



DEVELOPMENT OF INNOVATION PRACTICES IN A UNIVERSITY

Lappeenranta–Lahti University of Technology LUT

Master's Thesis in Industrial Engineering and Management

2022

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Examiners: Associate Professor Lea Hannola

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ABSTRACT

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Keywords: improvement of innovation practices, innovation process, idea generation, creativity, idea selection

Innovations improve quality of life and they have already an important role in societies. Hence, it is important to investigate how the creation of innovations could be improved, which is the research objective of this study. This study focused more on the beginning of the innovation process, idea generation and idea selection, due to the author's interest towards them. This study's expected results were: to find information about how the creation of innovations could be improved in theory and in practice, at case organization.

The research approach for this study was qualitative and interviews were used as a research method. This study was done in four main parts: literature review, interviews, analysis of interview results and conclusions. The results and conclusions of this study were that it seems the creation of innovations can be improved with different acts. Suggestions on how innovation practices of case organization could be improved in practice were as follows. To increase connections between individuals within the network because that can cause more high-quality ideas. To have spare time to think creatively which could help idea generation. To share knowledge regularly inside the scientific community which can encourage unintended discovery. To increase the use of creativity in its activities because that could help idea generation as well. To use more selection criteria in idea selection to improve that function. There were also similarities found between literature and case organization's innovation practices, using metaphors in idea generation and to gather real market data in idea selection. Presented suggestions and similarities work in theory as well, hence they are possibly useful in practice for other organizations.

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Innovaatiot parantavat elämän laatua ja niillä on jo tärkeä rooli yhteiskunnissa. Siten, on tärkeää tutkia voisiko innovaatioiden luomista parantaa, joka on tämän tutkimuksen tavoite. Tämä tutkimus keskittyi enemmän innovaatioprosessin alkuvaiheisiin, ideoiden luomiseen ja ideoiden priorisointiin ja valintaan, koska nämä aiheet kiinnostivat tutkimuksen tekijää. Tälle tutkimukselle odotettiin seuraavia tuloksia: löytää tietoa voidaanko innovaatioiden luomista parantaa teoriassa ja käytännössä tutkimuksen case-organisaatiossa.

Työn tutkimustapa oli kvalitatiivinen ja tutkimusmetodina käytettiin haastatteluja. Tutkimus tehtiin neljässä pääosassa: kirjallisuuskatsaus, haastattelut, haastattelutulosten analysointi ja johtopäätökset. Tutkimuksen tulokset ja johtopäätökset olivat, että vaikuttaa siltä, että innovaatioiden luomista voidaan parantaa erilaisilla toimilla. Ehdotuksia kuinka case-organisaation innovaatiokäytäntöjä voisi parantaa käytännössä olivat seuraavanlaisia. Lisätä yhteyksien määrää yksilöiden välillä verkoston sisällä, koska se voi tuottaa enemmän korkealaatuisia ideoita. Antaa vapaa-aikaa luovaan ajatteluun, joka voi auttaa ideointia. Jakaa tietoa säännöllisesti tieteellisessä yhteisössä, joka voi kannustaa tahattomiin löytöihin. Lisätä luovuuden käyttöä toiminoissa, koska se voi auttaa myös ideointia. Käyttää enemmän valintakriteerejä ideoiden priorisoinnissa ja valinnassa parantaakseen sitä. Löytyi myös samanlaisuuksia teorian ja case-organisaation innovaatiokäytäntöjen välillä, vertauskuvien käyttö ideoinnissa ja todellisen markkinatiedon kerääminen ideoiden priorisoinnissa ja valinnassa. Esitetyt ehdotukset ja samanlaisuudet toimivat myös teoriassa ja ovat siten mahdollisesti hyödyllisiä käytännössä muille organisaatioille.

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1 Introduction

This Chapter gives an introduction for the topic, presents this study's research objective, questions and limitations, presents how this study was done, and presents what kind of different parts this study include. Innovations create new ways to have better quality of life, in other words, they make our lives better. Role of innovations might become even more important in future when humankind tries to solve critical problems, like global warming and waste problems. Even though many innovations have been invented, it is still not an easy job to create an innovation. In other words, no equation or factory has been invented that would produce innovations like car factory produces cars. However, it does not mean that the topic, how to create innovations, should not be researched.

Moreover, there are general features how innovation can be managed in any organization (O'Sullivan and Dooley, 2009). To understand better the role of innovation, Atkinson and Ezell (2012) presented that innovation is nowadays the key driver of national economic wellbeing and competitiveness. It has been also proposed that the most successful companies conduct innovative efforts because of the satisfaction of customer needs (Biazzo and Filippini, 2021). To understand better what innovation is, O'Sullivan and Dooley (2009) presented that innovation is the process of performing changes to something known by bringing into use something new. As well it has been said that the principal action for change in every organization is innovation and that innovation is something that helps organizations to grow. Growth can occur in turnover or profit, and as well in knowledge, human experience, efficiency and quality. There are also drivers of innovation and they are emerging technologies, competitor actions, emerging changes in the external environment, and new ideas from customers, strategic partners, and employees. Moreover, it has been said that sources of emerging technologies can be universities, high-technology startups, and competing organizations. Innovation has been also said to be something that society can benefit from. Innovation can have significant positive impact to economic growth. However, innovation can as well have negative effect on society, for example by removing traditional industries, or a chemical innovation that can help farmers to grow more crops but it can also pollute the environment. (O'Sullivan and Dooley, 2009)

As it can be seen, innovation is an important part of world. Therefore, understanding how to possibly produce innovations in a better way is something that is worth to investigate. This is the aim of this study, to look for better ways how innovations can be produced and possibly find the best ways. These best practices how innovations can be produced are searched from different sources of literature. To get empirical evidence for this study, a case organization for this study was chosen. The case organization is author's home University, LUT University (LUT). In the empirical part of this study the aim is to describe innovation practices of LUT and to find ways to improve these practices. Additionally, later suggestions, based on comparison between literature review and interview results of this study, how to improve innovation practices in case organization are given. Hence, the results of this study are information how improve innovation practices in general and in practice at case organization.

1.1 Research objective, questions and limitations

This study aims to find answers to four research questions that are related to the research objective of this study. The research objective of this study is to find ways how generation of innovations could be improved.

The first research question of this study is:

From what different sources do ideas emerge at the beginning of the innovation process?

The first research question aims to look for what are sources of ideas and what could be possible new sources of ideas. This research question also tries to find out are there some sources of ideas that are not yet known at the case organization of this study and that could be then beneficial for case organization to know. This research question tries to approach the subject, sources of ideas, from as wide point of view as possible and therefore multidisciplinary answers for this research question are welcomed as well.

The second research question of this study is:

Can the quantity and quality of ideas be influenced in the ideation phase, are there better methods of ideation than others?

The second research question of this study aims to look for is it possible to affect to the quality and quantity of ideas generated in a positive way, and if it is, are there some methods for idea generation that are better than other. This research question also tries to find encouraging information what should be done to improve case organization's idea generation practices and to look for the most suitable ways to generate ideas for the case organization.

The third research question of this study is:

Can innovation be controlled?

The third research question of this study aims to get information can innovation be controlled and if it can, in what extent innovation can be controlled. Especially, this research question tries to find are there some ways to control innovation that is not well known. For case organization of this study, this research question tries to provide information how innovation could be better controlled at case organization to improve generation of innovations.

The fourth research question of this study is:

What would be the most ideal way to innovate?

The fourth research question includes topics from previous research questions and it simply tries to find out is there some ideal way to innovate and if there is, what are the characteristics of it. For case organization of this study, this research question aims to find information what would be the most ideal ways to innovate for the case organization.

This study emphasizes the beginning of the innovation process, in other words, idea generation and idea selection parts but also other steps that are needed to be conducted to create an innovation are handled in this study. This emphasis was chosen because it interested the author of the study the most in the creation of innovation. Empirical part of this study is focused on one case organization, LUT University, and no other universities or organizations are presented.

1.2 Research design

This study aimed to look for information from literature that would answer to the research questions, and that would make it possible to give suggestions how innovation practices of the case organization could be improved. The chosen research approach for this study was qualitative and interviews were used as a research method. More information about research methodology of this study is presented in Chapter 3. The study was done in four main parts: the literature review, the interviews of case organization, the analysis of the interview results and conclusions. The study was conducted during approximately one year, located between spring 2021 and spring 2022.

1.3 Structure of thesis

This study continues after this chapter with the literature review presented in Chapter 2 that is also one source of data for this study. Chapter 2 aims to look for information how innovations could be produced most best ways. After this, there is Chapter 3 that presents case organization of this study, the research methodology chosen for this study and how empirical part of this study was conducted. Then in Chapter 4 the interview results of this study's empirical part are presented and this Chapter is also the other source of data for this study. Then next part of this study is Chapter 5 that focuses on the analysis of the interview results. In Chapter 5 interview results are compared to information presented in Chapter 2, literature part of this study, and based on this comparison suggestions are given how to improve current innovation practices of case organization. As well, in Chapter 5, similarities between literature review and current innovation practices of case organization are presented. Next, in Chapter 6, conclusions for this study are presented and this chapter is divided to two themes that are answers to research questions and possible directions for future research. Lastly Chapter 7 ends this report with summary of this study.

2 Literature review

In this chapter information about how creation of innovation could be improved is presented from different sources of literature. Aim of this chapter is to give sufficient information about the topic of this study that can be benefitted in later chapters of this study. This chapter begins with definitions of innovation, then information about innovation process is presented, and then next chapters after these follows the structure of innovation process.

2.1 Definitions of innovation

To be able to talk about innovation it is first needed to define innovation as a term. It has been said about innovation that it is a creative new solution to the prevalent circumstances and trends, and meets the expressed and latent needs and wants of stakeholders and customers (Rainey, 2005). Innovation is also something which can be mastered by learning its fundamentals (Mehregany, 2018). Innovations have been also said to be crucial for science, companies and society in general (Lembregts, Pandelaere and Paolacci, 2014). Moreover, understanding innovation is important because understanding it makes innovation attainable and far less elusive (Kahn, 2018). O'Sullivan and Dooley (2009) propose simple definition that innovation is just creativity and exploitation summed together, and it is said that this definition is more suitable to organization that are not actively joined in product innovation. Furthermore, it is said that creativity, which comes only from the human brain, becomes an innovation when it is applied to solve more special technical problems that increases the added value to the final consumer. In addition, it has been said that only combination of new, successful and adding value is the real way to achieve innovation. However, innovation is not easy to deal with, it has a high level of risk, one has to face many problems when working with it, and innovation needs to be nurtured within a special environment including systematic approaches, means and cultural aspects. (Sorli and Stokic, 2009)

One definition for innovation is that it is three different things: innovation is an outcome, innovation is a process and innovation is a mindset. Moreover, in this same definition, innovation

as an outcome includes for example: product innovation, marketing innovation, business model innovation, supply chain innovation and organizational innovation. By thinking innovation as a process, is also a good way to define it, because innovation is like a process and it should be organized as process to be able produce outcomes. (Kahn, 2018) Innovation as a process is more discussed as a topic later in this chapter. By defining innovation as a mindset, characteristics which are important for mindset considerations for innovation includes people-centric, cross-disciplinary, collaborative, holistic, integrative, flexible, comfortable with ambiguity, communicative, open to learning, willing to test new ideas and unhindered by failure (Luchs, Swam and Griffin, 2016). Innovation is also defined by du Plessis (2007, p. 21) as following: *“Innovation as the creation of new knowledge and ideas to facilitate new business outcomes, aimed at improving internal business processes and structures and to create market driven products and services. Innovation encompasses both radical and incremental innovation.”*

Other definition of innovation is defined by Baregheh et al. (2009, p. 1334) as following: *“Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace.”* For engineers, innovation has also defined to be something which turns inventions into business opportunities. Moreover, innovation can be a brand new or build from previous ones or something between these. Innovation can also be done because of necessity or just for curiosity’s sake and this what makes innovation fun. In other word, innovation does not have to have any boundaries. It has been also said about innovation that business success requires purposeful innovation. There is also defined three types of innovation which are incremental, breakthrough and disruptive. In this definition incremental innovation means making small betterments to something which already exists, for example adding new features to an existing product. Breakthrough innovation means in this definition something tough problem which has been finally solved. Disruptive innovation means in this definition as changing the basis of competition. When moving from incremental to disruptive, and to breakthrough, potential reward increases but same happens to risk of success. Moreover, incremental innovation is frequently not enough to be a differentiator. (Mehregany, 2018) It has also said about innovation that it is more than ideas and generating something new, it is execution in terms of getting the offering into hands of consumers. Which is why it is said that without deliver phase, an organization has not achieved innovation. (Kahn, 2018)

There are also misunderstandings about innovation and one of them is that innovation should always be completely new and radical in nature when minor incremental innovation would not be counted. This misunderstanding has a problem because radical innovation is very demanding, it may need special resources and it reflects significant risk certainly more than incremental innovation. That is why successful organizations know that innovation is a continuum which includes minor incremental changes and major radical innovations. (Kahn, 2018)

2.2 Different innovation processes

Because this study focuses to present and improve innovation practices, next information related to innovation process is presented. Information about innovation processes is useful in this context because with that one can see what different kind of stages and tasks are usually needed to be conducted to create an innovation.

One way to manage innovation process is stage-gate systems. It has been said about stage-gate system that it is a conceptual and operational pattern for moving a new product from idea to launch. Moreover, stage-gate systems see product innovation as a process and as other processes, innovation is something that can be managed. In other word, stage-gate systems use methodologies of process-management to innovation process. Stage-gate system can be custom-tailored, it usually has from four to seven stages and gates, it depends on company or division how many is suitable for them. Each stage have been said to be usually more expensive than the previous one. At the same time, when is went forward in stages, information becomes better and then risk is managed. In stage-gate system each gate is an entry to each stage and these gates control the process. Every of these gates has a set of inputs, a set of exit criteria, and an output. The inputs are the things that are needed brought to the gate. The criteria is how project will be judged, things that project need to pass at that gate to get the gate opened for the next stage. The outputs mean the decisions done at the gate, which are usually a Go/Kill/Hold/Recycle decision, and the acceptance of an action plan for the next stage. Parallel processing is a facet of stage-gate models that is ensuring timely completion of projects and it means inside the stages of the model activities can be done in a parallel way. (Cooper, 1990)

There has been also a study where agile project management and stage-gate model are combined to create a hybrid management framework. The results of this study demonstrate positive impact on the project and product development performance. This study propose that compounding these two approaches, agile project management and stage-gate model, to stabilize stability with flexibility is a potential solution for managing innovation projects in high-technology based companies. (Conforto and Amaral, 2016)

One version of stage-gate system based innovation process is presented in Figure 1. In Figure 1, the process starts with “Idea stage” which means there is a new product idea that is submitted to “Gate 1”. Next is “Gate 1” which is the first decision to commit resources to the project, in other word, the project is born here. In case of the decision is Go, the project proceeds to “Stage 1”. This “Gate 1” is called a “gentle” screen and it has “should meet” and “must meet” criteria. These criteria are related to strategic alignment, project feasibility, magnitude of the opportunity, differential advantage, and market attractiveness. In addition, it has been said that financial criteria is not included in this screen. To help focusing the discussion and ranking projects in this early screen, a checklist for the “must meet” criteria and a scoring model for the “should meet” criteria are utilized. After this there is “Stage 1” in this process and it has goal of determining the project’s technical and marketplace merits. In “Stage 1” project must be also clearly defined, and market research and competitive analysis are done in this stage as well. In addition, concept testing is done in this stage where the likely customer acceptance of the new product is determined. Moreover, a detailed technical appraisal must be done in this stage and it means that customer needs and “wish lists” need to be translated into technically and economically feasible solutions. Additionally, operations assessment can be part of this stage where the issues of manufacturability, costs to manufacture, and investments required are investigated. And if appropriate, detailed legal/patent/copyright work is conducted in this stage as well. Lastly in this stage, a detailed financial analysis is done and it is an input to “Gate 2”. Next in this process is “Gate 2” that is the final gate before the development stage and it is also the final point where the project can be killed before entering heavy spending. In other word, “Gate 2” means “go to heavy spend”. In this gate, a review of the activities in “Stage 1” is done and it is checked that results were positive. Lastly, because it is committed to heavy spending as result of Go – decision at this gate, the outcomes of financial analysis are an important part of this screen. There is also second part of this “Gate 2” that is related to definition of the project. Moreover, at “Gate

2” there need to be an agreement on number of key items before the project continues into the development stage. The items have been said to contain target market definition, definition of the product concept, specification of product positioning strategy, and agreement on essential and desired product features, attributes and specifications. The development plan and the preliminary marketing and operations plans, are reviewed and accepted at this gate. After this gate, there is a “Stage 2” in this process which includes the development of the product and detailed test, marketing and operations plans. This stage also includes an updated financial analysis and legal/patent/copyright issues are resolved in this stage as well. In addition, this stage try out the entire viability of the project. In other word, in this stage it is tested following things: the product itself, the production process, customer acceptance, and the economics of the project. After this stage there is a “Gate 3” in this process which is the final gate and it opens door to full commercialization. This gate is the final point where project can be still killed. Focus of this gate is on the quality of the activities at the “Stage 2” and their outcomes. In this gate, financial projections are in a key role in the decision to proceed. Lastly in this gate, the operations and marketing plans are checked and accepted for implementation in “Stage 3”. After this gate, there is a final stage called “Stage 3” which includes implementation of the marketing launch plan and the operations plan. (Cooper, 1990)

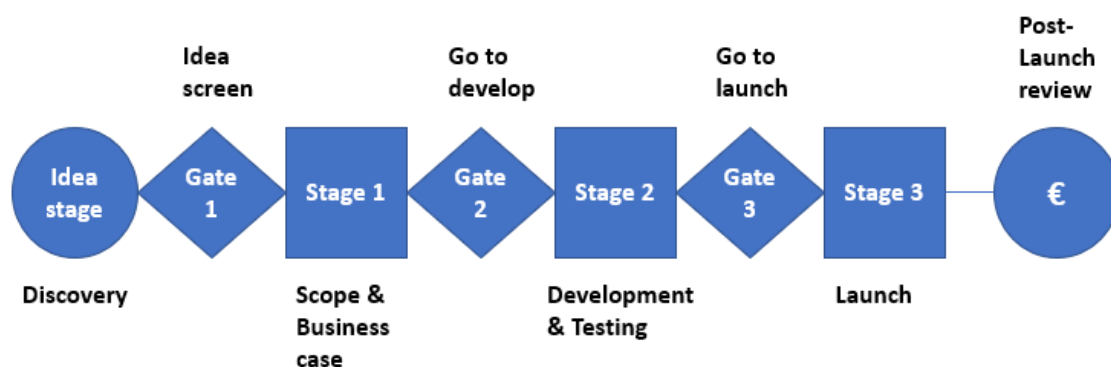


Figure 1. Stage-gate system based innovation process. (Cooper, 1990; 2014)

Finally in stage gate system based innovation process there is an action after stage 3 that is called “Post-Launch review” and it has a purpose to review the project and product’s performance. Moreover, the latest data on revenues, costs, expenditures, profits and timing are

crosschecked to projections to assess the performance. Lastly, a post-audit, that is critical assessment of the project's strengths and weaknesses, and what can be learned from the project and done better in next one, is conducted. This review ends the project. (Cooper, 1990)

Benefits of the stage-gate process are that pattern puts discipline into a process that is in too many firms ad hoc and severely inadequate. Moreover, process is visible and relatively simple that means what is needed at each gate and stage is understood by all. In addition, it has been said that the stage-gate system is just a discipline that builds the success components into the innovation process. The results of using stage-gate process are better decisions, more focus, less failures and quicker developments. (Cooper, 1990) There is also criticism about stage-gate process and it has been presented that the stage-gate model is extensively seen as being lack-luster at managing unique innovation projects that could make it possible to have leaps of growth. Moreover, in spite of the attempts to make the process more elastic, criticism continues that the process does not promote blockbuster innovation because it tends to foster ideas that lack creativity and boldness. (Hutchins and Muller, 2012)

There is also another process that describes path the innovation takes before it goes to market. This process has six steps altogether and it starts from step called "problem definition" which is the first step of the process, after it there is a step called "ideation", then there is a step called "selecting the best idea", next step is called "the architecture or building phase", second last step is called "testing and revising", and last step is called "implementation". (Harris, 2014) This process is presented in Figure 2.

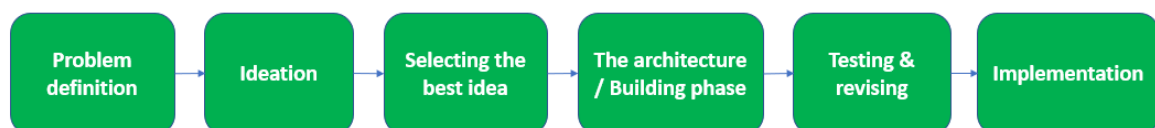


Figure 2. Step-by-step process before an innovation goes to market. (Harris, 2014)

As it can be seen from Figure 1 and Figure 2, there are a lot of similarities how innovation as a process is been defined in literature. This information about innovation as a process works as a basic structure in later steps in this theory chapter and innovation is presented in these kind of steps as it is presented in these innovation process definitions. Hence, first ideation stage of innovation process is presented in next chapter.

2.3 Idea generation phase

Idea generation that is also known as ideation, is defined as starting point in previous presented innovation processes. In other words, it is the starting point for innovation. Next information about it is presented from different sources of literature. First term idea is opened to give sufficient background information to the topic.

2.3.1 What is an idea

Ideas have been said to be engines of progress. They have also been said to improve people's lives by generating better ways to do things. Ideas also build and grow successful organizations and keep them prosperous and healthy. Organization without an ability to get new ideas, get nowhere and crumble and finally will be removed by competitors who have fresh ideas. As a person becomes aware of a problem or opportunity idea begins. Regular employees see every day a lot of problems and opportunities and come up with good ideas. (Robinson and Schroeder, 2004) Ideas have also been defined to be discrete or enumerated descriptions of solutions to a problem posed. Moreover, ideas can have various degrees of elaboration and can be partial or incomplete proposals. (Kornish and Hutchison-Krupat, 2017) In addition, it has been said about ideas that they form inventions and they exist at the intersection of recognized problems, creativity, and irrational thought. Moreover, it has been presented that one need to stay open to the ways that ideas can be generated and pursued. Sources of ideas can be in-licenced IP from Universities, internal R&D projects and individual contributors, product and market driven extensions, merger and acquisitions or joint venture projects, and inventions. (Schaufeld, 2015) Sources for ideas can be also existing products. In addition, sources of ideas can be available through examination of markets and customers to identify unsatisfied needs. For instance, every

time when an employee addresses a customer need or makes a contact with customer, there are opportunities to get ideas about new products. (Rainey, 2005)

2.3.2 Idea generation

As Harris (2014) defined innovation process, after problem definition step, there is a step called ideation where one can use variety of ways to think creatively to solve that problem. Successful ideation is creative but also rigorous and disciplined. There is a much energy spend in ideation process but it is great for cultivating creativity when it is done properly. (Harris, 2014) Also it has been said that ideation capabilities in large organizations are managerial and organizational processes for the stimulation, identification, selection and implementation of ideas. Moreover, a study shows that there are different kind of approaches to ideation between companies. Additionally, it has been said that firms can gain advantages from more conscious approaches to ideation. Especially then when if these approaches are wide and balanced and concentrate on both to build capabilities that formalize informal, in terms of establishing explicit processes, roles and systems, and to build capabilities needed to manage informal structures in new ways. (Björk, Boccardelli and Magnusson, 2010)

Idea generation has been also said to be an important step in innovation. Idea generation is a creative activity and multi-faceted process. In addition, it has points related to psychological processes, social interactions, communication, economic incentives and organizational efficiency. Therefore, there is a work related to it in plenty of the business areas: operations, marketing, organizations, psychology, economics and various branches of engineering. (Kornish and Hutchison-Krupat, 2017) It has been said that ideas have a way of snowballing which means that the best way to get whole process going is to prime it with an any idea. It is just enough when idea is something new and different, it doesn't matter if the idea makes sense or solves the problem. It has been said as well that to have lots of ideas is the best way to get a good idea. (Foster, 2007) Moreover, idea generation phase produces ideas that usually lack full definition which might seem to be weakness but it is actually one of the strengths of the new product development (NPD) process because that is cost-effective and simple to produce a lot of ideas

in idea generation phase. Additionally, it has been said that creativity and out-of-the-box thinking are central components of idea generation. (Rainey, 2005)

2.3.3 Creativity

It has been said that creative idea generation is central to novel concept development and ultimately innovation (Howard, Culley and Dekoninck, 2011). Creativity has been defined to mean any act, idea, or product that modifies an existing domain, or that transforms an existing domain into a new one. In addition, it has been proposed that creativity does not occur inside people's heads but in the interaction between person's thoughts and a sociocultural context. Moreover, it has been said to be systemic rather than an individual phenomenon. Additionally, a genuinely creative achievement is not nearly ever result of sudden insight, it comes after years of hard work. (Csikszentmihalyi, 1996)

Humans have been said to be by nature creative problem solvers because otherwise it would be hard to navigate our lives. In other word, creativity is in our nature. Additionally, positive mood is conducive to creative thinking and negativity is not. (Mehregany, 2018) It has been agreed by most of scholars that team work advance creativity (Sorli and Stokic, 2009).

It has been said that one of the key resources for creativity is "spare time" to think creatively (Sorli and Stokic, 2009). Creative thinking is a learned skill and it can be improved by practicing it. Sure ways to fail in creative thinking is to follow the old rules, selecting the first idea which pops into someone's head, being quiet for fear of failing and believing there is only one best answer. Creative thinking uses imagination to repurpose an idea and that way it sees beyond the obvious. (Harris, 2014)

It has been defined that creativity has two processes which are related to cognitive activity and these are problem redefinition and ideation. Relationship between these processes can be defined by iteration where redefining is done before ideation and after ideation, if emergent ideas does not lead towards a solution, redefining can be done again when ideation also again follow

it. Redefinition can itself help to solve the problem and it at least give a direction to process of solution generation by offering newer or different approaches to the problem. Every human being is born with ability to ideate but this ability is often stifled during the process of socialization. The ability to ideate is possible to recharge, develop and maintain by training and practicing creative techniques. (D'Cruz, 2008) It is also said about creative thinking process that it has four basic stages which are saturation, incubation, illumination and verification. Moreover, by learning and practicing, it is possible to become quite a good at it. (Mehregany, 2018)

Additionally, a creative process has been defined by Sawyer (2012) to contain eight stages. First stage is to find and formulate the problem which means that good problem need to be found and formulated such a way that it will be more likely to lead to a creative solution. Second stage is to find knowledge that is relevant to the problem, which can be summarized to mean that creativity is always based on mastery, practice and expertise. Third stage is to collect wide range of potentially related information which means that creativity often results from alert awareness to unexpected and apparently unrelated information in the environment. Fourth stage is to take time off for incubation which means that when one has gathered relevant knowledge and some amount of apparently unrelated information, the unconscious mind will process and associate that information in surprising and unpredictable ways. Fifth stage is to create a large variety of ideas and in this stage it has been said that unconscious incubation supports the generation of potential solutions to the problem but also that conscious attention to the problem can result in potential solutions. Sixth stage is to compound ideas in unexpected ways and it has been said that many creative ideas result from a combination of existing mental concepts or ideas. Seventh stage is to select the best ideas by using relevant criteria which means that creative process results in a large number of potential solutions and most of them will turn out not to be operative solutions, and then successful creators need to be good at choosing which ideas to continue further. Eight stage is to externalize the idea by using materials and representations, and in this stage it has been said that creativity is not just having an idea, creative ideas emerge, develop and transform when they are expressed in the world. Moreover, it is also said that there is consensus resulting from cognitive psychology that creativity isn't a single, united mental process, instead of it, creativity is due to many different mental processes each related to one of the presented eight stages. (Sawyer, 2012)

2.3.4 Serendipity

Serendipity has been said to mean creativity that appears through an act of unintentional good fortune (O'Sullivan and Dooley, 2009). Serendipity in entrepreneurship has been defined to mean as search leading to unintended discovery (Dew, 2009). In addition, serendipity equation has been defined to contain two things which are fortunate accidents and sagacity. Moreover, serendipity means that it occurs when fortunate accidents happens to sagacious people. There are three approaches how company can take to promote it: increasing the frequency of accidents that can turn out be fortunate which can be done for example by acting to expose him – or herself to potentially fortunate accidents, increasing awareness of accidents that occur which is because serendipitous events happen more often in companies than people realize, increasing company's domain of sagacity to turn more accidents into fortunate ones which can be done for example by encouraging employees to take classes that are not directly related to their job because one can never know when new knowledge will become useful. (Robinson and Stern, 1997) It has also been said that some innovations are mainly result of an intentional search for a particular product, others are mainly result of serendipity which means both types can not be underestimated (Lembregts, Pandelaere and Paolacci, 2014). In addition, it has been said that the regular sharing of knowledge inside scientific community that way other scientists can utilize that information, will encourage serendipitous discovery (Copeland, 2017).

2.3.5 Ways to improve idea generation

There is evidence from study that there is interrelationship between network connectivity and the quality of the innovation ideas created. Moreover, there is obviously a demand for certain amount of relations to increase the proportion of high-quality innovation ideas generated. More connections between individuals within the network caused higher proportion of high-quality ideas. Results show that for individuals possibility of interacting with other people should be supported and facilitated. One way to improve possibility of individuals to make their connectivity higher could be to generate arenas and meeting points where information and knowledge relevant for innovation could be exchanged. Examples of these kind of possibilities could be to create and support communities, to use idea generation techniques in projects and other groups, to increase formal collaboration between individuals from different departments, and to

improve sharing of knowledge and information by other available means, such as idea databases and knowledge management systems. Additionally, it has been noticed that formalization of ideation activities can offer way and attention to the important work of generating new innovation ideas and it can also possibly allow management to support their development. However, a clear way can possibly have a negative impact on idea generation work which spontaneously take place in informal network of organization. In addition, a clear direction might cause missing of potential radical or discontinuous ideas, and formal mechanisms for evaluation and selection of ideas can possibly increase this risk more. Answer for this problem may be just like many other questions related to innovation and it has been said to be likely found by balancing with counteracting forces and rarely it can be found in one of the extremes. (Björk and Magnusson, 2009) Additionally, it has been found strong support for that quality of ideas generated by team are higher with team who work individually some fraction of time and then work together, compared to group of individuals that works as a team in the same time and space. This result is due to the fact that the hybrid structure (the team that worked individually some fraction of time and then together) creates about three times as many ideas per unit of time and that these ideas are of substantially higher quality on average. (Terwiesch, Girotra and Ulrich, 2010)

2.3.6 Idea generation techniques

There are several techniques for idea generation which Gyskiewicz and Taylor (2003) have presented and these techniques include Brainstorming, Brainwriting, Restating the problem, Perspectives, Metaphor, and Excursion technique. Harris (2014) also presents idea generation technique called Lateral thinking. In addition, Boden (1998) describes how Artificial Intelligence (AI) can be used to create ideas. Next these techniques are presented more specifically.

Brainstorming, this is familiar method for most of people but it can be misunderstood to mean “free for all” which means brainstorming as a method does have rules even it has chaotic style (Gyskiewicz and Taylor, 2003). Rules for Brainstorming are following:

- Suspend judgement, positive or negative of any idea, failure to follow this rule is the major reason why some brainstorming sessions do not generate the needed results

- Encourage freewheeling, which means the wilder the idea the better
- Generate a large number of ideas, which means stress quantity over quality and value all ideas equally
- Cross-fertilize or build each other's ideas, create ideas using previous ones as launch pads, encourage people to adjust, steal or invert ideas already presented (Gryskiewicz and Taylor, 2003).

Idea of brainstorming sessions is not only to grow ideas but also combine and enhance them. It has been also found that most effective is to come prepared by doing some individual creative sessions before team sessions. For example write down ideas and bring them to team brainstorming session. In addition, even after the team session one can do more individual brainstorming to tweak ideas and then bring these tweaked ideas back to the team for further refinement and discussion. (Harris, 2014)

There are also limitations in brainstorming which are called blocking, evaluation anxiety and personality clashes. Blocking means that only one person can talk at a time and this causes problems because when other are patiently waiting for a chance to talk, their ideas will be forgotten, judged or edited. In addition, when brainstorming team gets bigger then the number of blocked participants also increases which lead to fewer ideas compared to situation when people would generate ideas on their own. Evaluation anxiety means that some people are apprehensive about expressing crazy ideas because they fear of being judged and that is why they might not want to participate. Personality clashes means that there are team members who control the brainstorming session by overpowering team members if facilitator does not manage the session correctly. There might be also team members who present only safe ideas. As well there can be team members who have difficulty of accepting ideas of others. (Harris, 2014)

Brainwriting, this idea generation process is based on that participants write down several ideas on different pieces of paper and then papers are regularly exchanged among participants which enables participants to keying new ideas from ideas already produced by other participants. There is no talking in this method. The papers can circulate through the group as often

and as long as is wanted. The rules of Brainstorming are applied to Brainwriting. Advantage of this technique is that people do not need to attend face-to-face meetings. Although, it is easy to use this method for example via email, it is needed to supervise that participants attend to this method. That can be done for example by asking participants to reply directly moderator who is in charge to send ideas to next person in the group. (Gryskiewicz and Taylor, 2003)

Restating the problem, this technique takes group back to the original problem statement with the directive to state what group members think the real problem is. This technique is based on idea that restating the problem often leads to new perspectives on the problem and new approaches that might be more efficient in developing a solution. (Gryskiewicz and Taylor, 2003)

Perspectives, in this technique group uses a list of frameworks to stimulate idea generation. The group can find situations analogous to its present situation by searching through different perspectives. Finally, alternative perspectives can lead to ideas that can be transferred to a solution for the original problem. (Gryskiewicz and Taylor, 2003)

Metaphor, this kind of approach is at the core of many creative problem-solving techniques. This technique can reduce internal censorship, introduce a novel mind-set and lead to new and valuable ideas, and often even to breakthroughs. First step of this technique is to try and find another context from which one might derive analogies. In this technique, metaphoric content can be found in the imagination of individuals in the group or from the results of just presented Perspectives – technique. The next step is to restate the problem using the new context. In this step the group should aim for a problem statement that is parallel to its real problem in some significant way. The third step of this technique is to make the metaphorical statement as a subject of a brainstorming session. The last step is to connect metaphoric responses to possible solutions to the original problem. (Gryskiewicz and Taylor, 2003)

Excursion technique, this creative exercise tends to create a high percentage of breakaway ideas. Idea of this technique is to get group's mind off the problem which enable ideas flow more freely. In this technique, an excursion can be as simple as to get group members close

their eyes and visualize ideas and solutions, or it can be as well a trip to another location. Some examples of possible excursions are called Visual connections, The field trip, Future fair, and Novel scenarios. However, one can be as creative as one like and invent an own excursion. (Gryskiewicz and Taylor, 2003)

Lateral thinking, is a stance which is used for insight and creativity. Idea of lateral thinking is based on that human mind have an incredible ability to handle incoming information by establishing a code system that recognizes patterns. Moreover, lateral thinking brings insight to the process of breaking through the confines of outdated ideas and produces creativity by generating new patterns. It has been noticed that if one work consistently on lateral thinking skills, the creative thinking process comes easier in the end and eventually it becomes a habitual way of thinking. In lateral thinking, as many alternative ideas as possible have to be searched, no matter does them seem reasonable or not. New patterns provokes when many possibilities are searched. Lateral thinking process validates the idea that has been ultimately selected and not because it is the only one but because it was selected from group of possibilities. (Harris, 2014)

Idea generation by Artificial Intelligence, Boden (1998) presents that creativity is a fundamental attribute of human intelligence and a challenge for Artificial Intelligence (AI). However, with AI techniques it is possible to generate new ideas in three ways. By producing new combinations of familiar ideas, by examining the potential of conceptual spaces, and by making transformations that make it possible to generate previously impossible ideas. Moreover, it has been said that AI have less difficulty in modelling the creation of new ideas than in automating their assessment. (Boden, 1998)

It can be demanding to choose the right idea generation technique because there are so many of them existing nowadays and that is further complicated by the elusiveness of the mechanisms of the idea generation techniques. However, by classifying idea generation techniques, it is possible to select idea generation techniques in a more systematic way. (Wang, 2019) It has been also said that key to successful idea generation is likely to start by using a range of sources and techniques and quickly to drop the ones which are the least fruitful for the company (Sowrey, 1990).

2.3.7 Challenges in the beginning of innovation process

Gijs van Wulfen (2011) presents ten things which can go wrong at the start of innovation. First one of them is that it is not known what is wanted regarding innovation which means that for example poor management related to innovation can disturb creative thinking and then lead to worse results. Second is that same things are invented again and again which might be because of there is same “creative team” doing brainstorm session every time. Third thing is that companies stay in usual conventions of market which means they copy each other’s successes which can then lead to that there are common conventions in the market and companies lose their sight what customer really wants. This can then also open a door for a new competitor which can take advantage of this kind situation. Fourth thing is that brainstorming sessions are dominated by extroverts and the highest bosses which leads to situation that not to everyone has given a fair chance. Fifth thing is that even there might be good ideas invented in brainstorming session, these ideas might be judged immediately which does not give a real chance for creativity. Moreover, this kind of behavior creates a spiral of negativity where everyone is silenced within a short time. Sixth thing is that after brainstorming session there can be hundreds of yellow post-its on the wall but it is not known what to do next which can lead to that situation that good ideas in the post-its can not be benefitted. This kind of situation can be avoided by understanding that setting up and facilitating of a brainstorm session is a profession. Seventh thing is that product ideas remain vague which means that in brainstorming session product ideas can be presented with beautiful sounding way which may not mean anything and those ideas can still have long way to go. Eighth thing is that senior management is out to reject very innovative ideas which can lead to not optimal situation. Ninth thing is that when new product idea is passed from the product inventors to the product developers, this is usually the stage where most of the energy disappears from the idea. Moreover, every developer has their own vision to which direction original product idea should go in. This can lead to situation where product idea can start to look like ideas the company already has. Tenth thing is that line management always resist innovative ideas. (Wulfen, 2011)

2.4 Idea selection phase

Next phase in innovation process after idea generation phase is called idea selection or concept development and selection, depending on sources of literature. Next this phase is opened with different sources of literature. Harris (2014) presents that creativity is not just found in the process of ideation, it is found in the process of defining criteria for choosing the idea that moves forward. Concept development and selection extend the elementary perspectives of the idea generation phase into comprehensive new product candidates. This is done based on adequate analyses that the product, marketing, market, production and financial dimensions can be determined and articulated. The primary goals of this phase are to evaluate the potential of each of the candidates and to define which ones should be developed into new products. It has been also said that concept development and selection includes the transition of new-product ideas into fully articulated concepts that can be ranked, screened and selected for next phases. In other word, it transforms the basic elements of the new-product ideas into a wide understanding of the business chances based on an evaluation of the internal and external dimensions. One can save time and money by having well-tuned concept development and selection phase. (Rainey, 2005)

Moreover, when ideas are generated, organizations need to have some way to select the ones that will get additional investment. Idea selection has been said to be often a multi-round process, described as a tunnel or a tournament. (Kornish and Hutchison-Krupat, 2017) It has been also said that idea selection needs to be a serious well controlled selection and evaluation process to filter ideas that finally could be suitable. In addition, it has been proposed that idea selection needs knowledge handling in order to enable idea analysis, evaluation, combination, and selection of the most promising ones for later analysis and elaboration. In other word, ideas need to be effectively evaluated to select those which most likely lead to innovative solutions. (Sorli and Stokic, 2009)

Harris (2014) presents how to select the best idea by describing what preliminary work related to ideas selection is needed to be done and what are the selection criteria and tools that are needed to select the best idea. The idea team, another internal group or an external group can

be the decision makers. The following preliminary work needs to be communicated to the people making the decision before the selection process begins: first of them is called the defined problem, second of them is called the two to three potential solutions, third one is called the user profile, and the fourth is called the selection criteria. The defined problem means that one should begin by restating the problem that needs to be solved because it is beneficial to have the problem statement written out so that the decision-makers have it within view. Two to three potential solutions means that after restating the problem one should list two to three possible ideas that should be further developed and implemented with a brief description of each. The user profile means that before screening for the best solution for the problem, one should put together a user profile using the information previously collected about the people who will use the product, service or process. This information need to be available for the decision makers. Notes about this preliminary work is that by closely listening to the interview responses from the user or client, much can be learned about what they need and want in product, service or process. It is reminded about this work that if not enough time is used profiling the user, more time will be spent in the redesigning phase which results higher costs for the company. The selection criteria means that how the idea will be judged need to be determined. This process helps to define the value system and also what the company thinks is most significant. There is a list of criteria used to determine the best solution for the problem. One can select maximum of five criteria from the list or add one's own. Examples of criteria from list are: appeal, feasibility, viability, usefulness, aesthetics, ergonomics, accessibility, resources, and flexibility. (Harris, 2014)

Kornish and Hutchinson-Krupat (2017) propose two points of view on idea selection processes, one that is concentrated on making predictions from assessments, ratings, or intentions, and the other that is focused on gathering real market data. These two points of view are not totally different but the key difference between them is that the real market data – focused point of view puts some developed version of the idea into a market where the gathered data is not what a person would do but what they did do. Idea selection has been also said to be, at its core, a prediction task. In addition, it has been said that organizations try to choose the ideas that will be the best, by some criteria and even though the criteria are very clear, good predictions are not easy to make. Furthermore, idea selection is even harder because there might be a lot of ideas from which to choose. The higher number of ideas there are, the less detail one is probably

to have about the market potential and feasibility of each, and the less attention will be provided to each one. However, idea selection is a difficult prediction task, practice and research guides how one should do it: what should be asked, who should be asked, and how to use the information collected. Moreover, the decision about what questions should be asked is depended on specific domain. For instance, if there are consumer packaged goods, new ideas related to them are routinely tested by using a concept test including a purchase intent question with five standard likelihood responses. Compared to more industrial setting, for instance in development of scientific instruments, idea selection would concentrate more on the technical feasibility of the ideas. (Kornish and Hutchison-Krupat, 2017)

Rainey (2005) describes main steps of concept development and selection as following:

- First step is called concept development, which concentrates to understanding the needs and positioning of the product in a target market segment
- Second step is called concept assessment, which focus to analyze the external impacts of the new product and to determine the internal program elements
- Third step is called concept testing and screening, which focuses on to rank and evaluate the candidates
- Fourth step is called concept selection, which focus on to choose the best candidates to proceed to the next phase (Rainey, 2005).

On the other hand, the methods that are used to analyze and develop the concept(s) are depended on the business environment and the type of new-product opportunity. Moreover, simple analytical techniques are usually required in incremental innovations and more sophisticated methods are required in radical improvements or dramatic changes. In addition, to do everything necessary to make good choices is the basic philosophy. However, it has been said that it is a balancing act between doing too much for an opportunity that will be discarded and not enough for the opportunities that have been selected but where doubts are still present. The more money and time are invested to the candidates, the better information there is of their potential and viability. These kind of investments make sense and decrease uncertainty and risks but the

negative side is delayed time to market and to consume resources that do not contribute to build value. (Rainey, 2005)

Harris (2014) also presents screening tools for selecting the best idea. Moreover, there are a number of screening tools that can be used to select the top solution to a problem. Some of these techniques are individual activities, some are group activities and some are a combination. Some of them have a fast turnaround and some of them require a time commitment. Following idea selection tools are based on logical and linear thinking: Idea Criteria Tool, Delphi Tool, Priority Tool, Voting Tool, AFV Tool, and Pros & Cons Tool. These just presented objective techniques work if the team is at a standstill, if there is a disagreement within the team as to which idea to move forward, or if one idea does not stand out to the team due to there are several great ideas. (Harris, 2014) Next some of just presented idea selection tools are presented in more detail.

Idea Criteria Tool (Group Consensus), is described to be a screening process to weigh the alternatives based on how each idea match the criteria for which it is being judged. In this tool, group agrees on three to five criteria, and the weight (importance) of each criteria. This idea selection technique can be conducted as a group consensus. Moreover, it takes time commitment to allow discussion. Discussing the importance of each criteria in this tool should be open and inclusive, that everyone is on board with the weight of each. This process helps to understand any compromise that results and the reasons for the decision. (Harris, 2014)

Idea Criteria Tool (Individual Ratings), this tool use the same process as just presented Idea Criteria Tool (Group Consensus). In this tool the difference is that there is no formal group discussion, and each person fills out the matrix individually and sends the form to a designated point person. Moreover, the scores are totaled and then divided by the number of team members to get an average percentage of each idea alternative. (Harris, 2014)

Voting tool, this tool is an easy group idea selection activity with fast turnaround using a democratic process. In this tool, after open discussion about the potential solutions, the voting

process begins. There are multiple ways of implementing this voting process: sticky dots, a tally, anonymous voting, or online voting. In case of sticky dots are used, they can be different colors to represent different company roles or different values. In case of a tally approach is used, whiteboards or flipcharts can be marked with numbers, checks, ticks, or crosses. In case of anonymity is important, that members are not persuaded by peer pressure, blind voting on paper works. Sometimes to set up online voting is more convenient, particularly if an incubation period is needed before the final vote. Moreover, the benefit in voting online is that data is collected and can be saved. (Harris, 2014)

Pros & Cons Tool, this tool is a method of understanding the challenges and benefits of an idea. This tool is a way of working through any misunderstandings of the benefits and drawbacks of the ideas. This tool is usually done in a group setting and has average turnaround. Every possible solution to the problem is listed at the top. Then a line is drawn down the middle with the columns “pros” and “cons”. Every of the positive aspects of the idea that add value are listed in the pros column. Every of the reasons the idea is a negative choice are listed in the cons column. Moreover, discussion continues on the value of each pro and con and which idea has the most benefits. In some cases voting is used to make a decision. (Harris, 2014)

2.5 Design and development phase

In innovation process next phase is called development phase or building phase, again depending on source of literature. Next how to conduct this phase is presented. Rainey (2005) presented that design and development phase exchanges customer needs and the intentions of the concept into design specifications and technical instruments to generate a marketable and producible product. O’Sullivan and Dooley (2009) proposed that development stage is a very costly stage because the product becomes tangible in this stage. Design and development phase includes simultaneous development of the product architecture with production, marketing and financial functional programs. Moreover, it has been said that design and development phase is the transformation from planning, analysis and conceptual processes, which are said to be more investigative, to more-grounded processes that are based on real-world considerations. In other word, conceptual is transformed into the practical in design and development. (Rainey, 2005)

Rainey (2005) also presents following necessary elements and learning objectives which the design and development phase includes:

- First one: to locate the new product in the light of market realities and building elasticity into the process
- Second one: to reaffirm the proper product attributes and to understand the functions and advantages from the perspective of customer and stakeholder needs and wants
- Third one: to ascertain the critical driving forces pertaining to customers, related industries, stakeholders, supply networks, competitors and the infrastructure
- Fourth one: to build an effective and integrated design process that leads to successful commercialization
- Fifth one: to choose the right marketing programs for the product's introduction
- Sixth one: to select the best means for producing and delivering the product to the market
- Seventh one: to manage the financial implications to ensure that the product is and remains viable (Rainey, 2005).

Therefore, Rainey (2005) presents that the design and development phase includes designing the product, determining the production and delivery methods, selecting the marketing programs, and understanding the financial implications. O'Sullivan and Dooley (2009) continue that the length, costs and challenge of development stage is depended on the comparative ambition of the concept. Moreover, it has been said that in development stage the team can produce related findings and breakthroughs as a byproduct of the work. These findings are frequently sent to ideation phase of the process and then they become the creative starting point for different innovation projects. In addition, it has been said that even though successful ideas get pass this stage having won their technological difficulties, plenty of them are rejected because the project extent or the needed skills are outside the resources of the organization at that time. Hence, depended on the result of the development stage, directors need to choose will the project be rejected, permitted to resume in development, or advanced to the subsequent stage. The decision is affected with following points: the advance done during development phase, the

related costs (till now and future), and the attractiveness of the idea in case of market possibilities based on present knowledge. (O'Sullivan and Dooley, 2009)

2.6 Validation and testing phase

Next phase in innovation process is called validation or testing phase, depending on source of literature. Next what this phase includes is presented. Rainey (2005) has presented that in validation phase, decisions done during design and development are assessed and tested to ensure that the new product matches customer and stakeholder expectations. Moreover, the validation process contains exploring the most substantial elements of the new product development program to prove that the product matches specifications and to reduce defects and burdens. During the validation phase reduction of uncertainties offers management and practitioners confidence that critical success factors have been duly considered and that obstacles to implementation have been reduced. It has been also said that validation phase offers display that the potential of the new product is worth the investment and that there are no undue concerns about spending the money to launch the product. (Rainey, 2005)

Rainey (2005) presents following topics and learning objectives that validation phase includes:

- To test a prototype of the new product by using real-world conditions
- To determine the potential effectiveness of the marketing program, containing testing and advertising copy, pricing, distribution channel(s) and other elements
- To discover the potential safety, health, and environmental consequences of the product and the potential impacts of its production processes and their potential impacts
- To examine the risks and potential liabilities facing customers and stakeholders
- To explore the business and financial implications of the liabilities and risks
- To determine overall risk of new product development program (Rainey, 2005).

The money and time associated with testing need to be balanced with the advantages resulted from the activities (Rainey, 2005). It has been also said that not sufficient results in this stage may frequently cause the concept to go back to development stage to fix the problems. Moreover, in some cases the results of the testing and validation phase are that much unsatisfactory that it can cause rejection of whole concept. (O'Sullivan and Dooley, 2009)

2.7 Launch phase

After validation and testing phase, there is launch phase in innovation process. This is the last phase of innovation process. Next is presented what this phase includes. Rainey (2005) divides activities related to the launch to pre-commercialization, launch, and post-launch review and continuous improvement. The pre-commercialization phase make sure that the needed resources are obtainable and that the commercialization game plan is ready to roll. Moreover, the actual things of the pre-commercialization phase range from situation to situation. However, pre-commercialization phase generally includes finalizing the specific means to get the product or service to the market. The major requirements of pre-commercialization phase usually include to produce sufficient levels of the product to ensure it is available for distribution to the channels or directly to the customers, completing the marketing program elements, and committing the financial resources to the product delivery system and marketing communication plans. In other word, the pre-commercialization phase includes the transformation from design and development, and validation to the execution of the launch. Furthermore, each new-product development program does not need a broad pre-commercialization phase. There are situations when new product is ready for commercialization instantly after the validation phase. This is the case especially for services or software products that do not need major production or inventory requirements. For large, complex programs with many elements that need to be timed perfectly at launch, the pre-commercialization phase is critical. (Rainey, 2005)

To commercialize the new product and gain success in the market, is the objective of the launch. Moreover, success is the criteria, not the track taken to get to it. Depending on the business situation and the industry, launch is a term that has many meanings. Often in large programs with a national launch there is a beforehand set launch date when the product need to be

obtainable to all customers. On the other hand, if the new product is introduced in stages, there may not be an official launch date. In these kind of cases, the product simply becomes obtainable to customers when the marketing programs and distribution channels reach them. In such cases, when there is no official launch date, the point when product is actually introduced is not clear. During the launch the new product development team in many organizations gives way to the product-delivery organization that has the full responsibility of ensuring success of the product in the long term. (Rainey, 2005) About difficulties in commercialization phase, it has been said that if development stage has not considered sufficiently production and market needs in definition of final design, problems can be faced (O'Sullivan and Dooley, 2009).

Rainey (2005) describes that there is the initial post-launch review that explores the results gathered to that point with respect to the metrics used for the new product development program. The meaning of this initial post-launch review is to define whether the new product is on track with the game plan and whether corrective actions are needed. Furthermore, the initial post launch review offers instant feedback to the senior management and production personnel which makes possible to improve new product development process based on the lessons learned during the phases of the program and the post launch situation. The review should also explore the negative implications of change. For instance, competitor responses can be more aggressive than expected. If the new product succeeds, the next stage in its ongoing development is to look for additional chances for exploiting the market, strategic, and financial benefits created after launch. Moreover, when potential customer becomes aware of the benefits of the new product, other market segments can be analyzed to define the suitability of entering additional market targets. There is also activity in post launch reviews called the first year review which may not be standard practice but it is a chance to get an objective view of the new product based on the actual history. It has been also said about the first year review that it can be a formal audit or a quick evaluation of the results and their implications. However, the meaning is the same, to get a valid view of the attainments and challenges. The first year review, in most cases, is based on the goals and expectations of the original game plan. The format selected, is depended on the situation and the goals of the review. The first-year review contains analyzing resource utilization, purchasing, materials management, quality aspects, supplier relationships, standardization, cost implications, outsourcing, and electronic-information flow. (Rainey, 2005)

Reflecting on the entire new product development program and ascertaining the process elements that are possible to improve for the next program, are included to continuous process improvement. The continuous improvement efforts are investigative and the emphasis in it is on the development of new or refined practices, methods, and approaches to guide businesses in the management of new-product development. Moreover, the continuous improvement tries to explore the way in which the organization develops innovative processes for managing new product development programs, and for generating tools to facilitate the related activities. Insights and lessons learned that can be applied in the future, are the expected results of these kind of efforts. Furthermore, it has been also said about continuous improvement efforts that them are empirical inquiries that explore phenomena within the real-world context using multiple sources of evidence. (Rainey, 2005)

3 Case description and research methodology

This chapter presents this study's case organization, chosen research methodology for this study, and how this study's interviews and analysis of interview answers were done. Aim of this chapter is provide reader sufficient understanding in which environment and how this study's empirical part was done.

3.1 Case LUT University

This study's empirical part was conducted to LUT University (LUT) and therefore LUT has been presented here as a background information for the study. LUT is located in Finland and it has been forerunner in combining technology and business since its' inception in 1969. LUT has campuses in Lappeenranta, which is the main campus, and in Lahti. LUT has three schools and those are LUT School of Energy Systems, LUT School of Engineering Science, and LUT School of Business and Management. The LUT School of Energy Systems has area of expertise in energy technology, mechanical engineering, electrical engineering, and sustainability science. The LUT School of Engineering Science is acting in the fields of separation, purification and process technology, green chemistry, machine vision and pattern recognition, industrial mathematics, physics, industrial engineering and management, and software engineering. The LUT School of Business and Management is focusing on sustainable business renewal in education and research, and its' strategic research area is sustainable business revolution. (LUT University, 2022)

3.2 Qualitative research approach

According to Sofaer (1999) qualitative research methods are useful in offering rich descriptions of complex phenomena. They are also useful in tracking unexpected or unique incidents. Qualitative research methods are also helpful in illuminating the experience and interpretation of events by actors with widely differing roles and stakes. In addition, qualitative research methods are as well useful in giving voice to those whose views that are seldom heard, and in conducting

initial explorations to develop theories and to create and even test hypotheses. As well qualitative research methods are useful in moving toward explanations. Moreover, it has been said that the best qualitative research is rigorous and systematic, and it looks for to decrease error and bias and to recognize evidence that disconfirms initial or emergent hypotheses. (Sofaer, 1999) Based on just presented descriptions in which kind of situation qualitative research methods are useful, research method for this study was selected to be qualitative method. Especially, because qualitative research method is useful in offering rich descriptions of complex phenomena, this method was chosen for this study because this study explores big entity of LUT University's innovation practices that can be seen as complex phenomena.

3.3 Interviews

Interviews for this study were conducted by interviewing different LUT University's employees. The employees are professors or associate professors of LUT University's before mentioned schools and personnel from LUT University's supportive services. There were all together eight persons interviewed in six interviews. In four interviews one person was interviewed at the time and in two interviews two persons were interviewed at the same time. The interviews were done between 13.10.2021 – 08.11.2021 with Microsoft Teams – application and the interviews were recorded. The questions used in interviews worked as a basic structure for interviews but them were not strictly followed. Hence, interviews were semi-structured and open discussion related to the topic were allowed. In prepared questions, there was first background questions that focused on asking in what position interviewed person works at LUT University and how long they have been working at LUT University. After background questions there were question about the topic and there were 24 of them in total. The topic based questions focused to ask from interviewed persons how they define innovation, does LUT University has innovation and ideation processes defined in and in use, from which sources ideas are coming from at LUT University, are idea generation techniques used at LUT University, are there any upcoming future idea generation techniques known, how ideas are selected for further development, how creativity is benefitted in idea generation and are there suggestions how creativity could be better benefitted at LUT University, are there challenges related to current innovation practices at LUT University, how LUT University's innovation practices could be developed, any other important that should be asked, and who would be useful person

to be interviewed as well at LUT University. The main goal of the interviews was to collect data that what kind of are LUT University's current innovation practices and how them could be developed.

3.4 Data analysis

When interviews were successfully conducted, next step was the lettering of interview recordings. In other word, all interviews were listened through and written to text format. This was done to help to find results from the interviews for later steps. First, in results were presented the definitions for innovation defined by LUT University's personnel. These definitions were written in text paragraph. The other results were categorized in three categories: 1) Current innovation practices, 2) Problems related to the current innovation practices, and 3) Development ideas related to the current innovation practices. For each of these categories, a table was done where all the results were summarized. In addition, after each table there was a text paragraph that contains more specific description of some results and other additional information related to the results. The data of this study was presented this way because it was thought to be most clear way to present the results.

4 Interview results

Next the interview results of this study are presented. First definitions of innovation at LUT University defined by interviewed persons are presented. Then current innovation practices at LUT University are presented. Further, the problems related to the current innovation practices at LUT University are told. And finally, the development ideas to the current innovation practices at LUT University are shown.

4.1 Definitions of innovation

In the interviews from interviewed persons it was asked how they define innovation. Results for it were following. One interviewed person defined innovation in a broad sense which means that it can be the development of an invention into a completely new thing, a new product or a new service but it can be also smaller level development and improvement. Other person presented that innovation is an idea related to a service or product that generates some practical benefit or value for someone, and it is not necessarily a thing to pay for, but it is a useful new thing that has not existed in that particular context before, or at least it is different. For another person innovation means a radical development to something that is being done, that such an incremental development may not lead to innovation, but a radical that gives birth to something new. One person answered:

“Innovation has been studied for almost a hundred years and nevertheless, depending on the intended use, the context and what you want to convey, the exact definition may and will continue to vary, it has not been nailed completely universally in place during that time.”

And the same person further continued that innovation is something which is new and which is usable. Moreover, it involves novelty but novelty does not have to be new to the whole world but can be new in the context in which it is considered and novelty comes only as a result of creativity, ideas and the use of the human brain. It must also be usable in some way, including

non-commercial usability, and usability also means that it has to have a place in the world and it has to have a use case that makes sense.

4.2 Current innovation practices

In the interviews questions were asked what kind of innovation practices exists at LUT University. In Table 1, that is in the next pages, these found innovation practices are presented. In text after Table 1 more information about some innovation practices is presented.

Table 1. Current innovation practices at LUT University.

# Innovation practice	Further description of the practice
#1 Intranet initiative and feedback boxes work and they bring ideas, initiatives and feedback	It has been experienced that it might not be this active if the feedback and its equivalents did not become publicly available
#2 All degree programs have feedback workshops to review student feedback	Said to be a clear innovation process
#3 Internal audits no longer exist	Because they were found not to provide sufficient added value and effectiveness
#4 Research platforms that have launched after year 2015	Based on that, together and in collaboration, combining different perspectives, different competencies and different experts can bring much better and more added value to ideation, design, development, more traditional innovation processes and inventions
#5 Listening in leadership	<ul style="list-style-type: none"> • Based on that supervisors are not like teachers saying what is happening and what is being done, but rather listening to what is happening and what is being done • Everyone notices that here we are genuinely listened • Listening in leadership has increased
#6 Serendipity	<ul style="list-style-type: none"> • Something else is invented than that was planned in advance • Several interviewed persons for this study says that this is happening at LUT University
#7 Activities are not forced to be described as process diagrams if there is no added value and it doesn't seem to help anything	It has been found that describing the process is not valuable itself
#8 The process of experimental development	Idea is immediately tested in the market, for example with real customers, and then it is learned whether it works or not
#9 Ideation outside of the university	Best ideas do not arise in the clinical environment of the University, it is good to go elsewhere
#10 Useful in creation of ideas: Reception for signals from elsewhere, goal orientation, there must be a problem one want to solve	One should not be closed and stick to that own thing too much, but have that own experience base and own thoughts and then be receptive in every situation when one meet people or read/watches something
#11 Utilizing intuition to create ideas	When there is a problem that needs to be solved, then one have to get as much information about it from different sources as possible, then have days of intuition when do nothing, have freedom to be, for instance it's a day of cleaning, sports or hobbies, and don't demand any results, and then some idea might come from subconscious
#12 Ideas with commercialization potential will be selected in the future	Idea can also come to "the second round" later if things have improved

#13 Ideas are coming from researchers and companies	Researchers themselves have developed something they would like to commercialize, companies have an idea they would like to work together to develop
#14 Several used ideation techniques / methods	<ul style="list-style-type: none"> • Double team • Canvas tools: Jam board, MIRO, Mural • Group decision support - laboratory (online versions)
#15 The ideas selected for further development are those which have a tough class of research expertise and a clear business need	No matter how good a research idea is, but if there is no clear need for companies, then it is not a project that could receive Business Finland funding
#16 The creation of new research ideas often follows similar processes	<ol style="list-style-type: none"> 1) Getting enough information, for example by reading 2) Notice something new 3) Confirm from literature is it a new thing
#17 Another typical starting point for a research idea	<ol style="list-style-type: none"> 1) Researchers notices that someone else is doing a thing a little differently 2) Researchers tries to explain that and notice that explanation contain something fresh
#18 Solution based ideation for the needs of a company	One way to generate ideas is to understand companies' needs and then try figure out solution to fill those companies' needs
#19 Use of metaphors	Metaphors has been perceived as useful and it enables the emergence of new ideas
#20 People are listened well at the University, regardless of their role	If you have an idea and you have justified it well, you are not ignored because you for example belong to some group, the idea is taken forward and tested
#21 LUT University has the most business cooperation nationally of all Finnish universities, a very good prerequisite for getting ideas from the real world	LUT University has a strategy that is broad-minded and focuses on issues that resonate with people's values, for example sustainability and its promotion, and that is something that genuinely affects people, and also a thing that strongly motivates companies, and it helps this cooperation
#22 People are positively encouraged and listened	Increases relevance of the work
#23 LUT University has not defined the innovation process at the organizational level	Possibly because innovations take place in several different environments and it is difficult to harmonize activities
#24 Ideas arise from one's own background of experience and when one gets an impulse from the outside world to see one's own idea in a whole new way then	One need to have one's own background, one's own thoughts on that background
#25 Ideas are gathered up in a booklet by sketching, writing, and drawing small pictures	One need to quickly write down good idea because if one forget it, it is nothing
#26 The dialogue between LUT University and business generates ideas	Something is invented and researched at the University, then in the end it should go there for the business world to utilize, and vice versa, if there is a problem in the business world for which solutions are sought, then they can approach the University

About Practice #2, All degree programs have feedback workshops to review student feedback, it was said also that workshops are based on involvement and common brainstorming. For Practice #4, Research platforms that have launched after year 2015, it is also said that research platforms have significantly increased co-operation between experts in various fields and people have been very satisfied about it. About Practice #5 it is also said that listening in leadership strongly promotes, develops and strengthens innovation and development. Additionally, interviewed person said about Practice #5 that:

"I would say that listening is so much more important than talking."

For Practice #6 it is furthermore said that combining two different areas easily produces serendipitous ideas. Moreover, for Practice #6 it was also said that especially on the basic research side, it is never even known where that application will end up. In addition, it was said about Practice #6 that it helps when one open mouth, then others will comment "what if", "and if" or "and when". Interviewed person also said about Practice #6 that:

"It's really typical that there is added value created in that discussion to some other thing than the one that is being dealt with."

Related to the Practice #7, reasons why LUT University has not forced to describe activities in process diagrams, may be following as one interviewed person said:

"The more I have looked at this world, the less enthusiastic I am about the processes. That's deadly that kind of form-based processing, it destroys the ideation or its creativity from it, and that's most important of all at the beginning."

In addition, related Practice #7, other person also said following that can be as well reason why LUT University has not forced to describe activities in process diagrams:

"I wouldn't think too much about ideation from the point of view of the process, but it's about creating the conditions."

For Practice #8 it is also said that one can take for example 1 or 2 features that are developed and tested first and thus to find out how well they work. Additionally, it has been said about Practice #8 that it usually happens that there is a lot of feedback that try to develop it in that direction, then it would be better or you are solving the completely wrong problem, for example think about whether you are in the right area at all. About Practice #10 it is also said that if researcher reads a professional book, that book should not be read for fun, there should be always a goal to come up with at least one idea based on that book. For Practice #24 it is also said that impulse can come from anywhere, it can come for example from seminars, other people, books, and Youtube – videos.

4.3 Problems related to current innovation practices

In the interviews from interviewed persons it was asked are there any problems related to current innovation practices at LUT University. In Table 2, that is in the next page, the found problems are presented. In text after Table 2 some of the problems are described more specifically and solutions provided for certain problems are as well presented.

Table 2. Problems related to current innovation practices at LUT University.

# Problem	Further description of the problem
#1 If there are attempts to increase people's encounters, for example through open events for LUT's staff, then no people will attend	People don't have enough passion for that type of activity
#2 At LUT University too much time is spent developing an idea without knowing the true value of the idea to the user	The idea is not dared to take it to the real world to show what kind of it is
#3 All researchers do not have capabilities to commercialize ideas	Very few researchers have the knowledge or desire to commercialize ideas
#4 Feedback received from the customer on the idea is not benefitted	There is not enough time to focus on the feedback received from the customer on the idea
#5 Bureaucracy weakens working, takes time and kills enthusiasm	We need to have some level in the bureaucracy, but then when it is taken down to an insane level, it starts to become negative
#6 Companies do not know who to contact at LUT University if they would like to collaborate and vice versa	Going forward with ideas would always require collaboration between companies and the university
#7 Documentation of ideas in workshops does not work properly	Good-looking ideas born in workshops are changed in documentation into a few words that are useless
#8 Business Finland's changed financing model has made the situation in LUT more difficult, as LUT can no longer take the idea forward and look for a company as a partner, but today it is company-oriented and LUT has to get ideas from there	It has caused quite a lot of growth pain in LUT University
#9 Anonymity will be possibly taken off from Intra's feedback channel and it might prevent initiative in this channel	A notification procedure in accordance with the European Union directive will be possibly being added to the feedback channel

For Problem #1 it was furthermore presented that people don't go to dining tables with people who they do not know. As a solution for Problem #1 it was presented to build structures at LUT University that would support the emergence of spontaneous human encounters and the emergence of human encounters in general. For Problem #1 reasons why people do not attend to open events can be following as one interviewed person said:

"It's been noticed time and time again in the management literature that it's very difficult to force communication and collaboration, and there are well-founded psychological responses to it, which is why people don't easily get it if they don't see any kind of incentive or reason."

About Problem #2 it was additionally presented that ideas don't run out, but there are far too few experiments and that innovation culture is wrong in this way. As solution for Problem #2 it was presented that one should dare to grab an idea and test it quickly and get feedback on whether it made any sense here and grab someone else to replace it if there wasn't. For Problem #4 it was presented as a solution that the group should think and decide clearly what to do next based on feedback. About Problem #5 it was also told that if there are people and the organization has an ability to give birth to new things, then bureaucracy takes time and kills enthusiasm. As a solution for Problem #6 it was proposed that companies should understand what LUT University does and LUT University should understand how companies work, then there could be more ideas generated when there is a sight where it is possible to get. As a solution for Problem #7 it was suggested that Artificial Intelligence (AI) could record a conversation in workshops and better raise that group's wisdom from conversation by creating conclusions. In addition, it was proposed as a solution for Problem #7 that AI could also identify the tone of the conversation in the recordings of workshops, for example where the group gets excited and raises these stages to the top of the ranking and vice versa drops them down in the ranking where there is a flat conversation. About Problem #8 it was also presented that it has not been natural for University that customer must be considered first. For Problem #9 it was also said that there is a small risk that it will prevent such a free-flowing throwing of initiatives when it might become too formal.

4.4 Development ideas related to current innovation practices

In interviews it was asked from interviewed persons how LUT University's current innovation practices should be developed. The found development ideas are presented in Table 3, that is in the next pages. In text after Table 3, some of the development ideas are described more specifically and problem behind some development ideas are presented as well.

Table 3. Development ideas related to current innovation practices at LUT University.

# Development idea	Further description of the development idea
#1 More students engaged to all operations in LUT University	Especially to development operations
#2 Benefitting virtuality to get people all around the world innovating together	This way global society could better solve together challenging common problems
#3 Idea competitions in LUT University could be useful	LUT University could for example have idea competition once in a five year
#4 In ideation not going too fast to group	Individuals need to have peace to think first for themselves and not to force anything to be produced
#5 Researchers should themselves dare to commercialize the idea to the end	Because no one take ideas for further processing
#6 It could help idea generation that individuals would be given time, half a day once in a week, to develop new	Otherwise it is joined to the wave of incremental development which means that when individual is in execute mode, even a little results are need to be done and that can be done, but if it is wanted to have bigger jump then there need to be space and freedom in brain to get that idea generated
#7 People from different fields of expertise work together to solve problems at LUT University	There could be bigger challenges to be solved that can not be solved with one field of expertise, these kind of idea or problem blanks could be brought to table and then solutions for them would be thought in group
#8 Encouraging LUT staff to be entrepreneurial, in other word, putting ideas into practice	The idea is more likely to be put into practice when individual or a team itself take it under to their development work
#9 Project is not ended with a prototype	University management should point out that a project related to an idea does not end with a prototype, but is only over after it has been tested by the right customer and the information obtained has been shown to companies
#10 The mentality of the university world should be such that we are there to help us in this task, that Finland and the world develop into a better place	And not that we produce information or even those prototypes, but that we produce as verified information about its benefits
#11 If people get something done, then the reward system should be in place against it and there should also be financial incentives	Personal feedback feels good, but the good incentive is that there are some financial incentives too
#12 Interdisciplinarity and free-form occasional encounters would be possibly needed	Them are possibly needed to promote creativity at the LUT University
#13 LUT University's interdisciplinary research platforms could potentially serve as a source of new innovations in addition to research	LUT University's interdisciplinary research platforms could work for such a starting point, that they now have a research focus, but in the future it would be possible to find ideas that would eventually develop into innovations
#14 It is hoped that LUT University would have more different levels of creativity-related activities and training	In general, if one talks about creativity and holds one of the workshops, then everyone could benefit from it in whatever role they play or what they do, creative

	methods are the ones that always give birth to something new
#15 LUT researchers would really benefit from doing research with the real companies	Because that way they always have the relevant information
#16 Better awareness of own knowhow	Expertise should be better known at LUT University that what could be offered to the business side
#17 The data must be analyzed honestly, the data must not be distorted and what is relevant in the data must be listened to	One can not choose to take those positive things out of that data because then one is going in the wrong direction
#18 Within the university, cross-pollination would be good, people from different fields would cooperate more and face more	Especially now because we are more closed due to corona

For Development idea #4 it was additionally said that individuals first thinking what the solutions could be and then in group those solutions can be boosted to be better. About Development idea #5 it was furthermore said that researcher has know-how and passion to one's own idea and that is why researcher should take that own idea forward in practice. As a problem behind Development idea #5 it was said that it is Universities problem related to business world, not only LUT University's problem, that a lot of money are spend when ideation and research are done but just a little money is spend on how to ensure that the idea continues its journey to into real life. A problem behind Development idea #7 was that there are quite a variety of skills in the University and they are too isolated from each other, fields of expertise are doing their own things and there is too little cross-pollination.

About Development idea #8 it was as well said that the team who has developed the idea in the context of research project can take it further, commercialize it and become an entrepreneur. A problem behind Development idea #9 was told to be that money is spent terribly on all sorts of research and development, but most of it leads nowhere and not everyone needs to lead it, not all ideas are so good that they should be put into practice, but a culture should be created that it doesn't end there when we have that prototype. For Development idea #14 it was also said that it is seen as very important in creating something new if there would be more creative activities and training at different levels in LUT University. A problem behind Development idea #14 was said to be that creativity is absolutely underused in LUT University.

5 Analysis of the interview results

In this chapter the interview results are analyzed by comparing interview answers for information presented in theory chapters, and by then looking for similarities between them and by looking for sections where suggestions could be given how LUT University could improve its' current innovation practices.

Björk and Magnusson (2009) presented in Chapter 2.3.5 that more connections between individuals within the network caused higher proportion of high-quality ideas and that for individuals possibility of interacting with other people should be promoted and facilitated. In interviews it was noticed that to promote creativity at the LUT University, interdisciplinarity and free-form occasional encounters would be possibly needed (Development idea #12). In addition, in interview results, in Development idea #18 it was presented that cross-pollination would be good within the University, people from different fields would cooperate more and face more. Additionally, in interview results as a solution for Problem #1, it was presented to build structures at LUT University that would support the emergence of spontaneous human encounters and the emergence of human encounters in general. Furthermore, in Practice #4 it was said that LUT University's research platforms has significantly increased co-operation between experts in various fields and people have been very satisfied about it. However, one person said in interviews, in Problem #1, that it has been noticed in the management literature that it is very difficult to force communication and collaboration, and there are well-founded psychological responses to it, which is why people do not easily get it if they do not see any kind of incentive or reason. As well it was said in interview results, in Problem #1 that if there are attempts to increase people's encounters at LUT University, for example through open events for LUT University's staff, then no people will attend. It can be said that even though it might not be an easy job for LUT University to increase connections between individuals within LUT University's network, it might be anyway useful to try it because with success in it, it would be possible to get more high-quality ideas. And also because similar kind of activity was asked and suggested in interviews. And as well because based on interviews, there has been positive experiences about people co-operating more at LUT University. Therefore, increasing connections

between individuals at LUT University, would be also possibly positively accepted by LUT University's personnel.

In Chapter 2.3.3 Sorli and Stokic (2009) presented that "spare time" to think creatively is one of the key resources for creativity. In addition, Sawyer (2012) presented that in creative process there is a stage to take time off for incubation which means that once one has gathered relevant knowledge and some amount of apparently unrelated information, the unconscious mind will process and associate that information in surprising and unpredictable ways. In interview results, Development idea #6 presented similar kind of activity that could be useful at LUT University. In this development idea, it was said that if individuals would be given time, half a day once in a week to develop, it could help idea generation. Hence, here is one thing LUT University should consider, to give its' employees free time to think creatively. This would be also possibly positively accepted by LUT University's personnel because it is already suggested by LUT University's personnel.

In interview results it was presented that there is a problem behind Development idea #14 that in LUT University, creativity is absolutely underused. In addition, in interview results, it was suggested in Development idea #14 that LUT University would have more different levels of creativity-related activities and training. In Chapter 2.3.2 Rainey (2005) presented that essential part of idea generation is creativity. Therefore, it can be suggested that LUT University could increase the use of creativity in its' activities because it could benefit idea generation. It could be also positively accepted because it is also suggested by LUT University's personnel.

In interview results, in Practice #14, it was presented that idea generation techniques that LUT University have used are: Group decision support - laboratory (online versions), Double team, Jam board, MIRO, Mural. These were different techniques than that was presented in theory part of this study, in Chapter 2.3.6. Furthermore, it can be said that quite a few idea generation techniques have been used in LUT University based on interviews. Hence, LUT University could consider to use idea generation techniques presented in Chapter 2.3.6 to support idea generation.

In interview results, in Practice #6, it was agreed by many interviewed persons that serendipity (something else is invented than that was planned in advance) happens at LUT University. Even though it seems that serendipity is happening at LUT University, it could be possibly increased in a way Copeland (2017) suggested in Chapter 2.3.4 that regular sharing of knowledge inside scientific community that other scientists can utilize that information, will encourage serendipitous discovery. Hence, LUT University could possibly encourage its' personnel to share knowledge inside scientific community. It is not known how much information is already shared inside scientific community at LUT University based on interviews, but if there is way to increase it, that could be considered.

In Chapter 2.3.1 Rainey (2005) presented that source of ideas can be available through examination of markets and customers to identify unsatisfied needs, and once a customer need is addressed, there is a chance to get ideas about new products. In interview results, in Practice #18, it was said that to understand companies needs and then try figure out solution to fill those companies needs, is one way to generate ideas. Hence, it can be said that there are similarities in this topic between LUT University's current innovation practices and literature, and that LUT University is doing this thing in a way it is recommended in literature.

In interview results, in Practice #12, it was said that ideas that will be selected in the future are the ones which have commercialization potential. Additionally, in interview results, in Practice #15, it was said that the ideas that are selected for further development are those which have a tough class of research expertise and a clear business need. In Chapter 2.4 Harris (2014) presented examples of selection criteria, where the selection criteria mean that how the idea will be judged, and these examples of selection criteria included feasibility and viability. Hence, it can be said that LUT University is selecting ideas for further development based on selection criteria that is similar kind of than in literature. However, Harris (2014) also suggested other selection criteria in Chapter 2.4 that are for example accessibility and flexibility, and that one can add one's own criteria. Therefore, it can be recommended for LUT University that they could possibly use more selection criteria than currently to possibly improve idea selection, even though it is not known totally are there possibly other criteria used in LUT University, those that were not found in interviews.

In interview results, in Practice #8 it was presented that LUT University use the process of experimental development and it is based on that idea is immediately tested in the market, for instance with real customers, and then it is learned whether it works or not. In Chapter 2.4 Kornish and Hutchinson-Krupat (2017) presented that idea selection process can be focused on gathering real market data. Hence, it can be said that Practice #8 is similar kind of what is presented in literature.

In interview results, in Practice #19 it was presented that use of metaphors has been perceived as useful and it enables the emergence of new ideas. In Chapter 2.3.6 there was presented by Gyskiewicz and Taylor (2003) an idea generation technique that benefits metaphors and it is called Metaphor. Therefore, it can be said that in this topic as well that LUT University is having innovation practice that is similar kind of to that is presented in literature.

In interview results, in Development idea #4, it was said that in ideation there should not go too fast to a group and that individuals should first be thinking what the solutions could be and then in group those solutions can be boosted to be better. In Chapter 2.3.5, Terwiesch et al. (2010) presented that team that works individually some fraction of time and then together, produced ideas that have higher quality compared to group of individuals that works as a team in the same time and space. Hence, it can be said that this Development idea #4 could be useful for LUT University also based on literature.

In interview results, in Development idea #5, it was said that researchers should themselves dare to commercialize the idea to the end. In addition, in interview results it was said that the problem behind Development idea #5 is that Universities has a problem related business world, including LUT University, that a lot of money are spend when ideation and research are done but just a little money is spend on how to ensure that the idea continues its' journey to into real life. Additionally, in interview results, in Development idea #9 it was suggested that University management should point out that a project related to an idea does not end with a prototype but it is only over after it has been tested by the customer and the information obtained has been shown to companies. Hence, it seems that there is development work in LUT University's innovation practices related to how to develop and build an idea to an innovation. In Chapters

2.5, 2.6 and 2.7 it was presented an information how ideas can be developed and built to innovations. Therefore, it might be useful for LUT University, to consider to look if activities presented in Chapters 2.5, 2.6 and 2.7 could be benefitted.

6 Conclusions

This Chapter focuses on answering to this study's research questions and proposing possible future research directions based on this study. First answers for research questions are presented and then is proposed possible future research directions.

6.1 Answers for research questions

Answer for the first research question, *'From what different sources do ideas emerge at the beginning of the innovation process?'*, was that sources of ideas can be multiple. Sources of ideas were found in the literature review and in the interview results of this study. Sources of ideas based on this study's literature part can be following as Schaufeld (2015) presented: in-licensed IP from Universities, internal R&D projects and individual contributors, product and market driven extensions, merger and acquisitions or join venture projects, and inventions. Rainey (2005) also presented that sources of ideas can be available through examination of markets and customers to identify unsatisfied needs. The literature part also presented idea generation techniques and examples of them are Brainstorming, Brainwriting, Restating the problem, Perspectives, Metaphor, and Excursion technique (Gryskiewicz and Taylor, 2003). In this study's interview results many ways how ideas can be created were found, next these ways are presented. It was found that LUT University's intranet initiative and feedback boxes bring ideas. In addition, it was found that utilizing intuition create ideas. Moreover, it was presented that ideas come from researchers when they have developed something and they would like to commercialize it, or from companies when they have an idea and they would like to work together to develop it. Additionally, it was noticed that one way to create ideas is to understand companies' needs and then try figure out solution to fill those companies' needs. Furthermore, it was presented that use of metaphors enables the emergence of new ideas. It was also said that ideas arise from one's own background of experience and when one gets an impulse from the outside world to see one's own idea in a whole new way then. It was as well told that the dialogue between LUT University and business generate ideas. As it can be noticed there are many sources of ideas based on this study's literature review and interview results.

Answer for the second research question, '*Can the quantity and quality of ideas be influenced in the ideation, are there better methods of ideation than others?*', was that it seems based on this study's literature work and interview results that quantity and quality of ideas can be influenced in the ideation, but it can not be said that are there better methods of ideation than others. Moreover, Björk and Magnusson (2009) presented that more connections between individuals within the network caused higher proportion of high-quality ideas. In addition, Terwiesch et al. (2010) presented that it has been found strong support that quality of ideas generated by team are higher with team who work individually some fraction of time and then work together, compared to group of individuals that works as a team in the same time and space. In interview results of this study it was said that best ideas do not arise in the clinical environment of the University, it is good to go elsewhere. Additionally, it was said in this study's interview results that useful in creation of ideas is reception for signals from elsewhere, goal orientation, and that there must be a problem one want to solve. As it can be seen there are acts, based on literature review and interviews of this study, that can be done to affect to the ideation in a positive way.

Answer for the third research question, '*Can innovation be controlled?*', was that it seems based on this study's literature work and interview results that innovation is something that can be controlled in some extent but not limitlessly. Moreover, it seems that it is useful to try to control innovation but not to everything in generation of innovations can be controlled. Examples about this can be seen in the literature part of this study where Cooper (1990) presented that stage-gate systems see product innovation as a process and as other processes, it is possible to manage innovation. It has been also said about stage-gate systems that them use methodologies of process-management to innovation process (Cooper, 1990). Additionally, Baregheh et al. (2009) presented that innovation is the multi-stage process whereby organization change ideas into new/improved products, service, or processes. In addition, ways how innovation can be managed were presented in interview results, next these ways are presented. The process of experimental development was presented and that means idea is immediately tested in the market, for example with real customers, and then it is learned whether it works or not. Another example how innovation can be managed was that the ideas selected for further development are those in which have a tough class of research expertise and a clear business need. Based on these examples one can see that there are acts and practices how innovation can be managed but there is no one method or practice that would ensure the creation of innovations. In other word, it

definitely seems useful to try to manage innovation but no simple equation or set of tasks that would produce innovations like production line, has not been invented based on this study.

Answer for the fourth research question, '*What would be the most ideal way to innovate?*', was that in this study no ideal way to innovate was defined but acts that could improve creation of innovations were found. Moreover, ideal way to innovate could be found possibly by testing different ways to manage innovation, in those areas where it can be managed, and then by selecting the best ways for it.

6.2 Possible directions for future research

Based on this study, possible direction for future research could be to investigate is there innovation process defined in other Universities and if there is and there is positive results of it, could such a process be beneficial to define at LUT University to possibly improve creation of innovations in this way. Another possible direction for future research could be to explore how co-operation between LUT University and business world could be improved, to make it possible to develop more ideas into innovations. In addition, one possible direction for future research could be to explore how creativity could be more benefitted at LUT University to benefit idea creation and then creation of innovations. For example, it could be researched related to this, is creativity more benefitted in other Universities than at LUT University with positive results, and if it is, would it be beneficial to utilize those practices of creativity from other Universities at case organization. Furthermore, one possible direction for future research could be to look for what kind of are other Universities' innovation practices and could those practices be benefitted at LUT University.

7 Summary

Innovations are important in improving quality of life. Therefore, this study was conducted and its' objective was to investigate could creation of innovations be improved in theory and in practice, at case organization of this study, LUT University. The thesis focused more on in the first steps in creation of innovations, idea generation and idea selection, due to author's interest towards those steps. The wanted results of the study were to find answers for four research questions related to the research objective and to present innovation practices of this study's case organization, and possibly as well give suggestions how to improve those practices.

This thesis was conducted in four main parts: by searching useful information from literature, by conducting interviews to case organization, by analyzing interview results and by creating conclusions. To theory part of this study, useful information from different sources of literature was gathered. Empirical part of this thesis, interviews, were conducted by interviewing different employees of case organization. After interviews most relevant information from interview answers were chosen and that information was divided to four sections: definition of innovation at case organization, current innovation practices at case organization, problems related to current innovation practices at case organization, and development ideas related to current innovation practices at case organization. Analysis of the interview results was done by comparing found information from literature to the answers of interviews, and then it was analyzed are there similarities between them and are there sections where suggestions what to do better could be given. As a result of analysis of the interview results, similarities were found and suggestions were given as well. Conclusions were done by answering to four research questions of this study with information gathered during this study, and by giving suggestions for possible future research directions.

The results and conclusions of this thesis were that it seems that creation of innovations can be improved with different acts. For example, it was found that from literature that more connections between individuals within network can cause higher proportion of high-quality ideas. It was also noticed in literature that giving spare time to think creatively is one of the key resources

for creativity and it could then help idea generation as well. As well, it was found in literature that regular sharing of knowledge inside scientific community can encourage serendipitous, unintended, discovery. The suggestions that how case organization could improve its' innovation practices were related just mentioned acts, and as well it was suggested that case organization could increase the use of creativity in its' activities because creativity was found in theory to be essential part of idea generation. For idea selection, it was suggested that case organization could consider to use more selection criteria in addition to found current selection criteria at case organization to possibly improve idea selection, because it was found in literature more criteria than that was used in case organization based on interviews. In addition, it was suggested for case organization to consider to benefit actions presented in this study's literature part related development, testing and launch phases of innovation process because it seemed based on interviews that there is development work related to these phases of innovation work at case organization.

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