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NEW PRODUCT DEVELOPMENT PROCESS IN FINNISH SOFTWARE START-UPS AND UNIVERSITY SPIN-OUTS

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ABSTRACT

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This scientific work touches upon the actual and popular topic of the software industry today. In particular, the importance of the process of developing a new product on the example of Finnish start-ups and spinouts is studied. The thesis aimed to investigate how new software development process design affects the success of the new innovative venture and find out if there are significant differences or similarities between software start-ups and university spin-outs in Finland.

The literature that advanced this study is divided into the studies in the new product development area, approaches to the process of developing a new software, a comparative systematic analysis of the characteristics of start-ups and spin-outs, and an outlook on Finland's exclusive innovation system.

The results of this qualitative study highlighted the importance of customer-orientation and attempted to contribute to the contemporary perception of integration of spin-outs to the innovation system. From the interviews, it is evident that spin-outs are slightly less successful in managing new software development than start-ups.

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"Much learning does not teach understanding"
– Heraclitus

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The initial interest in this topic originated and was developing ever since the first course I have attended at LUT – Marketing of High Technology Products and Innovations with Dr. Sanjit Sengupta. Further studies and experiences only reinforced my desire to write a final work on this topic and, behold, it happened.

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1. INTRODUCTION

The aim of this thesis is to define how new software development process design affects the success of high-tech innovation start-ups and university spin-outs in Finland. In more detail, the thesis was designed to find an optimal approach to innovation commercialization process of high tech start-ups and spin-outs. It is particularly interesting to take a deeper look into the most successful and profitable examples of innovations that have already been commercialized. The software industry in question has been chosen due to its impressive growth indicators. Globally, software industry revenues have shown growth at five to eight percent annually. The Finnish software industry continues to grow and, according to the results of the Software Company Survey 2017, the software and IT services grew by 5.9% in 2016. (Luoma 2015; Luoma and Rönkkö 2017).

In addition, Finland has the highest industry adoption level of cloud services in Europe, followed closely by other Nordic countries. While in 2016 the average percent of companies using cloud services in the EU was 21, in Finland it was more than double as much – 57 percent (Eurostat 2017). The peak of cloud services growth has happened in recent years due to the fact that the barriers for using third-party services are relatively low and Finnish companies readily purchase them. The considerable growth of software-as-a-service (SaaS) in Finland is also one of the reasons for broad adaptation of cloud services. The SaaS market presense is more than 90 percent while models are starting to become popular as well. Among them are, for example, private infrastructure as a service (IaaS) and OpenStack platforms for cloud computing (Export.gov 2017).

Without doubt, the booming software industry provides the state with high-paying jobs and therefore promotes economic growth. According to Eurostat (2018), The European Union had almost forty-six thousand enterprises in high-tech manufacturing in 2014. However, in Finland, there is still a notable shortage of skillful IT specialists.

According to Fortune (2016), Finland urgently needs 7,000 software development experts. The demand is expected to grow by up to 3,800 people per year, meaning that in the 2020 the deficit is anticipated to extend to 15,000 which will cost approximately 3-4 billion euro

per year in lost GDP (Fortune 2016). Luoma and Rönkkö (2017) survey confirms that software companies feel it is difficult to find skillful software experts in their needs and that there is a need for thousands of experts in the industry. According to the survey, this is not just about the number of experts but also about the rapidly changing skills requirements. Programming and related tasks are only about half of the tasks required. There is a need for other skills as well. "Businesses need extensive know-how: not only software specialists, but also experts for various tasks, such as analysts, designers and project experts," says Ville Peltola, Vice President, Digitalization at the Technology Industries. Fast development creates major challenges for the education system because skills needs are already significantly different from the current educational provision. The changing needs of working life should also be considered in the curricula and in the planning and conversion training. Digitalization is a prerequisite for stable growth in Finland and now it clearly suffers. (Teknologiateollisuus.fi, 2017)

The results of the thesis sum up the most successful steps applied by Finnish software industry firms during their international new service development process. This chapter provides a background for the research and literature review, outlines research gaps and problems along with research questions, presents theoretical framework and definitions of key concepts. Finally, the delimitations, research methodology and the structure of the thesis are presented in the end of this chapter.

1.1 Background of the Thesis

There has been a certain concern that European high-tech industry has been experiencing a recession during the past five years. After Nokia was acquired by Microsoft, Europe was practically left with no representation at world's top ten handset makers. However, European companies show reliable performance in the business-to-business (B2B) sector (Collignon et al. 2014). There are different opinions on this disbalance and the way to cope with it. Blau (2014), for instance, argues that European governments must focus on producing more graduates in mathematics, information technology, natural sciences and technology, as well as ensure there is a stable supply of rare-earth metals, since they dictate the future growth of many high-tech goods. In conclusion, Blau (2014) even gives a warning that if Europe does

not act, it will lose the high-tech battle to remain a noticeable player and therefore catalyze other industries as well.

Since 2006, European Commission has communicated the innovation strategy, that focused on the creation of regional clusters of innovative high-technology companies. These clusters play a significantly important role in the European economic and technological scene. Caused by the evolution of advanced economies from manufacturing to services, the shift towards enterprise size reduction emerged in Europe already fifty years ago (Keeble and Wilkinson 2017)

Nowadays, high-tech developments appear faster than they can be adopted by consumers and business models change so fast that it is more and more difficult to name them (e.g. SaaS, PaaS, IaaS, MaaS, AaaS – Software, Platform, Infrastructure, Mobility, Analytics as a service). All these peculiar names are part of the fourth Industrial Revolution or Industry 4.0. According to Tom Garinis, senior advisor for Deloitte Consulting, it means that advanced production techniques intercept with smart digital technologies to create a digital enterprise that would be interconnected, autonomous and will be able to analyze, communicate and use data to initiate intelligent activity in real time in real world. As a result, this smart and connected technology will be interconnected with processes and people inside the organizations. There are several potential high technologies that will support this process including Artificial Intelligence (AI), robots, wearables and the Internet of Things (IoT) (Deloitte Insights 2017).

Nevertheless, brave entrepreneurs strive to commercialize their invention faster than everyone else on the world market. Here and there entrepreneurs talk about the start-up culture that reflects the agility and adaptability of a new venture expected to adapt quickly to internal and external market pressures in order to survive. Indeed, the pace of business globally has significantly increased, affected by rapid advances in technology, and even big companies realize they can benefit from startup culture values, by being more agile and resilient. This definite need pushes these large firms to develop the new capabilities to meet the requirements of market competition. Koskinen et al. (2013, 42) rightfully argue that this expertise must be aligned to the "resources, knowledge and tools (dynamic capabilities)" of the company.

Globalization and emerging markets have caused another trend – it became much more difficult to stand out by quality for western high-tech companies because manufacturing companies in Asia and elsewhere are quickly following or even outstripping them. The trend is also supported by the fact that Asia has the highest percentage of mobile-first behavior along with fast adoption rates of modern technologies. For example, the number of consumers who use only their smartphones to access banking services in China and Indonesia has grown by 102% and 125%, while in UK and Spain its 63% and 61% respectively (Comscore 2017). In Finland, on the contrary, 92 percent of people aged 16-74 uses online banking, which is the highest number in the EU28 (Eurostat 2017). Moreover, according to one of the leading business families, Europe falls behind the USA and China in the field of artificial intelligence and quantum technology in particular (Milne 2017) These trends and observations identified in the field lead to a logical question:

How European high-tech ventures can outperform growing international competition?

Product distinction is seen as the extent of superiority of the new product compared to other products on the market based on its unique, technical and economic qualities (Cooper 1979). So, if innovative startups are the key to improving European positions on global high-tech arena, then how to ensure the project delivers its value. In an answer to this question, regional high-tech clusters have been created in Europe in the recent decade. The differences of these regional centers are extremely interesting and important for further research on new product development process in high-tech industry. Abundant literature on the topic emphasizes the importance of innovative clusters along with industrial activities. Many researchers (Etzkowitz & Leydesdorff 2000; Huahai et al. 2011; Smith & Bagchi-Sem 2010) argue that regional innovativeness is affected by local actors: Academia, Industry, Government. This view is called Triple Helix Triangulation model (Figure 1) and is built on the inter-relationships among these circles which represent key institutions to the knowledge that itself is the "key to production that becomes the key to stable interactions" (Farinha and Ferreira 2013, 20).

Plunket (2006) also distinguishes a second direction of research which is based on geographical economics and the effect of geographical proximity. However, even though there is a wide range of available literature on innovation clusters, there is no established research methodology for comparison of competition and innovation levels.

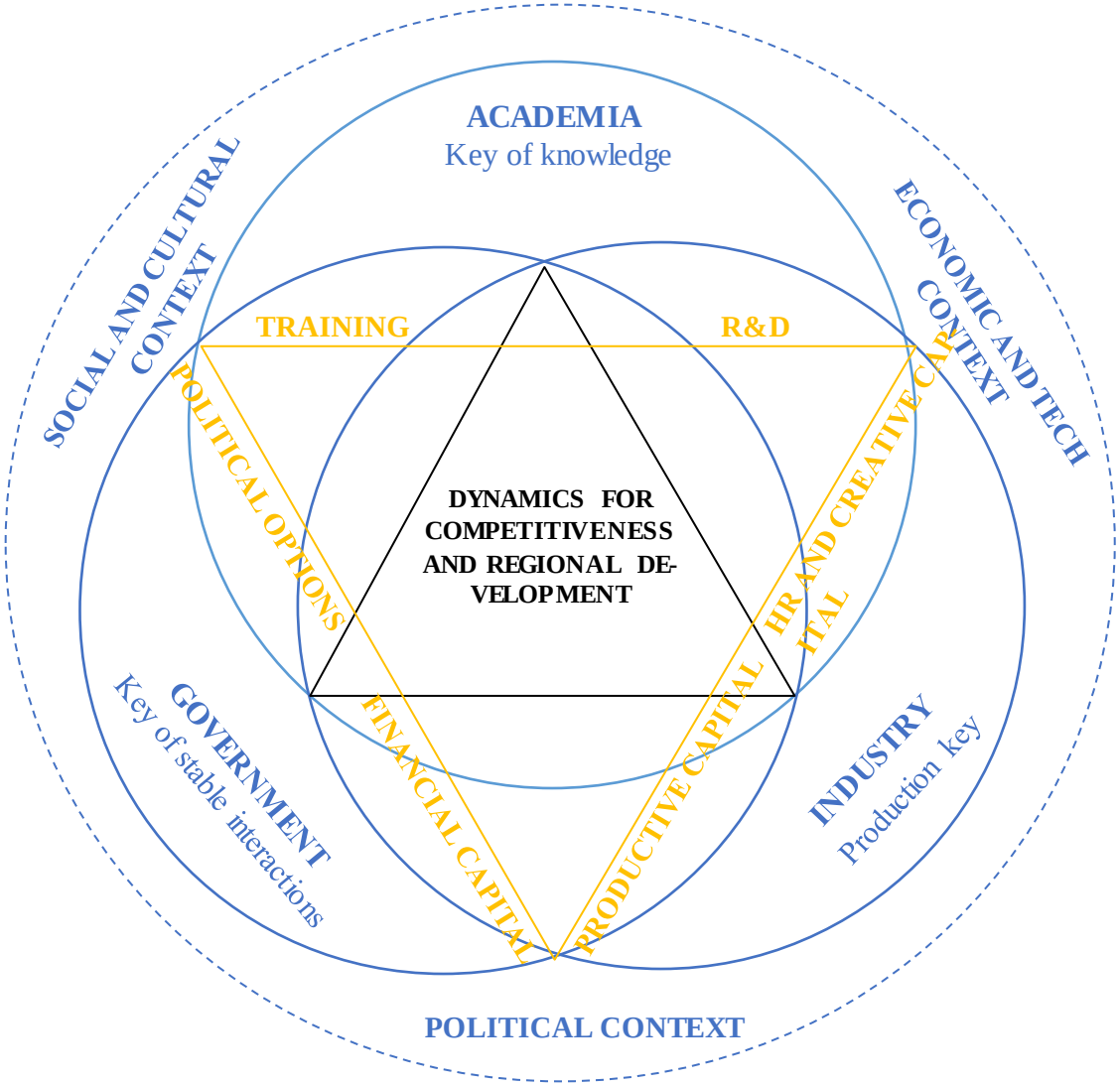

Figure 1. Triple Helix Triangulation model. Adopted from Farinha and Ferreira (2013)

Finland's successful performance on worldwide arena was one of the premises to look deeper into the process of commercialization of particular ventures (software start-ups and spin-outs). Global Competitiveness Index positioned Finland on the 10th place in the world. This prominent position is due to public health and primary education excellence as well as higher educational institutions ranked second in the world. It is apparent that Finland has found the right path to the education of future game changers through original teaching practices and further on, to the establishment of competitive national innovation system, which is fourth best in the world, majorly because of the strong research and development collaboration between universities and businesses (GCI, 2018).

Indeed, the trend is ongoing, as in 2016 OECD evaluated the gross domestic spending on R&D as follows:

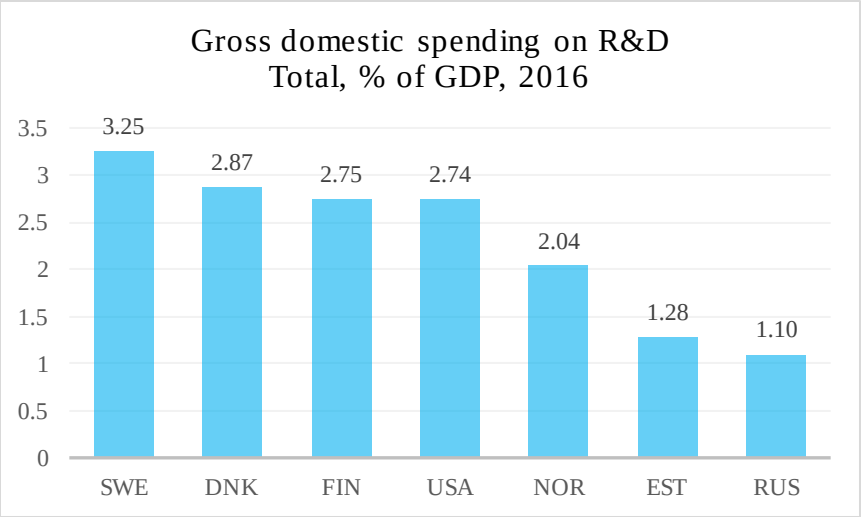

Figure 2. Gross domestic spending on R&D Total, % of GDP, 2016 (OECD, 2018b)

An STI (Science, Technology and Industry) e-outlook for all OECD countries proves the point by claiming that Finland is considered to have a "strong science base, high public-sector expenditure on R&D, highly ranked universities and a growing entrepreneurship culture." The latter is supported by a "booming venture capital industry and a very high relative number of young patenting firms." Again, the STI system of Finland was rated among the top ones internationally. The economical system is open, so companies have excellent international partnerships, despite the fact that research system is largely domestic (OECD, 2018a). In 2015 the value of the Finnish IT industry turnover was 10.7 billion euros and it employed around 58,000 people and has shown its continued ability to adapt to new technologies such as cloud computing and software-as-a-service (SaaS), as well as collaborative and content applications. In 2017 turnover of Finnish IT industry has grown to 12.4 billion euros with 62,600 people employed (Teknologiateollisuus.fi 2017).

Interestingly, Tampere region, which is some 180 kilometres north of Helsinki is moving towards an innovative economy of the future with a clear focus on high-tech and advanced skills. For example, Intel and Qualcomm have chosen to invest in Tampere and regional high-growth tech firms that raised 1 million US dollars in under 48 hours. These large firms strongly contribute to the growth of the ICT cluster and attract other early-stage innovative

companies. In general, in Finland, however, regional policy is rather mixed with strong existing development programmes in southern and western regions (Siteselection.com 2015).

1.2 Literature review

This section contains a literature review of the existing sources and provides theoretical background to the high-tech start-ups and university spin-outs commercialization and new product development activities. Finnish innovation commercialization research in question is reviewed. General theoretical and managerial approaches to new product development are given the most attention in this chapter along with the success factors derived from previous studies for start-ups and spin-outs that are using each of them.

In principle, this research of NPD (Tabe 1) recognizes two main thinking streams, acknowledged also in the literature. First implies that innovative endeavors in start-ups and spin-outs are considered as part of the ecosystem. It is visible from related contextual frameworks: innovation system model and triple helix triangulation model. The interconnectedness of this ecosystem determines the speed of growth and scaling of the enterprise. Startups and spin-outs become independent players on the business arena, because they have access to the resources of the ecosystem (such as government-funded consulting). The question that arises from this is how does the NPD process differ in start-ups and spin-outs and how does this affect their success?

Table 1.Key research on NPD

Author	Key findings
Kotler and Keller (2011, 56)	"Idea generation, idea screening, concept development and testing, marketing strategy development, business analysis, product development, market testing, commercialization".
Hollensen (2010, 406)	"Idea generation, screening, concept development and testing, business analysis, product development and testing, test marketing, commercialisation and launch".
Baker and Hart (1999, 14)	Tasks that have to be executed at several internal departments ("R&D, marketing, engineering/design, manufacturing") and executed together with "external partners (suppliers and customers)"

Robertson and Ulrich (1998)	The product platform approach to new product development will save crucial resources and eventually result in better commercial results. This is due to the savings on production costs, equipment and support and, as mentioned earlier, development time
Storey and Easingwood (1999)	Well-managed new product development process results in the effective improvement of company image, penetration of new markets and creating a platform for next new products

The second aspect is the market orientation, which is defined on the literature as an approach to do business or also as a philosophy of identifying and meeting customer needs and wants. Previous studies (Table 2) discuss market orientation in the context of the processes related to the NPD, namely fuzzy front-end and commercialization. Attempts have been made to structure and create models describing these complex processes, but it turns out that the fuzzy front-end is a chaotic environment that is extremely difficult to conceptualize. The researchers from related disciplines often used different terms and it brought inconclusive results.

Table 2. Key research on market-oriented behavior

Author	Key findings
Han et al. (1998)	Favourable influence of market-orientated behavior on innovation
Christensen's (1997)	Feedback may have a more negative effect on disruptive rather than sustaining technologies
Kok and Biemans (2009).	Previous studies are inconclusive as to whether consumer research and market-oriented culture have any good or bad influence on new product performance
Slater and Narver (1995)	Market orientation promotes creativity, since it involves the creation and distribution of the response to market intelligence and knowledge in response to market demand
Im and Workman (2004)	Beneficial influence of the three aspects of market orientation on new products and "marketing programms creativity"
Day (1994), Hunt and Morgan (1995)	Customer orientation involves collecting customer information to meet their needs and wants, as they react to new and meaningful incentives
Miller and Swaddling (2002,15)	Deficiency in the modern state of new product development "can be directly or indirectly tied with the quality and availability of related consumer research."

Van Kleef and Van Trijp (2003)	To prevent the marketing myopia and subsequent loss of opportunities the firms often chose to take a proactive approach towards opportunity recognition in the closely-related fields of the existing market offerings. The purpose is to obtain an innovative and inspiring external viewpoint on product ideas based on customer feedback
Ulwick (2002)	"Asking consumers what they want is useless, because they do not know what they want unless they see it."

The research in recent years have covered start-up and university spin-out related phenomenon across different fields. Several researchers suggest that there should be more focus on technology transfer and entrepreneurship. For example, Wright et al. (2004) noticed that existing literature is built around the idea of necessity of different university-based spin-outs and mainly descriptive research. However, not only the phenomenon, but its operational and managerial implications have to be studied. Wright et al. (2004) also claim that it is important to research what exactly leads to commercialization, and what affects the process of creation and development of university spin-outs.

In a fast economy of change, nonstop advancement is an essential ongoing activity. Profoundly inventive firms are able to distinguish and rapidly seize market changes. Highly innovative companies often focus on creating innovation-friendly environment and readiness to take risks, encouraging teamwork and embracing the uncertainty of constantly changing consumer preferences, adoption curve, strengthened competition and short product life cycles (Kotler and Keller 2011). Nonaka and Takeuchi (1995) have previously argued that innovation a key element of business success. The European Commission (2004) has concluded that innovative businesses growing more than non-innovative businesses.

The success factors of high-tech companies were studied by Koskinen (2014), who has suggested a new perception of company's dynamic capabilities and flexibility operations in a form of dynamic business model (DBM). The research has shown that a few "key factors, including entrepreneurial strategy, R&D to market performance, dynamic operational excellence, and intellectual capital with decentralized decision-making processes are critical for high technology companies" in the dynamic environment.

Previous studies on new product design in high-tech have mainly focused on a broad innovation design and often used a number of innovations or patents, also took the strategic business unit (SBU) as their level of analysis. This became an issue for further research and as Wind & Mahajan (1997) noticed, the studies in the field could be quite puzzling because of ambiguous descriptions of innovation. This constraint is particularly noticeable when it is associated with company efficiency, since innovation usually equals to profitable product brought to the world as a result.

1.2.1 Distinguishing between the Spin-out and the Start-up

Since many American universities classify start-ups as scientific spin-outs, it is necessary to distinguish between these two concepts. (Bayes-Brown 2015) The one difference between the spin-out and private sector innovation is mode of investment for R&D. Most of the universities around the world are partly or full funded by public, so they are obliged to serve the public. Private sector, on the other hand, invest their own funds to generate knowledge, focused on a product or services which they believe bring high dividends and have an entrepreneurial strategy to protect their technical know-how. However, universities do not focus only on commercialization but on the knowledge, irrespective of the rate of rerun on investment. Also, entrepreneurial strategy may not be as rigorous as those of private sector. The focus is new knowledge and disseminates that knowledge to public. Entrepreneurial individuals may use this knowledge to gain profit while serving the public. Because of difference in underlined principles on sincerity and reciprocity, sustainability of new products and service of spin-outs may be higher than those of private sector although they are sources of innovation (Arachchilage 2012).

University spin-out firms also commonly called “university spin-offs” or “research related start-up ventures”, are acknowledged in the literature as one of the key drivers of economic change and growth (Bercovitz and Feldman 2006). Originally a phenomenon thought to be specific to the US, today most advanced national economies aim to generate economic wealth by distributing and capitalizing on public research through the spin-outs (Clarysse et al. 2005). Start-ups, in turn, do not originate from within the organization, but rather from external environment, because their goal is to capitalize on a market niche with immense capacity under a limited time. Acording to Eric Ries (the author of “The Lean Startup”), a

startup is defined as "a human institution designed to create a new product or service under conditions of extreme uncertainty" (Forbes.com, 2017). Table 3 contains the summary of the main differences of both types.

Table 3. Comparison between the Start-ups and Spin-Outs (Adopted from Hamano 2011)

	Spin-out	Start-up
Created by	University	Outside University
Technologies	Owned by University	Licensed by University
Financed by	University	Outside University
Managed by	University	Outside University

Comparison research has proven that there are slight differences in university-based spin-outs and self-funded start-ups. Considering attracting investments and commercializing the technology, university spin-outs are more successful than other companies. The reason for it are rich research and development activities performed on university base. At the same time, this indicates that industry values the technical advances created by university-based spin-outs and justifies them as an important aspect of technology transfer (Mustar et al. 2006; Shane 2002). Moreover, Plunket (2006) found evidence of the impact of sectoral and regional R&D investments at the regional level. Besides, if the impact of private R&D investments is very high, the impact of public investment in turn, is not quite clear.

Mustar (2001) outlines the functions of most spin-outs as a conductor or interpreter connecting scientific research in public institutions to the commercial representatives from the industry. It explains the increasing the industry's curiosity about building spin-outs, in fact, there are many ways how government agencies, national and regional institutions are central drivers of change, e.g. by encouraging experimentation in policy support. It is important to maintain that innovation policies are vital for the support of spin-outs. The whole arsenal should be present in regional innovation centres, despite the fact that it is expensive and difficult to create novelty. Following this direction, Audretsch et al. (2006) suggest that the function of spin-outs in utilizing knowledge is mutually directly proportional to the function of start-ups as agents of knowledge-transfer networks inside the innovation systems results

in the overall encouragement of the transfer of knowledge among academic institutions and wider group of companies.

To date, the number of research spin-out companies is growing rapidly around the world (Table 4). More and more countries are giving universities and research centres a key role in creating innovation and future economic growth. For example, over the past ten years, a large number of programs have been launched in the United States and EU countries that encourage the transfer of technology from universities to new companies (OECD, 2001; 2010). Government-subsidized initial investment funds, technology transfer centres and business incubators set the task of motivating scientists to create new technology companies. However, despite the amount of measures taken, the growth of spin-out companies remains insignificant (OECD 2001).

General ambiguity in the field as well as differences in determining which type of relationship between a university and a technology company is a side effect that hinders the possibility to assess operations of spin-outs in different regions. Countries including Finland tend to use their own assessment criteria to determine the national formation rates for spin-outs. It seems that there are significant differences between countries in the ways of producing spin-outs and that the countries have a lot of potential to boost the innovation system which promotes spin-out creation. More data is needed to conduct research on growth factors and funding to open the sources of obstacles to the formation spin-outs (Callan, 2001).

According to Clarysse et al. (2001, 2014) the moderate spin-out emergence rates are not related to the architectural flaws (e.g. economic conditions, rules of practice, etc.). By contrast, regional environment resources and culture of risk taking both significantly affect the success of a spin-out. Moreover, those regions which do not foster the initial requirements of spin-out activities even prior to the allocation of funds, do not show consistency in the generation of booming and disruptive enterprises. Therefore, the main European consideration should be the establishment of the innovation system, favourable to spin-outs, local institutions, businesses and societies. It should be easy and simple to ensure the transfer the knowledge into the competitive and unique offerings based on sustainable business models. Hence, 'middle-man' organizations, such as entrepreneurship societies and accelerators have a great importance (OECD, 2001).

Van der Sijde and Van Tilburg (2000); Schutte and Van der Sijde (2000) established that service policies offered by the universities such as "incubator facilities, coaching, counselling, financing, networking, training, and new incentives for mobility" drive the success of European university spin-outs. Policies that support resource allocation to disruptive innovations (along with spin-outs) in high technology industries can contribute to the increased level of innovation and jobs (OECD, 2010)

Koster (2004) claims that spin-outs are positioned one stage forward compared to start-ups which do not have any assistance from the industry. During the pilot periods of functioning, spin-outs show show a tendency to hire personnel and enter into contract relationships earlier than start-ups. Spin-outs are quite similar to start-ups that do not have any funding from the beginning.

According to Czarnitzki et al. (2013), spin-outs that were based on scientific research are typically recognized as results of a knowledge spillovers from a public educational/research institution. Often these small firms, focused on the technical implementation of the research concept, become catalysts for innovation, employment and economic growth. Spin-outs are characterized by the emergence of highly skilled jobs, new companies and industry branches, as well as significant impact on research directions, relatively slow growth rates and longer survival score compared to start-ups (OECD, 1999).

An essential element that determines the success of spin-out at an early stage of development is the presence in its team of a specialist with experience in developing new products. The creators of spin-out companies, as a rule, have a lot of experience in basic and laboratory research. However, this experience may not be enough to create a product that can meet the needs of customers and at the same time be optimized for production (Shane, 2004). Spin-outs attract highly qualified specialists because they perceive ambitious and challenging goals. Spin-outs generate more employment than start-ups, thus partially compensating the high social cost associated with their operations. They are also bigger in size; seem to pay more attention to innovation than start-ups; register more patents and research and development activities. Interestingly, funding opportunities and evaluations of the credit risk are similar in start-ups and spin-outs. (Czarnitzki et al., 2013).

The widespread belief that spin-outs are identical to start-ups is oversimplified. The two innovative technology ventures are capable of generating comparable advantages for the industry, e.g. high-skilled jobs which are effective factors for economic performance, although it is important to mention that social cost for a new spin-out is higher in the scenario where spin-out triggers loss of know-how and NDA breaches. Subsequently, it is worth mentioning that the scientific developments on which the spin-out company is based must have strong protection of intellectual property rights (IPR). Intellectual property is the main competitive advantage of the young spin-out company at the time of its creation. Almost no investor will risk financing a spin-out company with non-patented inventions. (Czarnitzki et al., 2013).

Table 4. Main findings on start-up and spin-out definitions and functions

Author	Key findings
Czarnitzki et al. (2013)	Spin-outs usually drive more significant employment growth than start-ups
OECD (1999).	Spin-outs are characterized by the emergence of highly skilled jobs, significant impact on research directions, relatively slow growth rates and longer survival score compared to start-ups
Koster (2004)	Spin-outs are quite similar to start-ups, that do not have any funding from the beginning.
Van der Sijde and Van Tilburg (2000), Schutte and Van der Sijde (2000)	Service policies offered by the universities such as "incubator facilities, coaching, counselling, financing, networking, training, and new incentives for mobility" drive the success of European university spin-outs
Clarysse et al. (2001, 2014)	Regional environment resources and culture of risk taking both significantly affect the success of a spin-out
Callan (2001).	Countries including Finland tend to use their own assessment criteria to determine the national formation rates for spin-outs, there are significant differences between countries in the ways of producing spin-outs and that the countries have a lot of potential to boost the innovation system which promotes spin-out creation
Audretsch et al. (2006)	The function of spin-outs in utilizing knowledge is mutually directly proportional to the function of start-ups as agents of knowledge-transfer networks inside the innovation systems results in the overall encouragement of the transfer of knowledge among academic institutions and wider group of companies.
Mustar (2001), Mustar et al. (2006), Shane (2002).	The functions of most spin-outs are a conductor or interpreter connecting scientific research in public institutions to the commercial representatives from the industry

Bercovitz and Feldman (2006)	Spin-outs are one of the key drivers of economic change and growth

1.2.2 Finnish Innovation System

National Innovation System concept was first introduced in 1992 by Bengt-Åke Lundvall. The concept emphasizes knowledge exchange between participants as a code to innovation, as well as emphasizes the intercommunication among the players that results in the product or service relevant to the market needs and superior to competitors. More recent theories describe it as a collaborative process among industrial companies, customers, research bodies and government and public bodies that leads to the utilization of the state-of-art know-how mostly in high tech. A goal is to advance national economy and research to increase overall competitiveness of the country (Hekkert et al., 2011).

Boschma (2005) argues that regional innovative centers and research institutions must address the issue of too limited geographic proximity seriously by incorporating efficient communication channels. Universities played an important role in regional advancement of Finland. Notably after 1990s, universities of applied sciences were created in order to enhance the local business. Authority and unique intermediary position has allowed UAS to generate significant input for the innovation in the regions. However, even to this date it is crucial to focus on the business needs and consequently to expand services.

Local economic growth and prosperity yields to the high degree on the capacity of regional actors to adjust to turbulent technological environments by fostering continuous innovation from within. The functions of universities in local innovation systems are dictated by those changes in the market and in the industry that are economically relevant at the moment in this place (Kajanus, 2010).

Regions themselves are responsible for providing universities with timely and relevant information and sharing thoughts and needs based on regional economics. Companies are bound to engage in long-term partnerships with universities as well as in overall innovation-creation process, which will allow them to predict and affect national and local economic

developments. Such industries as agriculture and forestry also need fresh insights from academic spin-outs to be able to more easily apply them into their operations so that as a result the region gets economic upward, healthy competition and lower unemployment. (Kajanus, 2010).

Spin-outs are deeply affected by the unpredicted changes in the environment, whether legal, political or market, so they need better organized innovation policy implementation. Forsman (2009) proposed to encourage the creation of means to intersect innovation creation and maintenance rather than 'extinguishing small fires' by boosting different innovation creation stages.

ETLA (2009) argues that Finland's most urgently important task is to facilitate development of higher quality research by supporting independent initiatives of universities via financial requirements promoting research quality; to centralize education-research structure; and to advocate more internationalized research environment by bringing skilled foreigners to Finland. Moreover, the goal for Finland should be to achieve outstanding academic research levels, since the country already has an ambition to become the best in the world in high-tech innovation activities. All actors of innovation system will benefit from this direction. Companies will have access to top talents and groundbreaking R&D results. Society will benefit from new jobs and economic boom. Current situation indicates that typical SME from Finland is not benefiting from the advantages of the information system. In order to change the existing process, it is necessary to simultaneously improve the quality of supply and demand (ETLA, 2009).

Finnish innovation system has distinct traits of the Triple Helix model (Etzkowitz, 1995). The blend of interrelations inside the triple helix decreases risks related to decision making, improves the flexibiltity of network participants in the national innovation system towards the challenges of turbulent environment and fosters knowledge and capital creation. Therefore, the win-win situations and associated integrated synergy effects lead to constant upgrades of market position (Ketels, 2009).

Woiceshyn and Eriksson (2014) described Finnish innovation system as the network of government policies, funding, research institutions. Finnish level of networking was rated

among the highest across OECD countries (Kaitila and Kotilainen, 2008), this leads to strengthened trust and consequently improved quality of collaboration in the R&D. Currently Finnish state is in the transformation process from traditional R&D to collaborative R&D and companies, research entities, universities and society are connected by the common aim to pioneer in high-tech commercialization (Cooke et al., 1997). An overview of the current situation in a form of SWOT-analysis is presented in the Table 4.

To conclude this literature review, the thesis attempts to have a deeper look at how new product development (NPD) process affects the success of software startups and university spin-outs in Finland. The current state of knowledge presented above suggests that previous studies did not focus on internal process of new product development, but rather analyzed start-ups and spin-outs from external-market point of view and assessed performance of these ventures based on traditional top-down approaches. In this thesis, the opposite attempt has been made as to analyze the commercialization stage with a bottom-up design of the research. By answering the questions related to new product development in start-ups and spin-outs, this study will contribute to the understanding of the broad topic of commercialization of state-of-the-art software technology.

Table 5. SWOT analysis of Finnish Innovation System. Adopted from OECD (2017)

Strengths	Weaknesses
-Political stability with clear rule of law -Strong base in resource-based and ICT -Strong ICT communities -High-skilled professionals -Excellent education system -Culture of co-operation and implementation -High levels of public and private R&D investment -Small but growing start-up scene	-Few exporting sectors and firms -Small market size -Few leading industries and companies -Low overall rate of entrepreneurship -Low rate of radical innovation -Talents leaving due to reduced research budgets -More strengths in knowledge than in its deployment
Opportunities	**Threats**

-Restructure production in high value-added segments -Grow strength in manufacturing and digitalization -Leverage ICT expertise for digitalization -Boosting productivity in industries -Foster young talent and professionals -Embracing entrepreneurship(start-up boom) -Growing attraction of foreign investors (VC business angels) and start-up networks (accelerators, etc.) -Ambition to improve cohesive, knowledge- and evidence-based policy making	-Declining competitiveness and loss of export markets -Declining knowledge and human capital generation -Loss of confidence in research as a basis for innovation -Weakened consistency in innovation policy making; -Uncertain business and innovation environment -Internationalization challenges are not adequately tackled -Continuously reduced ability to adjust to globalisation-led changes

1.3 Objectives and research questions

The aim of this study is to define how new product development process design affects the success of high-tech innovation start-ups and university spin-outs in Finland. After establishing the main differences, the thesis work then refers to the implemented best practices from Finnish software industry and finds possible similarities and закономерности from the perspective of market orientation and innovation system. Final conclusions contribute to the theoretical research on new product development in Finland in high-technology context in particular. In order to structure and evaluate the outcome of the research, the following research questions are to be answered:

Table 6. Research questions

RQ1	**How new product development process design affects the success of innovative software start-ups and university spin-outs?**
RQ2	How NPD structurally differs among start-ups and spin-outs?
RQ3	What factors affect the NPD process and software development process of software start-ups and spin-outs?
RQ4	What characterizes most successful and profitable examples of innovations that have already been commercialized in Finland in the software industry?

1.4 Theoretical framework

The theoretical framework (Figure 3) which lays base for this study relies on two main research frameworks. The innovation system prism is more external, because it focuses on environmental relationships of SBUs in question (start-ups and spin-outs).

The market orientation prism is somewhat more internal, reflecting decisions of the companies to be responsive to the customer needs and wants. The combination of these approaches gives a comprehensive view on the implications of well-realized new product development process.

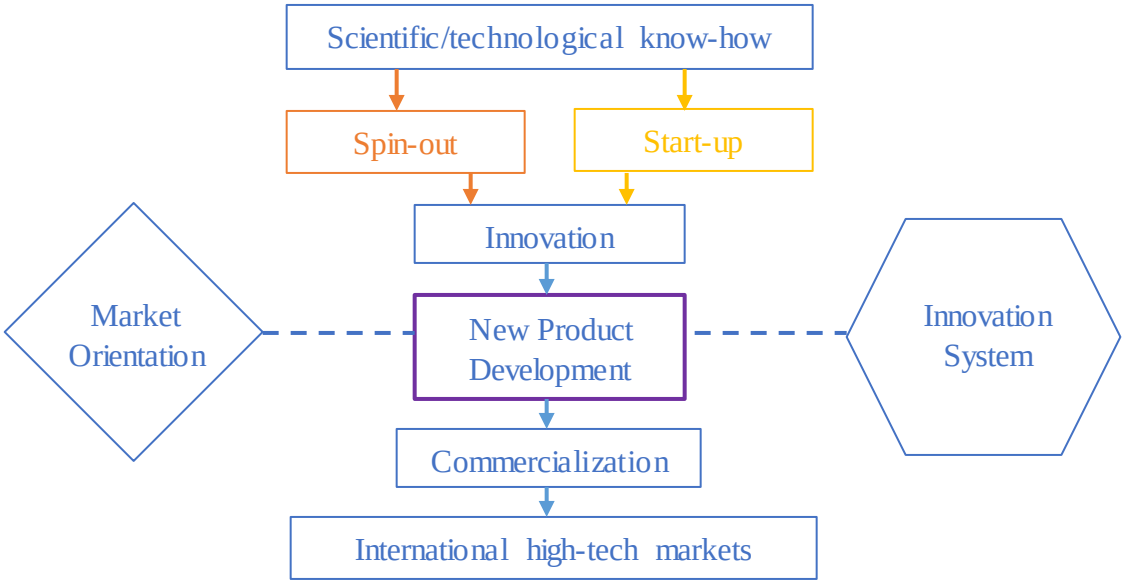

Figure 3. The theoretical framework

1.5 Definitions of key concepts

This subchapter presents the definitions of the key concepts that are used in this study and are relevant to the background of the study. The definitions are derived from theoretical literature which was overviewed previously. It is important to mention that some of the concepts have diverse definitions and are being developed with the same pace as industry in question is developing and therefore are not widely used.

Innovation

Innovation can be seen as "Creative Destruction", as first named by Drucker (1954) or, in other words, it could be understood as a process that takes place from the emergence and development of an initial idea to the creation of new products, services and technologies (or their improvement) with the provision of legal protection of copyrights (IPR) and with the subsequent creation of a prototype or model confirming their practical feasibility. Later, it was argued by Nonaka and Takeuchi (1995) that innovation a key element of business success. The definition which is particularly relevant for this thesis was created by Philip Kotler (1999), stating that innovation is a "new product development leading to greater sales volume and enhanced profitability". Moreover, some researchers suggest that imitation, rather than innovation, is more important for new products success (Schnaars 1994).

High Technology (High-Tech)

According to Merriam-webster.com (2018) high technology is "a scientific technology involving the production or use of advanced or sophisticated devices especially in the fields of electronics and computers". McArthur (1990) has suggested that the preferred alternative is two-dimensional classification of technology-based activities into "widely diffusing" and "newly emerging" technologies, but it was not subsequently adopted (Keeble and Wilkinson, 2017). Similar to McArthur (1990), Steenhuis and de Bruijn (2006) also suggested two-dimensional definition. First dimension is complexity, a static concept that is applied to both the final product and the production process. The second dimension being the newness, or an expectation to upgrade products as well as processes. Keeble and Wilinson (2017) have noted that the term is often used to denote industries which produce technologically-advanced and sophisticated products. Im and Workman (2004) demonstrated that novelty and meaningfulness should be examined separately rather than combined into a single creativity construct.

New Product Development (NPD)

According to The PDMA Handbook of New Product Development (2007), new product development is the overall process of strategy setting, organization, concept generation, product and marketing plan creation and evaluation, and commercialization of a new product.

Well-planned NPD process ensures that the firm invests in profitable research and development activities, along with market research, engineering and testing (Hauser and Dahan 2007).

Intellectual Property Rights (IPR)

According to OECD glossary, IPR refers to the general term for the assignment of property rights through patents, copyrights and trademarks. These property rights authorize the holder to apply a monopoly on the use of the item for a certain period (Khemani and Shapiro 1993).

1.6 Delimitations

Theoretical delimitations include innovation creation process and notion of creativity in general. Internationalization theories and market-entry theories are not specifically covered, because the main goal of the study was to identify optimal approach to high-tech innovation commercialization from greenfield to the point that it creates monetary revenue. Therefore, there is more analysis presented on the reasoning behind new product development and approaches to commercialization of spin-outs and start-ups of software industry. The scaling of these ventures also falls out of the focus zone of this study.

The contextual delimitations of this study are geographically conditioned to four countries in Europe: Finland. The study is not covering SMEs operations connected to new product development. Moreover, there is a focus on high-tech industry and software industry in particular. These delimitations were applied in order to provide a clear perspective on differences and peculiarities of high-tech innovation commercialization in different geographic regions of Europe. The results of this study are particularly relevant in these regions and in the scope that is discussed earlier.

1.7 Research methodology

This chapter covers the research methodology applied in the empirical part of this thesis. The nature of the research methods is qualitative, and a qualitative multiple case study approach is a primary method. The research design is explained in line with the context. The multiple case study method is explained in detail.

Qualitative research is endemic by nature and is based on relativist ontology, where findings are considered subjective and co-created. In the methodology of qualitative research, data is collected through in-depth interactions. The goal of qualitative research is to reconstruct and interpret subjective meaning in relation to its context (Killiam 2013). Qualitative research is focused on business-related phenomena in its real-life contexts. It usually answers the question of why things work in a specific way or how we can understand them. Qualitative research is an adequate method of knowledge production and it does not need any link to quantitative research. Qualitative methods usually generate a lot of specific and complicated data about limited number of individuals and cases. This positively affects the comprehension of the cases and circumstances in question but lowers the degree of possibility for general conclusions (Patton 2002).

The exact method used for primary data collection in this study is semi-structured interviews. Secondly, a comprehensive analysis of results of semi-structured interviews was chosen with the aim to conduct an in-depth analysis of both start-ups and spin-outs thus ensure the comprehensiveness of the objects of the study. Choosing qualitative methods for data collection makes it easier to find the premise and reasons of the phenomenon or behavior.

The netnography was chosen as a contemporary approach to contemporary issue. Netnography is an online research method originating in ethnography which is applied to understanding social interaction in contemporary digital communications contexts. It is defined as a specific set of research practices related to data collection, analysis, research ethics, and representation.

Secondary Data collection is performed via the extensive ethnography research. Several similar academic case studies were identified and used as a source of qualitative information. Industrial and governmental reports have been chosen as well, e.g. European Commission reports and United Nations reports.

1.8 Structure of the Thesis

The first part of thesis is explanatory and mainly provides a background for the research and literature review, outlines research gaps and problems along with research questions. The

first chapter also presents theoretical framework, defines the key concepts and discusses. The second chapter reviews the new software development process in the contemporary context. Detailed analysis of new software development is presented from two focal points of view: market-orientation and innovation system points of view.

The third chapter serves as a bridge between theoretical and empirical parts. It uncovers research design, describes methodology in detail and considers the applicability of the chosen approach. Most importantly, the data collection and data analysis process are discussed. The chapter concludes with a reflection on the process in general, mentions research ethics together with the reliability and validity of the research data.

The second part of thesis is empirical and describes the implementation of the research. It highlights the main findings and results of the study, followed by discussion of the results in connection to managerial and theoretical contributions and suggestions for further research. The limitations are presented, and the thesis concludes with the list of references and appendices.

To present the results of research in a comprehensive manner, the thesis consists of six chapters: *Introduction, New Software Development, Research Design, Findings, Discussion & Conclusions*. The general structure is outlined in Figure 4.

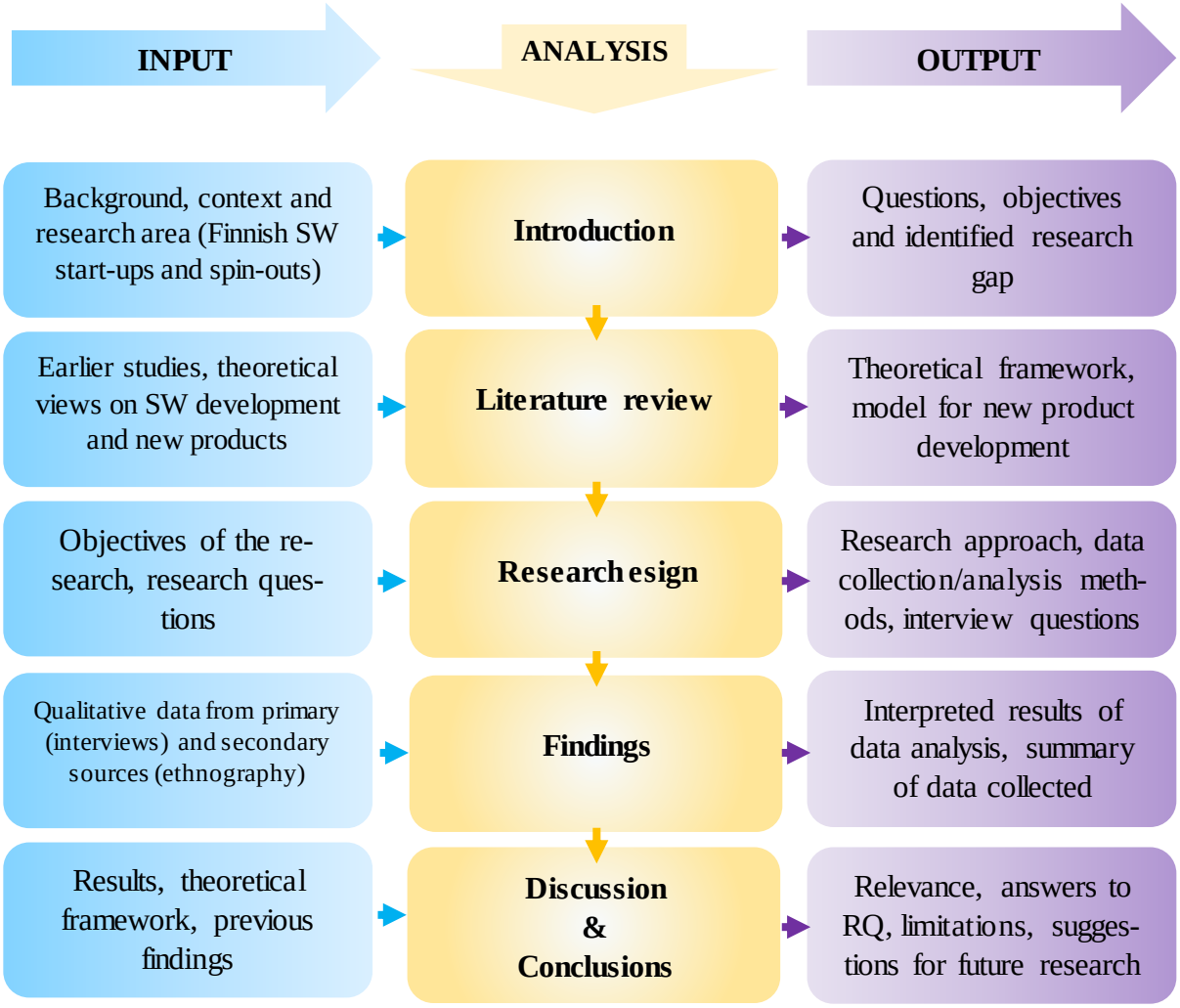

Figure 4. The structure of the thesis

2. NEW SOFTWARE DEVELOPMENT PROCESS

Since this study focuses of the implications on new product development (NPD) in Finnish high-tech innovations in software industry and attempts to support the existing theoretical findings on new product development in high-tech industries, there should be a clear and comprehensive overview of the focal notion of the study. This chapter summarizes the findings from previous studies on the topic of NPD, overviews different software developments methodologies and approaches, reviews various factors that were argued to influence the success of a new software product, and, most importantly, the chapter creates solid foundation for the empirical part of the study.

2.1 Definition and structure of the process

The structure and stages of new product development process is unique for every innovative venture. Based on previous studies and literature on the topic of NPD, Figure 5 presents a concise view on the process, where fuzzy front-end acts as a base for further ideas and concept, which are in turn being prototyped and tested using both the Stage-gate© Process and Market oriented approach. Stage-gate© process supports the iterative nature of the NPD process and Market orientation is needed to facilitate user co-creation and deliver the best results. After market research in the form of the situational analysis, the product is continued to be developed and tested to the point when it is ready to be demo-launched to the market.

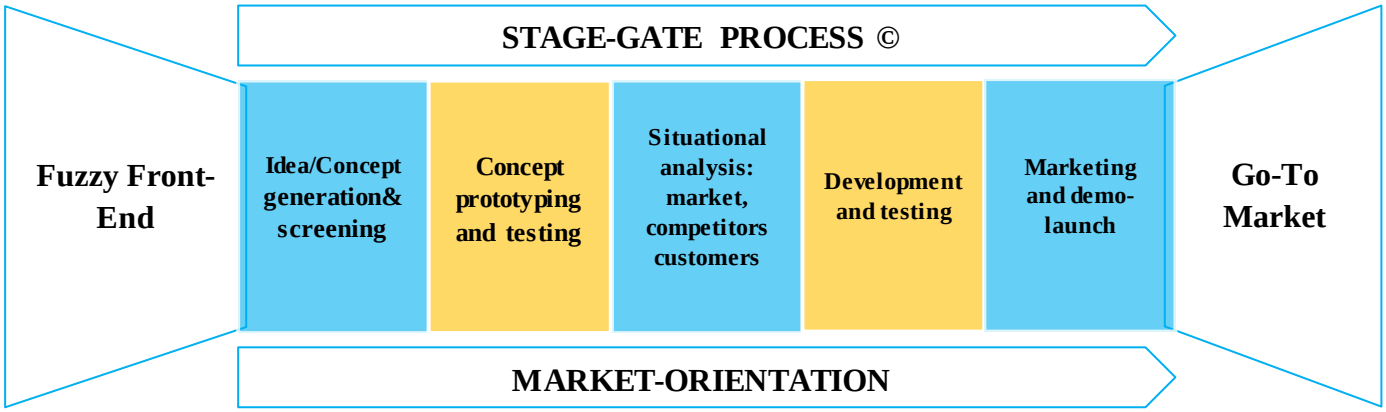

Figure 5. New Product Development process

The initial stages in new product development are commonly known as the "fuzzy front-end of NPD". The name reflects the hectic nature, uncertainties and improvised decisions. Producing the consumer research that supports these decisions is not a straightforward task that requires almost transcendent flexibility and deep understanding from the market researcher. Ulwick (2002) claims that "asking consumers what they want is useless, because they do not know what they want unless they see it." However, it is important to remember that even though consumers might not be able to communicate their needs, it is necessary to research and observe how they perceive new products, how the key needs are formulated and affected, and how it contributes to the choices they make (Van Kleef and Van Trijp 2003).

Fuzzy front-end is defined as the starting stage, usually ad-hoc, consisting of identifying opportunities and generating ideas and ends by accepting new concepts to a better structured phase of the new product development process (Koen et al. 2001). This stage is considered a part of a Stage Gate process (Cooper 1990), realized by NPD teams. Takey and Carvalho (2016) discuss how the fuzzy front end has emerged in the context of new product development inside single organization. Previous studies usually limited by organizational boundaries and focus mainly on single additional stakeholder in the ecosystem, e.g. customers (Magnusson 2009) or suppliers (Wagner 2012). Collaboration between the stakeholders has been studied before (Brettel et al. 2011) but only limited by single organization.

The development process of a new software solution or application has several distinctive characteristics in comparison to traditional new product development (Urban and von Hippel 1988). Earlier studies on new product development emphasized more universal results relevant to various industries instead of concrete results applicable to a singular industry. A need for detailed studies for each industry in connection to NPD is clear. Song and Noh (2006) were first to suggest that efficient and effective new software development and management are a central characteristic of competitive advantage of high technology companies. The study focused on Korean high-tech industry and therefore is focused on eastern managerial and theoretical implications; it provided anticipated inconsistencies with western high-tech research. Authors claim that the project environment plays a pivotal role in the success and failure of the project.

High technology industries are characterized by "technological uncertainty, market uncertainty and competitive volatility" (Mohr 2010, 11). However, the dynamic nature of high-tech markets is rarely considered as a significant factor affecting the success of NPD. High-tech firms emphasize marketing skills and resources more than technical skills and resources during all stages of the NPD process. Market and customer orientation is considered very important factor for successful new product launch. Song and Noh (2006) concluded that an NPD process usually starts with the identification of current customer needs by means of comprehensive marketing analysis, followed by segmentation, targeting and positioning strategies.

The product strategy and R&D activities have to be aligned with the broader business and marketing strategy. Here, product or service positioning is an extremely important decision for a recently emerged company. Link (1987) argued that product positioning based on consumer benefits is of the most important success factors. In fact, both qualitative superiority and leadership in costs can be both achieved in a high-tech NPD process and advance its success. However, positioning the product in two categories simultaneously is often viewed as potentially damaging for the strategy. By trying to pursue both differentiation and cost leadership, technology leaders can end up stuck in the middle (Porter 1985).

Leadership is also considered a significant factor in new product success. Akgun et al. (2004) argued that successful startups had a clearer, more stable and supported vision than unsuccessful ones, where vision is an essential attribute of any leader. The management efficiency of the process of new product development, as well as the role and commitment of the team play central role in the success of the high-tech innovations (Ernst 2002). Without doubt, careful consideration of these tasks, combined with organization's cultural principles can ensure the best results. The later stages of the NPD process have a stronger effect on new product outcome. Moreover, the smooth information exchange between R&D and manufacturing during all stages of NPD is crucial to technical and financial success (Song and Noh 2006).

2.2 Approaches and methodologies

In software industry, new product development process is rightfully referred to as software development process (Marzocchi 2001). There are numerous different software development approaches, methodologies, established best practices, that ensure the completion of final software product or framework that has been developed through history. A timeline of the evolution of the software development methodologies is presented in Figure 6.

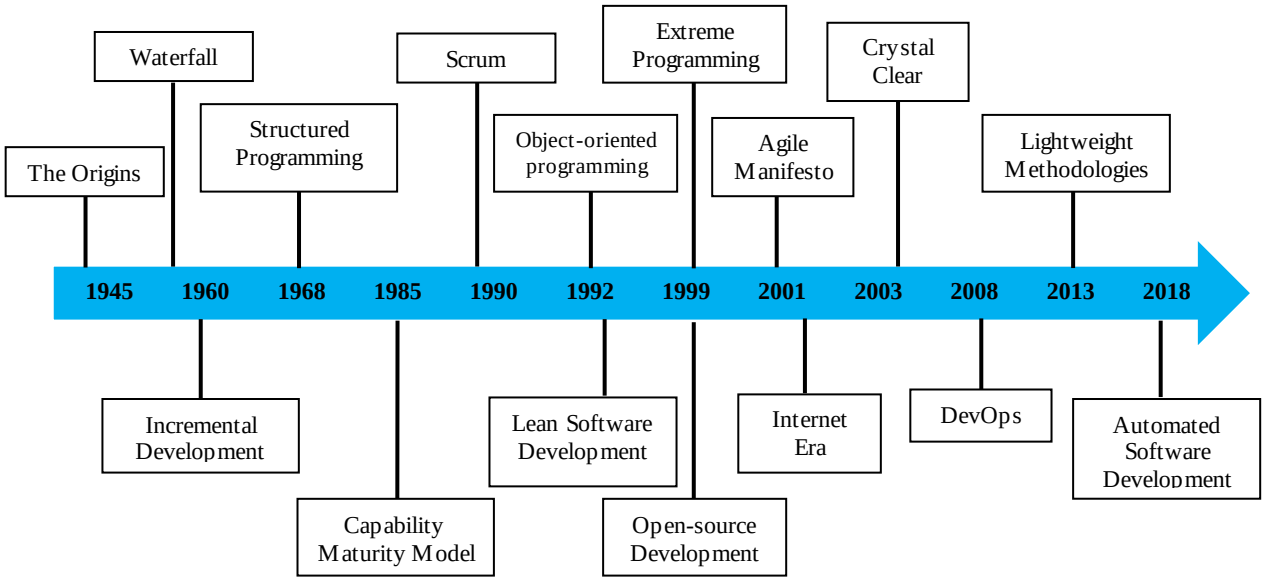

Figure 6. Timeline of software development methodologies

2.2.1 Traditional approach

The first approach is traditional, or linear. It includes such methodologies as Waterfall, where the stages strictly rather than flexibly follow one another. The Waterfall model refers to the classic, traditional understanding of software development. The whole process is rigid and linear, has clear goals for each stage, a new phase begins at the conclusion of the previous one – there is no going back. Advantages of the waterfall methodology are decentralization and strict control over the timing and quality of execution. In practice, Waterfall often fails to meet expectations, because it ignores dynamic changes. So, after testing, it's very difficult to roll back the process and lay down functions not considered at the design stage.

Waterfall is inefficient because it involves temporary downtime for employees within a single project. Testing is carried out only at the end of the development, although the problems found at this stage are costly corrections. According to Jeff Sutherland, creator of Scrum,

what happens in the Waterfall model, when the problem occurs, resembles the behavior pattern of the Political Bureau of the Central Committee of the USSR in the late 1980s, when it allegedly believed the all-positive reports it received on the eve of the collapse of the Soviet Union.

2.2.2 Agile approach

The second approach or philosophy is Agile. It is a flexible approach to development that includes different methodologies (Scrum, Kanban, Lean and others). It includes various agile methodologies, designed to minimize all risks with a help of a set of principles. These very principles and four basic ideas are collected in the Agile Manifesto (Agilelemanifesto.org, 2001) in Figure 7. Agile Manifesto consists of crystallized considerations that guide all those who work with agile.

Agile-techniques are easy to identify by key characteristics, such as risk minimization; iterative development and short development cycles; people and communication – are the main objectives in any flexible approach. Agile approach makes sense for both the customer and the team. The customer needs to receive at least a minimally working product on time (especially with software products where the uncertainty is high) (Miller, 2001).

The team has the opportunity to communicate with the customer and colleagues (without "You misunderstood me - change everything quickly, and yes, it's necessary!"). Transparency of processes improves, which reduces the chances of unpleasant surprises. Also, quick problem solving is enabled, which reduces the chances of irreversible consequences. Many understand where time goes and where work stops so the development companies wants to ensure that the engineers do not have to overwork, and everything is done on time.

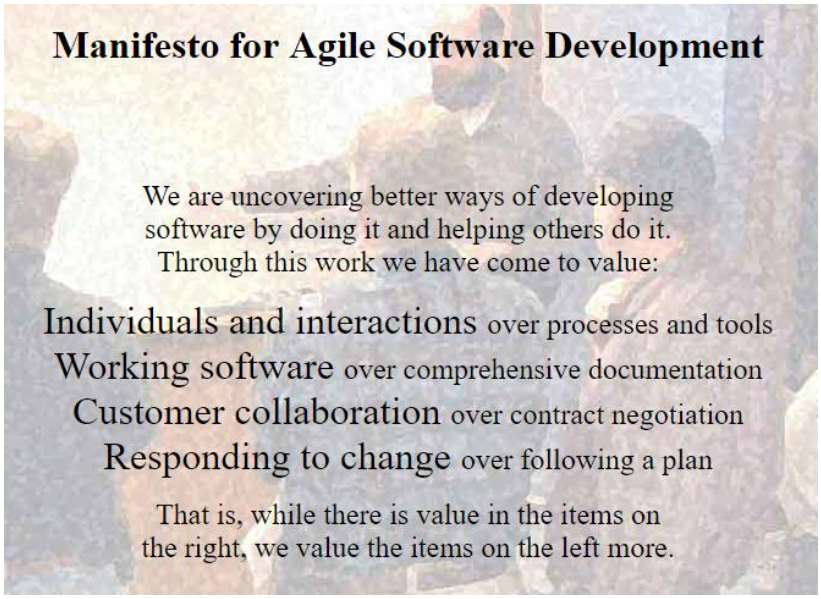

Figure 7. Manifesto for Agile Software Development. Agilemanifesto.org (2001)

Agile is a set of philosophical values. They sound simple but it's difficult to apply them in real life. Not every team can start working without a boss. It's unclear how to do the project without detailed technical tasks. Not every client agrees to go to the development office or call several times a day. And it is unclear how to begin to be agile in general. To apply the philosophy in practice, teams use frameworks: Scrum, Kanban and others.

Scrum is an iterative and incremental framework for managing new product development. Since its inception, the Scrum concept has formed the basis for the design of new software products for the technology industries. However, having gained recognition among project managers and success in the Silicon Valley for new product development effectiveness, in the general business practice Scrum remains an underrated and unknown methodology despite the fact that agile-thinking is suitable for any industry where in the process of creating a product conditions may change, and flexibility is needed.

Nonaka and Takeuchi (1995) in their work “The knowledge creating company” introduced the conceptual framework for Scrum, describing it in connections knowledge creation, they claimed that organizational knowledge creation is useful at producing innovation “continuously, incrementally and spirally". Scrum involves working in short iterations, at the end of each, a working product that has value for the customer should be presented. This product

can be simple, partly lacking functions and features, but it cannot be a bundle of documents and technical requirements, because the paper does not represent values for the client.

The most important principle of Scrum is a mutual recognition that customers will change their mind about what they want or what they do not want (volatility of requirements) and that there will be unexpected problems for which the forecasted or planned approach does not work. Thus, Scrum uses an empirical, evidence-based approach, recognizing that the problem cannot be fully presumed and defined in advance, but instead emphasized the ability of the team to deliver timely and to respond to changing requirements and evolving technologies as well as constant changes in market environment.

The choice depends on the specifics of the project, the budgeting system, subjective preferences and even the temperament of the manager. In modern practice, software development models are varied: here is no unified approach for all projects, because starting conditions and payment schemes are unique. Even agile methodology, which is preferred by many, cannot be used ubiquitously due to the unwillingness of some customers or the impossibility of flexible financing. It possible to say that the software development methodologies overlap in arsenal and are sometimes very similar to each other.

All software development process models consist of several subprocesses. In the Waterfall model they go one after another, in other models their sequence changes, in agile models the process itself is more iterative (Figure 8). The US Office of Information Service (2008) distinguishes the following stages: Initial Investigation, Requirements Definition, System Design, Coding, Testing, Implementation, Operation, Support. According to Gao and Xiong (2015) there are only four main subprocesses: specification, designing, coding, testing, where testing could be modular, integrational, system and acceptance testing.

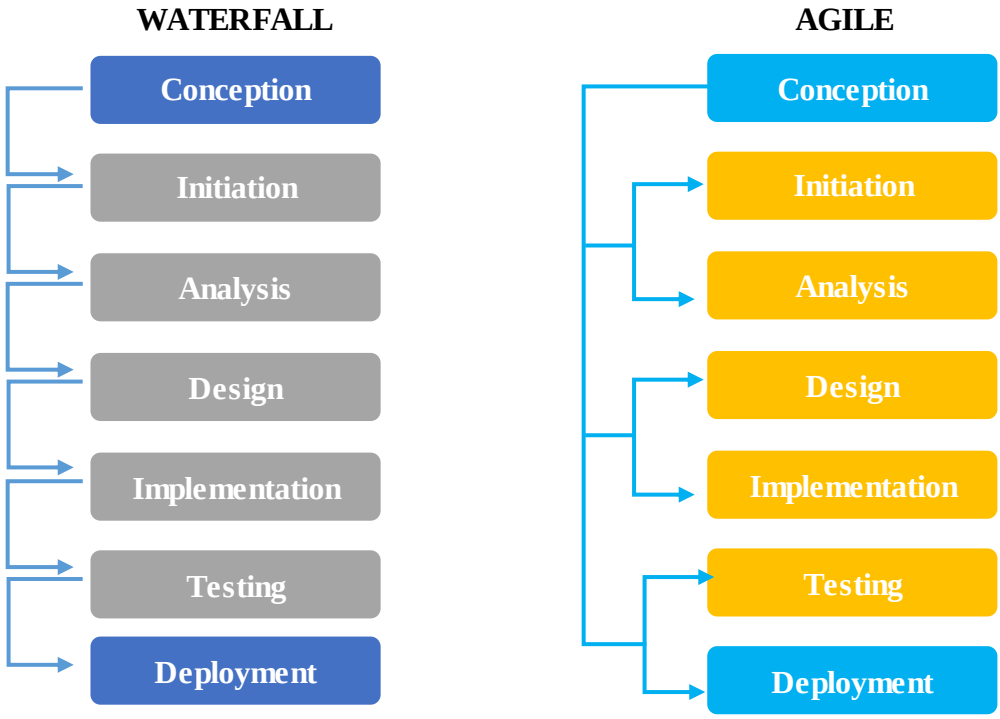

Figure 8. Process differences between the Waterfall and Agile methodologies

2.3 Market-orientation and co-creation

Information technology industry is currently characterized by the high levels of competition due to the low barriers to entry as well as the ongoing development of high technology. Sustainable competitive advantage can only be achieved with the capacity to efficiently generate better innovative solutions faster than other players on the market. The time in which a new product is being developed and is preparing to be launched on the market became a crucial performance indicator. Thus, firms that are able to reduce their time to market and cut the gap between product development and market launch have higher chances to succeed.

The approach, commonly chosen by companies to reduce the adoption time is incremental development. In this approach, software versions are being released shortly one after another and they usually include minor performance improvements based on user feedback. This careful consideration helps to reduce risks at the initial stages of launching new product/service. Depending on the software lifecycle stage, time intervals between versions fluctuate a lot. Initially, they could be from three to six months, gradually rising to six to twelve months

when the software is being developed more naturally. Finally, when the project reaches maturity stage these intervals could be between twelve to eighteen months.

The traditional approach to software development process goes as so multifunctional teams create software versions, or releases, that are deployed every six weeks. The developers then transfer them to the testing team for three weeks to ensure that the complete system is stable. The traditional new product development process, where engineers and marketers constantly battle with manufacturing, causes bad communication and lowers speed, making it harder to fix issues.

The new continuous approach to software delivery encourages direct incorporation of customer response to the later versions of the software, while boosting co-creation, therefore customer relationships help to derive the value of the future versions. For example, Elon Musk build a community of believers in the future of electro mobiles, who are ready to wait for the issues to be fixed, and more importantly, they are willing to help and share ideas. This customer behavior is highly beneficial for high tech companies launching their first new product (HBR 2014a).

New product development is by nature a collaborative knowledge creation process and therefore it is important to highlight the relationship aspect of it as well as to investigate how trust and mutual goal influences these relationships. An approach, which is beneficial for new software products, is to start involving the end users as early as possible. Customers provide the most valuable information on the future potential of the product, they can even participate in the co-creation process and share their innovative suggestions (Marzocchi et al. 2001). Failure to maintain an open dialogue between end users and development team may result in a counter-productive and abrupt change of course in the final stages of the development process. To avoid that, it is crucial to always be listening to the core requirements set by the end users and conduct beta tests (Figure 9).

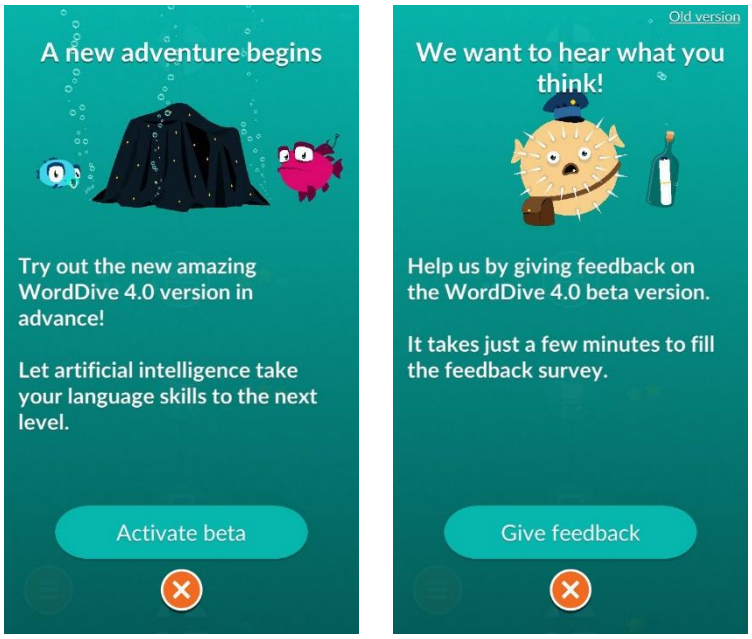

Figure 9. An example of the beta test Worddive (2018)

The beta test is a variation of user acceptance test, it consists of suggesting a group of customers to use the newer, but incomplete version of the software. This is done to collect user feedback and further improvements before the finish of the development process. Usually, users are willing to take part in beta testing either because they are curious and have high loyalty towards the product or because their need in the new features of the product is urgent and they are able to compromise and experience them even if they are imperfect. Often users who are willing to become beta testers are early adopters of innovation and are ready to co-create the new product. The support provided by the developer helps to lower the knowledge barrier and reduce the cost of learning how to use a new software. Thus, user experience can affect the success of the software due to network externalities (Cheng 2011).

Allowing customers to lead on the development of new features makes the products and platforms more tailored to their needs. The concept of joint creation of goods was first proposed in 2000 by Prahalad and Ramaswamy. One of the features of the modern economy is the fact that consumers have become far more interested in co-creating value than in the past. Especially in high-technology industry where the value of an end product can change tremendously during the development process. Customers are no longer left alone, uninformed and static actors, instead, they are encouraged to be active participants of the development

process, to connect with the product or service even before it has been launched. The influence of this consumer of a new age is manifested ubiquitously in many areas, including information technology, consumer goods and services (Prahalad et al. 2004).

The traditional value creation process implied that customers do not play a special role in creating value. The concept of value creation lies in the fact that it occurs within companies as a part of the company's own activities. The role of companies and customers in production and consumption is clearly differentiated. In this view, the market is separated from the value creation process and does not play a role in creating value. Whereas in co-creation, this company-customer dynamic is completely different. Consumers become increasingly directly engaged in the creation of value.

The co-creation has become a major trend because it helps to address the challenges brought by the VUCA world (Volatile, Uncertain, Complex, Ambiguous). In this world, cost management is not enough anymore, companies need to create new value for customers. This process is not an easy path to follow on one's own. Therefore, by adding different shareholders to the decision table, companies increase their chances of success. According to Payne et al. (2007), the availability of information, know-how, trainings and other resources that can be used by clients influence the capacity to accomplish these goals.

The use of co-creation requires significant changes in organizational culture and business model. This agile approach to customer relationships reduces risks, but in many ways, co-creation means accepting uncertainty and managing chaos. Interestingly, Tijmes (2010) have investigated the effects of co-creation on new product development in the innovative context and claimed that these effects are equally statistically insignificant and economically irrelevant, leading to the increase in the probability of success by only four percent. It is noted, however, that co-creation brings so-called favorable side-effects in a form of lowering costs of marketing research and increasing customer loyalty and trust.

According to Salomo et al. (2003), clients are believed to be a resource of the environment which is especially relevant for the company success. Existing and potential clients are those who have contextual know-how that is valuable to companies (Von Hippel 2005). Since customer knowledge becomes a significant asset for the companies, it creates a premise for

achieving competitive advantage. For this reason, companies tend to realize that including customers into the software development process is now more relevant than ever. This tendency to fully rely on information about the most important determinants that have an effect on consumer demand, forces companies to use different strategies to manage the increasing uncertainty and to secure the position of greater knowledge than customers.

Collaboration with clients is one of the ways to align the means of the company with needs of the client. It appears to be increasingly relevant for high technology field, where the market risks are the highest. Thus, by reducing the knowledge gap between the client and the company, the company reduces risks associated with the launch of innovative product or service. The most profound way to create value together with customers according to Salomo et al. (2003) is to talk and listen to the customer actively and attentively, because it facilitates the adequate exchange of explicit and tacit knowledge between the company and the client.

This level of sincerity can be successfully achieved through joint efforts of clients and the company to create an open environment for dialogue, indicating the transparency of mutual intentions. Ultimately, this will lead to the added values to both sides, since different choice dimensions will become available. Such situations represent the deepest form of joint creativity (Prahalad and Ramaswamy 2004).

The ability to provide products and services that meet the needs of clients by introducing customer knowledge through joint value creation, implies that the process should ideally lead to the successful innovation. It can be achieved by various means, which are seen differently by the researchers in the field. Carbonell et al. (2009) differentiates two preconditions to the innovation success: operational and market. The quality of a product, cost per unit and lead time are considered as operational preconditions, while client experience and relative sales are the market preconditions.

For consumers, the degree of innovativeness is one of the key characteristics of a quality product. Innovation, in turn, is a vague term with various definitions that can mean particular things in different contexts. Szymanski et al. (2007) argue that new products cause variety-seeking feelings and actions, therefore leading to repetitive buying of the product. Besides newness, Mohr et al. (2009) emphasizes such important characteristics as practical usability,

feasibility, price and expected time to market. In the event that new product or service manages to qualify with all of these characteristics it is more likely to attract customers.

Consumers of the modern markets expect more specific and extensive customizable software solutions. Customization is possible with accurate information about the customers and their needs. Information resources, know-how and skills are the most important competitive advantages on global markets. Customers are widely perceived as the main assets for businesses. Therefore, managing customer knowledge is vital to supplement the product innovation and new product development as well as increase customer loyalty and relationship (Uden et al. 2013).

Innovative companies give power to the customers to be participants and creators. This process is described as strategic customer knowledge management and includes obtaining, distributing and developing further the customer knowledge in order for it to turn into capital. The nature of this process of customer knowledge management is continuous and aimed at utilizing the results of it inside the company so that it benefits both customers and the company (Sofianti et al. 2010).

Joint application development is one of the numerous software development methods that focuses on enhancing customer participation and accelerating development as well as aiming to make requirements more detailed and comprehensive. The broad philosophy behind it is user-centered software design process (Figure 10). The graph clearly indicates the iterative process of agreeing with clients on every step of the process.

Productive companies deliver products and services to customers and therefore satisfy them. Because of that, customer knowledge must be maintained so that companies can be confident that they will always meet the current needs of customers (Plessis et al. 2004). A notable example of co-created software product is Linux. The operation system software is open-source and allows millions of customers and software developers to improve and give feedback on its features.

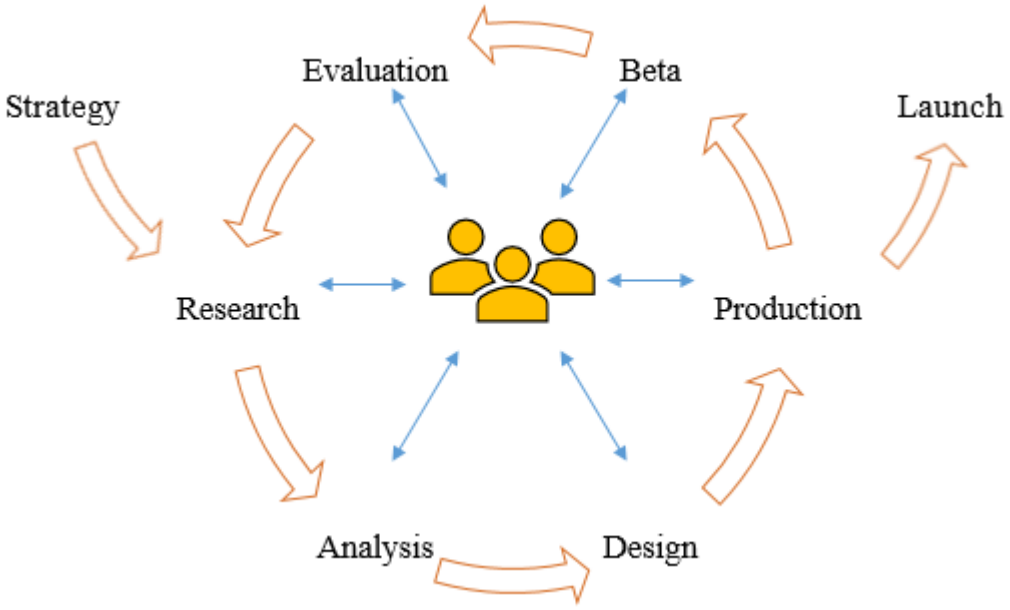

Figure 10. User-centered software design process

Customer knowledge management is a blend of the instruments and processes which are utilized by the firm to collect, accumulate, structure and interpret client information to strengthen its sales performance. In knowledge management the point of view is from within the organization, and it focuses on customer information exchange between employees. From the perspective of business goals, knowledge management seeks to improve performance and pace, while customer relationship management aim is to develop its customer portfolio and keep existing customers. The tasks of customer knowledge management are cooperation with customers and shared value creation (Uden et al. 2013). To start customer knowledge management process, it is important to rightly perceive the value of the customer knowledge and accordingly align it with the software development process.

Customer co-creation is seen as an essential way to enhance innovative activities. Without doubt, co-creation is a long-term trend. Forefront companies learn how to utilize its benefits and become top-performing in customer research and development. Most significantly, co-creation is a key opportunity for discovering the enormous resourcefulness of external actors as a tool for solving the most quintessential element of business which is to know its customers. The instrument for it is simply genius – to cooperate and create environment for comfortable sharing of knowledge.

2.4 Success factors in software product development

For the purposes of this thesis it is essential to distinguish between the success factors of new product development and new software development processes. Essentially, the success characteristics of new product development process also relate to new software development process, with an exception of the influence of a few internal elements. Thorough assessment of success factors of new software development process requires understanding of what leads to success in general new product development applications. By doing that, it is possible to further and deeper see the NPD phenomenon in the perspective of new software development.

According to Trott (2005), the generally successful new product development process has two primary features, first being able to develop right products at the right time (product innovation management) and second being able to develop the products right (product development process). Other researchers distinguish parameters such as the quality of the product, cost & time of development (Mäkela, 2008); or more precisely technical performance, innovation degree, manufacturing and design costs, level of service and attractiveness of the product or service (Krisnan and Ulrich, 2001).

Besides these factors, there are several more generalized viewpoints from new product development research unattached to the particular industry. For example, Day (1994), Souder and Monaert (1992) claim that cooperation between marketing and research and development is vital to the success. Cohan and Unger (2006), Nonaka and Takeuchi (1986), in turn, support the vision that team and management capabilities are the one and only most far-reaching characteristic of the successful venture. An overview of the NPD success factors derived from research is presented in Table 7.

Table 7. Success factors of new product development derived from key research

Authors	Success Factors
Trott, 2005	Ability to develop right products at the right time (product innovation management) and

	ability to develop the products right (product development process).
Mäkelä, 2008	Product quality, development cost and development time
Krisnan and Ulrich, 2001	Product technical performance, innovativeness, cost (design and production), service level, lead time, and market fit (attractiveness)
Day, 1994; Souder and Monaert, 1992	Cooperation between marketing and research and development
Cohan and Unger, 2006; Nonaka and Takeuchi, 1986	Adaptive management style, team capabilities (hiring top talent), entrepreneurial leadership,

Essentially, the success characteristics of new product development process also relate to new software development process, with an exception of the influence of a few internal elements. MacCormack (2001) argued that user engagement at an early stage and systematic architecture design have a pivotal role in the success of innovative technology product/service. The factors found to be relevant in software development context are summarized in Table 8.

Table 8.Success factors of new software development derived from key research

Authors	Success Factors
Colby et al., 2015	Culture, feedback, communication, staffing, collaboration, time/budget
Sudhakar, 2012	Top management support, communication in the project, clear project goal, user involvement, team work, reliability of output and project planning
Chow and Cao, 2008	Correct delivery strategy, proper use of agile software engineering techniques, strong team capability, adaptive management style

Baskerville et al., 2006	Quality, cost, and development speed
MacCormack, 2001	Product quality (reliability, technical performance, breadth of functionality), superiority to the competitors, project resource productivity
Curtis et al., 1988	Software productivity and quality

In the past two decades, many studies have been conducted on the overall success factors and associated risks in the development of software. Nonetheless, occurrences of new product development studies related to the software are notably limited. Colby et al. (2015) research is particularly relevant for the purposes of this study. The research aimed at developing succinct yet detailed diagnostic tool that was also reliable and valid. The outcome of the research was Product Development Success Index that recognized culture, feedback, communication, staffing, collaboration and time/budget focus at key success factors for new product development in the software industry (Figure 11)

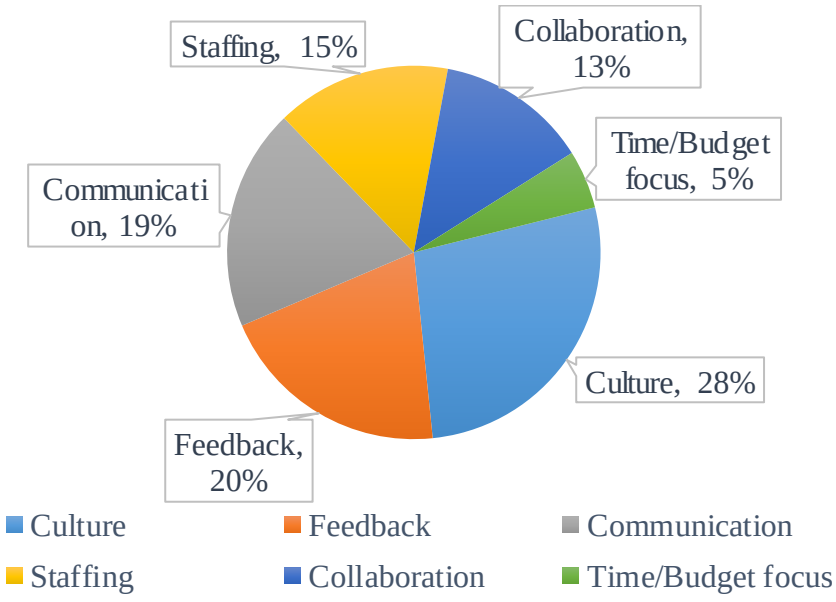

Figure 11. Sub-Index Importance to PDSI (Colby et al., 2015)

It is interesting that the factors are not entirely technology-linked, but rather quite few of the factors are associated with technology. Culture, for example, implies that leadership really fosters and supports innovation initiatives. Another characteristic, customer feedback proves that it is essential to consistently integrate this feedback and knowledge into further versions.

Communication between development and marketing functions is of course the key to transparent processes. Staffing is important in a wider sense: outsourcing and diversity should be taken seriously. Team collaboration involves the absence of hierarchies and open environment. Finally, time and budget considerations, which are believed to be the most measurable indicators are in fact proved to only slightly affect the success of new software product development (Colby et al., 2015).

Moreover, the research found out that success is directly connected to the implementation of agile frameworks. While twenty six percent of respondents ranked "successful" implement agile thinking to some degree, respondents that were ranked as "rarely successful" do not implement any practices of the agile approach to software development. This finding was supported by other research on this topic e.g. Bavani (2009), Ahimbisibwe et al. (2015). Kettunen (2009) concluded that agile software development has better chances of being effective if implemented using the strategic business angle (outside-in) while considering the fact that software development functions are components of the overall value-creation system in the new product development context.

The capability to successfully develop new software products and services is increasingly becoming critical for the company of the future. And the focus on process quality will only continue to grow since customers are already adopting new technologies at almost the same rate as they evolve on the market. The adoption rates for high technology are also higher than ever (Hall and Khan, 2003; OurWorldinData.com, 2018). Nowadays, the firms that realize that they have to adopt to the change in market and consumer trends in high tech context are the most likely to succeed in the world of new business models and disruptive competitors. The framework that reflects these issues by Colby at al. (2015) is presented in Figure 12.

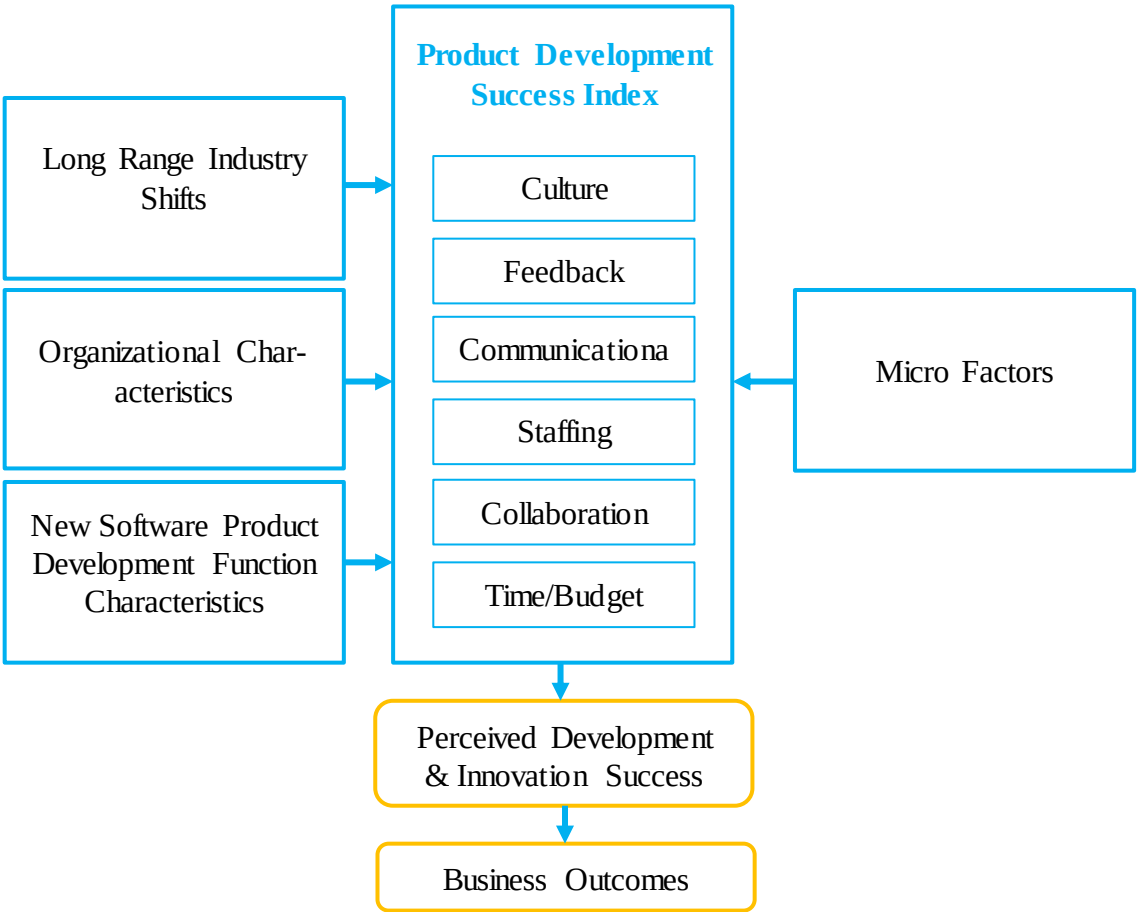

Figure 12. Product Development and Innovation Success Framework Adopted from Colby et al. (2015)

2.5 Managerial influence of software development process

Previously, software was sold mostly in packages, like a product. Today, in the internet-based market, most companies choose another business model which is called Software-as-a-Service (SaaS). Software is used to design all kinds of consumer and industrial goods, it is present in every industry in varying degrees. Ecommerce has become a huge trend, with more and more people buying things online every day for both personal and business needs. The transition has inevitably caused changes to the business models and management practices.

The software industry is experiencing a fast and steep growth and the release of new products happens every day. This continuous change pushes the demand for the emergence of new

management practices and overall catching up in new product development from other fields. Similarly to how Ford and Toyota have changed perceptions in management, software industry representatives are doing it today (HBR 2014a)

Amazon is the world's leading Ecommerce company. It has disrupted the online market with its entirely different and more efficient approach to software development. The difference is that Amazon's core online eCommerce application is split into smaller responsibility zones. Each developing team is responsible for a small part of the system and supports only a number of services, releasing the changes to them as soon as they are ready. These updates are happening every eleven seconds reaching eight thousand updates in a day. While competitors roll up one release every nine weeks, Amazon continuously improves its architecture and processes.

Management practices that facilitate the traditional approach, including hierarchy and micromanagement are slowing down the progress that could have been made with agile models of new product development. High-tech industry was built around the concept of constant innovation and in needs modern management practices that support it, not dim its fire. Software development process and related managerial practices are serving as a template for more and more continuous business development and perpetual creation of innovations across different industries.

Scrum, for example, have gained recognition among project managers and success in the Silicon Valley for new product development effectiveness, but in the general business practice Scrum remains an underrated and unknown methodology despite the fact that agile-thinking is suitable for any industry where in the process of creating a product conditions may change, and flexibility is needed.

In the modern globally changing environment and complex markets filled with software products and applications most of the giants understand the importance of management of the new software development process. Financial figures started to play significant role and companies more often choose to start to develop their new software in the cheaper labor markets. Many companies have strong concerns about international development teams as they are far more challenging to manage and therefore it could be harder to achieve results.

According to Uotila (2003), the role of new software development management is more significant in global software development ventures than in local ventures. Remote work has confidently entered the everyday lives of software developers around the world. Some travel around the world and work in exotic countries, because all that is needed for productive work is the fast Internet. However, working as a remote developer, one often cannot come face-to-face with a client, personally present the project, sit down at a desk with a colleague to solve a problem together. Because of this, some may have the impression that the remote work has a number of serious shortcomings. Remote developers as a whole are happier, work harder, and quickly learn the appropriate tools for teamwork. Of course, remote work is not an easy thing.

In fact, business leaders fluctuate between remote and combined teams. The author of the latest sensation was Marissa Mayer, who calls Yahoo employees to return to Sunnyvale. Many remember her memorandum of "no-at-home-work", discussed in February 2013 in the ruling circles behind closed doors (Businessinsider.com 2013). One of the myths about remote employees is that they sit at home with folded hands and skip their work. For some, it is fair, but such people will be unproductive in the office too. This does not apply to qualified team members motivated to fulfill their role in your mission. Indeed, the Stanford study demonstrated: remote workers are more productive. However, the authors explain that it seems to that the higher the degree of automation of work, the more significant are the benefits (HBR 2014b).

A fully virtual team embeds the documentation into the network that provides the work. During meetings Google Docs is working by collecting all ideas in real time. It is possible to submit the artifact for consideration to the internal network so that each team member can see and express their opinion. Everything that is done, and every decision taken is documented for everyone which enhances productivity.

The ambiguity of high-tech environment causes managers to rely on their ability to deal with the consequences by managing uncertainty. It tends to increase their commitment and therefore willing to succeed with the venture. This results in a biased perspective on the data e.g. market research so that it is consistent with their plans to launch new software. Mohr et al.

(2010) argues that the more motivated the decision maker is the more likely he or she is to seek information that supports his or her beliefs. (Boulding et al. 1997)

This can happen when neutral results perceived as favorable or negative results are neglected because they prove opposite to the manager point of view. Keil and Montealegre (2000) claim that misinterpretation of negative results as positive happens much more often than vice versa. These prejudices are one of the reasons why the quality and reliability of information influencing the decision to cancel the launch of a new product does not always lead to action.

Solving this issue does not seem like an easy task. It is inefficient to expect from decision makers to establish and follow a no-go rule, because to take actions they need to understand and accept the possible existence of the problem. Managers should be conscientious towards negative information and analyze it critically to be able to identify the issue (Keil and Montealegre 2000).

In addition, the choice to revoke implies careful review of the already decided strategy, both in defining and redefining the scope of the problem by management. Challenges arise because of contradictory opinions and management styles. While some interested parties are only interested to keep things as they were, others are always forcing change and adaptability.Complicated decision-making in volatile high-tech industry suggests that managers should look for different opportunities and to try to access realistic information about the problems and identify promising directions.

Here, creative approach is essential to address known issues from a different perspective as well as contributes to the development of innovative culture in the company. The motivation of team leaders can spread among the team and can lead to common feeling of inspiration and high team spirit. Thus, it makes sense to distribute critically minded people separately from creative people from the very beginning. The team of developers of new software requires a management figure, a person who will be responsible for making the decision to alter or cancel the plans based on reliable information and feedback.

Change management is an essential skill during the launch of the new product and management representatives should be able to convince others, create alliances and implement action plans. Sometimes, if the decision is made from the top the execution runs smoother and with less objections. Biyalagorsky et al. (2006) argue that managerial system must be changed according to needs of the company. Ideally, an external executive with no previous opinions on the new product shall enter the firm and decide whether to go or no-go to market. Authors emphasize the importance of unbiased information sources as well as creation of guidelines and protocols for adequate decision making. An outline of the recommendations to management, based on most common biases, by Mohr et al. (2010) is prepared in Table 9.

Table 9. Managerial biases and ways to cope with them Modified from Mohr et al. (2010)

Bias	Indication	Recommendation
Data manipulation and negligence	Managers justify the use of information that it is consistent with their plans while ignoring the negative information	Replace a leader who is too conservative and make managers responsible
Investment-related	Unreasonable desire to continue the launch of a new product due to already invested money	Create a list of unforeseen circumstances leading to withdrawal, when the budgets are inadequate
Inaccurate assessment of the situation	The tendency to inadequately correct the estimates from the original value	Seek independent expertise

The decision maker of a high-tech start-up company is faced with a number of challenging decisions as they have to balance between marketing team and software development team whilst maintaining fresh look. Usually, the CEO of a start-up is engaged in all sorts of tasks with no clear definition of his or her role in each function. This creates the premise for the conflict of interest and the battle of opinions. The team leader usually participates in marketing and research activities, e.g. interviewing potential users, conducting market research, pricing, competitor analysis. However, during deployment if the software, priorities tend to shift towards the software development team management, because the risks are often there at the launch stage.

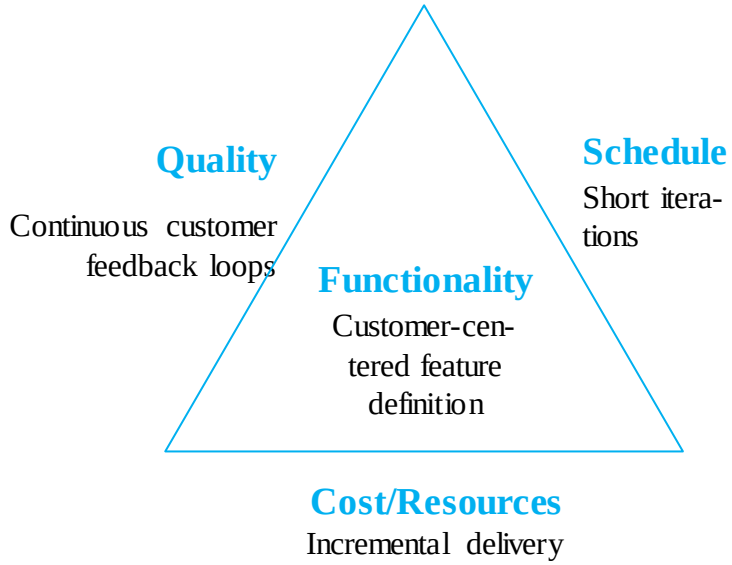

Figure 13. Key management attributes of agile software development. Adopted from Kettunen (2009)

The duties of the founder are certainly complex and versatile. One should be able to manage development of marketing materials, communications and PR, acquiring first customers and getting them on board for further co-creation, arranging meetings and showings with key people in the industry and investors, learning how to patent the invention and effectively growing knowledge about software that is being developed. These processes are presented in Figure 13.

3. RESEARCH DESIGN, METHODOLOGY AND PROCESS

This chapter contains information about research design, methodology and process. First, the design of the research is explained in connection to the research context. Second, the methods that were chosen for the collection and analysis of data are described in detail. The applicability and relevance of the methods is discussed. Finally, the reliability and validity of the data is justified, as well as ethics of the research process are considered. The chapter presents general information about research process and covers the research methodology applied in the empirical part of this thesis.

3.1 Research design

During research design process, data collection strategy was formulated as well as theoretical literature and empirical gathering of information were planned. Research design is a plan for collecting and analyzing evidence that will make it possible for the investigator to answer whatever questions he or she has posed. The design of an investigation touches almost all aspects of the research, from the minute details of data collection to the selection of the techniques of data analysis (Ragin 1994, 191).

This research was designed as an exploratory study, which is considered to be particularly appropriate approach for making clear the studied phenomenon (Saunders et al. 2016, 175). For this reason, the choice of questions was made to reflect the focus on deep meaning and sub context of the matter of new software development process. The questions should start with "why", "how" or "what" so that they facilitate the uncovering of the true reasons behind the phenomenon in focus (Saunders et al. 2016, 43).

Qualitative research design decisions are usually made based on complex philosophies of how data has to be collected and analyzed. In other words, researchers interact with participants and try to gather as much specific information as possible. From this information then patterns or common findings are identified, based on which an assumption is created. This approach is called inductive reasoning, where researcher derives general principles from specific observations and search for the proof, linked to the context, which was studied.

3.2 Research methodology

Methodology (sometimes called "the philosophy of methods") refers to organizing principles, which provide the procedure for guiding the research process and research design. Methodology is how knowledge is discovered and analyzed in a systematic way (Eriksson and Kovalainen 2008).

The research methodology applied to the empirical part of this thesis is qualitative, therefore the main relevant qualitative method was chosen as semi-structured interviews. Qualitative research is endemic by nature and is based on relativist ontology, where findings are considered subjective and co-created. In the methodology of qualitative research, data is collected through in-depth interactions. The goal of qualitative research is to recon-struct and interpret subjective meaning in relation to its context (Killiam 2013).

Qualitative research is focused on business-related phenomena in its real-life contexts. It usually answers the question of why things work in a specific way or how we can understand them. Qualitative research is an adequate method of knowledge production and it does not need any link to quantitative research. Qualitative methods usually generate a lot of specific and complicated data about limited number of individuals and cases. This positively affects the comprehension of the cases and circumstances in question but lowers the degree of possibility for general conclusions (Patton 2002).

3.3 Data collection methods

Primary data was collected by means of informal semi-structured interviews that took place in Helsinki Metropolitan Area in April 2018. X representatives of start-up companies were interviewed and X representatives from spin-out companies. The roles of the interviewees varied from software developers to marketing specialist and co-founders. The interviewees agreed to participate in the research anonymously and therefore roles and companies are not to be cross-references and released. This was decided because of the fact that start-ups and spin-outs are usually of small size and it is easy to guess the respondent. Information about

the interview process is presented in Table 10. The list of interview questions could be found in Appendix 1.

Table 10. The list of interviews

Interview participant	Date	Start-up/Spin-out
Interview participant 1	17.04.2018	Start-up
Interview participant 2	18.04.2018	Spin-out
Interview participant 3	21.04.2018	Start-up
Interview participant 4	22.04.2018	Start-up
Interview participant 5	22.04.2018	Spin-out
Interview participant 6	24.04.2018	Start-up
Interview participant 7	25.04.2018	Spin-out
Interview participant 8	25.04.2018	Spin-out
Interview participant 9	28.04.2018	Start-up
Interview participant 10	29.04.2018	Spin-out

Semi-structured interviews are a blend between structured and an informal approach to the interview conduction process (Hisjärvi et al. 2009). There is a predefined list of questions, however wording and order of them can be slightly modified to better suit the achievement of the research aim. In order to have more insight into the new software development process implications in Finnish high-tech start-ups and university spin-outs, semi-structured interviews were conducted, since they require reasonable use of time and better suited for the purpose of analyzing the contexts of the issue. The choice of qualitative approach for data collection makes it easier to find the premise and reasons of the phenomenon or behavior. The advantages of semi-structured interviews lie in the miscellaneous answers which can raise subjects that were not assumed by the researcher of beforehand (Hisjärvi et al. 2009).

The majority of research conducted with qualitative research interviews view the knowledge obtained during interviews from a realistic or relativistic perspective. Meaning that the perceived reality is in fact a reality derived from social construction, where all actors equally participate in the creation of truth (Denzin & Lincoln 2011).

In qualitative research, sampling is defined by the specifics of the study, where research objectives and the characteristics of the study population (such as size and diversity) determine which and how many people to select. Purposeful sampling was used. Purposeful sampling is a technique widely used in qualitative research for the identification and selection of information-rich cases for the most effective use of limited resources (Patton 2002).

The method required direct contact so that respondent can be interviewed in the natural context, and so that rapport can be created. Invitation inquiries were sent to the respondents by email and interview date and time were agreed. The interviews were individual and lasted from 30 to 45 minutes. The interviews were conducted in English. Audio recordings were conducted with verbal consent of an interviewee. Written notes during the interviews supported data collection process. All the notes and recordings were subsequently transcribed and analyzed. In the beginning of each interview, the purpose of the research was clearly stated, research interests were discussed, and ethical aspects were covered.

The interviewing process took place in a calm, quiet atmosphere: coffee shops, coworking spaces and meeting rooms. In general, spin-out representatives were more hesitant when answering questions related to understanding the business terms and sharing information about funding. What is more, start-up representatives were clearly open and enthusiastic and one of them even asked the interviewer to join the team to do marketing research. The level of motivation and attitude to the company was quite high among all respondents and the author tried to maintain a neutral-optimistic tone of the interview.

Secondary Data collection was performed via the extensive ethnography research. Several similar academic works were identified and used as a source of qualitative information. Industrial and governmental reports have been chosen as well, e.g. European Commission reports and United Nations reports. Online data was widely used and websites of the start-ups and spin-outs before the interviews with their representatives and to complement the primary data gathered during the interviews.

3.4 Data analysis methods

Simply observing and interviewing do not ensure that the research is qualitative. Hence, the qualitative researcher must also interpret the beliefs and behaviors of participants (Janesick 2000). Data should be transformed into results in order to solve research problem and explain the phenomenon. The analysis of the data is a process of turning the data into the results of the study. Massive amounts of data have to be fitted into concise statements which depict, clarify and foresee conclusions on the research topic (LeCompte & Schensul 1999).

Reflection is an essential part of qualitative research process, it takes place ahead, amidst or after the actual study and aims at allowing readers to understand the context in more detail. The key principle of reflection is not to neglect the biases of the researcher, but rather to acknowledge them in adequate and direct manner so that subjective views and beliefs of the researcher are expressed. It contributes to the overall understanding off the context and prism of the study by the readers. can better understand the filters through which questions were asked, data were gathered and analyzed, and findings were reported (Sutton & Austin 2015).

To conduct qualitative research researcher has to put him or herself in the situation of another person and see the world from the point of view of this person. According to Hsieh and Shannon (2005), the analysis of the qualitative content is a part of subjective interpretation of information via an analytical process of determining topics and patterns.

The main idea of data analysis and management is that it should be true for the respondents. It is the responsibility of the researcher to present and portray their opinions and feelings in a manner that is true, useful and interesting to the reader. It is often the case that the researcher starts to understand and feel the experience of the interviewees connected to phenomenon therefore developing empathy and deep rapport. It brings up the topics and questions that could be discussed in further interviews. Thus, the story of one respondent forms the perception of following and so on. The task of researcher here is to reach the saturation of the answers that clearly shows that the new knowledge has been created (LeCompte 2000).

Coding is the next important issue that influenced the analysis of the data in this research. After transcription and checking of the interview input data: audio recordings and notes proved to be useful sources of information to facilitate this process. Coding process consists of the recognition of topics, questions, similarities and differences which are unveiled in the stories of interviewees and portrayed by the researcher. The coding truly affects the ability of the researcher to see the situation from the viewpoint of the respondent (Sutton & Austin 2015).

Because of the period between the data collection and analysis memory bias towards the context and atmosphere of the interview is common. During this study the time gap between the collection and analysis of data was from one to two weeks and it did not influence the interpretation of data. However, understanding the possibility and premise for biases helped to manage them during the process of analyzing the data.

The analysis of the interviews was made implementing inductive approach by classifying the information in two stages. Stage one is to design the distinct categories established after the interviews or previous literature. During stage two, the information is organized into the previously defined categories (Saunders et al. 2016).

According to Myers (2009), the goal of the analysis of qualitative data is to convert the data into the meaningful information. This study uses an inductive systemic approach to analysis of the interviews by classifying the information in two stages. Stage one is to design the distinct categories established after the interviews or previous literature. During stage two, the information is organized into the previously defined categories (Saunders et al. 2016).

Throughout the process of data analysis, researchers create classifications of subject matters at various levels of abstraction. These classifications are ubiquitous, and they are arranged into patterns during the pattern stage of analysis. In the structural stage, patterns, in turn, are arranged into structures that illustrate and interpret the subject of the study (LeCompte 2000). Another method used during the data analysis process besides pattern matching is explanation construction. This study pays great attention to the association of empirical findings with the theoretical part previously discussed. Explanation building method is applied during the analysis of data and creation of the explanatory structural narrative.

3.5 Reliability and validity

The ultimately important characteristic of a thorough research is trustworthiness. Trustworthiness includes four characteristics: credibility, transferability, dependability, and confirmability (Lincoln and Guba 1985). Validity and reliability of results can be limited to the nature of qualitative data, which tend to be affected by a range of factors and may vary due to changes in context. High interrelation with context matters may reflect on dependability criteria of this study e.g. internal economic situation and interviewee attitude bias may affect the answers.

In order to clarify the uncertainty of qualitative research setting, a comprehensive overview of factors, which affected the way data had been collected was presented. According to Stenbacka (2001), the validity of the research can be achieved if the interview participants can speak freely about their knowledge, the sampling is done right, and the interviewer does not push respondents to the expected answers. The smooth connection of existing literature and theoretical frameworks to the research questions and interview questions of this study also contributes to its validity (Kumar 2005).

The credibility of qualitative research depends on the richness of the information collected, rather than the amount of data collected (Patton 2002). Honesty of all participants cannot be assured. However, all respondents were aware of confidentiality and genuine reasons behind the research. The exploratory nature of the research supported the idea of acquiring information from credible sources, so a great attention was paid to the issue of truthful meaning of matters. Theoretical framework was carefully designed in order to support the findings and line them up with existing concepts. In order to achieve better transferability, appropriate methods were used, such us semi-structured interviews, which allowed to study the phenomenon comprehensively.

The data in this research presented in a way that can be understood by others. To assure confirmability of the research, data collection and interpretation processes were carefully designed. Analysis of the results has been done with a great amount of critical thinking and common sense. During data collection process a focus on details was made, so that important

insights are not missed. In order to ensure that the findings are the result of the experiences and ideas of the respondents, rather than the characteristics and preferences of the researcher, natural ability of an author for self-reflection had a great significance. Ability of the researcher to understand and describe predispositions for bias towards the study object are considered beneficial.

In conclusion, the research methods chosen supported the context of the research and have been implemented ethically and transparently. Interviews were conducted in person, which could have caused subject or participant bias (Saunders et al. 2016). The names and specific data were removed, and internal secrets were not disclosed.

4. FINDINGS

In this chapter the results of the study generated through analysis are presented, with their interpretations regarding research context. The research methods in this work were semi-structured interviews with representatives from start-ups and university spin-outs, which created primary data for analysis; and ethnography research, which created secondary data. The outcomes of the empirical part of the research are connected to the concepts introduced in theoretical parts in the next chapter.

Interview questions were designed so that strategical and general information could be gathered; opinions towards new software development process were identified and paths to business success were revealed. The results of the primary data collection are presented in the tables 11 and 12.

4.1 Start-ups

After transcribing and analyzing answers of respondents from start-ups, it is possible to identify the following patterns. In start-ups participating in the study, there is a similar position traceable regarding the key success factors. In fact, three respondents out of five expressed the opinion that understanding the client leads to success. However, the larger and older the start-up, the more there is focus is on the quality and competitive excellence of the product itself, in which customers' innovations and suggestions are already considered.

What is more, it did not seem possible to find patterns of a similar approach to the process of developing new software, but it can be concluded that all start-ups have different perceptions of the importance of this process. Only one respondent named two agile methodologies, but even them are not strictly implemented. It is obvious from the interviews that young companies have little thought on the very process of developing new software, their focus is shifted to attract the first customers and make a minimal viable product that can compete in the free market. It is justified by the respondent from start-up:

"We aimed from the beginning to be the best on the market and offer the best solutions to our customers no matter what."

In startups founded with the help of angel investors there is a clearer perception of customer co-creation and involvement of customers during the development process. This can be explained by the fact that the angel investor has a strong credibility for the founders of the start-up and often understands the business in a particular industry better. Thus, those startups that from the very beginning are trying to get an expert from the industry into their advisory board have a greater focus on the result and listen to the advice of the angel investors.

The key finding was the fact that startups have a distinct focus on the speed of development and deployment of the new system for the first customer. Short deadlines, hectic requirements and the general atmosphere of the startup, about which so many people write really was mentioned by all respondents. For example, the respondent from the second startup comments on this:

"The best part of it is the start-up spirit, everyone is always working on something. There is sometimes not enough time for sleep, because the speed of realization and implementation is crucial."

Overall, the findings showed solid motivation and recognition of its importance to the team as well as some considerations towards product quality and business strategy. The angle of most of the respondents from start-up was business-oriented with a twist of technological superiority. Importance of forming good team and recruiting right talent was mentioned. The vision of the leader is considered one of the key success factors.

Table 11. Results of interviews with representatives of start-ups

	Start-up 1	**Start-up 2**	**Start-up 3**	**Start-up 4**	**Start-up 5**
Field	*VR game zone*	*Mobile app for learning languages*	*Professional information management systems*	*Sales intelligence platform*	*Cloud-based solutions for managing IT devices*
Employees	*5*	*8*	*17*	110	27
Year of founding	*2017*	*2016*	*2014*	2013	2006
Funding source	*TEKES, private*	*Private, EU*	*Angel investor*	*Private, bootstrap*	*Angel investors*
Approach to new software development process	*Brainstorming; customer co-creation; trend capturing*	*Short deadlines, brainstorming, agile (scrum)*	*Scrum not followed strictly. Kanban also.*	*Integration, development is based on dialogue with our users*	*cloud-based 'out-of-the-box' solution, all-in-one solution*
Customer co-creation	*Suggestions, reviews and employees' personal observations of customers' behaviors*	*User needs analysis before the initial development; testing and feedback phase*	*New features discussed with some customers. Initial development with one customer. Once a year demo with new features.*	*Customer Success Director, important to find a customer who's happy.*	*Include customers in the product and the software development processes, customer focused philosophy, knowledge base*
Success factors	*Understand trends and customer needs (including latent ones)*	*High attention to details, Speed of realization*	*Close to clients from the beginning. Good team. Delegating to others*	*User-friendly platform. Be the best in your market, have a competitive product*	*To offer the most comprehensive Software-as-a-Service on the market*

4.2 Spin-outs

Analysis of the interview with representatives of spin-outs revealed the following trends. In companies that have ties to universities, investment in research and technology development has been named twice as one of the key success factors. A representative of the spin-out five commented on that:

"Our products stand firmly on piles made from years of research conducted in our partner research institutes."

Without doubt, these spin-outs remember their roots and strive to utilize academic knowledge to multiply business success. In fact, the university spin-out is by definition a new firm, created primarily for the practical application of intellectual property, which was developed by the university (Shane, 2004). In principle, the purpose of university spin-out is to commercialize the innovative technology, which was justified in this study.

The main pattern observed during interviews with representatives of spin-outs is that four out of five clearly expressed that they use agile philosophy and frameworks related to it. The respondent from the first company was even more precise:

"Since the number of employees is small, we are a team of six, the whole team uses Scrum framework and is very pleased with the result."

In larger companies, it is more difficult to establish the process of Scrum management practices, and many just approaching it, whereas a small scale of university spin-out allows to fully feel the benefits of a flexible but manageable task management methodology. In an interview with a representative from the second spin-out, it turned out that the founders initially knew a lot and were evangelists of a flexible agile approach to software development and brought this passion to the spin-out company. Also, it was mentioned that university habits to studying global trends help to keep a hand on the pulse and to be interested in innovative approaches.

Spin-out number five also emphasized the importance of a strong expert board performing the functions of an advisers, decisions on collection of feedback from clients at a prototyping stage have been put forward by one of the most experienced members. When asked about key success factors, respondent from spin out four said:

Key success factors are first – user-centered design, always think about the customer! And second: to develop operations not just next to the university but to establish contacts in the industry with other companies, look around, study demand. Understand how to expand the business and constantly look for opportunities to improve and develop the product or service.

Attitude towards clients in spin-outs is not very well developed, because the Academy is somewhat distanced from reality and clients. Studies of consumers often do not give a real picture of the world. In order to overcome this barrier, spin-outs aim to create partnerships with already profitable companies in the market and conduct testing on potential customers of these companies.

Involvement of the client at all stages of software development gives advantages in a higher probability to satisfy the desires and needs of the client, for the developer this reduces the amount of unnecessary functionality. Representative from spin-out number four has expressed an observation from meetings with customers:

"When testing with a client, you understand that out of ten functions they will only use two."

The philosophy of doing business in small university spin-outs does not need to be philanthropic since improving business skills occurs by communicating with entrepreneurs at conferences, professional communities and accelerators on campus. The respondents expressed clear interest in further professional development as specialists in their area of expertise.

Table 12. Results of interviews with representatives of university spin-outs

	Spin-out 1	**Spin-out 2**	**Spin-out 3**	**Spin-out 4**	**Spin-out 5**
Field	*Android mobile application*	*Mobile app with social impact*	*Real-time simulation*	*Wireless network design*	*Smart spaces*
N of employees	*6*	*7*	*19*	*49*	*9*
Year of founding	*2017*	*2015*	*2005*	*2000*	*2015*
Funding source	*TEKES, University*	*TEKES, private*	*TEKES, University*	*TEKES, private*	*TEKES, University*
Approach to new software development process	*Agile (Scrum)*	*Agile framework*	*In-house development*	*Agile environment, minimizing deployment time*	*Open source software, agile*
Customer co-creation	*Beta testing the application*	*Discussing with end users. Going to their places*	*Involving the customer closely in the development process, demonstration of the product under development*	*Training programs, personalized product demos Customer Experience and value*	*Ad-hoc user Interaction, feedback collection*
Success factors	*Vision, passion, focus on product, delivering good quality*	*Number of users. Satisfaction of end users with the service*	*Motivated team of professionals, invest in research and development*	*Create the easiest-to-use, most reliable solutions on the market*	*Research base, strong advisory board*

5. DISCUSSION

This chapter discusses the findings on the research, using an analysis of theoretical background as well as empirical findings in order to outline the answers to the research questions and present the insights, which helped to achieve research objective. The applicability of certain theoretical concepts and frameworks is examined in connection to the research context.

The chapter highlights how the research aim was achieved through answering research questions. Since this thesis primary purpose was to determine the influence of new product development process design on the effectiveness and success of new software companies in Finland, them being start-ups and spin-outs. Further investigation included the comparison between the characteristics of successful software start-ups and university spin-outs in Finland.

5.1 Influence of NPD process design on innovative start-ups and spin-outs

RQ1: How new product development process design affects the success of innovative software start-ups and university spin-outs?

Following the results of this qualitative study representatives of startups do not draw a parallel between the efficiency of the software development process and commercial success. Strong beliefs that commercial success comes to those companies who are able to put on the market the most high-quality product faster than competitors. This is supports the viewpoint of Skok (2010) that every early stage high-tech Software-as-a-Service company has to focus on scaling the business as fast as possible to capture the largest market share it possibly can before new competitors enter the arena. In high-tech markets there is a clear advantage of a pioneer, who focused on speed and commercialized the idea faster than everyone else.

Newly-established start-ups are less likely to think about involving the users in the development process to improve the final result. According to the results of the study, these understanding comes to those start-ups that more or less firmly stand on their feet and who have

support and advice from the angel investors. Small number of start-ups realizing the connection between customer co-creation and new product development is consistent with the research by Tijmes (2010), who claimed that this connection in innovative context is statistically insignificant and improves performance only a little.

It is difficult to say whether product platform approach (Robertson and Ulrich, 1998) is considered benefitial by representatives of start-ups or spin-outs. There was only one respondent that recognized how product platform approach reduces the additional costs of meeting specific needs and this allows the firm to concentrate on more accurate satisfaction of the needs of key customers.

5.2 Differences of start-ups and spin-outs in new software development process

RQ2: How new software development structurally differs among start-ups and spin-outs?

Start-ups speed of software development is increasing because all free time and money is spent on the development of technology. Speed does not mean quality, while agile and flexible iterative approach to software development does (Miller, 2001). Ultimately, the main pattern observed during interviews with representatives of spin-outs is that four out of five clearly expressed that they use agile philosophy and frameworks related to it. According to Colby et al. (2015), Bavani (2009) and Ahimbisibwe et al. (2015) the success is directly connected to the implementation of agile frameworks. This study is insufficient to prove or disprove this argument due to the sample size since respondents do not directly associate the design of their new software development process to success.

There is a bias in the existing managerial literature that there is initially more freedom and options to develop a start-up rather than spin-out. In the spin-outs, however, highly-skilled people often come from research projects on similar topic and stay in the project (evidence of importance of high motivation). These findings support previous findings by Czarnitzki et al. (2013) who claimed that spin-outs usually drive more significant employment growth than start-ups.

The findings from this research are not sufficient to contradict Koster (2004) research that claimed that spin-outs are positioned one stage forward compared to start-ups which do not have any assistance from the industry. Meaning that spin-outs are quite similar to start-ups, that do not have any funding from the beginning. The more detailed funding timeline and research on the direct effects of funding source on success of new software company is needed.

5.3 Factors influencing software development process

RQ3: What factors affect the NPD process and software development process of software start-ups and spin-outs?

Results showed relative consistency with previous research findings. Mostly contributing to findings by Mäkelä (2008), which are: product quality, development cost and development time and Colby et al. (2015) framework. Table 13 presents color-coded answer to this research question. MacCormack (2001) argued that user engagement at an early stage is vital for the success of innovative technology product/service. Indeed, the respondents mentioned User/customer requirements a few times, more from start-up side. Again, the successful new product development process yields to considerable extent on the amount and relevance of innovative ideas suggested at the concept generation phase as well as company's ability to utilize the appropriate approach to consumer research. (Van Kleef and Van Trijp 2003). The answer to this question is truly consistent with previous studies.

Presence of the people factor is supported by Nonaka and Takeuchi (1986) findings that team capabilities (hiring top talent) and entrepreneurial leadership are one of the main success factors. The respondents used the term "vision" which was not reflected in earlier literature review in this study. Another factor is time-to-market-related. It supports the Skok (2010) suggestion that scaling and realizing business opportunities is essential for innovative software companies. Last but not least, internal time-management is mentioned by respondents of both types of companies which speculates that speed of development is considered another crucial success factor.

Table 13. Success Factors that affect the NPD process in both start-ups and spin-outs

Start-up	Spin-out
Management vision	Vision of own path
Time scale	Business opportunities
User requirements	Team communication
Customer request	Time-management
Time to market	Motivation and commitment of the team
Entering new market	End users' suggestions or complaints
Available team	Advice from experts
Sometimes client feedback	Team skills

5.4 Characteristics of successful Finnish start-ups and spin-outs

RQ4: What characterizes most successful and profitable examples of innovations that have already been commercialized in Finland in the software industry?

Among the factors that influenced the success of the commercialization of innovation, many were named, they can be divided into six subgroups presented in Table 14: People-related, Product-related, Customer-related, Market-related, R&D-related. The results show consistency and answers were easy to classify.

The success factors of start-ups and spin-outs correspond to the viewpoints of Colby et al. (2015) and Sadhakar (2012). Communication, feedback and collaboration are on the top of the list, this can be explained by the size of both start-ups and spin-outs – there are greater focus on the people factors then on the other aspects of creating a new product (Cohan and Unger, 2006). Similar to conclusions of MacCormack (2001), user engagement seems to play a pivotal role in the software development processes among Finnish start-ups and spin-outs. Product-related factors named are similar to previous literature on the benefits of the product platform and agile approach – as software product quality is directly linked to the process of its manufacturing (Ulbert, 2014).

Table 14. Success factors of start-ups and spin-outs

People-related	Product-related	Customer-related
Vision and passion; Motivated team of professionals; Strong advisory board	Focus on product; Deliver good quality products; Create reliable solutions; High attention to details	Understand trends and customer needs; Be close to clients from the beginning; Satisfaction of end users with the service; User-friendly platform.
Market-related	**Process-related**	**R&D-related**
Have a competitive asset; High number of users; Offer easiest-to-use product on the market; Offer the most comprehensive SaaS on the market	Good team management; Speed of realization	Invest in research and development; Research background; Knowledge base

The numerical values of comparing software development practices in start-ups and spin-outs is clearly visible in Figures 15 and 16. The average indicators according to the framework by Colby et al. (2015) for start-ups and spin-outs differ. While start-up average product development readiness index rates 83.2, the spin-out average value is 78.2. The study-wide average was determined to be 73. The biggest fluctuations are in **staffing**: start-ups outran spin-outs by 20.5 points and **time/budget** category, where spin-outs again fall behind by 11 points. These numerical findings could be interpreted as following: **start-ups show better performance in software product development than spin-outs.**

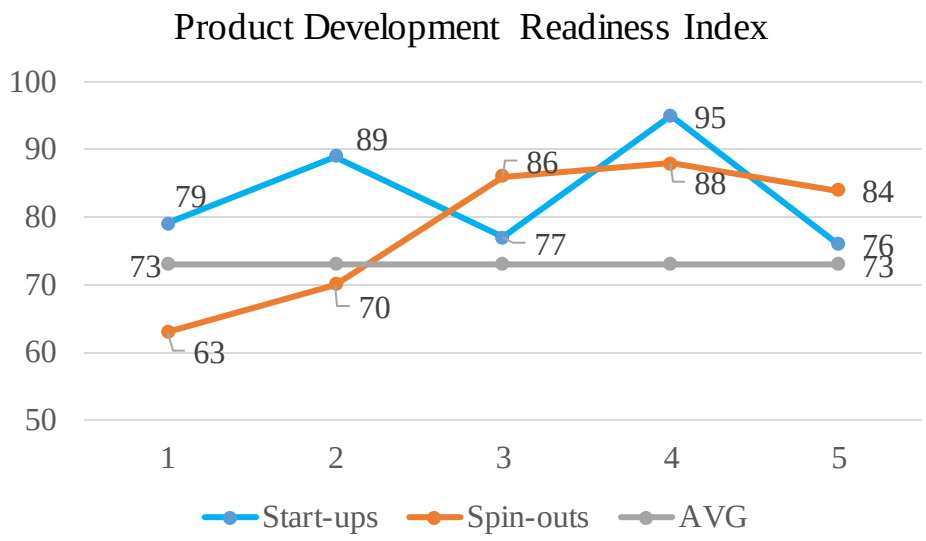

Figure 14. Results of the Product Development Readiness Index

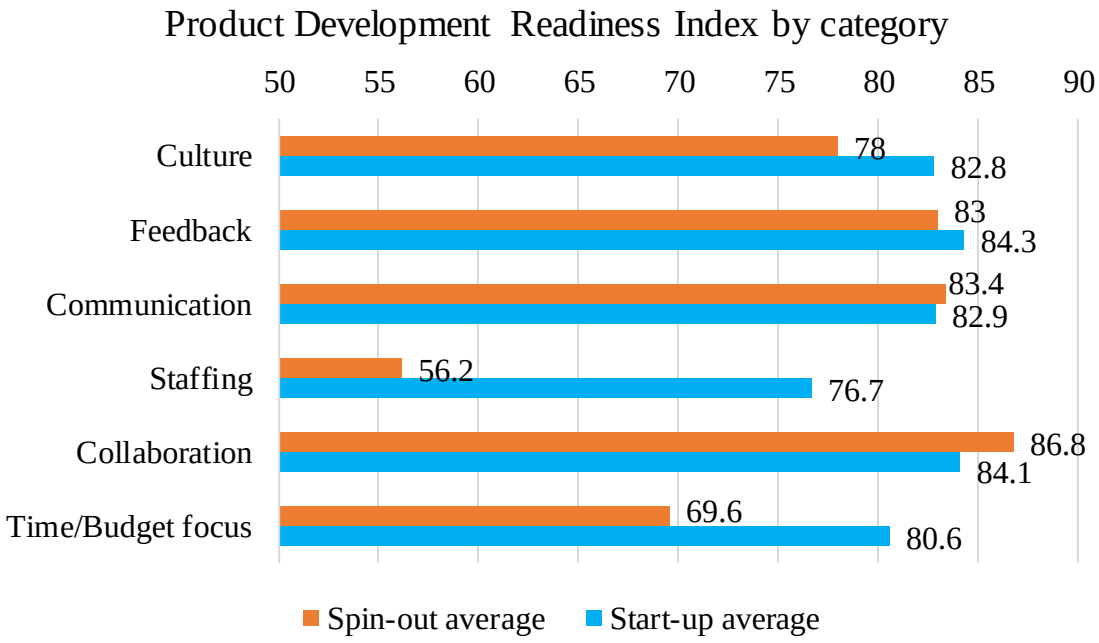

Figure 15. Results of the Product Development Readiness Index by category

6. CONCLUSIONS

The thesis studied the phenomenon of new product development process in the context of Finnish start-ups and university spin-outs. The chapter summarizes the implications for theoretical and managerial communities. Propositions for further research are made, with a connection to the previous studies in the area. Limitations of this study are discussed in the subchapter 6.3

6.1 Theoretical contribution

In this scientific work, the subject of the emergence of new software was expanded, thereby reducing the gap in the study of management practices in the newly established start-ups and university spin-outs. The results of the study imply that theoretical framework for new software development process has to be created and it should manage customer knowledge effectively.

The theoretical interest of the research concerned the scope of the process of creating new software as part of the process of commercializing innovation, both in start-ups and in university spin-outs. The results shed light on, among other things, the practical application of methodologies for an agile development approach in the newly created Finnish high-tech enterprises. Also, application to practice of such concepts as market-oriented behavior and customer co-creation is considered. Evidently, the focus shifts to the inclusion of clients in the new software development process already during the early stages, which confirms the earlier studies.

By significant part this thesis contributes to the enrichment of theoretical knowledge on the processes related to the commercialization of high-tech innovations by academic spin-outs because it highlights the specifics of product development practices and customer co-creation in such ventures, as well as draws the framework for the success factors related to them. Thesis also discusses on the point of how agile approach is ubiquitously used in new software development of spin-outs in connection to contemporary trends in the area.

6.2 Managerial implications

The results of this research are mostly applicable for the founders and members of start-ups and spin-outs who are looking for the right way to develop new software products. Consulting firms and bigger companies' management who are working with start-ups may find some interesting points also. The information presented in this study could prove suitable for IT industry experts, entrepreneurs, business students and academic and business consultants. In general, this thesis has clarified the process of new software development in Finnish start-ups and could be valuable for anyone interested in this topic.

In the modern chaotic environment of which is the high-tech market, it is quite difficult to distinguish winners and prospective start-ups from just another mobile game developers. Hopefully, this thesis is relevant to interested academics and experts on the commercialization of IT developments in Finland. Research will always be relevant, since it is trying to open the veil of internal operations of companies that are about to take over the world markets.

During the writing of this thesis, a thought has been developing all along. In order to develop innovations, it is necessary to learn how to measure their effectiveness, depending on such parameters as management style, approach to new software development, funding sources, team motivation and many others. Thus, this study described how the approach to software development can influence the company's success and therefore contributed to possible future management framework focused on measuring start-up effectiveness from the operational point of view.

6.3 Limitations and further research

As the thesis findings show, the commercialization process is highly complex, and its profound study requires extensive knowledge and insight on the subject. This thesis had a clear and focus on the research questions, thus it was important not to step away from the initial plan. The author did not cover the specifics of software development from technology point of view in this research and did not conduct nor include any financial figures and calculations related to the research area. No connection to other activities of the start-ups and spin-outs were made as this could have biased the direction of the research.

Qualitative method of data collection implies that the researcher easily influences information. During all phases, presence of researcher during data collection process was unavoidable and could have affected answers of the interviewees. The size of the sample is small, however reasonable for the research purposes.

The results of the study suggest that future research can be focused on the exact task and new software development process management, a proper quantitative research can add value to the achieved findings. A suggestion is made that different angle of the phenomenon can be researched, meaning that new software development process is unique and dynamic in every company, so it has to be supported with serious internal company-level research, which could identify the nature of networks of internal relationships.

It would also be relevant to conduct similar research in consumer products industry to determine how the new product development is perceived by the start-ups and SMEs and how these companies are engaging with customers. Geographical scope of such research should be bigger in order to obtain comprehensive data and develop region- wide patterns. The sample size is suggested to be more than two hundred companies.

From the point of view of relation of spin-outs to the university and its activities, the study provided very limited insight and could be continued to the area of innovation system communications concerning e.g. funding, execution and so on. Most importantly, the study does not cover the measurement of the impact of funding from different institutions. Further study

is required to analyze the implications of university-based innovation funding in more detail and compare the findings with existing literature.

LIST OF REFERENCES

Ahimbisibwe, A., Cavana R.Y., Daellenbach U. (2015).A contingency fit model of critical success factors for software development projects: A comparison of agile and traditional plan-based methodologies", Journal of Enterprise Information Management, Vol. 28 Issue: 1, pp.7-33, https://doi.org/10.1108/JEIM-08-2013-0060 [Accessed 10 March 2018].

Arachchilage, U.W. (2012) Answer to: Is There Any Significant Differences Between University Spin-offs and Innovative Start-ups? [www document]. Available at : https://www.researchgate.net/post/Is_there_any_significant_differences_between_university_spin-offs_and_innovative_start-ups [Accessed 12 February 2018].

Asheim, B. (2009). Regional Endowment", in OECD (2009), Entrepreneurship and the Innovation System of the Agder Region, Norway, OECD LEED Programme report, Ch. 6, OECD, Paris, pp. 261-304.

Baker, M. and Hart, S., (1999) Product Strategy and Management, 2nd Edition. Prentice Hall

Bavani, R. (2009). Critical success factors in distributed agile for outsourced product development", Proceedings of International Conference on Software Engineering (CONSEG 09), Chennai, December 17-19, pp. 75-79.

Bayes-Brown, G. (2015) Universities' early stage best practices. [www document]. Available at: http://www.globaluniversityventuring.com/article.php/4642/universities-early-stage-best-practices [Accessed 27 February 2018].

Bercovitz, J., Feldman, M. (2006). Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development. The Journal of Technology Transfer, 2006, vol. 31, issue 1, 175-188.

Bessant, J. (2008) Dealing with discontinuous innovation: the European experience. International Journal of Technology Management, 42(1-2), 36-50.

Biyalagorsky, E., Boulding W., Staelin, R. (2006). Stuck in the Past: Why Managers Persist with New Product Failures, Journal of Marketing 70 (April 2006), pp. 108–121.

Blau, J. (2014) European High-Tech Industry at the Crossroads. Research-Technology Management, Jan/Feb2014, Vol. 57 Issue 1, p 2-3.

Boschma, R. A. (2005). Proximity and innovation: a critical assessment, Regional Studies 39, 61-74.

Boulding, W., Ruskin M., Staelin, R. (1997). Pulling the Plug to Stop the New Product Drain. Journal of Marketing Research 34 (February 1997), pp. 164–176.

Brettel, M., Heinemann, F., Engelen, A., Neubauer, S. (2011). Cross-functional integration of R&D, marketing, and manufacturing in radical and incremental product innovations and its effects on project effectiveness and efficiency. J. Prod. Innov. Manag. 28 (2), 251–269.

Bughin J., (2014). Three ways companies can make co-creation pay off. https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/three-ways-companies-can-make-co-creation-pay-off

Businessinsider.com (2013) Marissa Mayer Defends Her Work From Home Ban [online] Available at: http://www.businessinsider.com/marissa-mayer-defends-her-work-from-home-ban-2013-4?r=US&IR=T&IR=T [Accessed 13 April 2018]

Callan, B. (2001). Generating Spin-Offs: Evidence from Across the OECD, OECD Science Technology and Industry Review, Vol. 26, 13.56, OECD, Paris.

Carbonell, P., Rodriguez-Escudero, A.I., Pujari, D. (2009). Customer Involvment in New Service Development: An Examination of Antecedents and Outcomes. Journal of Product Innovation Management, 26, 536-550

Cheng, Y.-M. 2011. "Antecedents and Consequences of E-learning Acceptance," Information Systems Journal (21:3), pp. 269-299.

Christensen, C.M. (1997) The Innovator's Dilemma. When New Technologies Cause Great Firms to Fail. Harvard Business School Press

Clarysse, B., Heirman, A., & Degroof, J. (2001). An institutional and resource-based explanation of growth patterns of research-based spin-offs in Europe. STI REVIEW, 26, 75–96.

Clarysse, B., Wright, M., Lockett, A., Van de Velde, E., Vohora, A. (2005). Spinning off new ventures: A typology of incubation strategies from European research institutions. Journal of Business Venturing. 20 (2), 183-216.

Clarysse, B.B., Wright, M., Bruneel, J., Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems, Research Policy, Elsevier, vol. 43(7), pages 1164-1176. [online] Available at: https://www.enterpriseresearch.ac.uk/wp-content/uploads/2014/08/ERC-RP-Creating-Value-in-Ecosystems.-Research-Paper-No-22.pdf [Accessed 20 April 2018]

Cohan, P.S., Unger, B. (2006). Sources of Advantage. Business Strategy Review (Spring), 9-14.

Colby, C. L., Mithas, S., Orlando, T., and Norman, E. (2015). "What Drives Successful Product Development and Innovation in the Software Development Process? The Product Development Success Index (PDSI) " Frontiers in Service Conference, San Jose, CA [online]. Available at: https://www.slideshare.net/ccolby/frontiers-2015-by-3-pillar-ces-rockbridge-50735368 and http://productdevelopmentsuccess.com/about [Accessed 28 Apr. 2018].

Collignon, H., Freyberg, A., Kratzert, T. (2014) Rebooting Europe's High-Tech Industry A.T. Kearney. [www document]. Available at: https://www.atkearney.fi/communications-media-technology/ideas-insights/future-of-europes-high-tech-industry [Accessed 5 March 2018]

Cooke, P., Uranga, M. G., Etxebarria, G. (1997). Regional innovation systems: Institutional and organisational dimensions. Research Policy. Vol. 26, Issues 4-5. 475-491

Comscore. (2017). Infographic: Understanding 'mobile first' consumer behaviours. [online] Available at: https://www.comscore.com/Insights/Data-Mine/Infographic-Understanding-mobile-first-consumer-behaviours [Accessed 19 Mar. 2018].

Cooper, R. (1990) Stage-gate systems: a new tool for managing new products. Bus. Horiz. 33 (3), 44–54.

Cooper, R. (1979). The Dimensions of Industrial New Product Success and Failure. Journal of Marketing, 43 (Summer), 93–103.

Czarnitzki, D., Rammer, C., Toole, A.A. (2013). University Spinoffs and the "Performance Premium" [online] Available at: http://ftp.zew.de/pub/zew-docs/dp/dp13004.pdf [Accessed 23 April 2018]

Day, G.S. (1994). The Capabilities of Market-Driven Organizations. Journal of Marketing 58, 37-52.

Deloitte Insights. (2017). Forces of change: Industry 4.0. [online] Available at: https://www2.deloitte.com/insights/us/en/focus/industry-4-0/overview.html [Accessed 19 March 2018].

Denzin, N. K., & Lincoln, Y. S. (2011). The SAGE handbook of qualitative research. Sage.

Drucker, P.F. (1954) The Practice of Management. HarperBusiness

Eriksson, P., Kovalainen, A. (2008). Qualitative Methods in Business Research. SAGE Publications Ltd.

ETLA (2009). Evaluation of the Finnish National Innovation System – Policy Report. Helsinki University Print, 2009 [online] Available at: https://www.etla.fi/wp-content/uploads/InnoEvalFi_POLICY_Report_28-Oct-2009.pdf [Accessed 29 April 2018]

Etzkowitz, H., Leydesdorff, L. (1995). The Triple Helix - University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development. Rochester, NY.

Etzkowitz, H., Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university – industry – government relations. Science and Technology, 109-123

European Commission (2004) Innovation in Europe: Results for the EU, Iceland and Norway. Data 1998–2001

Eurostat. (2017). Digital economy and society in the EU. Luxembourg: Publications Office of the European Union [online] Available at: http://ec.europa.eu/eurostat/cache/infographs/ict/index.html [Accessed 27 Mar. 2018]

Eurostat. (2018) High-Tech statistics – Economic Data. [www document] Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/High-tech_statistics_-_economic_data . [Accessed 12 February 2018].

Export.gov (2017) Finland - Market overview https://www.export.gov/article?series=a0pt0000000PAtmAAG&type=Country_Commercial__kav [Accessed 27 March 2018]

Farinha, L., Ferreira, J.J. (2013) Triangulation of the Triple Helix: A Conceptual Framework. Tripple Helix Association. Working paper No. 1 [PDF-document] Available at: https://www.triplehelixassociation.org/wp-content/uploads/2013/01/Triangulation-of-the-Triple-Helix-A-Conceptual-Framework.pdf [Accessed 21 March 2018].

Flurry Analytics (2018). The Europe Report: Early Adopters Continue to Evolve. [online] Available at: http://flurrymobile.tumblr.com/post/133792415780/europereport [Accessed 23 Mar. 2018].

Forsman, H. (2009). Improving Innovation Capabilities of Small Enterprises: Cluster Strategy as a Tool. International Journal of Innovation Management 2009 13:02, 221-243

Forbes.com (2017). Eric Ries: Why Companies Need To Create An Entrepreneurial Culture. [online] Available at: https://www.forbes.com/sites/danschawbel/2017/10/17/eric-ries-why-companies-need-to-create-an-entrepreneurial-culture/#2ed37d8d495c [Accessed 22 April 2018]

Fortune. (2016). Finland Is Struggling to Fill 7,000 Programmer Jobs. [online] Available at: http://fortune.com/2016/06/14/finland-has-7000-programmer-jobs-to-fill/ [Accessed 27 Mar. 2018].

Gao, R. and Xiong, S. (2015) Intelligent Computing Theories and Methodologies: 11th International Conference, ICIC 2015, Fuzhou, China, pp.13-23

GCI (2018). Global Competitiveness Index 2017 2018. [online] Available at: http://reports.weforum.org/global-competitiveness-index-2017-2018/ [Accessed 11 Apr. 2018].

Hall, B. and Khan, B. (2003). Adoption of new technology. Berkeley, CA: Institute of Business and Economic Research.

Hamano, Y. (2011) Commercialization Procedures: Licensing, Spinoffs and Start-ups. [www document]. Available at: http://www.wipo.int/edocs/mdocs/aspac/en/wipo_ip_han_11/wipo_ip_han_11_ref_t7b.pdf [Accessed 12 February 2018].

Han, J.K., Kim, N., Srivastava, R.K. (1998), Market Orientation and Organizational Performance: Is Innovation a Missing Link?. Journal of Marketing, 62, 30–45.

HBR (2014a) How the Software Industry Redefines Product Management [online] Available at: https://hbr.org/2014/06/how-the-software-industry-redefines-product-management [Accessed 20 April 2018]

HBR (2014b) To Raise Productivity, Let More Employees Work from Home [online] Available at: https://hbr.org/2014/01/to-raise-productivity-let-more-employees-work-from-home [Accessed 20 April 2018]

Hekkert, M., Negro, S., Heimeriks, G., Harmsen, R. (2011). Technological Innovation System Analysis. Utrecht University. [online] Available at: http://www.innovation-system.net/wp-content/uploads/2013/03/UU_02rapport_Technological_Innovation_System_Analysis.pdf [Accessed 29 April 2018]

Hirsjärvi, S., Remes, P., & Sajavaara, P. (2009). Explore and Write. 15th revised edition. Helsinki: Tammi.

Hollensen, S. (2010) Marketing Management: A relationship approach, 2nd ed., Financial Times/Prentice Hall

Hsieh, H.-F. & Shannon, S.E. (2005) Three Approaches to Qualitative Content Analysis. Qualitative Health Research 15, 9, 1277-1288

Huahai, L., Xuping, Z., & Feng, Z. (2011). Regional Innovation System Efficiency Evaluation Based on the Triple Helix Model. 2011 International Conference on Business Computing and Global Informatization, 154-157.

Hunt, S.D., Morgan, R.M. (1995). The Comparative Advantage Theory of Competition. Journal of Marketing, 59 (April), 1–15.

Im, S., Workman J. (2004) Market Orientation, Creativity, and New Product Performance in High-Technology Firms. Journal of Marketing Vol. 68 (April 2004), 114–132

Isaksen, A., Nilsson, M. (2013). Combined innovation policy: linking scientific and practical knowledge in innovation systems. Eur. Plan. Stud., 21 (12) (2013), pp. 1919-1936

Jensen, M.B., Johnson, B., Lorenz, E., Lundvall, B.A. (2007). Forms of knowledge and modes of innovation. Res. Policy, 36 (2007), pp. 680-693

Kaitila, V., Kotilainen, M. (2008). Not just Nokia: Finland, Small Country Innovation Systems, pp. 355-402, Edward Elgar, Cheltenham, UK

Kajanus, M. (2010). SME's Distributed Innovation model Facilitated by Networks of Higher Education Institutions. Savonia University of Applied Sciences. The Proceedings of the 3rd International FINPIN 2010 Conference. Joensuu, Finland, April 25–27, 2010.

Keeble, D. and Wilkinson, F. (2017) High-technology clusters, networking and collective learning in Europe. 1st ed. New York: Routledge.

Keil, M., Montealegre, R. (2000) Cutting Your Losses: Extricating Your Organization When a Big Project Goes Awry. Sloan Management Review 42 (Spring 2000), pp. 55–68.

Ketels, C. (2009). Clusters, cluster policy, and Swedish competitiveness in the global economy. Globalisation Council.

Kettunen, P. (2009). Agile Software development in Large-scale new product development organization: team level perspective. Doctoral Dissertation. Helsinki University of Technology [online] Available at: http://lib.tkk.fi/Diss/2009/isbn9789522481146/ [Accessed 25 April 2018]

Khemani, R.S. and Shapiro, D.M. (1993) Glossary of Industrial Organisation Economics and Competition Law, commissioned by the Directorate for Financial, Fiscal and Enterprise Affairs, OECD. [www document]. Available at: http://www.oecd.org/data-oecd/8/61/2376087.pdf [Accessed 15 March 2018].

Killiam, L. (2013). Research terminology simplified: Paradigms, axiology, ontology, epistemology and methodology. Sadbury, ON: Author

Koen, P., Ajamian, G., Burkart, R., Clamen, A., Davidson, J., Amore, R.D., Elkins, C., (2001) Providing clarity and a common language to the "fuzzy front end". Res. Technol. Manag. 44 (2), 46–55.

Kok, R.A.W., Biemans, W.G. (2009). Creating a market-oriented product innovation process: A contingency approach. Technovation 29(2009), 517–526

Koskinen, J. (2014) A dynamic business model for high-tech industry in a global environment - The origin of operational patterns by means of social selection. Ph.D. dissertation. Acta Wasaensia 295, Industrial Management 34. University of Vaasa [PDF document]. Available at: https://www.univaasa.fi/en/research/publications/orders/database/?julkaisu=744 [Accessed 19 March 2018]

Koskinen, J., Takala, J., Awali, J.S. (2013) Dynamic Business Model Based on research in Power Electronics Industry. Management and Production Engineering Review. Volume 4, Number 4. December 2013, pp. 35–44

Koster, S. (2004). Spin-off firms and individual start-ups. Are they really different? 44th ERSA conference, 25–29 August 2004, Porto. [online] Available at: http://www-sre.wu.ac.at/ersa/ersaconfs/ersa04/PDF/287.pdf [Accessed 24 April 2018]

Kotler, P. (1999) Marketing Management, 10th Ed., Glencoe, IL Free Press.

Kotler, P., Keller, K. (2011) Framework for Marketing Management. Pearson. 5th international edition.

Kumar, R. 2005. Research methodology: a step-by-step guide for beginners. SAGE Publications Ltd, London

LeCompte, M.D. (2000). Analyzing Qualitative Data. Theory into Practice, Vol. 39, No. 3, Getting Good Qualitative Data to Improve Educational Practice (Summer, 2000), pp. 146-154 Available at: http://www.jstor.org/stable/1477546 [Accessed 29 April 2018]

LeCompte, M.D., & Schensul, J.J. (1999). Analyzing and interpreting ethnographic data. Book Five of The Ethnographer's Toolkit. Walnut Creek, CA: Altamira Press, a division of Sage Publications

Lincoln, Y., & Guba, E. G. (1985). Naturalistic inquiry. Newbury Park, CA: Sage

Lukas, B.A., Ferrell, O.C. (2000) The Effect of Market Orientation on Product Innovation, Journal of the Academy of Marketing Science, 28 (2), 239–47.

Lundvall, B-Å. (1992). National Innovation Systems: Towards a Theory of Innovation and Interactive Learning, Pinter, London.

Luoma, E. (2015) Finnish Software Industry Survey (2015) [www document] Available at: http://teknologiateollisuus.fi/sites/default/files/file_attachments/os-kari_2015_press_print.pdf. [Accessed 12 February 2018].

Luoma, E., Rönkkö, M. (2017). Ohjelmistoyrityskartoitus 2017. Jyväskylän yliopisto. [online] Available at: http://teknologiateollisuus.fi/sites/default/files/file_attachments/os-kari2017_final.pdf [Accessed 27 March 2018].

Magnusson, P. (2009). Exploring the contributions of involving ordinary users in ideation of technology-based services. J. Prod. Innov. Manag. 26 (5), 578–593.

Marzocchi, G.L., Brasini, S., Rimessi, M. (2001). New Product Development in the Software Industry: The Role of Conjoint Analysis

Merriam-webster.com. (2018). Definition of high technology. [online] Available at: https://www.merriam-webster.com/dictionary/high%20technology [Accessed 19 March 2018].

Miller, C., Swaddling, D.C. (2002) Don't Measure Customer Satisfaction. Insight MAS, Dublin

Miller G.G. (2001). The Characteristics of Agile Software Processes. Proceedings of the 39th Int'l Conf. and Exhibition on Technology of Object-Oriented Languages and Systems

(TOOLS'01). [online] Available at: https://pdfs.semanticscholar.org/40b2/5047e8f39a29c7dd26b06a88d95a0a7c0699.pdf [Accessed 25 April 2018]

Milne, R. (2017) Europe trails US and China in tech race, warn Wallenbergs. [online] Ft.com. Available at: https://www.ft.com/content/5ac1b1ba-d6ad-11e7-8c9a-d9c0a5c8d5c9 [Accessed 19 Mar. 2018].

Mohr, J.J., Sarin, S. (2009) Drucker's insights on market orientation and innovation. Implications for emerging areas in high-technology marketing. Journal of the Academy of Marketing Science, 37, 85-96.

Mohr, J.J., Sengupta, S., Slater, S. (2010). Marketing of high-technology products and innovations Pearson Prentice Hall. 3rd edition.

Mustar, P., Renault, M., Colombo, M.G., Piva, E., Fontes, M., Lockett, A., Wright, M.,

Clarysse, B., Moray, N., (2006). Conceptualising the heterogeneity of researchbased spin-offs: a multi-dimensional taxonomy. Research Policy 35 (2), 289–308.

Myers, M. (2009) Qualitative Research in Business & Management. Sage Publications: London.

Nonaka and Takeuchi (1995) Nonaka I. and Takeuchi H. 1995. The knowledge creating company: how Japanese companies create the dynamics of innovation, New York: Oxford University Press.

Nonaka, I., Takeuchi, H. (1986). The new new product development game. Harvard Business Review 64(1), 137-146.

OECD (2001). STI Review. Special Issue on Fostering High-tech Spin-offs: A Public Strategy for Innovation: Special Issue on Fostering High-tech Spin-offs: A Public Strategy for Innovation. Volume 2000 Issue 1. OECD Publishing

OECD (2010). High-Growth Enterprises: What Governments Can Do to Make a Difference, OECD, Paris.

OECD (2017), OECD Reviews of Innovation Policy: Finland 2017, OECD Publishing, Paris. [online] Available at: http://dx.doi.org/10.1787/9789264276369-en [Accessed on 12 April 2018]

OECD (2018a), Gross domestic spending on R&D (indicator). [online] Available at: http://dx.doi.org/10.1787/d8b068b4-en [Accessed on 12 April 2018]

OECD (2018b). Finland - OECD. [online] Available at: https://www.oecd.org/sti/outlook/e-outlook/sticountryprofiles/finland.htm [Accessed 23 March 2018].

OurWorldinData.com (2018). Technology adoption by households in the United States. [online] Available at: https://ourworldindata.org/grapher/technology-adoption-by-house-holds-in-the-united-states [Accessed 18 April 2018].

Patton, M. (2002). Qualitative Research & Evaluation Methods. 3rd edition. Thousand Oaks, CA: Sage

Payne, A.F., Storbacka, K., Frow, P. (2008). Managing the co-creation of value. Journal of the Academy of Marketing Science, 36, 83-96

Plessis, M., Boon, J.A. (2004) Knowledge management in eBusiness and customer relation-ship management: South African case study findings. International Journal of Information Management 24, 73–86

Plunket, A. (2006) Intra-sector and cross-region analysis of clusters, agglomeration and spillovers in high technology sectors. Blue Sky II Forum proceedings. Canada.

Prahalad, C.K., & Ramaswamy, V. (2004). The future of competition: co-creating unique value with customers. Boston, MA. Harvard Business School Press.

Ragin, C. (1994). Constructing Social Research. Thousand Oaks, CA: Pine Forge Press

Robertson, D., & Ulrich, K. (1998). Planning for Product Platforms. Sloan Management Review, 39 (4), 19-31. [online] Available at: https://repository.upenn.edu/oid_papers/266 [Accessed 30 March 2018]

Salomo, S, Steinhoff, F. & Trommsdorff, V. (2003). Customer orientation in innovation projects and new product development success and the moderating effect of product innovativeness. International Journal of Technology Management, 26, 442-463

Saunders, M., Lewis, P., & Thornhill, A. (2016). Research methods for business students. 7th ed. Pearson Education

Schutte, F., Van der Sijde, P. (2000). University and its region. Examples of Regional Development from the European Consortium of Innovative Universities. Twente University Press.

Shane, S. (2002) Selling university technology: patterns from MIT. Management Science, 48(1), 122-137.

Shane, S. A. (2004). Academic entrepreneurship: University spinoffs and wealth creation. Edward Elgar Publishing.

Siteselection.com (2015) Finland Adapts to a New Technology Landscape [online] Available at: https://siteselection.com/ssinternational/2015/apr/industry-clusters.cfm [Accessed 23 March 2018]

Skok, D. (2010) SaaS Economics – Part 2: Scaling the Business. [online] Available at : https://www.forentrepreneurs.com/saas-economics-2/ [Accessed 31 March 2018]

Slater S.F., Narver J.C. (1995). Market Orientation and the Learning Organization. Journal of Marketing, Vol. 59, No. 3 (Jul., 1995), pp. 63-74. American Marketing Association. Available at: http://www.jstor.org/stable/1252120 [Accessed 2 April 2018]

Slater S.F., Narver J.C. (1998). "Customer-Led and Market-Oriented: Let's Not Confuse the Two," Strategic Management Journal, 19 (October), 1001–1006.

Smith, H. L., Bagchi-Sen, S. (2010). Triple helix and regional development: a perspective from Oxfordshire in the UK. Technology Analysis & Strategic Management, 22(7), 805-818.

Sofianti, T.D., Suryadi, K., Govindaraju, R., Prihartono, B. (2010) Customer Knowledge Cocreation Process in New Product Development. WCE 2010, London, U.K., vol. 1

Song, M., Noh, J. (2006) Best new product development and management practices in the Korean high-tech industry. Industrial Marketing Management. Volume 35, Issue 3, April 2006, Pages 262-278

Souder, W.E., Moenaert, R.K. (1992). Integrating Marketing and R&D Project Personnel within Innovation Projects: An Information Uncertainty Model. Journal of Management Studies 29(4), 485-512.

Stenbacka, C. (2001) Qualitative research requires quality concepts of its own. Management Decision, 39(7), 551-555

Storey, C. and Easingwood, C.J. (1999) Types of new product performance: evidence from the consumer financial services sector. Journal of Business Research, 46 (2). pp. 193-203.

Sutton, J., & Austin, Z. (2015). Qualitative Research: Data Collection, Analysis, and Management. The Canadian Journal of Hospital Pharmacy, 68(3), 226–231 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4485510/ [Accessed 23 April 2018]

Szymanski, D.M., Kroff, M.W., Troy, L.C. (2007). Innovativeness and new product success. Insights from the cumulative evidence. Journal of the Academy of Marketing Science, 35, 35-52.

Takey S.M., Carvalho M.M., (2016) Fuzzy front end of systemic innovations: A conceptual framework based on a systematic literature review, Technological Forecasting and Social Change, Volume 111, 2016, Pages 97-109 [online] Available at: http://www.sciencedirect.com/science/article/pii/S0040162516301202 [Accessed 3 April 2018]

Teknologiateollisuus.fi. (2017). Suomen ohjelmistoala jatkaa kasvuaan – osaajatarve yritysten huolena. [online] Available at: http://teknologiateollisuus.fi/fi/ajankohtaista/uutiset/suomen-ohjelmistoala-jatkaa-kasvuaan-osaajatarve-yritysten-huolena [Accessed 27 March 2018]

The PDMA Handbook of New Product Development. (2007) [www document]. Available at: http://onlinelibrary.wiley.com/doi/10.1002/9780470172483.gloss/pdf [Accessed 15 March 2018].

The US Office of Information Service (2008). Selecting a development approach. United States Department of Health and Human Services (HHS) Available at: https://www.cms.gov/Research-Statistics-Data-and-Systems/CMS-Information-Technology/XLC/Downloads/SelectingDevelopmentApproach.pdf [Accessed 12 April 2018]

Tijmes, A.H. (2010). Co-creation and firm performance: innovation success enhancing effects of and motives for customer involvement. University of Twente. Aalborg University

Trott, P. (2005). Innovation Management and New Product Development. Pearson, England.

Uden, L., Aho, A.M., (2013) Customer Knowledge in Value Creation for Software Engineering Process. 7th International Conference on KMO, AISC 172, pp. 141–152.

Ulbert, Z. (2014). Software development processes and software quality assurance. University of Pannonia. [online] Available at : http://moodle.autolab.uni-pannon.hu/Mecha_tananyag/szoftverfejlesztesi_folyamatok_angol/ch12.html [Accessed 30 April 2018]

Ulwick, A.W. (2002) Turn Customer Input into Innovation. Harvard business review 80(1):91-7

Uotila, K. (2003). The impact of global software development on software configuration management. University of Tampere.

Van der Sijde, P., Van Tilburg, J., (2000). Support of university spin-off companies. The International Journal of Entrepreneurship and Innovation. 1 (1), 13-21. SAGE Publications.

Van Kleef, E., Van Trijp, H.C.M. (2007) Opportunity identification in new product development and innovation in food product development. [online] Available at: https://www.researchgate.net/publication/40105530_Opportunity_identification_in_new_product_development_and_innovation_in_food_product_development [Accessed 3 April 2018]

Von Hippel, E. (2005). Democratizing innovations. Boston, MA. MIT Press

Wagner, S.M. (2012) Tapping supplier innovation. J. Supply Chain Manag. 48 (2), 37–52.

Wind, J., Mahajan, V. (1997) Issues and Opportunities in New Product Development An Introduction to the Special Issue. Journal of Marketing Research, 34, 1-12

Woiceshyn, J. and Eriksson, P. (2014). How innovation systems in Finland and Alberta work: Lessons for policy and practice. Innovation: Management, Policy & Practice, 16(1), pp.19-31. [online] Available at: https://www.researchgate.net/publication/261562502_How_innovation_systems_in_Finland_and_Alberta_work_Lessons_for_policy_and_practice [Accessed 30 April 2018]

Wright, M., Birley, S., & Mosey, S. (2004). Entrepreneurship and university technology transfer. The Journal of Technology Transfer, 29(3-4), 235-246.

APPENDICES

APPENDIX 1 : Interview questions.

1) What is the field of the start-up/spin-out?
2) What is the number of employees of the start-up/spin-out?
3) What is the year of founding of the start-up/spin-out?
4) What is the nature of funding does the start-up/spin-out use?
5) Do you follow any framework for new software development?
6) If yes, which one? If no, why?
7) How customers are involved in the new software development process?
8) What success factors do you personally believe are the most important for the success of innovative software start-up/spin-out in Finland?
9) What is the most important in NPD process success?