-related motivation from users might not be easy thing to

utilize in corporate environment, since there are law protecting developers and inventors even without their will. Concept discussed by Raasch & von Hippel (2013) about free sharing of ideas by users might become central in coming years, because of raising IPR issues.

Because of the aforementioned IPR issues, Company 1 focusing on building the internal idea-generation platform among employees. Company 1 started several years ago by organizing “Innovations days”, where employees of the company participated in the conference suggesting their ideas and projects. Some of those projects resulted in internal startups and found their way into the existing product lines of the Company 1.

Another notable point extracted from the interviews, was the fact that for B2B-oriented companies it would be generally easier to utilize users, since every client already has its own dedicated manager, who is responsible for sales interactions as well as feedback collection. According to the Innovation manager of Company 1, B2B clients often unwillingly participate in innovation process, simply by interacting with client manager and sharing feedback and proposals.

Nowadays, Company 1 established crowdsourcing platform on the intranet portal of the organization. Managers believe that almost every employee of the company is aware of this platform, but only around 5% of total number are participating actively. Nevertheless, initiative received support from the top management and made its way into annual reports for the shareholders. Mangers agree on the fact that:

> *“Internal ‘kick-starter’ for ideas lowering the borders of organization and trying to get people work on the ideas and innovations globally within the company.”*
>
> Source: Interview 5, R&D and Innovations Manager

Overall, Company 1 operates in manufacturer active paradigm with only some

ideas proposed by users. In recent years company started to develop idea-collection platform for employees. Company's next step would be to open up this platform for everyone and encourage customers, Universities and partners to participate in innovation process.

6.1.2. Company 2

Company 2 was established in 1980s. It is a developer of embedded software and hardware solutions for the automotive, defense and wireless industries. The company operates in Europe, the US and Asia. It is headquartered in Finland and employs around 2000 people. Its automotive business segment offers a range of standard software products and professional tools supporting the whole process of in-car software development. The company's wireless business segment offers wireless device development and infrastructure solutions, device offering, device and platform development, reference designs and technology demos. It sells some of the wireless and communication solutions to the defense industries. In 2014, the company launched internal platform for idea collection among employees. Company provides tools for demonstration of the ideas to the management and partners for assessment and future implementation. It plans to collect prospective ideas from professionals in order to boost its innovation activity and increase range of products.

Company 2 in 2014 established a framework for collecting ideas from employees and creating initial demonstrations of the projects. On the first year of operation, this project resulted in more than 100 new ideas.

> *"We call it Light Demo framework. It is a systematic way to visualize ideas. We have a tool that helps to collect ideas, new features, products, process improvements. Some of those ideas have the potential to become products. We try to visualize what kind of feature or product clients like and want us to do. These demos are very light; people would spend only up to 2-3 days,*

> *just to create demonstrations with little effort."*
> Source: Interview 2, External subcontractor & Head of Quality and Environment

This initiative is aimed at increasing the speed of innovations process as well as at ensuring the quality of final solutions.

> *"This presentation would go to the management team that will assess it. In case of approval from the management, this idea goes into development."*
> Source: Interview 2, External subcontractor & Head of Quality and Environment

Company 2 expect to have first products and solutions already by the end of 2015 out of initial 100 projects created with Light Demo framework. In future platform will allow customers and partners to participate in demo creation process; today the initiative is still under consideration from top management. Head of the Light Demo project estimated that from 20% to 40% of the ideas in review inspired or suggested by users.

> *"We have user stories and we make workshops. We are doing it for the number of years already. We are quite good at it. What we try to do next is try to involve users into service design and making pilots."*
> Source: Interview 4, Quality Manager

The specifics of Company 2 Business are that company operates mainly on B2B segments, with only small portion less than 5% of all product available for B2C clients. Another significant feature of the Company 2's business is that some of its communication products used by military and defense industries. These factors limit the possibilities for feedback collection and user interaction.

> *“When it comes to B2B customers, feedback comes through workshops or feedback systems that we have with them.”*
> Source: Interview 4, Quality Manager

However, Company 2 found a way to get closer to its direct users by offering training events and meetings with users. Those events provide valuable feedback and sometimes even new ideas to the company. Those ideas inspire new products and increase quality of existing ones.

> *“For complex products we have user training package. On these trainings, we could see how end users work with the product and listen to their ideas. Moreover, some of them suggested very simple but brilliant ideas. There are cases, when we modified our products based on the feedback. “*
> Source: Interview 4, Quality Manager

Company 2 admits that their techniques and experience of user involvement and feedback collection progressed significantly over the years. Company started its business without direct channel of communication with its customers. It evolved into feedback collection, training seminars and even idea generation platform.

> *“10 years ago we had collected all the requirements and that was it, and then we produced product with exactly that requirements. It was set in stone from the start of the project. Now, market requires us to be more adaptive, faster. Now these optional packages are very important. We do not set all the requirement in stone, rather we define them together with customers, with partners, with 3rd parties Together with the customers we are more flexible than we have been.”*
> Source: Interview 4, Quality Manager

This user involvement evolution brought its first results. Company started to

broaden its client portfolio, shifted to markets, where there products were used by consumers rather than another businesses, established channels of communication with end users via technology integrators.

> *“Client suggest the upgrade and we realized that we could do that. Customer came up with the idea on their own and said: “we want that and we are prepared to buy the first version of this product.” I think that is perfect example, they already had idea. We had a concept and they had a user case for it. They already had our infrastructure and system. That is the best case; we get a product and customer at the same time.”*
> Source: Interview 2, External subcontractor & Head of Quality and Environment

On the other hand, there are military technologies, in which Company 2 specialize; this business does not favor open innovation process and collaboration with third parties. Involvement in defense sector provide stable cash flows and order, but does not contribute to the innovation development. Military solutions focus on proved technologies rather than new ideas and trends on the market.

> *“Military business is different from the regular mobile business, it requires formalities and bureaucracy, documents. You have to prove that you product is competent and you have to prove it with evidence.”*
> Source: Interview 4, Quality Manager

Company 2 also admits to benchmark the ideas from its biggest competitors on telecommunications market. Company 2 does not have the assess to the extensive financial and human resources, thus it tries to compensate with technological capabilities and intellectual capital in order to compete on the market.

> *“In our case, we look at ideas from our competitors. We consider costs, time and technology. Technology is one thing that separates us from the others.”*
> Source: Interview 4, Quality Manager

Overall, Company 2 presents the example of company operating almost entirely in B2B segment. Despite being involved with military and defense technologies, Company 2 managed to evolve its user involvement and user interactions. Nowadays company develops idea collection platform, which allow its employees to submit ideas and create small-scale demonstrations of their solutions to the top management. Company 2 expects to start product testing of the newly created products in late 2015. Future plans also include involvement of the third parties such as end users, universities and system integrators to idea generation and innovation process.

6.1.3. Company 3

Company 3 is a Finnish enterprise software company specialized in planning and developing processes and systems that are related to identity and access management. Company was found in 2003, since then it has created its own identity software platform. It has also become pioneer in utilizing Service Oriented Architecture (SOA) on designing and implementing solutions. Utilizing SOA is aimed to achieve flexible and independent interaction between different systems. Service Oriented Architecture and solutions based on it enables dynamic searching and flexible creation of new services. Company provides services to multiple public and private organizations in Finland and other EU countries. The company also develops e-services for municipalities and their citizens. Most installations are built on SOA architecture with integration to legacy systems. Based on its own software platform, company offers solution for managing HR, compliance, efficiency, security and access rights. Company is looking forward to create an electronic forum to facilitate its interactions with users.

Company 3 is a medium sized company with focus on B2B market segment. Company started by crating innovation for users, using the unique set of competences and specific knowledge in identity management. After the market success, Company 3 started to develop its user involvement techniques. Initially, the only direct channel of communication was through the client mangers, who collected all of the requirements before the project. Afterwards company included iterative feedback collection after each major step in product implementation. Nowadays, Company 3 involve users directly into the user interface development.

> *"We do a little bit of both innovation for and with users. Usually the development that we do ourselves is more technical and not so visible for the end user, but when it comes to the user interaction and user interface functionalities, then the demands usually comes from the market or directly from our customers. We have a model that we do the joint development with our customers."*
>
> Source: Interview 3, Development manager

The main challenges, which Company 3 faced, while introducing new user involvement procedure were IPR issues and lack of customer's technical knowledge. Company 3 does not want to open source code of its main products, therefore all the development is done internally. However, company found a way to involve user's initiatives into development by allowing user interface and applications development done in cooperation.

> *"Usually our customers are not IT technicians, they are more like business people, so they what they want, but they cannot relate to the technical implementation that much. Therefore, what we ask from them is to define initial sketches for user interface, to define skeleton for the UI, and then describe how it would work in real life situation."*

Source: Interview 3, Development manager

Another user involvement technique, which Company 3 utilize, is developers' conventions. These events helps to not only increase word of mouth and sales of products, but also give the ability for developers to interact with end users and decision maker face-to-face.

> *"We come on user forum twice a year, It is an event, it is half a day or full day event. It is targeted at the decision makers and the key users of customers. We discuss new versions, ideas, we listen to the requirements, and we try to find similar needs from different customers."*
> Source: Interview 3, Development manager

Nowadays, Company 3 is interested in creating online platform for idea sharing and communication with end users. Company realize all the benefits of co-creation and user innovations, nevertheless this venture requires some changes on the market and in customers attitude. Interviewee admitted that the main issue with online idea collection in B2B context lies in additional responsibilities. Client companies would require having employee responsible for the feedback sharing. The other concern is popularity of such platform, for small and medium companies, there would be very little response from the customers. Company 3 would prefer to see changes on the market in order for social network for B2B companies to arise; since such a network would allow for spread of the ideas.

> *"It seems that it is too difficult or people are too busy with their work and do not have the time. We are still trying to figure out how to motivate and encourage users to participate in this forum. We need some kind of B2B social media thing."*

Overall, Company 3 despite having only B2B clients tries to involve users into user interface and application development. It utilizes developers' conventions

and events in order to get access to end users and their feedback. Company plans to create idea collection platform online for the existing clients to participate in development and innovation process.

6.1.4. Company 4

Company 4 is a software developing company. Company was founded by group of students as a technological startup in mid 2000s. Nowadays company grew in size, revenues and number of employees to the medium company sized company on ICT market. Company 4 specialize in auxiliary application development for computer games and electronic sports events. The company operates in B2B segment of video game market; its main clients are major developers such as EA, Valve, Ubisoft and Microsoft. Company utilizes support from gamer as an end users to enhance its product. Company 4 has own online community of technology enthusiasts and supporters, who helps to enhance gaming experience across multiple games utilizing Company 4's solutions.

On the game development market, where product lifecycle is relatively small, direct channel of interaction with users is crucial. Company 4 started by offering its technology to the biggest studios. Despite the market success and increase in sales in first year, company quickly realized that end users' feedback is vitally important for product development and improvements. Company asked its clients for the feedback from the gamers; however, the process took a long time to get from gamer to developer studious and later to Company 4. Company 4 started to pay closer attention to gamer's forums and online communities, where games and their product were discussed by end users. This idea later helped to establish own online community of technology enthusiast and gamers, which allowed Company 4 to establish direct channel of interaction with end users.

> *"Despite the fact that our main clients are major game development studious, we collect feedback directly from gamers via our online forums. We started by gathering*

> *feedback from developers, but quickly realized that we could eliminate the intermediary in our interaction with end users by addressing gamers directly. “*
> Source: Interview 6, Head of R&D

For the last years, Company 4 base their innovation process entirely around the feedback from end users. This approach made their product well known and unique on the market and increased B2B sales respectively.

> *“Gamers’ community is very responsive and active online. People like to share their ideas and see them implemented into the end products immediately.”*
> Source: Interview 6, Head of R&D

The main quality of online idea collection and co-creation with users is relative speed of the reaction. New games and improvements appear on the weekly basis, online community helps to react to all the changes and improve the software accordingly to the latest changes.

Company 4 plans to increase its user interaction by organizing first online and later actual meeting with technology enthusiasts and member of online community. Company hopes to receive ideas for the new product line and benchmark best practices from its competitors.

> *“Next year we would like to organize a small-scale online conference for technology enthusiasts. We expect to receive a lot of ideas for our future improvement and development as well as suggestion on how to improve our existing products.“*
> Source: Interview 6, Head of R&D

Overall, Company 4 fully embraced the concept of user-driven innovations and user interactions. Company develops its product

according to the feedback and ideas from its online community of experts and end users. Company 4 plans to organize online conferences with most active member of the community in order to enhance its innovative capabilities.

6.2. Analysis of the results

All four companies though work in the same industry, and mainly in B2B segment, see the customer participation in the project in different way. As per challenges identified by Paasi et al (2014), we did not notice the strategic level of challenges of customer integration. In ICT B2B sector, the collaboration for innovation starts after the strategic choice of partnership is already made. Therefore, we did not find support for this statement in our data. However another strategic type of challenge was identified: As an example, Company 2, working with military wireless technologies, admits the troubles with idea and feedback collection from its clients due to bureaucracy and restrictions. Many IT firms also agrees on restrictions, provided by current technologies at hand, which sometimes unable them to develop new features clients ask for. Lack of knowledge on the existing lead users in the field also hinders the innovation performance and user involvement in technology heavy industries such as ICT.

There are some IPR related issues mentioned by several companies. There is no unified scheme of user participation on the market, which would allow companies to eliminate property right liabilities, which might occur, when the new product or service is developed in collaboration with users. In some cases, companies avoid direct collaborations with end-users due to legal aspects and focus on ideas from employees instead.

Stage wise, the ideation stage seems to be the one where customers are involved most often, which supports the earlier literature statements (
Table 1). Development stage represented by the closed process inside company with small inclusions of user insights in some cases. Although, companies try to compensate lack of user involvement on the development

stage by engage with users on testing stage. Sometimes companies even launch open beta tests with users; in other cases focus groups are used to try newly developed products and solutions before market launch.

Commercialization stage remains heavily underdeveloped in terms of user involvement, since most of the interviewed companies do not fully utilize early adopters in order to boost commercialization of new products. In B2B context, companies managed to create their own initiatives like online forums, conferences, meetings and feedback collection tools in order to gather user opinions.

Table 1. Cross-company comparison of User Engagement and future plans

	Ideation stage	Development	Testing	Commercialization and after
Company1	**Currently:** feedback collection from different market and geographical segments **Future:** idea collection from online community (forum), innovations by users suggested to the company	**Currently:** user focus groups comment on **Future:** prototype sharing and submit ion, development with users	**Currently:** testing on focus groups of users **Future:** prototype distribution, collection of the feedback from the community	**Currently:** feedback from operators **Future:** lead users help with diffusion of the innovations
Company2	**Currently:** idea-collection from employees, feedback from customers **Future:** idea-collection from users	**Currently:** own closed process **Future:** development with users/employees, who provide the ideas	**Currently:** own testing team, beta-testers **Future:** testing with end-users	**Currently:** feedback from customers and distributors and system integrators **Future:** lead customers promote solutions

Company 3	**Currently:** feedback and requirement collection from customers **Future:** innovations by users suggested to the company	**Currently:** own closed process **Future:** co-creation with users	**Currently:** own quality assurance team **Future:** open beta testing	**Currently:** customer cases, feedback from existing customers **Future:** lead customers help with diffusion of the innovations
Company 4	**Currently:** Ideas and feedback from the online community **Future:** online conferences with technology enthusiasts	**Currently:** closed development with inclusion of user ideas **Future:** co-creation with users; open source	**Currently:** feedback from users online **Future:** beta-testing with active members of the online community	**Currently:** word of mouth from active forum users **Future:** face-to face interaction with users, gamers conferences

Big amount of ideas for innovation comes via technical and verbal feedback from customers. Company 2 mentioned, that feedback comes often from customers at workshops or via formal feedback systems established for communication. They see the customer involvement still rather low to what is wished in the company, at the moment 20-40% of customized products come from customer ideas:

“At the moment we are making more user centric approach. We have user stories and we make workshops. We are doing it for the number of years already. We are quite good at it. What we try to do next is try to involve users into service design and making pilots”.

At the ideation stage, the main missing connection point is that anyone who is

not a customer or an employee cannot offer an idea. There is no forward looking mechanism. In wide case scenario where the end customer would like to offer own idea for company to develop, there is nowhere to submit it. This could be an opportunity for expansion. IPR issues and information leakages are also important points of consideration for IT companies, developing software and devices.

In terms of user driven innovations and user involvement, Company 3 faces common challenge of access to the end-user feedback and time constraints. During the interview, company representative (director of development and services) shared his opinion that some kind of forum or online community would help to facilitate feedback collection from the clients. In his words, "B2B social network" solution would have positive effect on informational asymmetry between customer needs and company's product. On the other hand, Company 3 considers that the main issue with forums, online communities or "B2B social network" is lack of motivation from user side. In B2B context, companies do not often have spare employees to submit feedback. The bigger the client, the harder it is to gather useful feedback from end users and deliver it to the developers. Therefore, in most cases developers gather and assume necessary information from initial meetings with client representatives. This approach results in many iterations of small improvements in development process. User involvement in forms of online community or development with users could address these issues, although risks of getting some of the intellectual property leaked also increases.

Development stage of innovation process could definitely benefit from better user involvement. Among the most common corporate challenges of many companies at this stage are challenges with collecting feedback, lack of complementary technical knowledge and funding for prototypes. In addition, some companies highlight tight time limits as a hinder for better user involvement and development of the products. The further the development goes, the harder it is for companies to gather necessary information from users (Bråtå et al., 2009).

None of the companies used open source for development of products. Company 1 accepted that they are interested in trying it out, whilst Company 3 said that they are not interested in opening their code to anyone. Company 4 mentioned that they would like to make bug collection tool open source, but still keep the main code of their product proprietary. Another issue, which Company 3 could improve, is quality assurance via customer involvement. Company has its own team of quality assurance engineers; however, involvement of actual users to the testing could bring many constructive insights to the development process.

Challenges of user involvement on the last – commercialization - stage lead to higher probability of market failure due to lack of knowledge about broader market segments. For example, one of Company 1 application failed due to improper market positioning and lack of publicity. The biggest mistake company made with that product was in their understanding of user innovation: first, under user innovation they meant simply the marketing survey of potential users of what features the product should have. Secondly, company was not prepared for processing all the information they collected from the users. Additionally, they failed to develop the follow up processes for keeping the users involved further into the innovation process and hence lost the flow of user preferences in product features. Finally, when the product was brought to market, even with originally designed by users features, the demand was far too low due to failed communication. At the moment the Company 1 company is searching itself in B2C area and at the same time exploring user involvement opportunities at the commercialization stage. They have already implemented customer surveys to collect suggestions for improvement of the recently launched products.

Another fear for the companies is the large-scale production for mass market, because of the high cost and tough competition from cheap labor countries. This leads to the phenomenon, where potentially viable ideas are sorted out without users knowing about them. In general, most of the IT companies admit that they lack user involvement on the late stages of innovation process. Most

of the feedback collected from users gathered on the idea creation and research stage, while the potential of user involvement on development and commercialization stages is yet to be untapped. While studies shows that frequency and number of user involvement have a negative correlation with project uncertainties (Gales and Mansour-Cole, 1995).

7. DISCUSSION

7.1. Cross-case analysis and summary of the findings

Overall, case results show that despite adoption of the innovation process and terminology, only few companies distinguish lead users and recognize potential of utilizing them. Most of the companies' representatives familiar with the term "lead users", however further investigation always showed that they cannot successfully describe how and when to utilize lead users. In some cases, feedback collection on first stages of innovation process remains the only viable option for product development managers.

Most of the observed companies utilized knowledge from employees rather than from users and customers. They admitted that in ICT industry employee knowledge is substantial and it is easier for companies to extract ideas and projects via idea collection platforms inside the company rather than from the outside. Sometimes this peculiarity was described from the IPR point of view, since internal idea collection and project development prevents the leakage of the ideas to competitors. In other cases, companies started their pilot idea-collection project with employees and have not yet proceeded with the outsiders. Overall, utilization of technology savvy employees could be the first step towards user-driven innovation, thus innovation and R&D decided by several independent collaborating users rather than just responsible employees inside R&D departments.

The difference between user-driven and open innovation in practice seems

negligible in the eyes of managers. Most of the projects and initiatives develop in a conventional way with the idea being born inside the company and further developed with few or no user inputs at all. Hippel's manufacturer-active paradigm (MAP) is prevalent in ICT sector with only a few examples of customer-active paradigm (CAP). CAP is only possible in scenarios, where the competition is not that fierce, since competitive markets force companies to provide standardized product and services with few additional features. Software developers and telecommunication companies presented in this study have started to partially shift to the CAP paradigm only recently. Most of these projects considered in development and still under consideration of senior management. One of the interviewees admitted that without support and commitment from top management these changes in paradigm have no chance to succeed. It only proves the point made by von Hippel (2005) that support from the top management is a key success factor of changes in innovation process.

In terms of post-production support of the products and diffusion of innovations, the situation remains very conservative. ICT companies and especially in B2B context often works only with lead users inside the client company, once the project is finished, diffusion is done mostly by the client company itself with only technical support from the developers. This feature is unique to B2B context, since the decision-making process and purchase authorized on the top level and people who use the product every day often have no voting rights in purchase of the product. Therefore, Lead user curve and distinction between different types of users is limited in B2B context, however companies admitted that post-production support from their side widens and they sometimes take part in the innovation diffusion.

In some cases, companies create the communications channels with potential end users themselves. These initiatives could be, for instance, yearly meetings with existing and perspective clients, "day with the developers" events, online communities and forums, training seminars for the end users. Companies put more emphasis on the importance of the feedback, improve their feedback

collection techniques and in some case do not only rely on the system integrators and resellers in terms of feedback collection. Marketing research and interviews with actual users became standard routine for the modern development process in many companies.

Overall, it is possible to conclude that current state of the innovation process in companies lacks behind trends discussed in academia 5-10 years ago. Today's challenges are idea-collection tools, internal policymaking, internal start-ups, development of lead user utilization. Academic articles presented in the literature review covered those issues in late 1990s early 2000s. This lag could be explained by the slow rate of adoption as well as industry-specific factors. Since UDI theory originate from extreme sports and medicine, where it has higher probability of success as well as stronger impact due to rapid technology development. Today's software development and communication industries slow down their rates of technological advancement, established companies have emerged, therefore UDI theory spread occurs with lower speed than in other industries due to complexity and bureaucracy of the organizational structures.

Another important reason, which could explain the lag between theory and practice, could be the fact that academic literature on user innovations mainly focuses on extreme cases and examples in order to stretch theoretical horizons. Those cases could not be applicable on the mass market instantly due to the adoption process and knowledge transfer limitations.

7.2. Linking findings to theoretical framework

In case of software development industry, companies already adopted prototype development, feedback collection and user testing. Next logical step would be to incorporate user ideas on each stage of innovation process.

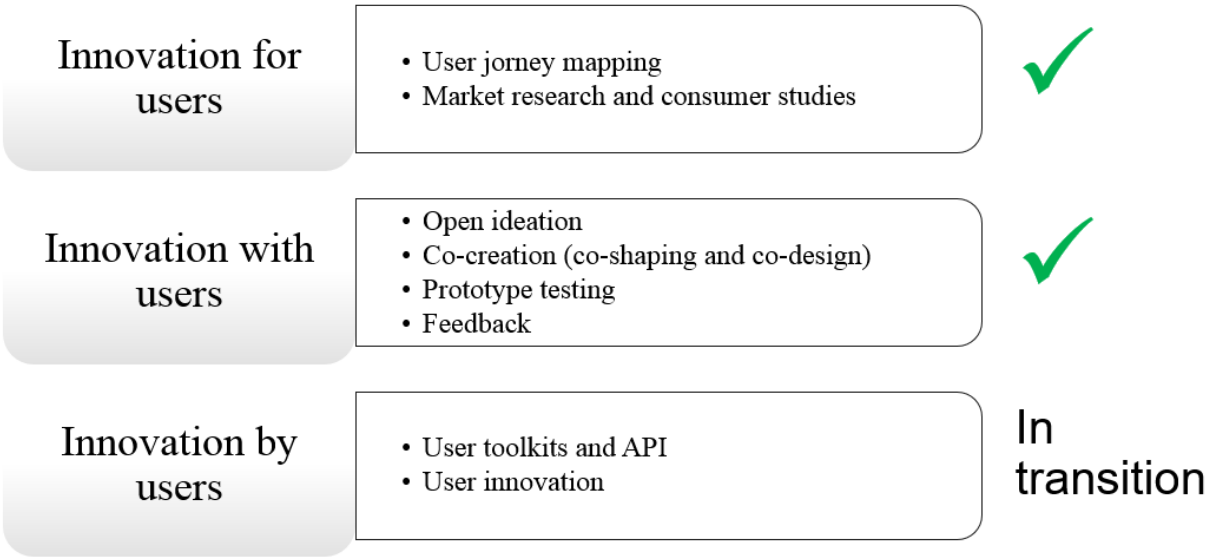


Figure 18. Types of user involvement
Source: adopted from Schuurman, Baccarne & Mechant, 2013

Nodaway's state of the user involvement in ICT sector lies in "Innovation with users" domain. All of the case companies went beyond "Innovation for users" stage; they already successfully utilize market researches and journey mapping techniques for almost a decade now. In most cases, user involvement techniques in use today is open ideation, co-creation and prototype testing, hence the ICT sector falls into "Innovation with users" category. However the successful transition to the last stage requires significant efforts from the companies. Creation of user toolkits and APIs requires man-hour and financial investments as well as business model changes. User innovation per se could not occur from nothing, especially in the established companies. Judging by the current rate of development, it could be suggested that in next 10 - 15 years the transition will happen, since previous change took approximately 10 - 20 years.

User involvement varies on different stages of innovation process. Case study results show that Ideation stage is the most studied and active among others. Companies utilize idea collection tools, set up online platforms and conduct market researches. Feedback collection and innovations by employees are also among popular tool used by ICT companies on that stage. Rampant activity on

this stage could be partly explained by relative ease of use and low investments required to utilize these user involvement techniques. Companies often willing to spend more time and money on Ideation stage in order to avoid investing into unreasonable project. Furthermore, information leakage on this stage is practically harmless; therefore, companies open up to users relatively easy.

Development stage is usually closed to users, since companies often utilize their own production capabilities. Most interviewees mentioned that in near future their companies would prefer to attract users and even allow co-creation, however detailed mechanisms for user involvement on this stage remain yet to be developed. In B2B context, when projects often have strict deadlines it is relatively hard to incorporate user's inputs without increasing development time significantly. Developers – engineers and software designers – rarely interact with clients directly if at all. Hence, feedback collection and transfer would take additional time and effort from solution providers. In today's context, companies tend to shift user feedback implementation to the next stages of innovation process, since it reduces the production time significantly. Nevertheless, interviewed companies recognize the potential benefits of co-creation with users process and express hope that in near future user toolkits and APIs would allow customers to directly input ideas and tweaks into development process, which would result in significant time economy on the testing stage.

Testing stages inherently has bigger possibilities for user interaction, since it require quality assurance as well as human testing of the newly developed products. All of the respondents claimed that they conduct beta testing with clients as well as pay close attention to feedback and end user's insights. Future perspectives for this stage includes prototype distribution and pilot projects with lead users. Overall, testing stage remains well thought in terms of user involvement.

The last stage of innovation process – Commercialization and postproduction support – has yet to be utilized to its full potential, since the most common practice among ICT companies is feedback collection. This happens mostly

because companies do not fully transitioned into “Innovation by users” paradigm therefore lead users do not contribute to the diffusion of the innovation. Despite Bråtå et al. (2009) suggestion that user have less opportunities to affect innovation process at late stages, there is still a significant room for improvement over the current state of the user involvement. Few companies utilize customer case studies, which could be a frugal way to spread the word about newly developed solution. There are almost no signs of the utilization of user communities and peer sharing among lead users. In most cases companies tend to produce standardized all-round solutions, which are easily tailored for many clients. This approach helps to establish steady revenue streams, however it limits the possibilities of user innovation development and innovation breakthroughs in general.

Examples of Oculus VR and DICE presented in the third chapter of this research show that user inputs could be utilized on both niche and highly competitive markets. However, it requires internal change from the developing company such as business model change or development process change. This issue is closely tied with classical problem of management and economy principal-agent problem. Significant changes in business model or development process or even customer interactions require commitment from the top management, ability to accept higher financial risks and long-term orientation. Innovations do not occur by themselves, they are often the results of stimulus and economic conditions on the market.

Today’s situation on ICT market promotes closed development process and standardized solution, since market saturation is low or not yet full. Situation might change significantly when all the existing clients would have their basic need saturated. When this happens, companies who invested in user innovation and customer interaction would benefit from clients they already have or could potentially acquire by providing unique innovative solutions.

Another possible success strategy is eco-system development. Major players on software development market such as IBM, Adobe and others creates

communities of lead users and utilize user's input in their continuous development process, which allows their product to stay competitive and up-to-date. B2C market favors eco-system development, since physical users have lower barrier to enter online communities and share ideas. B2B context on the contrary has limited possibilities to create online communities, since employees of the companies has their work duties and rarely exceed them by participating and sharing ideas in their "free" work time.

7.3. Future of user-driven innovations

Considering aforementioned arguments, future of user-driven innovations for ICT companies might be bright and the best time is yet to come. In next 10 years market saturation of both companies and product would rise, companies would mostly transition in to "Innovation by users" paradigm, participation-related benefits would outweigh financial risks for the companies to open-up and allow users to input ideas into development process. Today it is safer and more viable for IT developers and communication companies to provide solutions with zero to minimal customer inputs into development, however in the near future standards would rise and financial outcomes of conservative approach would fall, making user-driven innovation viable and attractive option for many companies.

It also important to mention, that concept discussed by Raasch & von Hippel (2013) about free sharing of ideas by users might become central in coming years, because of raising IPR issues. Currently there is no standard solution or model, which companies might use while interacting with users and commercializing crowdsourced ideas. In many countries IPR laws do not cover such instances or remain outdated. Every single interviewed company mentioned IPR issues. Most of the interviewees admitted that they have no clear picture of how to approach ideas from third parties. This ambiguity might become central issue of innovation with users and user-driven innovations in coming years.

Companies and governmental innovation centers already started researching possible solutions to the IPR problem. This task might require a while to solve, since international law making process is not the fastest mechanism, however with rising demand for ideas from users, acceptable schemes and model may arise in different industries in order to speed up the innovation process.

8. CONCLUSIONS, LIMITATIONS & FUTURE RESEARCH

The aim of this thesis was to study user involvement and user-driven innovations on different stages of innovation process. Thus, these phenomena were studied through literature review of the relevant academic literature as well as empirical research conducted via multiple case study of user involvement in ICT companies. Research questions were formulated in order to investigate to what extent companies utilize users on different stages of innovation process; how user involvement varies among different companies; how user-driven innovation process could stimulate commercialization of new products. The results suggest that ICT companies utilize “innovation with users” paradigm, with only few elements of user-driven innovations. However, it could be argued that in following years interviewed companies would shift to the “innovations by users” stage and improve user involvement on every stage of innovation process.

On the whole, findings point to very low involvement of users at the development and commercialization phase but demonstrate a tendency or at least a wish towards bigger engagement. The biggest challenges stay the resource constraints, lack of people and time from both customer and company side to integrate more customer feedback into the process. Such problems as bureaucracy in idea exchange due to sensitivity of customer industry sector also occur.

This paper contributes to the understanding of the user innovation processes and goes beyond the regular positive and exciting picture of user innovation, crowdsourcing and online communities, but demonstrates the real day-to-day problems companies have along innovation process to fight on the way towards user innovation. Therefore, theoretical contribution of this paper is in shedding the light on yet scarcely researched part of user innovation theory and hence deepening our understanding of this research field.

Companies excitingly pursue the user approach in their innovation; this is most common aspect of opening up the innovation process: involving users into the innovation. However, many are not aware of what follows next, when one goes beyond crowdsourcing and idea generation and tries to work with users closely through the innovation funnel. This paper discussed what are the challenges companies face after the ideation stage.

In the following sections, the conclusions and research contributions of the research are presented. Managerial implications as well as limitations and suggestions for future research are introduced in the last sections of this chapter.

8.1. Theoretical contributions

The research contributes to the previous academic literature by providing insights on the user-driven innovations and user involvement in Finnish ICT companies operating in B2B context. The main research question “How user-driven innovations are utilized on different stages of innovation process?” is answered in the findings and discussion sections of this thesis. Overall, interviewed companies engage with users actively on the early stages of innovation process by launching idea-collection and crowdsourcing platforms among employees. However, on late stages of innovation process there are no significant achievement currently, while companies promise to improve feedback collection and implementation and organize online communities of users.

Study also revealed that in terms of typology of user involvement by Schuurman, Baccarne & Mechant (2013) companies currently operates in innovation with users domain, while there are evidence of preparation for the transition to the innovation by users domain in coming years.

Moreover, results show that companies, which have contact with end users via B2C channels or online communities tend to incorporate that feedback into the solutions for B2B markets. While companies operating only in B2B context tend to utilize knowledge and ideas from their employees.

Finally, the results of this research supports Bråtå et al. (2009) theory of the user's opportunities to affect innovation process. There are fewer chances to influence innovation process on late stages of innovation process in ICT companies operating in B2B context.

8.2. Managerial implications

The results of the analysis conducted in this study provided several practical implications and suggestions. Due to the topicality and relevance of the studied issues, the results could be useful for the practitioners and company representatives in ICT industry as well as companies operating in B2B context. The insights shared by the interviewees suggest that even in limited B2B environment companies could create viable communication channels with end users.

The important practical implication of this research arise from the observations of the practices utilized by different companies throughout the innovation process. The main similarity among many companies is that instead of communicating with end users directly, companies start with utilizing knowledge and ideas of its employees. The internal idea-collection tools proved to be an effective solution and framework for the ideation and development process.

Another noticeable practical implication from employee idea collection platforms is IPR protection. The number of technology and idea leakages and IPR-related questions in the industry is relatively high. Companies in the ICT industry do not currently have universal customer interaction model, which would prevent any IPR issues, while providing viable interaction between company and end users. Companies try to avoid IPR issues by utilizing technology savvy employees. This could be seen as a first step towards user-driven innovation.

Furthermore, manager of the companies operating in B2B segments should seek the end user interaction with all the available tools. As the results suggest, even pure B2B oriented companies managed to set up yearly meetings and events with end users and technology enthusiast. These events act as an idea collection for future development in case of limited communications with end users.

It is also important to mention that balance of user involvement throughout the whole innovation process should be preserved. Companies should not focus entirely on ideation stage. User involvement on late stages of innovation process facilitate testing and validation and helps to boost commercialization of the newly developed products.

Useful insights also could be derived from the model of benefits from innovation process by Gales & Mansour-Cole (1995) and Raasch & von Hippel (2013). Interviewed companies currently focus mainly on output-related benefits neglecting participation related part. As researchers suggested, participation-related part of the benefits from innovation process could be on par or even greater that output-related, therefore providing free ideas and user collaboration for companies. Managers should not underestimate the potential of users looking for sharing their ideas just for the sake of enjoyment from the creation process. This could bring valuable outcomes for the companies.

Finally, the findings suggest that there is a significant lag between current academic literature and current challenges of user involvement in the

companies. Nowadays mainstream companies in ICT industry face challenges, which were discussed several years ago in relevant literature. This issue could be solved by promoting academic knowledge to the companies in need via seminars and knowledge sharing mechanisms. Companies and managers should apply systematic approach from theory to practice when developing user-driven innovations.

Overall, the results of the research are practical for managers and practitioners. The discussion section provide comprehensive overview of the current state of the user-driven innovation in ICT companies as well as predictions for the near future. Companies should tackle the IPR issues related to idea sharing as well as pay closer attention to the relevant academic literature, which could provide insightful solutions to the current challenges.

8.3. Limitations and suggestions for future research

The main limitations of this study derived from the data collection and the availability of interviewees. The access to the relevant and responsible people related to innovation process and user interaction in companies is very limited due to lack of time, networking and level of transparency of the companies. In the ideal scenario, the research should include as much as possible long, comprehensive interviews with innovation managers responsible for the design of innovation process and user involvement. However, presented interviews already shared significant amount of information on the researched topic to make meaningful conclusions and implications.

Moreover, the fact that the main focus of this study was set to ICT sector might limit the information on other companies operating in similar industries or market conditions, whose insights and solutions could be applicable in ICT as well. Generally, most of the industries with closed developing process currently share the same characteristics and challenges in user involvement as ICT companies presented in this study.

Another important limitation of this research could be the attention to the B2B context of the business. This limitation originated from the research gap and lack of comprehensive insight from B2B segment of ICT sector. Companies nowadays focus on user interactions in B2C context, while B2B user involvement remains complimentary. Although this study provides unique insight from the B2B perspective, it might lack description of commonly used techniques prevalent in B2C context such as social media interaction.

Finally, all of the interviewed companies operates on Finnish or Nordic markets. Some of the companies considered to be global and have its subsidiaries on the US and Asian markets as well, while other have not. The results of this study could be mainly applicable to the developed markets and markets similar to Nordic countries. The implications for developing markets and other business and economic environments may vary. For instance in countries with weak IPR enforcement such several Asian countries, the ideation with users would not be potentially challenging due to lack of IPR concerns.

The suggestion for further research might include comprehensive study of IPR-related issues in co-creation and idea collection. This thesis only highlighted the IPR issue, however future research of this matter could bring useful results applicable for many companies.

Another important suggestion for further research could be a study of the differences between B2B and B2C user involvement techniques. This issue is reviewed in the third chapter of this thesis, while discussing user involvement in ICT. However, it could be a frugal basis of the future studies. Moreover, the study of differences and challenges across different industries such as ICT, automotive, hardware and others could provide insightful implications for the development of user-driven innovation theory.

This thesis provided only a cross-sectional snapshot of the current situation in the ICT industry; hence, longitude study of user involvement after 5-10 years might bring interesting results. Additionally, only longitude study could evaluate

the success of the current initiatives and decisions. Therefore, such future study could tackle all the existing limitations towards time frame of the research.

Overall, this study produced a set of results and practical implications with number of limitations mentioned in this section. The suggestions for future research might include extended time frame of the research, comparison between B2B and B2C contexts as well as multi-industry analysis of user involvement techniques. These suggestions might help to establish more complex understanding of user-driven innovation across different context and industries.

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APPENDICES

Appendix 1: User-driven innovation literature review meta-analysis, table

Name	Authors	Year	Key words	Stage of Innovation process (1-5)	Results/Extra info	Industry	Research method	Size of sample	Types of users (1-5)	Type of user involvement
The dominant role of users in the scientific instrument innovaiton process	Eric von Hippel	1976	User-driven innovation, lead users	1-4	First paper on UDI	scientific instruments and tool, medical	surveys, questionnaires, cases	111 scientific instrument innovations	1	user innovation, diffusion by user
Transferring process equipment innovations from user-innovators to equipment manufacturing firms	Eric von Hippel	1977	User-driven innovation, lead users, innovation transfer	1-4	innovation transfer between innovative user and firm is a new step in innovation process	semiconductor manufacture and electronic subassembly	surveys, questionnaires, cases	49 process machinery innovations	1	user innovation, diffusion by user, innovation transfer to firm

Successful industrial products from customer ideas	Eric von Hippel	1978	Manufacturer-Active Paradigm (MAP), Customer-Active Paradigm (CAP)	1-5	MAP vs CAP		Conceptualization, empirical models		1-3	
Appropriability of innovation benefit as a predictor of the source of innovation	Eric von Hippel	1981	patents, innovation benefit, lead time	3-5	Concepts of innovation benefit and lead time		Cases		1	
Lead Users: An Important Source of Novel Product Concepts	Eric von Hippel	1986	Lead Users,		Methodology, lead users identification		Conceptualization		1	
Lead User Analyses for the Development of New Industrial Products	Urban, Glen L., Eric von Hippel	1988	Lead users,	3-5	PC-CAD	ICT,software	Surveys		1	User Involvement Methodology : 1) Specify Lead User Indicators, 2) Identify Lead User Group, 3) Generate Concept (Product) with Lead Users, 4) Test Lead User Concept (Product)

Developing New Product Concepts Via the Lead User Method: A Case Study in a "Low Tech" Field"	Cornelius Herstatt, Eric von Hippel	1992	Lead users,	1-5	Hilti AG case, industrial components manufacturing		Case study, surveys, interviews		1	User Involvement Methodology
Incentives to innovate and the sources of innovation: the case of scientific instruments	William Riggs, Eric von Hippel	1994	sources of innovation, incentives to innovate		strong links between appropriable innovation benefit, the sources of innovation and the types of innovation that are developed	scientific instruments	Cases	sample of 64 innovations related to scientific instrument used to analyze the surface chemistry of solid materials		

A Lead User Study of Electronic Home Banking Services: Lessons from the Learning Curve	Eric von Hippel, William Riggs	1996	Lead users, banking services, testing	3-5	(1) the value of identifying lead users via a networking process rather than by surveys of likely user populations; (2) an "innovation first" approach to lead user identification; (3) the value of understanding lead user systems when developing new product and service concepts; (4) learning from vs. adopting lead user innovations	Banking industry	Literature overview, conceptualization, case study		1-3	User Involvement Methodology
Creating Breakthroughs at 3M	Eric von Hippel, Stefan Thomke, Mary Sonnack	1999	3M, Users as Innovators, Lead users,	1-5			Case study, Conceptualization		1	

Determinants of User Innovation and Innovation Sharing in a Local Market	Pamela D. Morrison, John H. Roberts, Eric von Hippel	2000			OPAC, Australia	information search systems	Survey	122 completed surveys		
Performance Assessment of the Lead User Idea Generation Process for New Product Development	Gary L. Lilien, Pamela D. Morrison, Kathleen Searls, Mary Sonnack, Eric von Hippel	2002	new product development, lead users, idea generation		ideas generated by LU processes had forecast sales in year 5 that were more than 8 times higher than the sales of the contemporaneously funded projects: $146 million annual sales on average versus $18 million.		Case	47 funded ideas from 3M	1	User Involvement Methodology

Consumers as Co-Developers - Learning and innovation outside the firm	Lars Bo Jeppesen, Måns J. Molin	2003	Product Development, Consumer-to-Consumer Interaction, Learning, Consumer Innovation, Community, User-toolkits	2-4	Computer games and online communities	Computer games	Literature overview, conceptualization, case study	1 game community	1	online community
User-driven innovation Results and recommendations	Jørgen Rosted	2005	Innovation process, Denmark, policy	1-5	Detailed overview of user innovation in Denmark, recommendations, policy implications	electronics, fashion, medical device	User and firm surveys, questionnaires, cases	200 companies	1-5	User surveys
Finding commercially attractive user innovations: A test of lead user theory	Nikolaus Franke, Eric von Hippel, Martin Schreier	2005	Lead users, commercialization	3-5	from 10% to nearly 40% of users report having modified or developed a product	Extreme sports	surveys, questionnaires, cases	456 questionnaires from kite surfers	1	online community

How user innovations become commercial products: a theoretical investigation and case study	Carliss Baldwin, Christoph Hienerth, Eric von Hippel	2006	Commercialization, dominant design, User-innovators, User-purchasers, Established manufacturers	3-5		Extreme sports industries, Rodeo Kayak	cases, economic models		1-2	
User Innovation in SMEs: Incidence and Transfer to Producers	Jeroen P.J. de Jong, Eric von Hippel	2008	User innovation, SMEs, producers, transfer, diffusion, measurement, Netherlands	3-5	21% of all SMEs engage in user innovation in Netherlands	high-technology SMEs	surveys, cases	2416 SMEs in the Netherlands, 498 high-tech SMEs		supplier collaboration
Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation	Carliss Baldwin, Eric von Hippel	2009	economic viability, design costs, user producer and open innovation	1-5	economic viability of innovation by producers vs users and open innovation		Conceptualization, empirical models, economic models			Collaboration and Modularity

Measuring user innovation in Dutch high tech SMEs: Frequency, nature and transfer to producers	Jeroen P.J. de Jong, Eric von Hippel	2009	User innovation, SME innovation, innovation transfer, innovation diffusion, innovation measurement, open source.	1-5	Many transfers were made without any direct compensation, i.e. 48% were simply given away	high-technology SMEs	Surveys, cases	498 “high tech” SMEs in the Netherlands	1	open source
Users as Service Innovators: The Case of Banking Services	Eric von Hippel, Pedro Oliveira	2009	Service users, service innovation, self-service, user innovation, commercial and retail banking	1-5	Users’ role in services innovation, in 85% of these cases, users self-provided the service before any bank offered it.	Banking industry	Literature overview, exploratory empirical study	Histories of 47 functionally novel and important commercial and retail banking services.	1	
User-driven innovation? Challenges of user involvement in future technology analysis	Katrien De Moor, Katrien Berte, Lieven De Marez, Wout	2010	User-driven innovation, user involvement	1-4	mobile applications	ICT,mobile software	Literature overview, conceptualization	420		User surveys

	Joseph, Tom Derycke re and Luc Martens									
Users as Innovators: A Review, Critique, and Future Research Directions	Marcel Bogers, Allan Afuah, Bettina Bastian	2010	sources of innovation; user innovation; theory, knowledge; co-creation		Expected Benefit From Innovation, types of users		Literature overview		1-2	
Customers and users as drivers and resources of new service development: three approaches towards user needs driven service innovations	Arja Kuusist o, Jari Kuusist o	2010	service innovation, Finland, basic approaches to customers, user involvement	1-5	Building deep customer understanding; Involving customers as participants in new service development activities; and, Making use of user-generated content and innovations.		Literature overview, conceptuali zation		1-3	three basic approaches to customers

Measuring user innovation in the UK	Stephen Flowers, Eric von Hippel, Jeroen de Jong, Tanja Sinozic	2010	innovation measurement		UK	Software and IT services, Mining and quarrying, Aerospace and automotive, Financial services, Agriculture and fishing	Firm and customer surveys	2019 consumers older than 15, 1004 firms between ten and 250 employees in 15 industrial sectors		
Crowdsourcing as user-driven innovation, new business philosophy's model	Aleksejs Busarovs	2011	Crowdsourcing				Literature overview		1	

The Age of the Consumer-Innovator	Eric von Hippel, Susumu Ogawa, Jeroen P.J. De Jong	2011	Innovation Paradigm, consumers	1-5	Article, examples, graphs	multiple consumer products	Conceptualization, user survey	1173 U.K. Consumers	1	consumer design
User community vs. producer innovation development efficiency: A first empirical study	Christoph Hienerth, Eric von Hippel, Morten Berg Jensen	2011	Product innovations, efficiencies of scope, user vs. producer innovation efficiencies, user innovation expenditures	1-5	Empirical study of user vs. producer product development (whitewater kayaking), innovation efficiency calculations	Extreme sports industries (white water kayaking)	Empirical study , Case study innovation history	timeline of kayaling innovation, 201 respondents	1	online community
User Innovation and the Market	Fred Gault	2011	User innovation, consumer innovation, public sector innovation, official statistics				Surveys, literature overview, conceptualization			

Facilitating customer involvement in collaborative online innovation communities	Maria Antikainen	2011	online communities, collaboration, intermediaries, motivation, rewarding, monetary, non-monetary, tangible, intangible, recognition, case study	1-5	collaboration and collective thinking enables companies to maximise the efficiency of customers' innovation potential	Industrial design	case study, literature overview	3 cases	1-2	Online innovation communities
Innovation effort as "productive consumption:" The power of participation benefits to amplify innovation	Christina Raasch, Eric von Hippel	2012	Participation benefits, motivation, innovation amplification, user involmenet		The case of the Finland survey (motivation)		Literature overview, Cases			
The role of the user in innovation Finnish Community Innovation Survey	Mervi Niemi, Jari Kuusisto	2013	Innovation activity, users, co-creation, commercialization		Up to 80 per cent of enterprises with innovation activity reported having incorporated user information or users in their innovation activity, slightly more common among service	manufacturing, mining and quarrying, electricity, gas and air	Survey questionnaire	2200 Finnish enterprises		co-creation with users

					enterprises	conditioning supply, water supply and waste management				
Market failure in the diffusion of user innovations: The case of "off-label" innovations by medical clinicians	Eric von Hippel, Harold DeMonaco	2013	User innovators, innovators' investment, innovation diffusion, failure		An empirical test of user-innovator diffusion incentives (the diffusion of new "off-label applications" for FDA-approved medical drugs or devices)	medical	Empirical exploration, Survey of clinician user innovators			
Firms, Users, and Innovation: An Interactive Model of Coupled Open Innovation	Frank Piller, Joel West	2014	open innovation; user innovation, coupled open innovation, collective model of innovation, co-creation	1-5	UDI vs OI comparisson, Chesbrough vs Von Hippel		Literature overview, conceptualization		1	

The diffusion of consumer-developed innovations: Patterns in Finland	Jeroen P.J. De Jong, Eric von Hippel, Fred Gault, Jari Kuusisto, Christina Raasch	2014	User innovation, commercial diffusion, peer-to-peer diffusion, general value, market failure		market failure is reducing the diffusion of user innovations developed by consumers for their own use		Review of the literature, Empirical analysis of the factors influencing diffusion			
The user innovation paradigm: impacts on markets and welfare	Alfonso Gambardella, Christina Raasch, Eric von Hippel	2014	investments in user innovations		firm profits and social welfare unambiguously increase, if firms invest in complementing user innovation		microeconomic model			

Appendix 2: Structure of the interviews

Interview questions

General questions

1. Could you give a brief overview of your position and role at Case Company?
2. Could you give a brief overview of the projects/products company working on nowadays? In which areas do you see the development in near future?
3. Could you define innovation process in Case Company?
4. How do you collect feedback from users on different stages of innovation process?
5. On which phases of innovation process do you involve users the most?
6. How do you incorporate ideas from users into new products/product development?
7. Are there any example of user ideas adopted in existing products? Can you name any examples of failures?
8. Do you think you engage with users enough? Are there any difficulties? Would you like to engage with users more?
9. How do you evaluate user participation? Any KPIs?
10. Is it possible for the common customer to promote his idea to the Case Company and see it implemented/created? Is there a procedure for that? Do you know any examples?

Additional questions:

1. How does the feedback and user involvement organized in company? Who is responsible for this? Who evaluate user ideas?
2. Do you follow or participate in any online communities of users or enthusiasts? How does it affect product development?
3. Do you in Case Company distinguish between different user groups? (For example lead users, early adopters etc.)
4. Do users participate in product testing? If yes how?
5. Do you distribute prototypes or versions of the products among users before market launch?

6. Do you feel the need to ask users about something when you create new products or develop existing ones?
7. Who are your main competitors in terms of innovation process? Do you use any companies as benchmarks?
8. How else could users contribute to product development?
9. What are the role of the word of mouth and social media in commercialization of your products?

Appendix 3: List of Interviews

Interview 1

Interviewee: Senior Manager (External Research Collaboration)

Type: Telephone interview

Date: 10th of September 2014

Duration: 1h 21min

Interview 2

Interviewees: External subcontractor & Head of Quality and Environment

Type: Telephone interview

Date: 30h of September 2014

Duration: 1h 12min

Interview 3

Interviewee: Development manager (Software development)

Type: Face-to-face interview

Place: Kouvola, Finland

Date: 20th of October 2014

Duration: 1h 01min

Interview 4

Interviewee: Quality Manager

Type: Telephone interview

Date: 24th of October 2014

Duration: 57min

Interview 5

Interviewee: R&D and Innovations manager

Type: Telephone interview

Date: 5th of December 2014

Duration: 1h 19min

Interview 6

Interviewee: Head of R&D

Type: Face-to-face interview

Place: Espoo, Finland

Date: 10th of March 2015

Duration: 1h 04min