MASTER THESIS IN BUSINESS ADMINISTRATION, SPECIALISATION IN INDUSTRIAL ECONOMICS

School of Business and Faculty of Social Sciences

Lean's impact on innovation processes

Qualitative study examining the influence Lean has on innovation processes and if this influence is dependent on the value creation logic

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04.05.2015

hbv.no

Høgskolen i
Buskerud og Vestfold

Preface

The present study is a master thesis report being a part of curriculum in Industrial Economics specialization at Buskerud and Vestfold University College. The present research introduces concepts of Lean and innovation and investigates interaction between these concepts. It is discussed how implementation of Lean principles may influence firms' innovation capabilities. Review the existing research on the field reveals several theories about ways of combining the two concepts in order to gain and sustain competitive advantage are presented. Additionally different value creation configurations are briefly discussed.

The general objective of this study is to increase understanding of the presented interaction. In this regard a qualitative explorative study of comparative character was conducted. The existing literature on this field is considered rather limited as it recently have gained awareness from researchers. Our motivation for choice of the research problem was that we find this topic highly interesting but likewise insufficient. Our aim was to some extent fill the gap in the existing research in this field. Working on this study expanded our comprehension not only on the chosen topic, but also around the research methodology and project based work. We went through a demanding learning process that we concern a valuable experience.

First we would like to thank our supervisor Eskil Le Bruyn Goldeng for valuable guidance and advice during the whole process. We appreciate the discussions and the constructive feedbacks and his involvement in our thesis. Next we would like to express our appreciation to our mentor Rolf Qvenild who helped us in establishing contact with the participating companies. Last but not least, we thank the participating companies whom without this study would have not been possible.

Drammen, May 2015

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Abstract

Title: *Qualitative study on Lean's impact on innovation processes*

Purpose: The purpose of this study is to investigate the influence Lean has on innovation processes and if this influence is dependent on the value creation logic of the enterprise.

Theoretical framework: The theoretical chapter of this study covers the concept of Lean, Innovation, Lean Product Development, Knowledge Based Development and Value Creation Configurations. We start with a presentation of our subjects separately before we finish with a review of studies made on combination of our two main concepts.

Methodology: This study was conducted with a qualitative approach, with informants from three different high technological companies allocated in Norway. The data for the study was collected by means of formally structured face-to-face interviews with seven informants with different positions and from different departments.

Empirical foundation: This chapter compares and investigate our subject based on our findings

Conclusion: The study confirms the possibility of positive combination of Lean and innovation as the majority of the informants consider the combination in a positive way. Although there is a common agreement about needs to achieve a balance between those two.

Limitations: The approach to the research design, the choice of participating companies, and the interview guide employed, are all considered limitations for obtaining the ideal form of the study.

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1. Introduction

This chapter starts with an introduction of the theme and highlights its significance. The developed background is followed by problem motivation that led to the problem statement. Further we present the objectives of the study and assigned research questions. The chapter ends with working assumptions, limitations and the presentation of the structure of the study.

1.1 Background to the research

Porter's Generic Strategies (1985) divided the business world into cost driven and innovation driven models. According to Porter the company could narrow their focus towards one of the models to achieve a competitive advantage. As the world moved thirty years forward, the borders get blurred and the competitive marked extended to the global scope. Simultaneously the customers are more demanding and the product life cycle is shorter. Even if these two strategies are major forces of business success, there is not enough to be either one. Norway and other western well-developed economies have high salaries, generous welfare arrangements, and generally a high standard of living. The only way we can maintain that level of welfare is by innovation. It is not enough to be efficient producers and copycats - we also constantly have to deliver unique solutions that improve the life. At the same time the company that only innovates without any concerns for cost will not be able to survive in the long term.

To be able to compete in this ever-changing world with increased competition and globalization, it is important for organisations nowadays to stay ahead of the competitors. This may be obtained through maintaining of high level of efficiency and delivery of innovative products of high quality. Lean philosophy and high degree of innovativeness are both some of the major driving forces of modern business' success. The challenge with these two concepts is the apparent conflict between them, considering the fact that both Lean thinking and innovation management are in principle built on opposing ideas. Some theorists argue that these two are likely to cause inconsistency within a company that aims to secure its growth by innovating (Chen & Taylor, 2009; Lewis, 2000; Lindeke et al., 2009; Mehri, 2006; Schuh et al., 2008).

Lean has its focus in continuous improvement and aim to eliminate waste and reduce costs. Lean principles may increase the organizational efficiency while removing significant levels of variability. Innovation on the other hand aims to promote new creative ideas that can contribute to achieving long-term competitiveness. Being different and diverge from the competitors depends on the organizations ability to innovate in both products and processes.

Like any relationship, the affair between Lean and innovation can be boisterous and controversial or constructively and creatively productive. The review on the existing research on this field shows that the combination of those apparently contrasting concepts may be rather ambiguous, as it reveals two differing approaches. First, the rather superficial approach, which emphasizes that the strong contrasts between the concepts cause a mutual exclusion. On the other hand, the second considerably more comprehensive approach affirms the complementary character of the interaction.

There is a genuine concern that Lean with its standardization and reduction of variability will narrow the freedom required to be creative and innovative. This controversial combination has created a distinction between both researchers and managers, with supporters on the one hand and opponents on the other. Supporters believe that Lean can contribute to more innovation, by freeing up resources that can be rather used advantageously to innovation (Johnstone et al., 2011; Reinertsen & Shaeffer, 2005). On the other hand, opponents believe that by being "too Lean" companies may weaken their long-term innovative ability by being too concerned with removing non-value added activities, considered waste (Chen & Taylor, 2009; Lewis, 2000; Lindeke et al., 2009).

Growing profits through cost cutting is not likely to be sustainable in the long-term and must be balanced with sales growth through new developments. However, organizations that excessively focus on promoting creativity and innovation may result in high degree of waste and cost inefficiency.

If implemented properly and understood by the entire organisation, Lean may be a powerful managerial tool. The challenge is to implement Lean without suppressing innovation. Combining

these two conflicting methods represent a challenging task for the management. Companies that have the ability to combine these two methods can obtain great opportunities by doing so in the long-term. A dream scenario for the organization is to continue innovating and at the same time cutting cost through eliminating waste, to have an organisation that learns, improves and innovates permanently.

1.2 Problem motivation

Lean has been one of the most important business trends over the last decades and has during the years led to countless success stories among organisations. At the same time it is important for modern organisations operating in the idea based, design-obsessed economy of today to be creative and to continuously innovate. In our opinion, these two opposing strategies may potentially cause a lot of tension in organisations. Although, during the recent years there has been a considerable interest in both Lean and innovation separately. However, the case is different regarding Lean combined with innovation, or as it may be called Lean innovation. This area has just recently started to attract the attention of researchers. The motivation for this thesis is partly to complement the limited research on the controversial mix that arouse curiosity among CEOs around the world. Another important motivation is our shared interest for concepts of Lean and innovation driven from both teachers and the curriculum.

1.3 Problem statement

Based on the foregoing discussion on the background of the chosen topic and the underlying motivation we wish to investigate the interaction between Lean and innovation. In order to achieve the aim, the following general research questions will be addressed:

- What is the influence of Lean on innovation processes?
- Is the influence negative or positive?
- Is the influence dependent or independent of the value creation logic?

These questions summarize the study and create the problem statement:

In what ways does Lean influence innovation processes, and is the influence dependent on the value creation logic of the enterprise?

With this study we hope to contribute in filling of the significant gap in the existing literature explaining how innovation can be affected by the implementation of Lean. In addition the findings of the study may contribute with some practical implications guiding managers considering the implementation of Lean in innovative environments.

1.4 Research questions and objectives

This study examines in general what ways Lean influences innovation processes in high-tech enterprises located in Norway. We also investigate if the influence is dependent on the value creation logic of the organizational unit, where we divide between value chains (e.g. manufacturing or testing department), and value shops (Research and Development department). Our main objectives is to fill the significant gap in the existing literature on this field and extend our own understanding, as well as to provide managerial and theoretical implications regarding the investigated interaction.

In order to achieve the objectives of the study we have designed an interview guide with seven sections, where two of the parts are directly related to answering the general questions. The second section relates to the value creation logics, where we examine structure and purpose of the organizational units the informants belong to. Furthermore, the last part examines informants' perceptions on the interaction between Lean and innovation. The remaining parts include more specific questions that suppose to support the general questions. What is innovation and how to facilitate it? What is Lean and how was it implemented? With use of the specific questions, which are directly related to our two subjects of Lean and innovation, we wish to increase our knowledge about Lean and innovation in practice and also investigate our informants' understanding about them.

1.5 Working Assumptions

Based on our theory review we made some assumptions to what we expected to find. First, we assumed that Lean has an influence on innovation, preferably in a negative matter. We also assumed that our informants had an opinion on the controversial nature of relationship between Lean and innovation, particularly about how Lean influences innovation by its standardization and focus on waste reduction. Furthermore, we expected that the informants' opinions and experiences were dependent to the value creation logic they belong to and their position as leader or non-leader. Finally, we assumed that our informants' views considering interaction between Lean and innovation would correspond with the theoretical picture drawn in the literature review.

1.6 Limitations to the study

The study is limited by choice of method, strategic selection and the time resources. The interview method is very subjective and dependent on who is answering. Time restraint has lead to a small informant selection, as well as to shortage in methodological choices in regard to data triangulation and method triangulation.

1.7 Disposition

In the following chapter we provide a theoretical insight into the concepts innovation and Lean, which are the two concepts that are central to our thesis. Additionally, the chapter includes a brief presentation of concepts of Knowledge Based Development and Lean Product Development. The chapter ends with a theoretical discussion on the interaction between Lean and innovation. In chapter 3 we present the methodological choices we have made with regard to conducting interviews and analysis of findings. Chapter 4 constitutes analysis of collected data material, while Chapter 5 provides discussion and the final conclusion. The study ends with chapter 6, which includes limitations, reflections and suggestions for further research.

2. Literature review

The purpose of this chapter is to provide a theoretical insight into concepts of Lean and innovation. This theoretical insight is believed to be of great importance as it acts as the underlying foundation for the rest of the study. First, we present the conceptual approach by reviewing some of the existing researches on innovation, its background and significance. New products and services that reveal new business and infrastructure opportunities increasingly control successful competition in the global market. Thus, innovations must be regarded not only as products in a marketplace, but rather as social actors increasingly changing our lifestyles. The practical approach to concept of innovation appeals to be comprehensive and defined in different ways depending on discipline it corresponds to. We also present briefly the different types and classifications of innovation and their consequences.

Both academia and industry world have been strongly affected by the Lean philosophy over the last few decades. The rapid extent from automotive industry into many other industry sectors caused a significant development and industry-specific adjustments of the Lean concept. Despite popularity and the proven efficiency increased by the successful implementations of Lean, the lack of ultimate definition causes certain confusion with other management concepts. We present the theoretical background of the Lean philosophy and its main principles and practices. Further, practical approach is discussed in regard to highlight importance of the concept.

In both literature and in managerial practice Lean philosophy appears to be discussed under several different "labels". We introduce two other closely related terms/concepts that are relevant for this thesis. Lean product development and Knowledge based development are concerned to be important domains associated with Lean. We briefly present background and significance of both concepts.

A literature review on relationship between the concepts of Lean and innovation reveals significant research deficiencies despite of the popularity of both highlighted. In next section we discuss the controversial mix of Lean philosophy and innovation management. The most relevant works that express both support and disapproval for this combination are highlighted.

Value creation is a major aspect in every organizational environment However, the logics regulating the framework for value creation may remarkably differ from each other depending on type of business, industry, culture, targets, etc. Therefore, in the final section of this chapter we discuss value creation configurations that are complementary for the traditional value chain defined by Michael Porter in 1980's. In the present work we engage two of presented configurations, value chain and value shop, as sort of control variables allowing us to differentiate the organizational units our informants work for. Thus, we can later compare the value chain which we associate with manufacturing/test department with value shops, represented by research and development department (called also R&D further in this paper). By dividing organizational in this manner we are able to analyse the differences between Lean manufacturing and Lean product development and recognize the impact on innovation.

2.1 Innovation

2.1.1 Conceptual approach

Since the late 1880s the term innovation was used in regard to something unusual. Nowadays the term is broadly defined and may be seen from several interdisciplinary perspectives. Its importance in business and economics is significant for development and satisfying customer requirements. Organizational innovation is supposed to trigger positive changes in efficiency, competitiveness and quality (Sledzik, 2013). In modern economics, it was Joseph Schumpeter who drew the attention to this influential phenomenon in 1930s. His definition of innovation was one of the first well-defined definitions: *"The introduction of new goods (...), new methods of production (...), the opening of new markets (...), the conquest of new sources of supply (...) and the carrying out of a new organization of any industry"* (in: Sledzik, 2013). Several other scholars made also a significant impact on research on innovation field in 1980s, among others Peter Drucker *("Change that creates a new dimension of performance"*), and Regis Cabral *("Innovation is a new element introduced in the network which changes, even if momentarily, the costs of transactions between at least two actors, elements or nodes, in the network"*) (Williams, 2013).

Amabile (1996) claims that all humans are able to initiate at least intermediate creative proposals at some point of life, depending on time and domain. Every individual may extend their creative thinking while being influenced by environment (Amabile, 1996). Thus, while we generate the new and useful ideas of different kinds, we need to also be able to trigger the innovation that, by Amabile's definition results in *"the successful implementation of creative ideas within an organization"*. The ideas that are commercially valuable can bring us desired profit.

According to Kline & Rosenberg (1986) "*innovation is complex, uncertain, somewhat disorderly, and subject to changes of many sorts. Innovation is also difficult to measure and demands close coordination of adequate technical knowledge and excellent marked judgment in order to satisfy economic, technological, and other types of constraints - all simultaneously".* This definition of innovation is essential, since it collects all the exacting characteristics of this phenomenon targeting organizational operations. Authors point also at the high uncertainty of the innovation process outcome.

Innovation does not only depend on creativity of an individual, but it often relies on groups' creative skills. Amabile (1996) identifies three factors that constitute organizational work environment that promotes individuals' creativity: organizational motivation to innovate, resources and management practices. It means that while supporting innovation at all organizational levels by engaging right idea development mechanisms together with well communication and reward system, both managers and all employees can lead the innovation successfully. Organization can include all available resources like people, time, expertise, materials and information to support these mechanisms. Appropriate management techniques that aid creative and effective teamwork set these factors together.

Kline & Rosenberg (1986) argue that successful innovation depends on two sets of forces: the commercial, to deal with the requirements, demands and market forces; and the technological, to maintain the effectiveness of manufacturing processes. It is also necessary to include bidirectional communication into all innovation-oriented processes and activities, since the feedback stimulates interactive continuous improvement that is essential for innovation.

Carayannis et al. (2003) distinguish between many different types of innovation. Generally, we differentiate between process and product innovation. Difference between these depends on object these two types refer to. While process innovation relates to the way an organization develops a given product, the product innovation considers the product itself. In addition there is administrative type of innovation that concerns transformations in organizational or institutional elements. Furthermore innovation can be classified into different degrees. Incremental innovation focuses on exploitation, value-adding and improving of existing technologies and developments often by dominant established firms. Radical innovation pioneers altered concepts to new markets and potential applications. That helps to differentiate already existing ones, often constructed on a different set of engineering or scientific principles. Generational innovation that incrementally leads to the creation of a new product or system, but is not as different as radical innovation. Architectural innovation, which "*serves to extend the radical- incremental classification of innovation and introduce the concept of changes in the way in which the components of a product or system are linked together*" (Carayannis et al., 2003).

Garcia (2010) adds two other important types: disruptive innovation, which is used to enter and initiate new markets by introducing new technologies, which replaces the existing ones in the existing markets; and sustaining innovation, which is based on existing products or processes that are improved or exploited by incumbent firms wishing to reinforce their core competences (Garcia, 2010).

It is however important to point that disruptive innovations are those which get the most of the attention of researchers (Bower & Christiansen, 1995; Markides, 2006). Markides (2006) discusses in his article "Disruptive Innovation: In Need of Better Theory" this type of innovation in three different perspectives: technology, business-model and product. He argues that it is incorrect to define the disruptive innovation just in general without distinguishing it into mentioned categories. That is because *"different kinds of innovations have different competitive effects and produce different kinds of markets", as well they "require different responses from incumbents"* (Markides, 2006). Less discussed but still important is disruptive business-model innovation. This type of innovation is thought to bring business-models that are fundamentally different from the existing ones. By differing from traditional way of satisfying requirements and

offering new marked approaches, disruptive business-model innovations attract new customers or/and increase consumption of current customer segments. Thus, it does not bring any new product to the market, but simply redefines the way existing ones are served to the customers. The disruptive technological innovation is often seen as the same as the previous mentioned, since it focuses on changes in processes and the way firms emerge and grow. The difference however lies in that "*disruptive technological innovations eventually grow to dominate the market"* (Bower & Christiansen, 1995), so that other players in the market are forced to respond to it in some way, for example by adopting it, copying or by trying to destroy it. The disruptive product innovation, which is another perspective, is discussed as a radical innovation type. If a product is seen as a radical innovation to both competitors and customers, then it is surely not driven by demand, but pushed through in order to develop new technology.

Markides (2006) makes an important argument on how the new technologies are used by firms of different scales. He means that while early pioneers, which often are small firms with expertise and emerging urge develop products with an emphasis of technical attributes and quality, the latecomers, often the big scale firms, turn the product into a simplified version with reduced cost and quality in order to provide it to the mass-markets. In this situation the winner is the latecomer who by "stealing" pioneers market share, increase the profit and reach mass market acceptance. Thus, the pioneers who often "overengineer" their new developments have to be satisfied with few market niches that latecomers are not interested in(Markides, 2006). That is why both parties should take a lesson of this finding and try to collaborate in order to maximize each their profits and satisfying their own needs and ambitions.

2.1.2 Practical approach

There are countless number of research initiatives on innovation, new developments and technological improvements in modern industries. We present some of the findings that in our point of view partly illustrate some of the important observations about innovation in practice.

Barlow (2000) studied how partnering between firms stimulates learning, innovation and performance. He argues that some industries, in particular construction industry, suffer due to

lack of innovation, as it is project-oriented in nature. In such manner project owners lose some of the control over flow and exchange of knowledge within the project. To this regard, innovativeness is limited to improvements at process level. Thus, it is common to serve different product solutions in regard to fulfil the same requirements given by different customers. This might often weaken learning processes as well as standardization and automatization of the processes in general.

That is why Barlow (2000) proposes establishment of partnerships between firm units in order to develop tools and techniques that will allow collection and integration of knowledge and skills needed to establish structures between those units. Such way of organizing the collaboration might be seen as a managerial solution for projects. It secures short-term improvements and stabilizes the performance, as well as it promotes both technical and business process innovation (Barlow, 2000).

Nevertheless, it is not enough to transfer and integrate the knowledge between the units as long as the partners do not comprehend the purpose of that process and do not appreciate the value that is carried with it. That is why there is need for some additional factors for succeeded knowledge transferring. Barlow (2000) mentions "absorptive capacity" that depends on firm's ability to engage and distribute the knowledge. Firms need "champions" who are represented by individuals responsible for promotion and implementation of partnership and all associated factors and experiences. The last factor is developing of standards and routines based on the repetitive business processes. This promotes innovation as an overall improvement.

Kline & Rosenberg (1996) and Nelson, et al. (2014) make an important but slightly distinct point about measuring the innovation. In both articles authors argue that innovation is difficult to measure because of its multi dimensionality and complexity, so that there is no simple and adequate measurement reference. Innovations consider a whole range of things that not necessarily are only physical developments. It may be associated with aspects like manufacture processes, activities and tasks necessary in development, material substitutions, and instrument improvements (Kline & Rosenberg, 1996).

Strand & Leydesdorff (2013) studied on allocation of innovation between firms and institutions, at different scales geographically. The study focused on knowledge exchange and interactions that simulates the innovation within the Triple-helix. The Triple-helix considers interaction between three legal actors: universities, industry and government, within the same country or region. Strand & Leydesdorff (2013) undertook their case at Norwegian Triple-helix. They found that the highest synergy in the knowledge functions between these three actors is placed at the western part of the country where medium-tech manufacturing firms are highly concentrated. In addition those counties are highest influenced by foreign factors operating in global markets.

Ford, et al. (2014) made a research on Australian oil and gas industry in order to find out how environmental regulations affect the innovation. They used *The Porter Hypothesis* (1991) as a background, and argue that "*environmental regulation spurs innovation and that innovation can outweigh the cost of compliance and provide benefits*". They differentiate between two types of regulations: "*command and control*" regulation that strictly specifies technologies and processes that should target given environmental specifications. Thus, this type of regulation represses the innovation developments. On the other hand there are "*market based regulative mechanisms*" that promote innovations by giving firms possibilities to decide the best methods to become environmentally efficient and achieve compliance. Authors make an important point that the social license, which builds on consumer awareness and firms' closeness to its customers, seems to influence firms' performance more than the traditional governmental regulations do. Proactive anticipation in order to achieve social acceptance of the innovations and to maintain the social license lies in firms focus though it is not even profitable. In this regard innovations become responsive to social and environmental requirements, while right undertaken managerial strategies make the innovation developers more viable in long-term.

Strand & Leydesdorff (2013) conclude with findings that somehow support *The Porter Hypothesis*, and at the same time prove that increased compliance with regulations promote innovation, at least in Australian oil and gas industry. This relationship is however very complex and includes competitive factors, collaborative activities and research and development (R&D). This means also that high level of competitive and internal capabilities of the firm, as well at its

collaborative ability, makes it more responsive to the environmental regulations throughout the innovativeness.

In their research on British high-technological industry Keogh & Bower (1997) claim that operators and contractors within the industry often hold back on innovation while fully exploiting the existing solutions in order to meet the changing regulations, conditions and requirements, additionally focusing on overall cost-effectiveness. However, all existing technologies have their exploitation limits that once reached create a need for new developments. There are however difficulties associated with adoption of the new solutions and technologies within that industry. Each new coming has to be evaluated reasonably and thoroughly since it might turn out that it is not even marketable after the resources are already invested in its development (Keogh & Bower, 1997). Although, firms seek that for profitable opportunity in innovation have to be willing to undertake the risk linked to necessary investments in things like new equipment, or increasing capacity and expertise.

2.2 Lean

2.2.1 Background and conceptual approach

Ever since Scientific Management, many different management concepts claiming to have the answer to success have been developed during last decades. Many of these concepts have according to Andersson, et al. (2006) different definitions, but the objective tends to be substantially comparable for all of them. For instance, the biggest trends in last thirty years, namely Total Quality Management, Six Sigma and Lean, focus on waste reducement and diminishing resource overuse while improving financial result and increasing customer satisfaction. These concepts also have the same origin: the quality evolution in Japanese industrial development after the World War II (Andersson, et al. 2006). Thus, we certainly can observe an evolution of a philosophy that through changing names and designs, continuously targets the maximization of profits and sufficient resource efficiency. As currently its most know name is Lean philosophy, we take a closer look at this interesting phenomenon and present some interesting findings by several international scholars.

The origin of the Lean philosophy dates back to the 1950s, after the World War II. The rise of the Lean philosophy started with a Japanese engineer that visited Ford's Rouge plant in Detroit, which was at that time the leading automotive producer with its mass production system. After the visit the Japanese engineer concluded that mass production would not work in Japan because of a lack of resources needed to produce according to the Ford-style mass production (Howell, 1999). Some of the biggest struggles in Japanese industry after World War II was shortage in resources - materials, labour and financial capital. Those issues caused a significant gap between the Eastern and Western competitors. These conditions led to the birth of Lean Production also called the Toyota Production System. Engineer Taiichi Ohno, who is nowadays considered the father of the Toyota Production System, developed Toyota Production System for Toyota. Ohno was dedicated to eliminate wastes ("Muda" in Japanese) and developed "The Seven Wastes" as part of the system. However, the exact term "Lean" was first presented by researcher John Krafcik in paper "*Triumph of the Lean Production System"* (1988), where Lean Production was described as a combination of cost cutting, reducing of inventory and high quality focus. The book "*The Machine That Changed The World*" by Womack et al. (1990) was the first to highlight the Japanese production methods. The book also compared and contrasted the Mass Production System seen in Europe and America with the Lean Production system seen in Japan (Melton, 2005). After the gap between Eastern and Western competitors turned dramatically with the benefit for Japanese manufacturers, the Western manufactures' interest in Lean increased drastically. The book highlighted particularly the performance gap between Toyota and other car producers. Krafcik's contribution in this field made the term Lean Production widely known all over the world.

2.2.2 Definition

But what actually is Lean? According to Pettersen (2009) Lean is a contemporary and well-known management concept that lacks a clear and concise definition that includes all arguments and factors argued by scholars. Thus, the currently available definitions are highly elusive (Pettersen, 2009). However, according to Womack et al (1990), Lean Production may be defined as "*a philosophy or as a strategy which depends on a set of practices used to minimize waste in*

order to improve an enterprise's performance". Graban (2008) defined Lean as "*a toolset, a management system and a philosophy*".

As presented in previous section, the concept of Lean Production was established for the Toyota Production System. The main idea of Lean philosophy concerns identifying of value added and non-value added activities in the value chain. When this selection is made, everything that does not entail value should be considered a waste and therefore be eliminated. Lean Production is primarily characterized by use of less input than traditional production (Womack et al., 1990; Womack & Jones, 2010).

Womack & Jones (2010) summarized Lean into five principles in their book "*Lean Thinking: Banish waste and create wealth in your organisation*". The purpose is to make it easier for managers to facilitate implementation of Lean in their organisation. Authors attempt to reduce leaders' feeling that they drown in crowd of various techniques, because they implement isolated bits of a Lean system without understanding the entire philosophy. The introduction of these principles placed customer value and waste reduction as a core of Lean philosophy. The five principles are; Provide the value customers actually desire, identify the value stream and eliminate waste, line up the remaining steps to create continuous flow, pull production based on customers consumption and to strive for perfection (Jooste et al., 2009).

Toyota still works toward the ideal, which is 100% value added work. By working with continuous improvement of eliminating waste, Toyota attempts to reach their ideal. According to this reasoning, perfect processes with no waste ensure maximization of customer value. Value added activities contribute directly to creating a product or service desired by the customers and everything that does not create value to the customer is considered to be non-value added activities, also called waste. Taiichi Ohno (1988) suggests that non-value added activities represent up to 95% of whole cost structure in non-Lean manufacturing environments. He identified seven forms of waste, in Japanese called "Muda", which consider following aspects: transport, waiting, overproduction, defects, inventories, unnecessary processing and unnecessary movement (Kilpatrick, 2003; Sayer & Williams, 2012).

Although, it is important to emphasize that waste can be split into two groups: waste, that is non-value adding but necessary for the company, and wastes that is both non-value adding and unnecessary. Lean Production system use a variety of techniques and tools for eliminating waste like: Just-in-time, cellular manufacturing, Value Stream Mapping, 5s, Kanban (Pull) systems, Kaizen, synchronous manufacturing, Poka-Yoke (Manea, 2013). These are innovations, resulting from a scarcity of resources and intense domestic competition in the Japanese automobile industry in 1980's. However, to achieve the gains, it is important that every enterprise implements the appropriate set of Lean tools and principles. Applying Lean to the business requires a fundamental comprehension of the philosophy that prevents from blind copying of Toyota's original system. The organizations that do not avoid this pitfall tend to have a tool-focused approach that causes failure to achieve the expected gains. Another common failure occurs when managers merely implement one or two of the Lean elements meaning that their companies become Lean. The reason for this way of acting is the multiplicity of Lean key tools which are not necessarily suitable for any organization. Firms need to find their own Lean tool case as well as their own manner to apply the chosen toolset simultaneously at all organizational levels. Implementation of Lean philosophy has a long learning curve and it is important that the corporate culture accepts the changes Lean brings (Abdullah, 2003).

There is a place for Lean principles in any activity. The two most prominent reasons why organisations choose to not adopt Lean to their business processes are the perceived lack of tangible benefits and the view that many business processes are already efficient.

2.2.3 Practical approach

After the success Lean made for Toyota Company it was quickly adopted by other automobile manufacturers all over the world. Its success has continued and after a few years the Lean principles spread to other manufacturer outside the automobile and vehicle industry, which experienced the benefits it can bring within business. Nowadays all types of organizations, from healthcare to government, find value from implementing Lean principles in their business. However, Lean is not near as predominant in other industries as it is in the manufacturing industry.

Womack, et al (1990) is one of the many who argue that Lean principles are applicable to any industry, also Arnheiter & Maleyeff (2005) claim that there is some misconceptions about Lean that should be dispelled. One of the first misconceptions they address to is that Lean is only well-suited for Japanese unique organizational culture. According to Arnheiter & Maleyeff (2005) this is proven to be wrong, because in fact some of the most successful Lean management implementations have been within non-Japanese companies. Rolfsen (2012) also argue in her studies that Lean can be difficult to implement in other cultures than the Japanese. However, difficulties and cultural differences do not make it impossible to implement Lean in any part of the world. Every organizational change is associated with a range of challenges.

There is also a misconception that Lean is developed only for manufacturing, Arnheiter & Maleyeff (2005) believe that in any business aiming to please their customers can successfully practice Lean management. Another common misinterpretation of Lean is that it can be applied only within certain environments. However, as argued by the authors, every organisation would benefit from reducing unnecessary waste in their organisation, hence reduce the organizational time cycle.

Any type of organisation could benefit from the whole range of Lean principles. However, some scholars argue that Lean approaches may not have universal applicability for all organisations. Richard Cooney (2002) argues that the possibility to become "Lean" is highly dependent upon business conditions that are not always met, thus limiting the "universality" of the concept. Cox & Chicksand (2005) argue in their article that there can never be any single best way of managing business strategy. This is because the business environments are in constant change at any time because of increasing globalization and the competition arena is complex. This requires organisations to be conscious about which strategy to choose in order to achieve long-term success. *"Managers, therefore, should have an open mind about whether or not they should adopt any particular operational means"* (Cox & Chicksand, 2005). Thus, Cox & Chicksand (2005) claim that Lean cannot be universally applicable in every organisation in every circumstance. Therefore it is crucial for firms willing to adopt Lean to have extensive knowledge about the philosophy and its complexity. Thus, an intern Lean expert may be the key to successful implementation.

Abdullah (2003) takes another approach in his article *"Lean Manufacturing tools and techniques in the process industry with a focus on steel"*, claiming that there are certain Lean techniques and tools that are more universal than other. He argues that tools like 5s and visual system are more easiest to adopt, while other tools may be more challenging because of their complexity and the need for expertise. Hence, some of the complex tools would be more adaptable in particular sectors, while in other the same tools could be harder to implement and less suitable. Nevertheless, Lean thinking in fact fits best for manufacturing organisations, but it is also proven to be successfully implemented in other industries.

2.3 Lean product development

Lean product development is when the tools from Lean production are used there, like waste elimination, process standardization, resource management and continuous improvement. Both Lean production and Lean product development has its roots from Toyota, who have been successful with the implementation of Lean in both areas. The Lean product development was first introduced in the influential book *"The Machine That Changed the World*" (Womack et al., 1990) the same book as the Lean philosophy itself. Therefore the idea of implementing Lean in product development and the benefits is not a new idea, but have compared to Lean production received very little attention. Because ever since the concept Lean production was introduced it has gained widespread attention both in literature and in practice, and it can also be fair to say that it has become a dominant strategy for organizing production system (Karlsson & Ahlstrom, 1996; Haque & Moore, 2004). The implementation of Lean thinking in innovation management has not been executed systematically so far. There is a lack of comparable examples for organisations that have succeeded with Lean in product development, unlike in production where there is a broad availability of examples (Morgan & Liker, 2006).

Schuh, Lenders & Hieber investigated this in their article "*Lean Innovation: Introducing Value Systems to Product Development" (2008)* by asking 143 German manufacturing companies, where only a third had begun to systematically identify waste in product development. Even do Womack and Jones stated in their book "*Lean Thinking: Banish waste and create wealth in your*

corporation" that Lean in production shops was only one chapter and that the focus was Lean in the whole enterprise (Liker & Morgan, 2006). Liker & Morgan (2006) argue in their article that Lean implementation cannot stop at the shop floor and that many manufacturing organizations have learned this the hard way. Isolated application of Lean will not lead to sustainable improvement. Lean in product development should be a part of a whole production strategy. Businesses that already have had success with Lean in production wants to apply the tools in other parts of the business and especially in product development. Lean thinking in product development can help the organizations deliver new products faster, which is a strategic import weapon in today's globally competitive environment where speed is everything.

Implementing Lean in product development can have many benefits beside from faster development process and less engineering hours. Better collaboration between different areas in the business can lead to better products with higher quality, fewer problems and that can offer better value to the customer because of improved manufacturability. But implementing Lean is not done in a day, both Toyota and other Japanese auto manufacturer has used many decades implementing Lean to achieve these and other benefits. Implementing Lean in product development is not the same as implementing Lean in production. Product development is an unpredictable area with high uncertainties and risk, which requires a different approach to implement Lean than in production. One big challenge with Lean in product development is to be able to reduce variability and to standardize the processes while still preserving the creativity process (Karlsson & Ahlstrom, 1996; Liker & Morgan, 2006).

2.4 Knowledge Based Development

By analysing responses in our two pilot-interviews, we observed that the informants several times used Lean and Knowledge Based Development (KBD) interchangeably. KBD was described as a technology, which meaning considers collecting, organizing, recording and re-usage of knowledge within engineering field. That resembles a general standardization of some of engineering processes in order to increase efficiency and customer value, what, as discussed previously, is also central aspect in Lean philosophy.

Searching for existing research on KBD gave us rather limited results. However, we found out that Knowledge Based Engineering is another name for the same phenomenon. Although both terms are have roots in Knowledge Management trend established in the late 1980s (Verhagen et al., 2012), there is much more research done on KBE than on KBE. The reason that our informants rather use KBD term is, in our opinion, a local character and popularity of it in the environment of companies we collected data from.

KBE was primarily developed as a technique addressed directly to programming and computer design field, in regard to automate repetitive, non-creative processes and achieve multidisciplinary integration, and by that save time and resources that may be used productively on creativity in various design phases (Verhagen et al., 2012). After some years however the technique became adopted also by other industries. That is because of its ultimate objective concentrated on reduction of time and cost in product development by capturing, retaining and re-use of knowledge, is suitable and desirable in any industry. Implementation of this technique requires a comprehensive analysis of processes, knowledge sharing culture and collaboration networks in the organization. Successful implementation results usually in standardization and clarifying of processes and technologies, as well as support for decision-making. Diminished design time and re-usage of traceable shared knowledge allows to respond quickly to specific and various requirements.

Krogstie et al. (2014) link KBD with New Product Development practices where knowledge flow is constant, but there is often *"lack of adequate processes for communicating and documenting (re)useable knowledge that may cause repeated problem solving, vagueness of own capabilities, etc."* In such case, engineers spend unreasonable amounts of their productive work time on collecting and organizing of information. As the result firm's performance and creation of customer value does not increase properly over time. That is where KBD "*aiming to reuse and improve existing product and manufacturing knowledge*" (Krogstie et al., 2014), may be used as a solution. As presented in previous chapter, Barlow (2000) discussed the importance of the interaction between innovation, learning and performance in high-technological firms. He does not refer to KBD concept, but the some of the main points in his research includes precisely the same process of capturing and organizing the knowledge for further use.

Krogstie et al. (2014) discuss also excessive compatibility of KBD and Lean Product Development, which we discussed in previous part of this paper. The reason of such near relation between those two concepts is in fact knowledge. If re-used in order to avoid task duplication and to save resources, knowledge enables firms to obtain high competitiveness. That corresponds with the process standardization and interdisciplinary collaboration at various organizational levels, which are very common aspects in Lean philosophy in general, as well as in Lean Product Development. As a result firm can spend more time on innovation and avoid reworking products, and rather focus on adding value.

In order to capture, organize and reuse knowledge, a concrete collaborative tool is needed. Authors present the knowledge brief (K-brief) that should be a standardized, objective and well-formulated document that visualizes the problem and the goal as well as corresponding processes and risks. Such tool gives and unique opportunity to transfer tacit knowledge into explicit knowledge within the organization. Here comes also the aspect of high need for organizational environment that promotes knowledge sharing. An important thing to reflect on is that leaders and non-leaders have different views on "how the things are done", which means that *talking about* and *working with* the things are often two highly different standpoints (Krogstie et al., 2014). That is a side aspect we attempt to uncover in this research.

2.5 Research on interaction between Lean and innovation

We have by now presented two concepts that can be applied in any industry. In our further discussion we combine these two, in order to investigate how they correlate within the business context. Literature review reveals conflicting opinions in this field. Because of the demanding character of Lean and the need for free expression and creativity assigned innovation, this relationship might seem rather controversial. Scholars do not seem to find the unambiguous answer for this problem, however, its it broadly proven that Lean may have a noticeably positive impact on innovative abilities of firms. In order to establish a proper framework for the present work and illustrate the differing point of view within this field, we present several studies that both confirm and undermine the negative interaction. The reviewed studies contributed to

increase our comprehension about the controversial relationship between the chosen concepts and corrected our previously engaged misconception about the negative character of the relationship. Although, multiple studies strongly criticize application of Lean in innovative environments. Usually it is determined by the manner the application is conducted, as presented in further in this chapter.

We find paper by Chen & Taylor (2009) the most significant for our thesis. Authors of this paper attempt to *"explore the impact of Lean innovation on innovation capability"*. It start with the argument that both of our chosen concepts are "driving forces of today's business success", but the interaction between them might be negative if the combination is not conducted correctly. Since Lean ideology focuses on removing waste, uncertainty, and non-value adding activities, it might be seen as the roadblock for all types of innovation activities that require mainly freedom for creativity, risk-taking, and uncertainty while testing the new ideas. Chen & Taylor's (2009) research investigates the possibility of maintaining the Lean practices while promoting employee creativity and innovative development of all kinds. There is made a point at the fact that going "too Lean" can certainly be injurious for any company, so there has to be developed a plan of combining those two concepts in a balanced way.

Chen & Taylor (2009) distinguish between Lean and innovation based on observations from Toyota Production System, where the Lean idea comes from. Their observations concern the company's approach to compromising and finding a way out from conflict between principles of Lean and principles of innovation. As Toyota's core Lean principles required waste cutting, product improvements based on benchmarking and standardization, the innovation development at Toyota was outsourced to other companies.

Impact of Lean on innovation was widely discussed by Chen & Taylor (2009) who by comparing the concepts against each other, illustrated how different and countervailing they are. The whole point of this conflict can be present in one sentence: *"The fundamental objective of waste elimination is usually translated into a Lean culture that reduces any forms of slack, risks, and variability, all of which are important to facilitate innovations"*. Lean however focuses also on continuous improvements that result typically in incremental innovation at process level.

Standardization of procedures, materials and parts though keeps the innovation in check, not requiring from engineers developing new technical skills or changes in architectural linkages. Lean ideally bases on developing for demand and requirements for customers. That again might be risky for the innovative approaches, which are based more on push than pull principles. Though, if customers are wrong, the requirements seen as ultimate are wrong too. Companies basing their products only on customers' demands able most likely will not be able to develop a breakthrough. That means also that they lose the possibility to achieve long- term competitive advantage caused by surpassing their competitors. It is also acknowledged that extensive Lean implementation harms individual creativity within the firm, while employees become less involved and less committed. At the same time it might cause increasing level of stress, which drives "creative tensions" but only in controlled amounts. Too much Lean gives too much stress and this again gives less creativity. That is why human resource managers have to take care of making their employees feel important respected and challenged by the company without stressing them out with too rigorous Lean implementation (Chen & Taylor, 2009).

The authors propose some solutions to compromise Lean and innovation while obtaining a sustainable competitive advantage, cutting costs, increasing market size and enhancing customer loyalty. First of all, the type of innovation has to be identified to match a suitable Lean management practice. Thereby, the appropriate corrective initiatives can be undertaken. Outsourcing innovation is thought for dynamic industries where changes appear suddenly and often. The firm *"outsources a significant part of its product from its suppliers, and relies on their knowledge and expertise to define new technologies"* (Chen & Taylor, 2009). This strategy can however kill all the rest of creativity within the company, as well as weaken its core competencies and the ability to react on new comings for the actual markets.

Another strategy focuses on establishing an Independent Innovation Centre (for example Temporal Think Tank (T3)) where interdisciplinary teams formed with firm's employees' working together temporally in order to generate creative and innovative solutions and ideas. Lindeke et al. (2009) discuss this method broadly and conclude that it facilitates innovation at different firm levels and promotes different types of innovations. This is caused by the fact that T3 members with extraordinary level of creativity and multidisciplinary backgrounds are

organizationally independent while given all the freedom to create and generate ideas. That is also supported by Amabile's (1996) claim that good work environment promotes individuals' creativity. Simultaneously, members' ideas are encouraged, safeguarded, and continuously processed because of the temporary character of the venture. This strategy strengthens company's creative ability at many levels, and the resources placed in it are not seen as waste since they generate long-term benefits and customer value.

Lean Innovation System is another approach, which can balance innovation and Lean within the firm. The point is to interpret and incorporate Lean principles into innovation development processes. *"It applies the Lean concepts to the R&D facilities to generate product differentiation with reduced resources and waste"* (Chen & Taylor, 2009). In this way idea creation becomes a value-adding activity that is positive from Lean perspective. This approach is also widely reported by Schuh et al. (2008) in regard to Lean Innovation concept, which is thought to implement Lean Thinking (principles about cut in waste and non-value- adding activities) into the R&D activities within the firm. Authors made a survey research on German manufacturers, and found out that their customers use only 70% of provided product functionalities. That means that remaining 30% can be called "overengineering" and with the same "waste" or "not value adding". Thus, the focus on customer value that is a central aspect of Lean seems to hinder efficiency in R&D. That is where implementation of the Lean Innovations System can be a solution. By "securing early" the aims, requirements and structure, "synchronizing easily" the activities with use of value stream mapping, and "adapting securely" the robust product, the firm's R&D may get more systematics and transparent, even with reduced disposition of resources. Simultaneously, customer requirements need to be fulfilled in regard to Lean Thinking principles. Implementation of value system, which identifies and defines both customer values and requirements, is helpful here. Requirements however should not be transferred directly into product specification. Transformation into technical requirements and appropriate management is needed intermediately. This shows how Lean thinking focused on customer value can be helpful in improving the structure and efficiency of innovative R&D activities.

The last strategy provided by Chen & Taylor (2009) is Innovative Product Development Process, which increases firms' capability for product innovation. According to this strategy, innovation needs to be applied wherever customer requirements or potential improvements are identified.

2.6 Lean Theory vs. Innovation Theory

In the article *"Creativity, innovation and Lean sigma: a controversial combination"* Johnstone et al., (2011) state the fact that Lean and innovation are two inherently conflicting theories. The authors highlight the genuine shared concern that the standardization and reduction of variability associated with Lean can suppress innovation and creativity in an organization. The authors bring up challenging industrial environments where organizations meet a range of demands which fulfilment is crucial for their growth. It is expected that successful firms satisfy multiple customer groups' requirements, are more innovative than competitors and at the same time continuously increase their cost effectiveness. Lean with its focus on continuous improvement has successfully revolutionized the cost and quality in the manufacture industry in recent decades. On the other hand, the increasing cost savings can as many believe kill innovation and creativity which are important in today's challenging markets. The authors argue that there does not need to be a trade-off between Lean and innovation. They claim that application of the continuous improvement philosophy can support innovativeness, and even facilitate its boost.

Analysis of several firms conducted by Byren et al., (2007) reveal that the most successful companies implementing Lean, are the companies that on purpose extended Lean principles into their innovation agenda. Pfizer is an example of a business that successfully implemented Lean without suppressing the innovation and creativity in the firm. On the contrary because of well-implemented Lean, Pfizer was able to stay ahead of their competition by continuously innovate while cutting their R&D costs (Barnhart, 2008). Thus, some of the Lean principles can help increase innovation if implemented properly according to the industry. The question therefore is - must Lean in R&D deviate considerably from Lean in manufacturing? The principles like reducing waste and reducing batch size are suitable for both R&D and manufacture companies. However, significant reduction of variability executed in R&D with the same manner as in

manufacturing would cause a considerable loss of value added R&D activities. Therefore this principle of Lean has to be implemented differently in the R&D (Reinertsen & Shaeffer, 2005).

Reinertsen & Shaeffer (2005) further argue that some of the approaches that gain benefits in Lean manufacturing actually do harm R&D, whereas other approaches may bring more benefits in R&D than in manufacturing. That considers mostly the concept of waste and the way of eliminating it in case of R&D. That is also proved by Lewis (2000) who performed a five year long research on three different companies in order to find out among others how implementation of Lean manufacturing principles would impact the company's' innovative abilities. The revealed result was as expected contrasting, as out of three firms only one succeeded since it adopted only some of the principles achieved success. Although its long-term competitive position was strengthened only in terms of increased innovative abilities, while the profitability did not change significantly because of implementation of Lean. The remaining companies that failed mostly because of the inappropriate and rather profound approach to the philosophy. The internal driven process in one of the failed companies required engagement of plenty additional resources. That resulted in unnecessary increase of company's complexity. That further impacted negatively the overall performance, primarily the innovativeness. The last company experienced an overall reduction of innovativeness, however it was not that dramatical.

Both Johnstone et al., (2011) and Reinertsen & Shaeffer (2005) present examples of how Lean principles can stimulate innovation. Lean principles may contribute to risk aversion and enhanced innovation by reducing cost, cycle times as well as they endorse continuously improvement and learning. The continuous improvement philosophy can be interpreted and implemented to support and promote innovation. Lean thinking encourages deep, root cause exploration of problems and helps to select the problems that are most important to address instead of jumping right to the wrong conclusion. Lean philosophy regards problems as sources of learning and inspiration that can stimulate new ideas that are rich and constructive. Lean philosophy also means that the employee closest to the problem should also handle it. Involving the employees in problem solving and giving them flexibility and autonomy to handle them, leads to more involved, motivated and committed employees. Individual's propensity and desire to think and act innovatively is according to Johnstone et al., (2011), driven by the environmental

conditions they experience in the organization and their motivation. Lean organizations in general report high levels of employee engagement.

Standardization in Lean does not necessarily consider doing the "same right thing" all the time. Combining it together with continuously improvement ensure that everyone conducts their work in line with company's best practice. It makes employees strive to improve upon every day and communicate their proven improvements. Continuous improvement of the organizational processes can lead to good underlying processes, which can reduce frustration and enable the employees' contribution. Poor processes cause frustration amongst the employees, which can have a negative impact on their creativity and innovation. Lean focuses on eliminating waste and increasing of the capacity in the organization by releasing human, time and material resources. The released resources can then be utilized more effectively in other processes and tasks. There is a golden opportunity for managers, especially in R&D organizations, to take advantage of the increased capacity and create more time and space for innovation, instead of exploiting the capacity in old-fashioned way. Operating at maximum level can lead to disadvantages like restricted flexibility and freedom and the inevitable creation of queues and waiting when problems arise.

Lean philosophy affects innovation and creativity in the organization. Some organisations have experienced negatively the adoption of Lean in innovation, an example is the company 3M, which is an company that was often considered as being one of the most successful innovators over many decades, until they implemented Lean and experienced a significant reduction in innovation (Johnstone et al., 2011). Even Toyota who is the father of Lean and considered to be one of the most innovative automobile designers have problem to make time to create completely new ideas, and do according to Mehri (2006) tends to purchase innovations from smaller firms instead of supporting innovation from within the company.

According to Chen & Taylor (2009), Lindeke et al., (2009) and Schuh et al., (2008) implementation of Lean in any business will affect its innovativeness to some extent. Authors claim that reducing waste that is not value adding to the customer will suppress innovation because innovation requires freedom for creativity, risk-taking, and uncertainty while testing

new ideas, activities that according to Lean is waste. The high focus on waste reduction is one of the reasons why Toyota is forced to purchase innovation from smaller firms (Chen & Taylor, 2012). Chen & Taylor (2012) also mentioned in their article that certain types of innovation are less likely to occur in companies that have implemented Lean.

2.6.1 Conclusion

There are many different opinions amongst authors and organisations about how management philosophies affect innovation and creativity in the organization. Some organisations have negatively experienced adoption of Lean in innovation. According to Chen & Taylor (2009), Lindeke et al. (2009) and Schuh et al. (2008) implementation of Lean in the business will affect innovation. They claim that by reducing waste that is not value adding to the customer will suppress innovation. Innovation requires freedom for creativity, risk-taking, and uncertainty while testing new ideas, activities that in Lean are considered to be waste. The authors Reinertsen & Shaeffer (2005) and Barnhart (2008) take other approaches and claim that Lean philosophy can affect innovation in the organization in a positive mater. Innovative companies can gain advantage by becoming more effective with lower cost and shorter cycle times. They support these statements with examples of how Lean principles can improve innovation and creative thinking. All the articles come up with guidelines of how to adopt Lean without suppressing innovation and claims that the success of Lean implementation will depend on capable and experienced change management, leadership and knowledge of effective culture change.

2.7 Value creation configurations

The concept of value chain was first presented Porter in "*Competitive Advantage: Creating and Sustaining Superior Performance*" (1985), which, in addition to resource based theory (Barney, 1991) and competitive analysis (Porter, 1980) started a new chapter in modern strategy field. Since that time, the framework for value creation analysis developed by the acclaimed researcher became an outline for configuring firms' activities and identifying value adding processes. But shortly after, the simplicity of the framework has been discussed and criticised by scholars (Stabell & Fjeldstad, 1998; Normann & Ramirez, 1993). The critics point that traditional value

chain focuses extensively on aspects considering unit costs, without considering extraordinary value creation, such as innovativeness, findings or relationship development (Stabell & Fjeldstad, 1998). Normann & Ramirez (1993) also discuss flaws of the traditional view on strategy where business was positioned in a value chain. They argue that uncertainty, continuous changes and no reliable forecasts that force firms not just to add value throughout the business process, but rather *reinvent* the value. In that regard, there is needed a value creating system which engages many actors who possess adequate skills and resources to co-produce value.

In regard to fill out drawbacks in the traditional value creation analysis, Stabell & Fjeldstad (1998) present two following configurations: value shop and value network, which are complementary for the value chain model. In the present work we decide to employ two value creation logics in order to establish a framework that facilitates comparison of different organizational units of the companies investigated in our project. The chosen configurations are value chain for sequential formed unit, in example manufacture or testing department; and value shop for more complex and interdisciplinary unit like R&D department. Those configurations are engaged to serve as control variables allowing us to distinguish between Lean in manufacturing and Lean in R&D.

Also Normann & Ramirez (1993) present different possible strategies for value creating system configurations: linking together knowledge and relationships (example: French Concessions) or/and combining competencies and customers (example: IKEA). That is because in their point of view it is not the firms who compete with each other, but it is their offerings that go against each towards the customer. Furthermore, minority of companies provide a wide range of multiple offerings these days. It is most common to bring fewer but intelligent and attractive offerings that involve both customers and business partners. The last point that Normann & Ramirez (1993) make about change from value chain to value configurations is the necessity of combining and mobilizing multiple activities that create value. Therefore in order to obtain sustaining competitive advantage the firm is obligated to first establish a dialogue with their customers. Secondly, there is needed a strictly planned and organized force which is essential to create the value (Normann & Ramirez, 1993).

The authors in both points of view consequently argue that value chain model is not well suited for every business model or each industry. The model splits business process into two types of activities: primary (inbound logistics, operations, outbound logistics, marketing and sales, service), which directly contribute to value creation; and support (organization, human resources, technology, purchasing), which facilitate and support the primary activities (Porter, 1985).

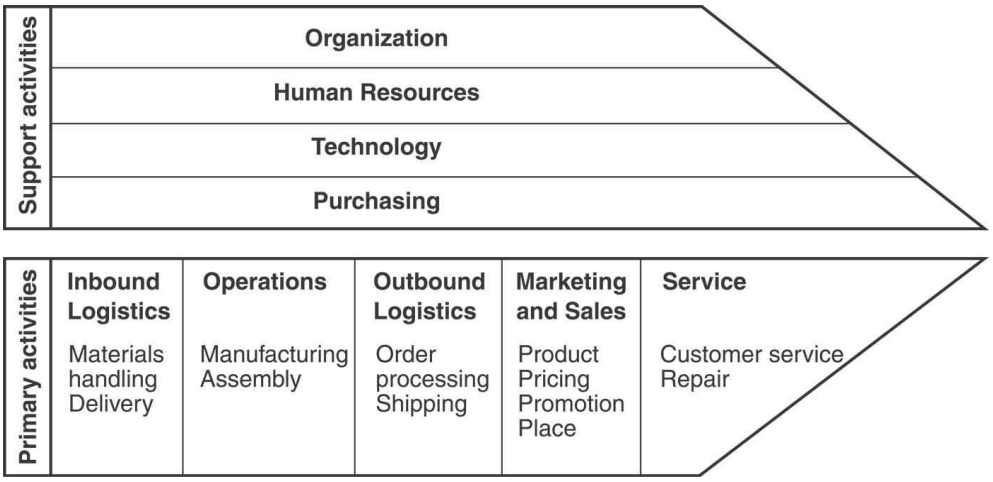


Figure 1: The value chain diagram by Michael E. Porter (1985)

This is an important classification, since those pieces contribute to firms positioning in order to cost-leadership or differentiation, as well as shape the competitive advantage. Although, those groups of activities are further described each by five generic categories. That often makes it difficult to adapt this framework to, for example, firms within service or R&D industry. Authors describe value chain as traditional and mostly conceptual. In this regard, it is best suited for manufacturing companies, because of transforming inputs into products, which transfer value from firm to customer, as well as because of its linear and sequential nature. In this context failures are visible and can be discovered immediately. Technology development in this configuration shall increase the price or reduce the cost (Stabell & Fjeldstad, 1998), what is characteristic for cost leadership strategy. Value creation is placed in block-structured process, which decomposed presents particular steps where value is added. This configuration allows identifying not only the flow of production, but also the critical activities, interdependency between them, and strategic point for improvements, but it does not help to reengineer the business process. That is why Stabell & Fjeldstad (1998) decided to transform value chain

analysis into value configuration analysis, which purpose is to diagnose and improve firm's competitive advantage, which is relative for each industry and any value creation logic.

In order to that, authors presented value shop and value network, as additional value creation logics. Value shop model was named after analogy to car shop where problems and solutions are matched and assembled together (Stabell & Fjeldstad, 1998). The model is most common for firms applying intensive technology, where focus lies on solving particular and complex problems given by customers. In other words, it concerns particularly the R&D oriented activities, which in the value chain model are considered to be support activities. In value shop primary and support activities are coperformed, because of the structure and aim complexity, especially when it comes to human resources, marketing and development. Elements of the model are iterative, cyclical, protracted processes, where output is often immaterial, and waste is discovered subsequently.

Following figure presents composition of primary (problem finding and acquisition, problem solving, choice, execution, control) and support (infrastructure, human resource management, technology development, procurement) activities in value shop model:

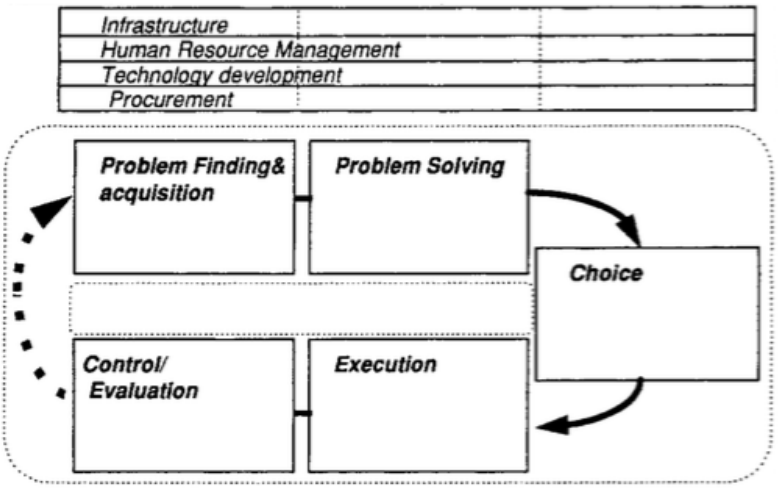


Figure 2: The value shop diagram, by Stabell & Fjeldstad (1998)

Product of value shops is the knowledge developed through composition of activities and resources that together provide solution for the unique problem (Stabell & Fjeldstad, 1998). Here, in contrast to value chain, activities are not fixed in a sequential order but scheduled freely according to specific needs and requirements.

In this model, filling the precipice between present state of matter and the aspired or desired state creates value. Because of its specific circular arrange presented in Figure 2 above, learning, relationships, reputation, high quality personnel drive value within this model. In relation between customer and the firm the strongest attribute that contributes to this kind of value creation is information asymmetry. The customer sees the value shop firm as a specialist possessing the abilities and knowledge needed to provide solution for the particular issue. Cyclical and iterative character of activities determines the interdependency based on feedback and information exchange. Therefore it is common to assign full-time cross-functional teams in value shops (Stabell & Fjeldstad, 1998).

Value network incorporates mediating technology in order to provide networking services among customers distributed in space and time (Stabell & Fjeldstad, 1998). The firm adopting this model becomes a mediator to its customers, whereas both parties are obligated to follow mutual set of regulations. The best example of such configuration is bank and insurance services. Linking services provided simultaneously at multiple levels are the core of value creation, and the charges depend on user's access and frequency of use of services. Standardization of mediating technology is an important factor that secures the operations' reliability as well as facilities matching and monitoring of linking. A simple failure i synchronization may destroy the whole system of coproducing, layered and interconnected networks. This model is not taken in consideration within this study; therefore we choose not to present it in detail like the two previous models.

Joint factors for all three configurations are focus directed on critical value activities divided into two types: primary and support, and the estimation of value drivers. The models presented by Stabell & Fjeldstad (1988) and configurations by Normann & Ramirez (1993) are developed in order to handle external changes and uncertainty in any industry. What differentiates them is

organization of primary activities that are determined by the different economics and industries. However, it is possible to organize the firm as a hybrid, with use of different configurations. The overall firm structure can easily be structured according to value chain, while a single department, like R&D, would possibly ba a value shop (Stabell & Fjeldstad, 1998). This may provide a unique competitive advantage for the firm cleverly operating these options.

3. Methodology

The purpose of this chapter is to provide a thorough description of the methodological choices and the research process we conducted for this research. Initially, we introduce at the research design and sample description for our project. Further the data collection method, data preparation and analysis are presented. Finally we discuss quality assurance of the study with focus on validity, as well as a review of research ethics is made at the end.

3.1 Research design

Our research question is designed in the background of the theory from earlier chapters and is as follows: *"In what ways does Lean influence innovation processes, and is the influence dependent on the value creation logic of the enterprise?"*. Our goal with the study is to explore and elaborate the subjects and therefore we choose an explorative study design. Explorative studies are most suitable when there is little knowledge about the field, and where the goal is to create insight and understanding of a problem. Exploratory design is thus an inductive approach.

Explorative studies start with a literature research to expose existing research about the current subjects, and find out whether there is data collected by others about the subject. Next step is to collect own data by using depth interviews (Thagaard, 2013; Jacobsen, 2005). When the aim and design of the research project is decided, we can discuss what method to choose when collecting the data. In order to obtain a broader knowledge about the chosen research objects, we started our thesis with a literature review where we collected secondary data from different researchers. In that way we established a basis for next step, which was the collecting of the primarily data.

When it comes to research methodology, we can choose between three different approaches, quantitative, qualitative or a combination of both. Quantitative research bases on measurement and analysis of causal relationships between variables, not processes, and is best suited when the researcher have extensive prior knowledge of the subject and when the problem is relatively clear (Jacobsen, 2005). Qualitative research can be conceived as a multi-method research, which uses an inductive and interpretive approach to its subject matter. Qualitative research is most often conducted amongst people rather than in laboratories. Qualitative methods intent to go into

depth of current theme and emphasize the significance, therefore qualitative depth interviews and focus groups are the most common data collection methods (Denzin and Lincoln, 1994).

In the present study we applied qualitative approach, since qualitative methods have proven to be best suited for obtaining depth information of a phenomenon or a situation where there is little or none existing knowledge. We investigate how different participants, such as managers and employees from different business and departments perceive the interaction between Lean and innovation, thus, comparing a single phenomenon in several contexts. The same standardized interview guide was used for all informants; therefore we mean that it is natural to avail ourselves of a comparative design. According to Mills (2008), comparative research is important to virtually all types of qualitative research and is a broad term with the purpose of examining similarities, variations and associations between selected units. It is natural to have a small range with few units, where we obtain depth information, instead of width, like in case of quantitative population. The core of any comparative design is to find theoretical interesting features about analysed units, which can be used to explain the outcome of the study (Ringdal, 2007). Within comparative research the main task is to compare a set of data with the remaining data to find potential similarities and differences. Data can be in the form of an interview, a statement, a theme, or another specified entity. Comparisons are thus used to create categories and conceptualizations, thereby investigate potential relationships between these categories (Mills, 2008).

3.2 Sample description

A general problem in every research is the fact that we rarely can examine all the people we would like to. This is especially true for qualitative methods, which in itself is costly to implement. In every research, the researcher must choose a sample based on different strategies. Qualitative studies are based on strategic selections, which means that we choose informants whose characteristics or qualifications are strategic to the research question, and that strengthens the understanding of the phenomena to be illuminated. Since the researcher in qualitative studies wants to go in depth rather than in width of the theme, the focus on generalization and representative selection is less important than in quantitative studies. The purpose is often to

detect phenomena. Although, in qualitative research it can be more difficult to find person that are willing to set up as interviewee than in quantitative research. This is because qualitative studies concerns more personal and partly intimate topics (Thagaard, 2013).

On the basis of theory and experience, we as researchers should specify the characteristics that the potential sample group possesses, which are significant for our study. For our research it was important to select informants based on their knowledge of the field. We chose informants who can provide information of both practical and theoretical character. We combined the sample selection in regard to informants' organizational position (leaders and non-leaders) and the departments they work for. In this manner we wish to observe the potential differences between approaches of those two groups. We also distinguish between previously presented value configurations, where value chain is associated with manufacturing/test department, while value shop equals R&D department.

We chose to conduct our research on three companies within the high technological industry in Norway. Our choice is motivated by prior knowledge of this industry achieved under education process as well as our interest in this industry. The choice is also motivated based on the companies' prior knowledge about our two subjects Lean and innovation, both practical and theoretical. Our own definition of the high technological industry is as follows: *a sector of economy including different technology sectors who develop and utilize the most advanced technology available and have the most potential for future growth.*

The chosen companies had different business models and strategies. Company 1 provides engineering services within development, testing and manufacturing of products. They are positioned as partners in business, what means that they do not own the developed products. That set them in position of partly external consultant responsible for given parts of the process. They do not manufacture final products in-house, although they take full responsibility for testing. In company 1 we interviewed two leaders and two non-leaders. We interviewed leader 1 and non-leader 1 from Purchase, Production and Testing, what we identified as value chain; and leader 2 and non-leader 2 from System Architecture, considered to be value shop.

Company 2 is a global provider of world-class products in high technological industry. They cooperate with the biggest respectable global actors. The company is responsible for every part of the process, beginning at the idea and ending at the final mass produced product. In this company we got a chance to speak with only one person, leader 3 with responsibility for a engineering team, identified as value shop. In company 2 the work workload is distributed between several cross-functional teams, therefore each team is responsible for the entire process from idea development to manufacturing and test. In this regard leader 3 has insight in both manufacturing and R&D, and provided answers considering both approaches to Lean. Leader 3 is also highly interested and involved with Lean activities locally in his company as well as nationwide.

Company 3 is another global market leader and a leading provider of technologies and services. Likewise to company 2, they develop products from idea to finished commercial product. Both companies develop both mass production products and single highly customized devices. At company 3 we conducted our pilot-interviews with informants possessing expert knowledge within researched in this paper field. We interviewed non-leader 3 responsible for coordination within Improvement and Business Excellence. He started as a Lean-expert in company 3 in 2005. He has the Chicago Lean Six Sigma Black Belt Certification, which gave him a great competence within this field. We also interviewed leader 4 who globally manage program for System and Product Lifecycle. His objective at the time was to guide implementation of Knowledge Based Development in the engineering units of the company. To link those two informants' positions to the value configurations, we consider non-leader 3 associated with value chain because of his responsibility within manufacture department. Leader's 4 position in the other hand is considered to be associated with development and engineering, what in our paper equals the value shop.

This selection of informants is rather limited because of restraints in time we met during this process. Although, the data we were able to collect by interviewing those informants gave us a partly varied and complementary answer to our research question. In addition, the division of organizational units with regard to the value configurations led to broader and more comparable results. Significant findings are discussed in further sections of this thesis.

3.3 Data collection

The following section presents methods of collecting qualitative data. We focused on a single informant interview method, which was used in the present work, though other possibilities such as group interview are also partially presented. Different interview guide configurations and practical aspects of interview scenario are discussed in this part.

Data can be collected in both a passive and active way. However, according to Yin (2011) the passive data collection, most often conducted by observation is not considered a direct qualitative data collection method. The most common active data collection technique in qualitative research is interviewing, which is also used in this paper. Beside it is also popular to conduct observing and collecting and examining of primary and secondary data (documents, artefacts and archival records). The possibility for conducting pilot-interviews allows the researcher to test the interview guide, as well as to complement potential knowledge gaps about the research object (Yin, 2011). Because of our lack of experience and limited comprehension for the researched field, we employed this possibility in the present work. The two pilot-interviews conducted at company 3 were the first phase of interview process.

While interviewing, information between researcher and informant is characterized by asymmetry, in the sense that the researcher defines and controls the interview situation with use of previously selected topics and questions. It is desired that the informant is open-minded, trusting and conversant. In the beginning the confidence is usually unilateral, therefore interview situation requires trustful atmosphere. The informant has control over the information that he or she will convey, while the researcher controls his own reactions and views. This creates bilateral confidence (Thagaard, 2013).

Another aspect is structure of qualitative interviews. Researchers need extensive knowledge of the principles that determine good questions and the formation of interpersonal relationship. Yin (2011) distinguishes between qualitative interview and structured interview. Those two types have the same aim, but they differ in the way interview is conducted. The first method is an open conversation, where topics are predetermined but the dialogue move freely. Researcher makes sure to reveal all topics during the interview but the sequence is not important. Questions can be

adapted along the process. The second method has a relatively structured manner, what means that the questions are designed in advance and the order is determined. The informant may answer freely on precisely configured set of questions. This provides a standard that enables the comparison of responses from several informants. This form is characterized by strong asymmetry and the focus is that the informant tells events from the past.

There is also a third option that combines the two. Partially structured method implies that the sequence of questions is determined along the interview, which ensures flexibility (Thagaard, 2013). The themes are basically determined; therefore the researcher must make sure to get information across all topics. This form is the most popular. It builds on interaction between researcher and informant that characterizes the answers and further also the interpretation and analysis. In case of our project the knowledge about investigated phenomenons was not extensive, what resulted in subjectively developed questions that in our opinion covered the area into the needed extent. The structure of the interview was formally structured. However, caused by the trustful atmosphere and good communication with majority of the informants while interviewing we allowed both ourselves and the informants to in some way change the structure, without losing the main point.

Despite the fact that in our project we performed only single interviews, we present the option where the interview may be conducted with the participation of multiple informants (Yin, 2011). By group interview it is possible to get complementarity between answers and uncover several themes. Although, it is desired that group members have the same background. However, there is a risk that the informants with the strongest opinions may control the discussion. Therefore it is essential for group interview that the researcher is able to direct his attention to one of the informants without ignoring the rest of the group. That requires training and researchers self-discipline. Groups can also be formed as "focus groups" (Yin, 2011), where participants are selected on the basis of one of few common factors, and the intention is to collect their opinions and experiences. In that form the researcher has little influence of dialogue direction, and should rather serve as a moderator. We did not choose this method for interviewing because of its challenging character that demands lots of experience and control.

While structuring the interview guide the researcher should pay attention to the development of the emotional levels during the interview. It is advisable to start neutrally to get closer to the informant. After such warm-up, some more emotionally charged or sensitive topics can be undertaken. Finally, the researcher should proceed to neutral topics again (Yin, 2011; Jacobsen, 2005). There are two models that interview guide can be built on. The first is the "tree-with-branches" model, where the main theme is the stem, while the branches are certain themes. This model is well suited when the researcher knows in advance which subthemes to identify. In our thesis this was not predetermined, therefore the "river-with-side streams" model was used. Here river equals the main theme, while the side streams are themes that arise meanwhile. Therefore, to obtain better results it was important to ask the follow-up questions (Thagaard, 2013). Whichever model is used, it is important with breaks during the interview. This gives both parties an opportunity to reflect on and evaluate the conversation so far. It fits well with the break in the transition to new topics.

When it comes to the design of questions, it was important for us to formulate questions that forced the informant to reflect on topics that we wanted to obtain depth information on. We carefully expressed reactions and feedbacks because they can encourage as well as interfere the conversation (Thagaard, 2013; Jacobsen, 2005). Careful leading of the conversation can be supported in several ways. While interviewing, we tried to rather use probes, the simple encouraging feedbacks that demonstrated our attention and interest on informants' responses. We also used follow-up questions that get the informant to provide more information or complete the answer. One can also ask for detailed descriptions of situations that provide more nuanced answer. The researcher can ask questions that are interpretive ("Do you mean..."), which give informant opportunity to clarify their answers. Those however should never have leading character. We chose not to engage interpretive questions because of the risk to obtain answers that in informant's reasoning are "expected" (Jacobsen, 2005). Researcher can also request specific examples in relation to general statements. Clear answers are very important for the interpretation and analysis. Being aware of this fact, we kept showing interest and understanding towards each informant, and gave the informant positive feedback that encouraged further interaction. If the questions are too general, the researcher does not encourage the informant to elaborate nuanced answers. In such case quality of the interview is considered poor (Thagaard,

2013). While interviewing, there occurred a few moments when some questions seemed too general. Therefore it was important for us to ask follow-up questions. Sometimes it was also crucial to use questions referring to the informant's previous answers in order to lead the direction of further conversation. However, Jacobsen (2005) argues that the researcher should never insist that the informant follow a certain way of thinking, the answer should be free. The researcher should be neutral and not affect data during collection. Dramaturgical perspective implies that interview is a dynamic interaction of creating opinions based on mutual transparency and an informal exchange of information.

It is strongly recommended that the researcher uses voice recording during the interview. This allows tracing back to particular moments and answers. Noting is often insufficient since while writing one misses a lot of information and can not focus on everything (body language, reactions, etc.), nor give the informant enough attention (Yin, 2011; Jacobsen, 2005). Notes should be complementary for recordings. However, if one for some reason can use only notes, it is recommended to make a comprehensive report right after the interview, in order to capture most of the information provided. Unfortunately, we were not allowed to record the two first interviews, therefore the notes and report were absolutely necessary to compensate for that obstacle.

There are dilemmas associated with guidelines for an interview. Questions like: Is the researcher understanding informant's reactions and interpretation of situations that are significant for the interview situation? How aggressive/offensive can the researcher be while interviewing? What are the contributions of listening attitude versus on-going attitude? Since both parties are supposed to contribute in meaningful creation. What is the difference or interaction between the information conveyed with words versus this conveyed by body language? This last topic is important to relate to since both sources of information must be interpreted, but they can be contradictory. The researcher must analyse and investigate why the body language contradicts or differs from that conveyed verbally (Thagaard, 2013). Therefore, researchers must be genuinely present, show interest and respond appropriately during whole interview. Personal chemistry and trust plays a major role in this context. Support and sympathy often creates a good atmosphere that ensures open and honest answers. The first few minutes may be crucial to the whole

interview situation. It is important to show respect from the very beginning. The interview or its result should never contribute to damage informant interests. Researchers should never provoke informant to respond in a certain way, nor contradict what was said by the informant (Jacobsen, 2005). We did not experience any of mentioned above obstacles during the interviews. Each time the atmosphere was friendly and open, and the body language of the informants was clearly in accordance with the verbally expressed statements. We assume that in case of such a professional and rather theoretical topic it is not typical to observe the involved feelings.

The present work was based on interview of combined character, which means that interview guide was partly structured and conversation floated freely between interviewer and the informant. Since the work is of explorative character, it was necessary with detailed questions that ensured the information flow in interview scenarios. The interview guide was constructed of seven sections, each applying to separate aspect of the researched field. Concepts of both Lean and innovation are difficult to delimit since they can be defined in many ways depending on interpretation and context. Therefore each section included several question aiming to explore different details. The choice of method and selection of informants was reasoned by comprehensive character of chosen research question, as well as time and resource limitations. The intent of the present work was not to formally test hypotheses, therefore quantitative method would not be an appropriate approach.

In this study researcher triangulation was used, in that meaning both authors participated at all interviews. Both of us participated actively in each interview. That ensured another dimension to collected data and allowed us to verify the data already during the data collection phase (Miles et al., 2014). Voice recordings and notes were taken at each interview when permission from each informant was obtained. However, as noticed previously, we were not allowed to use voice record by two of the informants. To overcome this obstruction, we made notes while interviewing and afterwards we made separate reports for each of the informants. The rest of the informants allowed us to make voice recordings. After each finished interview, we developed a memo/report to record our observations and impressions. That is also sort of method triangulation (Miles et al., 2014). Every informant was introduced for the anonymous character of his or her participation.

3.4 Value creation configurations

In our project we decided to engage control variables based on the theory of various value creation configurations (Stabell & Fjeldstad, 1998). In this regard we were able to clearly distinguish between the types of organizational units we performed the research on. To investigate the impact of Lean on innovation, we wished to examine its application in R&D department compared with manufacturing/testing department, which are more common to be linked with Lean. In this regard, as presented in theory chapter, we assigned the R&D to the value shop configuration, while the manufacturing/test referred to value chain configuration.

Ideally the research should be conducted with participation of two companies, where employees from the two different departments (manufacturing/test and R&D) would be interviewed. Unfortunately, finding and engaging the ideal selection of informants appeared to be a great challenge. Thus, we conducted the proper interviews in only one of the desired companies. At company 1 both leaders and non-leaders from the desired departments participated in the interviews. The two remaining companies contained the required departments. However, because of limited time assigned to this project, we were not able to reach all of the key persons responsible for those departments. Hence, in company 2 we interviewed leader 3, from R&D department, while in company 3 we spoke with both leader and non-leader from departments that we assigned the chosen value creation configurations (value chain and value shop), yet it is not considered to be conforming the ideal selection.

The interview guide included several questions examining this theoretical section. We wished to identify departments' positions and importance for the overall companies they belonged to. We were familiar with some facts in advance; however, we wished to examine informants' own view on this aspect. Because of differences in comprehension of some of the terms and logics included in our interview guide, we observed that the informants found it partly challenging to clearly answer some of the questions. Apparently, the leaders had different approach to this aspect, as compared to the non-leaders. This may be caused be the variety of informants' backgrounds and the scope of their theoretical knowledge. When compared, the definitions developed by the informants about their departments were consistent with the information we were given in advance.

Another aspect that was covered by the informants in this part of interview was the structure of the particular unit and the level of standardization applied there. While analysing the responses we observe the expected trend where value chain is associated with higher degree of standardization and highly developed sequential structure, while value shops tend to be less standardized, more interdisciplinary and interactive in the structure. That is consistent with the theoretical framework we engaged for this thesis. Although, it appears that some units have somehow varying structures caused by the type of project they are assigned for.

Some of the informants highlighted the lack of standardization in areas that potentially need it. That was most common for informants associated with value chain configurations. In this regard, we can assess a partial lack of focus on Lean principles in those particular units. Beside of that fact, we do not find any significant differences between the researched objects, no between the responses and the theory.

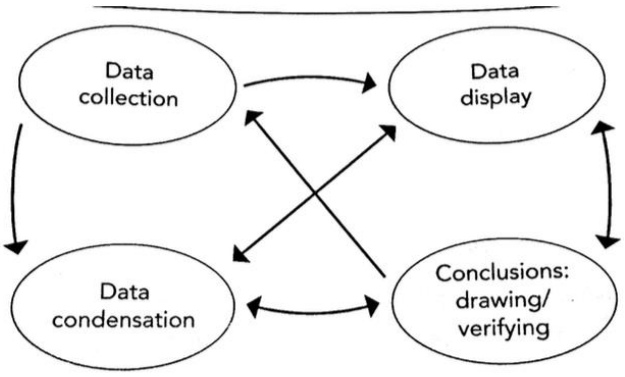
3.5 Data preparation and analysis

In this chapter we discuss two approaches to analysis process. All phases of the process are presented and illustrated with models. We pay attention to data preparation and present a tool supportive for qualitative data analysis, Nvivo.

In qualitative method, the transition line between the data collection and analysis is vague. Interpretation of data progresses during the collecting process, what allows adjustment of the elaboration teme. Collection process ends when the researcher leaves the informant, what partly limits informant's opportunity for control of data. Ethical guidelines protect the informant, and determine the interpretation and analysis tactics (Thagaard, 2013). We observed that our background and social position, as well as the limited expertise in existing theories significantly affected the process of interpretation and analysis. In such situation it is common that researchers attempt to develop a theoretical perspective based on the informant's perspective. Therefore, the informant's interests have to be secured by the researcher's loyalty, and not only by the informant's presence in the research context (Thagaard, 2013).

Qualitative research can be described by more than 20 different genres and traditions (Miles, et al. 2014). Some of them are ethnography, grounded theory, case study, phenomenology, content analysis, poetic inquiry, auto ethnology, etc. Out of these, we choose to characterize the present work as a content analysis. According to Hsieh & Shannon (2005) this approach can be further divided into three different types: (1) conventional content analysis, (2) directed content analysis, and (3) summative content analysis. Those three sorts depend on coding process, and that is where they differ from each other. While in the conventional content analysis codes are derived directly for the data, in the directed content analysis coding is based on and directed by existing theory. In summative content analysis codes are determined by counting of keywords or phrases, then comparisons and interpretation (Hsieh & Shannon, 2005). As follows, our work is mostly characterized by conventional content analysis, since the aim is to describe a phenomenon that has not been covered sufficiently in existing literature. We did not use pre-determined code categories, instead we allowed the categories and names flow from the data. The rest of analysis process is free to choose when coding process is defined (Hsieh & Shannon, 2005).

Data collection and analysis are often conducted parallel. Miles & Huberman (1994: Miles et al., 2014) present an interactive model of data analysis components. The model simplifies the process to four steps, which are interactive, which means that the researcher can go back and forth between different steps.



Source: Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Figure 3: Miles et al. (2014) Components of data analysis: Interactive model

After each time when data was collected, and after we left the informant, condensation process began. That implies simplifying, selecting and transforming the collected data into a sort of database that includes complete field notes, transcripts of interviews, and all other collected data.

McLellan et al. (2003) present guidelines for preparation and organizing of collected data. Above authors focus mostly on transcription of interviews, which is often neglected in terms of rigorous structuring. Such omission results often in superficiality and lack of consistence. Therefore, researchers should keep in mind a set of principles that may ensure better quality of transcriptions. Transcript should be developed maintaining all naturalness of word forms and text structure, thus being an exact reproduction. Moreover, the transcription should be complete an independent, as well as universal for any analytical tool and other researchers (McLellan et al., 2003). Another important point is that what is not said during the interview, is as important as what is said. That includes all non-linguistic observations like emotions, mispronunciations, grammar errors, body language, background noises etc. Therefore contextual information should be provided and included in transcription. Afterwards, it is necessary to manage all transcribed information. Standardization and use of templates may be the key to success at this point. Organizing all data in the same manner enables quick tracking and retrieving of specific information (McLellan et al., 2003). In present work we used standardized template for transcription where we included everything that was said and recorded by the voice recorder. The process of transcription was divided in two parts. First each of us transcribed delegated interviews, and secondly the other partner was responsible for controlling of the content. Because of the character of the researched topic the informants did not expose any unusual feelings or reactions, we did not find it necessary to focus on contextual information. Data condensation was performed throughout whole process. We established a database with all collected and organized data that was digitally available for both of us at any time.

One might associate data condensation with reducing or weakening the data, but that is not the intention. Condensation/transforming of data makes it stronger, more structured and complete (Miles et al., 2014). It may also help to the quantify data, but not necessarily. Data condensation is not a one-time activity, it is supposed to continue throughout whole qualitative analysis process. In this regard, even before we started the data collection, we attempted to condense the

future data by deciding on conceptual framework, research approach and questions. Further summaries, reports, developing of codes and categories, are also considered to be condensation activities that influenced shaping of forthcoming conclusions (Miles et al., 2014). MacQueen & Milstein (1999) split coding activities into *segmenting* and *metadata activities*. In order to that, text is segmented and defined with boundaries first, so that the creation of data about data (metadata) can be conducted. Metadata is generated as codes, comments, graphical presentations, that represent multidimensionality of coding patterns. Result of these two activities are presented in hyperlinked tabulator composition called *secondary-object data structure*, which makes ground for further conclusion drawing (MacQueen & Milstein, 1999).

In contrast, Yin (2011) divides the first step after data collection into three different stages: compiling of database, disassembling of data and reassembling of data. Here interaction between stages is also very common, as presented in the figure below.

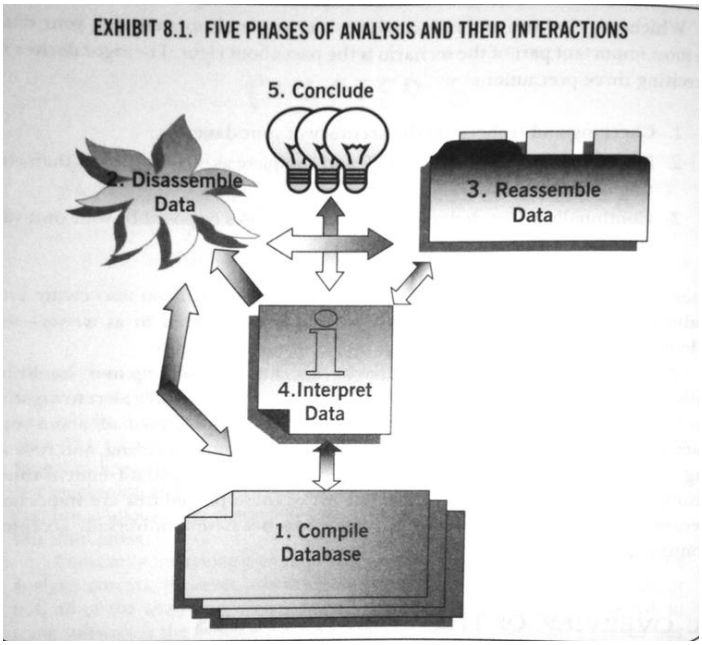


Figure 4: Yin (2011): Five phases of analysis and their interactions

According to Yin (2011), compiling is the first part of the analysis, and it aims at sorting of previously collected and refined data into a database. The order may just be simple and chronological (Yin, 2011). Afterwards, compiled data should be disassembled into smaller

fragments assigned with labels or codes, similarly to the condensing phase in Miles' et al. (2014) model. This part includes trial-and-error process in order to obtain most accurate coding of data. If that is obtained, process of reassembling might be easier to conduct. Disassembling and reassembling are highly interactive phases. In present work we focused on coding of the collected material continuously right after transcription while we still remembered the interviews and the informants well. Developed codes base on topics explaining our research problem.

In reassembling, substantive themes are used to reorganize previously coded data into groups, what may be facilitated by graphical or tabular composition (Yin, 2011). The order might be different from original notes and transcripts. This step is equivalent to Miles' & Huberman's (1994) data display phase, which they discuss as an important and separate part of the analysis. This is because, according to authors, poor quality of data display is a common failure in qualitative data analysis. Data display is defined as *"an organized, compressed assembly of information that allows conclusion drawing and action"* (Miles et al., 2014) When this part is formed as extended text, it is easy for the researcher to draw flawed and superficial conclusions. Correctly and transparently assembled display in form of graphs, tables, matrices, charts, allows the researcher to obtain greater insight in the data and make justified conclusions and actions. We did not use any form of data display other than text composition. We did not find it necessary in regard to analyze and draw conclusions from the limited amount of collected data.

Further, based on reassembled and coded material, interpreting phase was conducted. Yin (2011) explains it as a creating of a new narrative for the reorganized data. In this phase we used to go back to previous steps and recompiled the database in accordance with new insights. Doing this provided *"the key analytic portion of draft manuscript"* (Yin, 2011) which allows further interpretation, and conclusion drawing, as the final step in both presented analysis models (Yin, 2011; Miles et al., 2014). Both models refer in this point to quality and structure of results developed by previous phases. Also our experience, objectivity and skepticism played an important role in this part. We noticed frequently that some conclusions could be made already during data collection, but the closing conclusions took much more effort and reflection. There was also needed to verify the validity of the held conclusions (Miles et al., 2014).

Though, the whole analysis process was time consuming, it required us to conduct it thoroughly and elaborately. The results are mostly determined by researcher's skills combined with theoretical and methodological paradigms. Although, it is desired that the results are rather limited by researchers subjectivity than by a poorly organized database (MacQueen & Milstein, 1999).

Regardless which of presented approaches one choose, it is necessary to move back and forth between steps to achieve the best and accurate results and conclusions. This is different from the quantitative data analysis, which apart from that specific point, is driven by mostly the same conceptual rules for condensation, display and conclusion drawing and verification. Although, advantageously for the quantitative researchers, their sequential methodology is much more well defined and familiar, than the fluid and humanistic practice of their qualitative colleagues (Miles et al., 2014).

There are several software programs developed for more or less complex qualitative data analysis. In present work we used software from QSR International, Nvivo, which is a sophisticated tool developed to support qualitative data analysis. We were trained for this program under Qualitative Methodology course at Buskerud and Vestfold University College (autumn semester 2014). After training, we were familiar with its areas of use and possible applications and this is why we decided to use this software in our project.

Depending on project complexity, one can get advantage of Nvivo in different ways. Bazeley & Jackson (2013) present several applications of Nvivo, whereas the most important is managing of all kind of data (raw text, secondary data, non-textual data, etc) into an organized project where it is easy to track specific moments. In this way Nvivo also allows the researcher to manage the theoretical and conceptual knowledge that promote idea development. Another thing Nvivo help to is querying and searching of data, which enables the researcher to ask questions of the data and then retrieve information that generates the answer. When the answer is found, Nvivo supports visual representation of interpretive relationships among content's elements. Finally with use of Nvivo researcher can report developed knowledge, results and the research processes (Bazeley & Jackson, 2013). In our project we used Nvivo actively to store, code and organize

collected data. The tool was helpful in order to analyse and clarify conclusions, since it allows displaying the content in orderly way. However, because of the restricted project scale is we did not use any of the more advanced features of this software program.

Even though software programs like Nvivo simplifies qualitative data processing and analysis, it will never replace human work. Computer software can ensure precision on finding every term or code, as well as it provides a great and transparent structure of the collected data. It can also contribute to more methodical and rigorous analysis. Although, it will never be able to interpret and correlate of all collected pieces, nor find the contextual relationships between them. That is why software is only a tool that supports the analysis process, and not a solution for it (Bazeley & Jackson, 2013).

3.6 Data quality assurance

An important stage within qualitative investigations is verification, this is important in order to determine the generalizability, reliability and validity of the interview results (Kvale, 1997). These terms are used to evaluate the quality of the research, to determine how good the information is. In any discussion regarding credibility of the research are the two terms of reliability and validity central. Reliability describes the data's dependability, while validity describes the data's relevance to theory and research question. Generalizability concerns if the results from the study can be applied in other situations (Ringdal, 2001). Thagaard thought that since qualitative and quantitative analysis is so different, there should be own terms within qualitative research to evaluate the quality of the research. Therefore she chose to call it credibility, conformability and transferability instead of reliability, validity and generalizability, this in order to accentuate characterized by qualitative research (Thagaard, 2013). Regardless this fact, we have chosen to use the terms reliability, validity and generalizability further in our thesis.

Although validity and reliability reviews are central to all research, there is a general consensus that qualitative studies must be considered in a different way than quantitative (Johnson, 1997). According to LeCompte & Goetz (1982) is it an impossible goal for any research model to attain

absolute validity and reliability. But although it is impossible to achieve perfect reliability, it is important to reduce the threats one can as much as possible.

3.6.1 Reliability

Reliability refers to whether the research is reliable and trustworthy, which is measured by how the research design is implemented, through both data collection, processing and analysis of data. Reliability can be defined as follows: "*Reliability refers to the extent to which studies can be replicated. It requires that a researcher using the same methods can obtain the same results as those of a prior study*" (LeCompte & Goetz, 1982).

To obtain the same results depends on the information in the interview, because according to LeCompte & Goetz (1982) no study can be replicated exactly regardless of the methods and design employed, because human behaviour is never static. This applies especially in qualitative research.

Random errors will always occur in a scientific research, but the less the random errors are the more reliable is the research. Random error in an interview situation can be misunderstanding between the researcher and informant regarding the question, the researcher can note errors or omit things or the informant can recall wrong and thus respond incorrect. According to Ryen (2002) can the researcher ensure high reliability by using various measures, measures we will use in our research. First of all it is recommended to use a recorder during the interviews, this made sure that we had the informant's verbal versions and not our reconstructions of what they said. The recorder can also increase the reliability by registering data that we could have forgot and overlooked. During analysis, Ryes (2002) recommends that different researcher should categorize the material and then compare it, as a control. Since we are two conducting the study we both we categorized the material and then compared it. Finally it is recommended that our report clarify procedures for the data collection and introduce greater part of the data and not just summaries (Ryen, 2002).

We have documented all options and justified them so that the study is verifiable. Conformability was in this manner looked after. We also have in the interview guide chosen to base in relatively open questions to avoid impact. Standardized questions that are repeated at each interview will also increases the reliability. Another way for us to avoid random errors was according to Johnson (1997) reflexivity. This means that we actively engage in critical self-reflection about our potential bias and predispositions. By using reflexivity we were more self-aware and tried to monitor and control our biases.

3.6.2 Validity

Validity involves measuring what one intends to measure. A study can be reliable without being valid, but can never be considered valid without being reliable. Reliability is deemed to be a precondition for validity since measures, which are unreliable, cannot be valid. Validity involves both random errors and systematic errors.

Systematic errors is when one measure something else than what's intended (Gripsrud, 2004; Ringdal, 2001). *When qualitative researchers speaks about validity they are referring to research that is plausible, credible, trustworthy and therefore defensible* (Johnson, 1997). To increase validity in a study, it is important that the researcher carries out a critical self-reflection and also strives to disprove their own preconceptions, and avoid these influences during the interview.

The conceptual apparatus surrounding validity is huge. So we have chosen to focus on the article to Johnson (1997), which we were introduced to in the subject qualitative methods autumn 2014. Johnson describes in his article "Examining the validity structure of Qualitative research" five different types of validity forms with together 12 different strategies to increase validity in qualitative research This five are as follows.

3.6.3 Descriptive validity

In descriptive validity scientists are afraid they have misinterpreted things they have seen or heard during interview, so that what they report is wrong. Descriptive validity is safeguarded to

the extent actual events (events, objects, behaviours, people, setting) is precisely and correctly described. To make sure that we understand the informants correctly Johnson recommends to use the strategy investigator triangulation. Because we were two researchers in our study we made sure that we both made notes during the interviews, so that we could compare notes later. This way we would increase the descriptive validity in the study, by making sure we did not misinterpret things. We also met the requirement of descriptive validity by actively using critical self-reflection. In addition we used a tape recorder during the interviews (Johnson, 1997).

3.6.4 Interpretive validity

Interpretive validity means to understand the informant's thoughts, ideas, feelings and intentions properly, and to report this correct. For the researcher to understand things from the informant's perspectives to increase interpretive validity, the researcher must get inside the heads of the informant's. Try to look through the informants' eyes, and see and feel what they see and feel. To increase the interpretive validity we used two of the recommended strategies. First we used a lot of quotes that were not taken out of context to meet the strategy low inference descriptors. The second strategy was participant feedback; this was met meet by summing up what we had interpreted for the informant's at the end of the interview, to make sure that they agree (Johnson, 1997).

3.6.5 Theoretical validity

Theoretical validity implies that the theoretical explanations that are developed in the study are consistent with the data. Descriptive and interpretive validity are more exploratory, while theoretical validity is explanatory in addition. There are a lot of strategies recommended to increase the theoretical validity, but because of scarce resources like time, strategies like extended fieldwork was to be excessive. Theory triangulation is a strategy we have used during our literature search; so all our interpretations and conclusions are grounded through this. Other strategies we have used to increase our theoretical validity is investigator triangulation and peer review. The fact that we use a critical and knowledgeable tutor through our study will help to increase the theoretical validity (Johnson, 1997).

3.6.6 Internal validity

Internal validity implies that the researcher can justify or rationalize their claims about the existence of causal relationships between observed phenomena. The internal validity is high when there is no possible third variable. The researcher should take the role as a detective to search for the "true" truth of a phenomenon. We took on the role of a detective by searching for explanations. The strategies we have used to increase the internal validity is the researcher as a detective and data triangulation. During the research we have used both interview and document studies, which together will increase the internal validity. We also availed ourselves of data triangulation by collecting data from seven informants that differ from each other when it comes to position, department and enterprise (Johnson, 1997)

3.6.7 Transferability / Generalizability

External validity refers to the data retrieved from the pool to the population. The extent to which the results of a survey can be generalized to other people, situations and conditions. To increase the external validity it is important that we give thick descriptions to our readers. Description about how many informants there were, why they were selected, contextual information, the methods of data collection used and the data analysis techniques used. This will help the readers of the study to determine if the research can be generalized. We have also presented major excerpts of the interviews and not just summaries (Johnson, 1997).

According to Johnson (1997) generalizability is not the major purpose of qualitative research and also an element that is hard to achieve in qualitative research. One of the reasons is that the people and settings examined in qualitative research is not randomly selected, and the best way to generalize from sample to a population is by selecting randomly. Another reason is that qualitative researcher is more interested in documenting particularistic findings than universalistic findings (Johnson, 1997). Some experts argue that there can be made rough generalization from qualitative research, but then it is usually about theoretical generalization. Theoretical generalization is all about forming a more general theory of what reality looks like based on a small number of informants, but whether this theory is valid in other contexts than the one we have studied are difficult to ascertain (Jacobsen, 2005). The purpose of our study is not to

generalize but to create a deeper understanding of our two concepts and the combination between them. However, some of our findings can probably be generalized to other companies than from our informants.

3.7 Ethical considerations

When conducting research, it is important to take into account ethical aspects. According to Kvale (1997), the researcher should in advance have the knowledge of the moral issues that typically arise at various stages of the research. Ethical considerations are important during the whole research process, and not just a single study in the interview survey (Kvale, 1997). By having knowledge of the ethical aspects, the researcher can hit reflective choices during the planning process and be looking for critical and sensitive issues that may arise during the study. When researching people, Kvale (1997) states three ethical rules that one must take into consideration, which are, informed consent, confidentiality and consequences.

Informed consent means that informants participate voluntarily and that they are informed about the study's overall objectives, the main features of the project plan and the possible advantages and disadvantages of participating survey. It is also important to inform informants about the possibility to withdraw from the survey at anytime. Informed consent also include, how much information should be given and when. It is important to provide enough information to rule out all forms of deception. The purpose of the study was explained to the informants but not in details, to ensure that we get the informants natural views on the subject and not leads them to certain responses (Kvale, 1997).

Confidentiality involves not disclosing personal data that could reveal interview the person's identity. Tape from the interview should be kept locked and destroyed after the investigation is completed. Printing from interview to be shredded after the task / project is written. The data from the survey will be treated anonymously. In our study we have not revealed the names of the informants' nor the enterprises. We have used short description of each of the informants like "leader 1", "non-leader 1" and so on (Kvale, 1997).

Consequences of an interview study should be considered with regard to possible damage that may be caused to informants as well as the expected benefits the person may have to attend. Benefits are especially for situations where the risk in participating is big. The informant's in our research did not participate in a risky study and there was none or little consequences afterwards.

Our study was cleared by Norwegian Social Science Data Services and assigned with authorization number 42025.

4. Findings and Analysis

We chose to conduct a qualitative research allowing us to obtain a greater comprehension about the broad concepts of both Lean and innovation. We found this research design most appropriate because of the limitations and requirements regarding this thesis. We conducted seven interviews in three different high technological companies, whereas two of those, performed in the company 3 are considered pilot-interviews. We present the division of informants in the table below.

	Company 1	**Company 2**	**Company 3 (pilot)**	**Total**
Value Chain	Leader 1, Non-leader 1	none	Non-leader 3	1 Leader 2 Non-Leaders
Value Shop	Leader 2, Non-leader 2	Leader 3	Leader 4	3 Leaders 1 Non-leader

Table 1: Division of informants

We present detailed demographic characteristics of the informants in following table:

	Gender	**Age**	**Education**	**Total work experience in years**
Leader 1	male	44	Engineer - technical protection ethics	23
Leader 2	male	27	Engineer (soon Civil)	5
Leader 3	male	36	Civil mechanical engineer	11
Leader 4	male	42	Engineer (NTNU)	n/a
Non-leader 1	male	42	Civil mechanical engineer	16
Non-leader 2	male	44	Civil mechanical engineer	16
Non-leader 3	male	41	n/a (Chicago Lean Six Sigma Black Belt Certification)	n/a

Table 2: Demographic characteristics of the informants

A standardized interview guide was used for all interviews to ensure proper data collection and the most comparable results. In our literature review we revealed a distinction between theorists' views about how Lean can affect innovation in a company. The majority of the theorists believe that the implementation of Lean in the business will certainly affect innovation, however the character of the impact cannot be unambiguously defined as positive nor negative. That is also what we found out by examining the selected companies.

In this chapter we review the collected data and present significant findings. We link the underlying statements and quotations from our informants with the findings, in order to underpin subsequently developed conclusions. In the analysis of the findings we attempt to answer our research question, which is as follows:

"In what ways does Lean influence innovation processes, and is the influence dependent on the value creation logic of the enterprise?"

We divide the collected material into parts analogically to the order established in theory chapter. First, Innovation and Lean are reviewed separately in order to cover informants' understanding of the concepts and their subjective perception about them. Secondly, we review the relationship between subjects. Further, concepts of Knowledge Based Development and Lean Product Development are studied and discussed. Finally, we examine if previously chosen control concepts like Value Creation Configurations have any impact on the findings.

4.1 Word cloud

In following illustration we combined the most significant keywords found in overall responses to our interview. In this manner we wish to present the essence of the collected data to be analysed in following sections.

Figure 5: Word cloud

In the word cloud we can see which words that were mentioned under the interviews. Structure of the cloud reflects the use of the various terms. The size of words indicates how often the informants used them during the interviews. It is apparent that concepts of Lean and innovation are the biggest and the central points of the word cloud. Other words like *development, knowledge, balance, right things, continuous* are important in context of our study. Considering size of the words, Knowledge based development appears to be almost equal to Lean. That confirms the assumption made in the theory section of this paper. On the other hand, *right things, balance, continuous* are considered to be reinforcing the concept of Lean innovation.

4.2 Innovation

Both Lean and innovation are subjects that are of a strategic importance to modern organisations, which aspire to both, be able to create new products constantly and to be cost effective. The problem with both phenomena is that there are plenty different and often conflicting opinions

about how to define them. Innovation can be defined in various ways and can also be applied to both tangible and intangible business aspects, what makes it challenging to measure. That is why we wanted to ask our informants both leaders and non-leaders about what they associated with the term. We also wanted to reveal the informants view about what affects innovation and how to promote it.

4.2.1 Conceptual approach

First, we investigated what the informants associated with the term, since there are many various definitions of innovation in the reviewed literature. In this regard we used simple questions about innovation, which in a simple and understandable way capture the informants view about the subject. The following are definitions generated from informants concerning innovation:

"It is innovation to rethink and find a new way to solve a challenge, this is my definition of innovation." - *leader 1*

"(...) To see solutions to problems that others have not thought of before (...)." - *non-leader 1*

The answers from both leaders and non-leader correspond very well with the definition by Joseph Schumpeter: "*The introduction of new goods (...), new methods of production (...), the opening of new markets (...),the conquest of new sources of supply (...) and the carrying out of a new organization of any industry"* (in: Sledzik, 2013), where innovation can both be about inventing something completely new or simply making a small improvement in an already existing product. There was no significant difference in the answers from leader and non-leader, nor were there any significant difference between informants from value shop or value chain. All of the informants had a clear meaning about the term.

We also wanted to investigate the informants' views about what can promote innovation and what may hinder it. We wished to indirectly determine if the informants had any opinions about typical Lean adjustments, like standardization and cutting waste versus innovation, without

asking a direct question about it. First, we asked about the informants view about what aspects that can help to promote innovation.

"Well... Larger research budgets, like development budgets. (...). It should maybe be easier to apply Innovation Norway for research funds (...). "- non-leader 1

"What we often notice, is that entrepreneurs come up with good ideas but they get a little surprised when they hear how much it really costs to bring the idea to a final product. Therefore to get a good innovation I think is important to have some institution like Innovation Norway, which can come up with financial support to the good ideas (…)"- leader 2

Amabile (1996) identified three factors that can promote individual creativity in an organization. These three are organizational motivation to innovate, resources and management practices. The factors from Amabile fit very well with what our informants mentioned as to what promotes innovation. Majority of both leaders and non-leaders emphasized the importance of resources in regard to innovation, especially the financial support which is crucial for creating good ideas/innovations. Leader 3 also mentioned the need for innovation forums inside the organization where employees can present their ideas to a board. If an idea is good enough, the employee can get money to continue to work on the idea, which can also result in receiving a reward from the organization.

Concerning the question about what could hinder innovation, the informants mentioned aspects like the everyday routines and company's or employees' unwillingness to take risk. Although, what is interesting and significant for this thesis, none of the informants, neither leader nor non-leader mentioned aspects like standardisation or other typical Lean adjustment. Despite the fact that several informants are strongly associated with process innovation in their companies and Lean adjustment is often proved to affect processes innovation more than product innovation.

"Everyday life might be an obstacle. The primary task is to put an idea in a project then develop a product from A to Z, with all that it entails. Everything else the noise of everyday life: mail,

phones and meetings not least. (...) Sometimes there are particular things that we try to designate a group out of everyday life. To think a little outside the ordinary."- leader 3

"If you are afraid and do not dare to bet and invest, this can prevent innovation,"
- non-leader 2

Concluding the research questions concerning aspects that can promote and facilitate innovation we discovered that the informants' views did not differ significantly from each other. We observed that the answers were not influenced by the informants' position or which value configuration they belong to. Although, the answers from the informants differed significantly from the views we had expected in advance. We expected to receive statements about Lean principles' impact on innovation considering that the companies have implemented Lean extensively. Furthermore, based on the literature review, we expected that the opinions about the impact would be rather more diversified and contrasting. In case of examined firms the informants did not observe any obstacles caused by adopted Lean principles. However, based on this fact we can not conclude that this result would apply to every company.

4.2.2 Practical approach

Under this section we investigate the informants' practical approach to innovation. We also investigate what is typical for the informant organisations concerning innovation practices and facilitation of these. All of the informants are assigned departments that are to some extent associated with innovation. Although, not all of the informants experienced facilitation of innovation exclusively in their department. Most of the informants, regardless of whether it was a leader or a non-leader, mentioned innovation forums or workshops as practices to facilitate innovation.

"We have an ongoing process - if employees have a good idea, they can come with an invention note, which is a form of presentation that there is a possibility to develop a patent or something.

You can also present it for a proper forum where it gets approved or not. Then it goes into one of those "idea banks" where it can be retrieved later in the future. It is an exciting program."
- leader 2

"Inventing and developing things is what we are doing in all the routines, so it is common for us. Workshop for example is the method we use often, especially in early phases of a project."- non-leader 2

To conclude the practical approach of innovation we can say that all of the companies in our selection have routines to facilitate innovation, like innovation forums, workshops, rewards and other initiatives. Those contribute to more innovation and, as mentioned earlier in the thesis, have a strategic importance for the organizations.

4.2.3 Interpretation

Regardless of informants' position and the value configuration they are assigned to, the given answers concerning innovation are approximately equal. All of the informants showed a convenient comprehension about what innovation is and how their business facilitates it. Our informants emphasize the innovation's importance for organizational survival in nowadays-global market. We also attempted to investigate if the informants had any meaning about how Lean adjustments can affect innovation in their business. Instead of asking any direct question about it, we requested aspects that hinder or promote innovation. Our informants did not relate any of the typical Lean tools and adjustment as aspects that could hinder or facilitate innovation. Therefore neither a negative nor positive relationship has been proven yet.

4.3 Lean

Concept of Lean is central in our research and questions about it cover major part of the interview guide. Our intention was to uncover informants' perception of Lean in both a theoretical and a practical way. Thus, the purpose was to determine if there is difference between those two approaches, and if so, how do employees with different positions define them. We also take to consideration the value creations as control variables.

4.3.1 Conceptual approach

As repeatedly mentioned, concept of Lean is boundless and difficult to define unambiguously (Pettersen, 2009). Therefore in order to get acquainted with our informants' perception of this term, we included simple questions. This was in order to obtain a broader reflection about the very concept and the underlying principles. Answers were rather similar, but composed with different terms and expressions. Leader 3, similar to majority of the informants links Lean primarily with manufacturing and production.

"(...) I think immediately of manufacturing; Lean manufacturing and creating effective processes around, producing cheap, minimal waste, continuous improvement, minimum stock, minimum work in progress, etc." - leader 3

That is natural way of thinking, since Lean has its roots in Toyota Production System and its original purpose was to increase manufacturing efficiency. Additionally, the informants mentioned aspects of work efficiency, waste reduction and elimination, and visual tools. Those seem to be the most known sides of Lean, regardless of the organizational unit and the position of the informant.

"First you must become Lean to conduct Lean in the processes." - non-leader 3

"(...) it is not just to minimize wastes. But what I associate with Lean it is to do the right things at the right time. And try to do things only once." - leader 1

"(...) the frequent coordination and patch meetings where we "optimize" the individual projects. And the fact that employees themselves define their tasks and that they set up their own deadlines for tasks." - non-leader 2

In our meaning, those answers considering the waste reducing and efficiency improvement correspond with definition of Lean Production provided by Womack et al. (2009): "*a philosophy or as a strategy which depends on a set of practices used to minimize waste in order to improve an enterprise's performance*". What we find interesting is the fact that the non-leaders focused

mostly on the tools and techniques developed in regard to Lean philosophy. On the other hand, leaders talked mainly about the formal and theoretical side of Lean. That corresponds with the point made by Krogstie et al. (2014) about different views on "how the things are done", where *talking about* and *working with* the things are often two highly different standpoints, as shown by those answers.

Leader 1 emphasizes the importance of the mind-set that Lean truly is. As stated previously, leaders appear to have notably broader approach to Lean. That is most likely caused by their comprehensive theoretical knowledge in this field, while the non-leaders' knowledge is often limited to the practical application of various tools and their effects. Additionally, non-leader 3 believes that implementation of Lean is a comprehensive and demanding process. Therefore it is not possible to ever affirm the process as finished. That is also because of the mind-set where continuous improvement and searching for perfection are some of the main goals (Womack, 1990). Leader 1 also highlights that.

"(...) People need to get a quality approach to what they do, so that they do a right, good enough job and that they are not sloppy. It is something you must have in your spine. I think quality awareness is important, when you want to avoid much waste." - *leader 1*

Leader 2 made some statements about Lean in regard to creating value. That is an important point and we find it understated by other informants. Beside waste reduction, improvement of value creation is another elementary part of Lean philosophy (Womack & Jones, 2010). Leader 2 recognizes the importance of Lean's effects on value creation in a long-term perspective. In his opinion proper application of the philosophy may result in sustainable value chain and improved income flow.

"I think Lean fits very well in the value chain. Because we see what we deliver today and what is the income flow now, but with Lean, we extend the perspective and think about the future income flow as well. What can we do today to have a more sustainable supply chain." - *leader 2*

"(...) focus on value creation - what part of the work time or of total resource bank we use on value creation. Thus, identify what is value and what is not." - leader 2

The overall definition of Lean given by our informants does not differ significantly from the theoretical picture drawn in the previous chapter of this thesis. The various background of the informants, as well as their different standpoints towards the concept cause the broad reflection of the concept.

4.3.2 Practical approach

The informants' practical approach to Lean offers many variations, what makes it interesting to analyse and compose into an overall depiction. The interview guide includes five different questions about Lean in practice. We tried to find out how and when Lean was implemented and understood by different employees in different units. Simultaneously, due to variety in our informant selection, we were able to make observations in regard to implementation of Lean in different environments and business models. As presented in the theory section, there are conflicting views on this aspect. Based on the collected data, which is rather limited in this case, we cannot confirm the theory of Womack et al. (1990) claiming that Lean principles are suitable in any industry. This is why we decided to conduct our research on only one type of industry, which is however relatively broad. Nevertheless, the collected data can somehow support the theory by Cooney (2002) who argued dependency of successful Lean implementation upon the business conditions. The three companies that were our interview objects belong to the same industry, but their business models are different, as presented in sample description section. All companies have implemented Lean to a certain extent and claimed to be successful with the implementation at the concerned areas.

In regard to implementation of Lean we got an illustrative description from leader 3. In his point of view Lean is rather difficult to implement even though it may seem otherwise. The reason for this is the difficulties associated with coordination and motivation of employees at all levels. Apparently, it is common to fall back into old routines if leaders do not repeatedly remind the new rules.

"Defining it (new routines) is a demanding job. One must practice a lot on it, and one must keep repeating on it too. As a leader, one must constantly harp on it so people do not go back to the old routine." - leader 3

The similar point of view had non-leader 3 from another company. In his meaning the most of the pressure while implementing Lean lies on leaders shoulders. Non-leader 3 had experienced it by himself, when he was responsible for such process in company 3 for about seven years ago. According to him, the key to successful implementation of Lean is the management of the process. He means that it is entirely dependent on the key persons in the process. We find this point interesting as it appears that the framework and ideas are generic and fit any industry, but there is needed a "prophet" in the implementation to get the system to work properly. It is important to motivate employees, give them guidance and advising. Leader 3 emphasizes that the leader in such process should be dedicated and sociable and show empathy and understanding, in addition to all of the needed competencies.

Leader 3 illustrated also the transformation of workflow processes in his company in regard to implementing Lean principles. Although, he called it rather Knowledge Based Development, what we come back to in a later section.

"With the new process, we want to work very interdisciplinary and heavily at the start. Traditionally one starts with a lone constructor working along and drawing something. When it come closer to the finish suddenly there needs to be poured in money, resources, etc. (...) So we want now to rather run frontloading and add resources right at the start. So that we ensure a smooth process. To move the resources which are currently used to fire fighting over to the start phase, to ensure the workflow. But it is quite challenging…" - leader 3

Both leader 1 and leader 2 made some important points about their approach to implementation of Lean. Both leader 1 and leader 2 emphasized several times during the interviews the importance of measurability in regard to maintaining the continuous improvement and following up the standardized processes. In spite of this significant claim, none of the other informants had

made similar point with regard to Lean. Both leader 1 and leader 2 work for the same company, what makes the common point of view easier to understand.

"I think it is important to have a method to measure things. Because if you do not measure performance then it is just controlled by a gut feeling anyway. I think it is important to have some form of measurability in relation to what you are doing and what kind of value it contributes to. I think it will be perhaps the most important step to start using it (Lean). If not then you have nothing to adjust to." - leader 2

"The quality assured processes cause that we do not really need to assure the quality of the product. If we follow a quality assured process every time, then we know that we get quality assured products." - leader 1

Most of the informants made some interesting statements about their experiences with Lean in practice. Mostly leaders spoke of Lean in very positive manner, highlighting the importance and good result brought into their companies by this philosophy. The most emphasised outcome of Lean is the increased effectiveness/efficiency and economic performance. That is also considered to be the main goal of companies aspiring to become Lean (Abdullah, 2003). We assume that leader's higher understanding and involvement with Lean, as well as their desire to appear successful determine such positive expressions. Since we did not perform observations in any of the three companies, it is difficult for us to conclude which of those factors makes the biggest impact on leaders' statements given during the interviews. However, based on the knowledge leaders appeared to have about Lean, we assume that the declarations of success and positive experiences are frank.

"In relation to value creation we become better at doing things right the first time and we get less problems later in projects and overall we spend less money along the way." - non-leader 3

"I would say that Lean affects economic performance in a very large extent because the less waste we spend on projects, the better is often what we deliver and the more earnings we get

later when the customer comes back. We have identified the loyal customer as a key to survival." - leader 2

"One thing that enforced Lean into the firm was that with Lean we would be so much more effective if we were to develop faster and with less people. And if we had knowledge bases and routines in place we should really be able to do more with less. But we do not see the very effect in that way, it is slightly more fictitious. Yes, we are more effective, but we spend saved resources on other things and it comes out equal." - leader 3

"We work more efficiently, and also have more control on what we have. It is easier to display what we have in our offer to customers. We increase understanding and improve communication with more concise communication and documentation." - non-leader 2

The interview guide does not include any questions investigating feelings or attitudes towards aspects considering practical nor theoretical approach to Lean. However, we observed that non-leaders were most inclined to express their negative observations and experiences about the implemented Lean. The most of the critics was assigned the functional side of Lean. Non-leaders were unsatisfied with different initiations made in regard to visual communication, which in their meaning did not work well in their company because of the lack of overall engagement for this tool. Critics were also addressed to the shortage of proper training for all employees, as well as to the missing interest towards Lean expressed by some of the project leaders. Non-leaders attempted to explain this drawback as another administrative hassle for the project leaders and managers.

"(...) Typical visual tool we used were post-it notes... within a week all the post-it labels had fallen down, and then we had no longer stories about what happened anymore." - non-leader 2

"We have tried to organize it by buying enough boards, and equipment and stuff, but I think that it begins in the training of our project managers, that they see value of it. Because in many cases it becomes just another administrative task, which a project manager must take care of while he

is perhaps more than enough busy with other things that he must get done. It becomes an additional burden rather than a tool to facilitate it." - non-leader 1

We cannot conclude that everyone considers Lean in the same conceptual way, although it is highly correct as the concept lacks the clear and concise definition. As we clearly see, the difference in organizational position makes significant impact at the definition given by each informant. However, the focus is mostly concentrated at the tools used in regard to Lean philosophy, and not necessarily the philosophy itself. We consider the overall answers understandable and illustrative for the concept, and we do not recognize any biases.

4.3.3 Interpretation

We observed a considerable difference in perception of Lean in practice between leaders and non-leaders. While leaders spoke in somehow ideological way about practical aspects adopted in their firms, the non-leaders were rather inclined to admit the lack of proper implementation of Lean. Some of them indicated that they cannot see if the company is Lean or not. However, the non-leaders focused mostly on the very practical and rather visible aspects like visual communication and documentation. Thus, that may be a reason for their limited perception of Lean.

Comparing with the studies reviewed in theory section, we can neither fully support nor decline the universal applicability of Lean for all types organisations. We examined three different companies, however the industry they are allocated in is to some extent the same. That makes the companies' structures and targets partially similar. To support this theory there are needed more extended results that can be generalized. Although, we can observe that high-technological firms have high potential, and often also a strong need for implementation of Lean in order to stay ahead in the extremely dynamic and challenging environments they belong to.

4.4 Lean Product Development & Knowledge Based Development

Literature review revealed that many of the philosophies that have arisen in the business world over the decades have many similarities and some of them are two sides of the same coin. As

previously described in the theory chapter, this is what we also observed in case of Knowledge Based Development and Lean. During our interviews several informants mentioned KBD frequently and interchangeable with Lean. We noticed it already in the pilot-interview with leader 4, who highlighted the negative impact of lacking knowledge management in departments associated with development and engineering. We introduced some of the outcomes of such organizational shortcomings like excessive customer decision power, lack of proper product portfolio, waste of time and resources in regard to repetition of the same processes that are not standardized.

"Lean concept for me is very attached to what we call KBD - knowledge base development, but I know of course that both terms are used somewhat interchangeably."- leader 1

Although leader 3 extended the definition and compared the term KBD to Lean product development. His knowledge and involvement within this field gave us greater comprehension and awareness about the highlighted relationship. It is explained by the underlying theory presented previously in this paper and by the informant. Both Lean product development and KBD aim to increase efficiency and customer value within R&D/engineering field.

"Knowledge Based Development, some call it Lean product development. It has a lot of the same principles and both come from Toyota.(...)"- leader 1

However, the fundamental difference between KBD and the Lean manufacturing lies in KBD's focus on the knowledge distribution within the company (Krogstie et al., 2014). This aspect is not of the highest importance within traditional Lean, while in KBD proper and systematic reuse of knowledge allows to reduce waste and improve resource utilization. Leader 3 emphasizes the importance of knowledge distribution in his company. In his meaning, by properly capturing and storing the knowledge for further reuse, the company can improve its value stream.

"Knowledge between projects are not always well managed. Therefore much of the fundamental thing with KBD is to build knowledge across all projects and then boost the Value Stream. The knowledge is pulled into a project and reinforced with new knowledge generated during the

project. Then all the knowledge together is used to build a knowledge base. So in principle we get a wider knowledge source that can be reused." - leader 3

It seems also that both Lean and KBD are in some extent used as trademarks and promotion labels suited for marketing. Leader 3 explains it as the strategic reason why his company have chosen to use the term KBD instead of Lean product development.

"We have chosen the term a bit strategically to separate us from Lean, because Lean is implemented in very many factories in Norway and around the world. So with Lean one thinks Toyota and Lean manufacturing, but to somehow differentiate it we deliberately called it KBD"- leader 3

4.4.1 Interpretation

Concerning our informants there was only the leaders who mentioned and combined Lean with the term KBD. It is presumably caused by the same reason as with the term Lean, where leaders have greater understanding and dedication for the phenomenon. While the non-leaders practice it in their everyday work life without reflecting on which of the management philosophies they use, either it is Lean or KBD. As mentioned earlier there is a difference between *talking about* and *working with* the things.

4.5 Interaction between Lean and innovation

This part of the analysis is expected to provide an answer to the core of our research question. In the interview guide we included seven different questions investigating Lean's impact on innovation and organizational performance. The collected answers were different in regard to both scope and the approach. Here again, we observed the contrast between leaders and the non-leaders. Although, we do not notice differences between the value creation logics. Regardless the limited informant selection the overall picture of the examined relationship is rather complex.

The literature review revealed that the interaction is controversial regarding the potential conflict between the demands linked with each concept (Johnstone et al., 2011). The most transparent

difference between those two lies in perception of waste, which Lean attempts to eliminate, while innovation embraces it as a room for creativity. Apparently this seems to be a complete contradiction, however, the combination is also proved to be successfully implemented in several business sectors (Byren et al., 2007; Chen & Taylor, 2009; Lindeke et al., 2009; Schuh et al., 2008). Though, not every waste is unnecessary waste, as highlighted by leader 1. The key to success appears to lie in approach to implementation of Lean in innovative environments. Proper adjustments and change of perspective and focus, like in Knowledge Based Development, turns the contradictions into complementary elements.

"You should be careful when you start calling things waste because there exist necessary waste too. So when it comes to innovation and Lean it is not quite like that straight forward about what is necessary and unnecessary waste." - *leader 1*

In our thesis we attempted to examine the contradictory theories about this interaction by investigating the impact Lean have on innovation in three different high technological firms in Norway. First, we wanted to see if the informants perceived a difference between Lean in manufacturing versus Lean in R&D. This is because the theory presented in previous section accentuate that the principles of Lean should be implemented differently in R&D than in manufacturing. The selection of tools varies depending on departments as well as organizational structure or industry (Reinertsen & Shaeffer, 2005). Our informants, especially the leaders, pointed out a difference between Lean in manufacturing versus Lean in R&D. Leader 3 emphasised that it is probably easier to implement quantitative changes in manufacturing than in R&D because of the quantifiable character of the former. Therefore the reason why both company 1 and company 2 have achieved success with implementing Lean in both manufacturing and R&D may be because the principles and tools from Lean are implemented differently in the two departments.

"Often there are better measurements in production. It is easier to measure it. Therefore, it is also easier to implement quantitative changes there. So I think Lean production will probably be much more systematic and measurable. While in development, it is very difficult to see and

measure changes. Too often effects come at the end of the project and then there is no one who cares about it anyway." - *leader 2*

"I would say that these are the same concepts but they have a different approach. An example: in Lean manufacturing it is desirable with minimum stock, while in Lean development, we want to take care of knowledge to build up as much stock of knowledge as possible, to say so. Many want the least possible problems in Lean manufacturing, while here we want to consider all problems to learn from it. So yes, it is a little difference but it is in a way the two sides of the same coin."
- leader 3

The following statements prove the difference between Lean manufacturing and Lean product development, and draw a clear distinction between them. Simultaneously the similarities like focus on stock and value creation can be easily observed. However, those similar aspect have to be approached in different manners. As highlighted by leader 3, inventory in Lean manufacturing is desired to be reduced to the minimum, while in Lean R&D all problems and requests are stored in the knowledge database, which is a type of an expanding stock. The tangible and measurable character of Lean manufacturing distinguishes it from Lean product development, which is rather difficult to quantify. That is also what non-leader 3 emphasized while presenting the Lean manufacturing strategy in his company. In his opinion Lean principles are not suitable for R&D because of the dynamics and on-going continuous changes in this environment, as well as some organizational shortcomings. In compliance with leader 4, he highlighted that in company 3 the dominance of customers' voice in development processes, uniqueness of the products, as well as some flaws in their system, like lack of permanent product portfolio and standardization of processes, uncontrolled time and resource usage, enormous workload, external uncertainty, uncontrolled workflow, are considered the biggest issues enabling the company to implement Lean/KBD and standardize the knowledge flow. This seems to be the crucial problems in R&D to be solved by Lean, but there is no will imposed about it at the moment.

Leader 3 explained that in his company the core of KBD is an internal knowledge database, which can be considered a component/product portfolio, used in regard to new developments. Especially, as mentioned in previous section, this is a crucial thing missing in company 3. Leader

3 revealed that despite that KBD is well established in the company, there are still some employees who struggle to adapt to this system. That is because they feel constrained by a limited predetermined range of choices they can make, thus thinking outside the box appears frame worked to them. Leader 3 meant that it is a common misconception, however there is always a possibility to extend the knowledge database with new great ideas. Therefore, we daresay that the meaning of KBD/Lean is not to limit the innovation, but to conduct it in systematic and organized way that is possible to capture, analyse and eventually reuse in the future.

Despite that some of our informants were critical to the combination of Lean in R&D, the other informants did not see that there was any contradictions, at least if the tools and principles are adapted by the department. They have had a good experience with using different Lean tools in R&D, without this going at the expense of innovation. Especially the A3 tool, which was mentioned by most of our informants.

"I have never experienced any contradictions (between Lean and innovation) but (...) if one is to be innovative in the extreme degree so that in principle everything is new, then not all of principles of KBD (Lean) are suitable when one should think outside the box and develop entirely new solutions." - *leader 3*

"When you work with innovation you can benefit from Lean, they in a way complement each other. Because while working with innovation it is important to discriminate - what is relevant and what is not. And it is quite compatible with Lean mind-set and the focus on what creates value. But it's difficult to balance, because (...) innovation wants to explore, and Lean want to focus. But there is much in Lean that gives value in innovation too."- *leader 2*

"We focus on the gaps - what we can, what we cannot and if we have the technology to do it? (...) And based on what we define as a gap, (...) and build the knowledge to solve the problem (...). And that is a systematic way to be innovative, (...) an engineering way to build knowledge and knowing the solutions implemented." - *leader 3*

The majority of our informants see the benefits that Lean brings to R&D, but they also emphasize that there must be a balance. While it is important in R&D to explore in order to be creative and inventing, Lean in most part targets processes that create value to the customer. According to leader 3 there are many aspects of Lean that bring great value in innovation. Thus, comprehensive understanding about the contradictions and right selection of suitable tools, contribute to successful combination of the two seemingly conflicting concepts.

While analysing this part of the interview, we again observed the common difference between approaches to leaders and non-leaders. As presented above, leaders' perspective regarding Lean's impact on innovation is much broader and theoretical than the non-leaders' point of view. We observe that the non-leaders focus on the visible aspects of Lean, that means the tools used in their departments. The documentation tool A3 gets special attention because of its simplicity and usability in many contexts. The non-leaders accentuate its role for engineers wanting to introduce a new idea. Traditionally they would be obligated to deliver a comprehensive report concerning the idea, while by using an A3 they can shortly formulate their idea and the essential information. That is beneficial for both the writer and the reader. In this manner the ideas have greater chance to become a commercial product.

Both leaders and non-leaders frequently mentioned the standardization of processes that are lacking at some points in all companies. Majority of the informants wish that there were more and better defined guidelines and standards leading them through the particular processes. That is one of the most essential Lean principles enabling to among others reduce waste and decrease cycle time (Womack et al., 1990). However, based on the gathered data about the companies, we assess that despite of those claims, the investigated companies did not have significant deficiencies regarding standardization nor other Lean principles. We also observed high degree of multidisciplinary in the investigated companies, especially in company 1, where departments cooperate in regard to achieve highest level of efficiency, and company 2, which is multidisciplinary team, based. This Lean principle ensures knowledge sharing and reuse as well as obtaining the highest level of best practice within the company.

4.5.1 Interpretation

The majority of our informants did not see the negative interaction between Lean and innovation as one could think considering their conflicting nature. They had mainly only positive experience with the merger of the two subjects, but they also emphasized that there is a difference between Lean in manufacturing versus Lean in R&D, and that Lean principles and tools have a different function within R&D. If Lean is implemented appropriate in R&D it can provide a variety of advantages, the informants mentioned among others the advantages provided by tools like the A3. These benefits are also accentuated in our theory in earlier chapter, for example by Reinertsen & Shaeffer (2005) that explains that Lean thinking can encourage deep, root cause exploration of problems and help to select the problems that are most important to address instead of jumping right to the wrong conclusion. The companies appear to develop their knowledge by solving and analysing the emerging problems, instead of getting rid of them in the simpler possible way. In this manner the idea creation based either on existing problem or on new invention becomes a value-adding activity that is positive from Lean perspective (Chen & Taylor, 2009; Schuh et al., 2008). Achieving this appears to be enabled by the widely observed multidisciplinary structures engaged in the companies. Gathering together employees with multidisciplinary backgrounds create and generate ideas easier because of the stimulating context of this type of structure (Lindeke et al., 2009).

We observed that the answer to our research question depended on the attitudes and experiences. Company 3 believed that the combination of Lean and innovation could be a controversial, despite that they have not introduced it yet. However, they recently started the process of implementation of KBD. The remaining companies gave no indication that it was unusually controversial. The distinction between value chain and value shop configuration served here as a control variable. We observed that informants belonging to value shops were slightly more positive towards the influence of Lean on innovation. Informants assigned value chain configuration were more sceptical to this combination because in their mind Lean belongs to manufacturing. That can be also explained by their lack of experience with this combination. Although both leaders and non-leaders are mostly pleased with what they have experienced with Lean in R&D so far, there is still much implementation work that remains. Implementation of

Lean is not feasible overnight. Toyota spent decades on implementing Lean in their business and they have never purported to be done with the process (Womack et al., 1990).

We conclude that we expected to reveal more of the contrasting aspects between Lean and innovation in practice than we did. Apparently Lean and innovation do not represent such a significant contrasting problem in practice as believed by some of the theorists and our assumption. This may be because the majority of our investigated companies have innovation high on their agenda. They managed to succeed with this controversial combination of Lean and innovation by adapting Lean to the R&D department and not the opposite. By only using a few of the Lean tools and with proper adjustment company 1 and company 2 are both increasing the efficiency while also facilitating innovation. We have to emphasize that this is based on our investigated companies and that other companies can have another opinion.

5. Discussion

In this part of the thesis we review the results that emerged in the analysis chapter, and discuss our main findings and review these against our research question. By conducting this thesis we attempted to examine the conflicting theories about the relationship between Lean and innovation. Simultaneously, we wished to contribute to expand the existing deficient research in this field. In this regard we based the present work on the following general research question:

In what ways does Lean influence innovation processes, and is the influence dependent on the value creation logic of the enterprise?

First, we can conclude that unlikely to our assumption, the findings proved a rather positive interaction between Lean, or at least some tools from Lean, and innovation. Although, we expected more significant reflection about the conflicting nature of this two concepts and what kind of adjustment that have been made to make it work. Especially since some of our informants emphasized the importance of maintaining a balance between Lean and innovation. Based on the previous literature review we developed an expectation about collecting contrasting and nuanced information about this controversial combination.

Most of our informants did not observe any reasons for why Lean should not work in R&D. Simultaneously some highlighted the aspects about Lean's principles and tools that provide advantages in the R&D environment. A significant observation was made regarding the complementary character of Lean in R&D and the concept of Knowledge Based Development. We assume that those two concepts are equal to an extended degree, since both aim the same efficiency targets and are based on the same principles. In this regard it appears to rather be a matter of label or trademark that is used by different companies, who want to differentiate from the abundance of "Lean companies". That is a finding that we did not expect to reveal in this study. We went out to study Lean and innovation, but additionally we found a different label for the combination of those concepts. That is an interesting object for future research, as we partially revealed in case of company 3, that some firms may practice Lean innovation under cover of KBD without being aware of it. Later research may consider to integrate this finding to their perspective.

Despite of the positive interaction between the concepts of Lean and innovation revealed by the existing literature, we expected that the informants would mention the natural contrast between them and describe what they have done to work around the obstacles. As highlighted frequently throughout this thesis, the examples adduced in the literature prove that Lean and innovation can actually work well together and even lead to more innovation, but it is important that companies adapt Lean individually and cautiously to the company and each department. Lean, as any other managerial system, cannot be simply "copied and pasted" from other firms. Additionally, managers must be prepared for extensive cultural challenges within the company caused by a comprehensive organizational change like Lean.

Second, we observed distinct differences between leaders' and non-leaders' approaches to the researched topic/issue. As emphasized several times in previous sections of this paper, the interviewed leaders showed a considerably broader understanding and greater reflection regarding both practical and theoretical approach to Lean and innovation, as well as the interaction between them. Majority of the leaders drew a diversified and rather complex picture of the relationship between Lean and innovation. That is inconsistent with the assumption about the negative interaction while leaders' standpoint supports the positive relationship between Lean and innovation. On the other hand the non-leaders showed a rather simple understanding of the concept, while they focused mostly on the visible and tangible effects brought by Lean. We consider it to be a natural distinction in perceptions caused by the different levels and scope of informants' education and experience. By that we do not mean to underestimate the answers provided by the non-leaders, although their contribution to our research appears to be rather limited and not detailed enough. However, the non-leaders contributed with some negative experiences and observations regarding Lean in practice. This confirms our assumption regarding the difference between leaders' and non-leaders' perceptions of the interaction between the concepts.

In regard to the engaged value creation logics we did not observe any significant variation between the two types of value configurations. We used this distinction as a control variable but it appeared that it is rather differences between leaders and non-leaders that provide the

variation. We can conclude that this distinction worked well and contributed to creating a nuanced perspective on the researched topic, although it did not result in any significant finding.

5.1 Conclusion

The present study attempted to prove that companies do not need to limit their implementation of Lean by the traditional approach that relates mostly to manufacturing. Lean in R&D may be implemented differently, although it is based on the same principles applied in different and often contrasted ways. We did not collect any particular examples of obstacles for innovation caused by Lean, therefore it can be concluded that implementing Lean in innovative companies or departments is fully possible if one manage to adapt it to their own needs.

Both existing literature and this study indicate that Lean affects rather processes than products themselves. This fact was highlighted by leaders in company 1 and company 3. This leads to continuous innovation (improvement) of firms' work processes, which further indirectly influences the products.

We expected more negative expressions about the interaction, but got most positive or almost neutral responses. This may be caused by the selection of informants that included very innovative companies that have implemented Lean to a great extent. Therefore it would have been inconsistent if they reviewed the combination of Lean and innovation negatively. However company 3 had a negative opinion about Lean innovation, despite the fact they have not implemented it. Although, they are busy organizing the development and knowledge flow in compliance with Lean. However they do not call it Lean but KBD. We mean that it would be interesting to examine business that had tried to implement Lean without success. Most likely that would provide stronger contrasts in responses and even greater comprehension in this field.

5.2 Implications

The main result of this study can contribute with some implications, both theoretical and managerial. Regarding the academical approach to the examined topic, the present work supports

the theory of positive impact that Lean can have on innovation. Therefore our findings revealed in the present work are not fully consistent with the existing theories about the rather negative interaction (Chen & Taylor, 2009; Lewis, 2000; Lindeke et al., 2009; Mehri, 2006; Schuh et al., 2008). Although the findings suggest that innovation can be reinforced by Lean's principles as long as the balance between the concepts is achieved and maintained.

For research, the findings of the present work add understanding and extend the existing theory. Other finding regarding complementary character of Knowledge Based Development for Lean innovation should be taken in account when investigating this field further. Lean's impact on different types of innovation should be considered in future research. It is also suggested an examination of companies striving for innovation while applying Lean.

For organizations, the findings suggest that the proper adjustments at business level have to be made when implementing Lean in innovative environment. To achieve a positive balance it is important that Lean in R&D is treated differently than Lean in manufacturing. Tools and practices of Lean must be adapted to fit a whole environment, and it is important to consider implementing only some of the Lean adjustments. As mentioned earlier, going "too Lean" can affect the innovation negatively.

Some of the findings of the present work may be beneficial for managers. First, as highlighted by non-leader 3, it is crucial to engage an expert who can guide the implementation process and motivate and support the employees. The person employed as a "prophet" in this context should preferably be a current employee who knows the core competences and challenges of the company. Second, the Lean philosophy should be understood and accepted by the entire organization. In order to involve all employees, managers should provide for good communication between all levels and ensure that everyone works towards the same goal. Managers should be active and visible through the whole process. Employees should be aware that Lean is not limited to the simple tools and routines, but it is a comprehensive philosophy that the organization has to work towards continuously.

By conducting this study we found support for the positive impact Lean may have on companies' innovative abilities, we also found out that Lean may be successfully applied in both engaged value creations when proper adjustments are undertaken. The findings do not support the negative interaction between the concepts Lean and innovation. However, our study revealed another "label" that may be used for implementation of Lean in innovative environments (R&D, product development).

6. Limitations

After conducting a study it is important to critically evaluate the result and findings. Our study has certain limitations that need to be taken into account. First, as we chose to conduct a qualitative research the study is based on a strategic informant selection. A strategic selection naturally brings forth several limitations concerning generalization/transferability of the study's results. The greatest problem concerns the collected statements and information, which could have varied entirely if we had chosen another group of informants. Especially since our selection consist of companies within the same industry. More time and resources would allow us to include several companies from various sectors. It would be particularly interesting to include companies that have experienced a negative combination of Lean and innovation, since the majority of our informants had a positive view on the interaction.

During the analysis process we realized that some flaws and deficiencies had been made in the interview guide. If we could re-conduct the interviews, we would ask the informants' about the actual experiences, as we realized that the informants mainly presented their subjective points of view instead. With more time and resources we could also been able to include a quantitative approach to the study. By for example using surveys we could have reached a larger selection of similar companies within various industries. That could probably have contributed to greater insight in the investigated topic. Despite the limited selection we felt that our informants provided a lot of information and point of views helping to answer our research question.

6.1 Further research

As a further research it could be sensible to include both organizations that have succeeded with the controversial combination of Lean and innovation and organizations that have failed. We mean that we could have obtained a deeper understanding about the interaction if we had included organizations, which have experienced a negative interaction. It could also been interesting to examine which innovation types Lean adjustments affect the most. In addition, the complementarity between Lean innovation and Knowledge Based Development is a field that may potentially be an interesting objective for further investigation. The framework and terms should be acknowledged in later studies with similar aims as our study.

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Appendix 1: Interview guide

Part 1. General information

- Age
- Education
- Total work experience (years)
- Responsibility/position in the company
- How long in this position?

Part 2. Strategy – value creation

- What is the specialization of the department?
- Which strategy – cost leadership or differentiation?
- How would you describe value creation process within the department?
- What are the primary and support activities?
- How would you describe the structure of the department?
- What is department's core competency and its unique contribution to the entire company?
- How important is the department for the entire company?
- How would you describe the culture within the department?

Part 3. Innovation concept – comprehension

- What do you associate with concept of innovation?
- How to facilitate innovation?
- What can hinder innovation?

Part 4. Innovation / R&D – standard and routines within the department

- Is workload in your department associated with innovation?
    - If yes:
        - To what degree?
        - In what way?
        - How does it contribute within the organization?
- Are there any routines facilitating innovative work?

Part 5. Lean concept – comprehension

- What do you associate with concept of Lean?
- Which principles are in your opinion the most important?
- How to facilitate Lean in practice?

Part 6. Lean – practice

- When was Lean implemented in the company?
- Do labour unions have any influence on implementation of Lean in Norwegian enterprises?
- To what degree does your department follow the Lean principles?
- Are the principles presented for and understood by all of the employees within your department?
- Which routines according to Lean do you practice in the department?

Part 7. The interaction

- What is your opinion about implementation of Lean in manufacturing vs. in R&D?
- In what way does strategy of the department influence its innovative abilities?
- How do innovative abilities influence Lean in practice? (Why?)
- How does Lean influence innovativeness in your department? (Why?)
- What is the interaction between strategy, innovation and Lean?
- In what way does Lean influence value creation process?
- What is the significance of Lean for the department's performance and development?

Appendix 2: Registration receipt - Norwegian Social Science Data Services - Project nr. 42025

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr: 985 321 884

Eskil Le Bruyn Goldeng
Institutt for industriell økonomi (Kongsberg) Høgskolen i Buskerud og Vestfold
Postboks 235
3603 KONGSBERG

Vår dato: 02.03.2015 Vår ref: 42025 / 3 / LB Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 03.02.2015. Meldingen gjelder prosjektet:

42025	*In what ways does Lean influence innovation processes?*
Behandlingsansvarlig	*Høgskolen i Buskerud og Vestfold, ved institusjonens øverste leder*
Daglig ansvarlig	*Eskil Le Bruyn Goldeng*
Student	*Martha Schultz*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 15.06.2015, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Lene Christine M. Brandt

Kontaktperson: Lene Christine M. Brandt tlf: 55 58 89 26
Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Avdelingskontorer / *District Offices*:
OSLO: NSD. Universitetet i Oslo, Postboks 1055 Blindern, 0316 Oslo. Tel: +47-22 85 52 11. nsd@uio.no
TRONDHEIM: NSD. Norges teknisk-naturvitenskapelige universitet, 7491 Trondheim. Tel: +47-73 59 19 07. kyrre.svarva@svt.ntnu.no
TROMSØ: NSD. SVF, Universitetet i Tromsø, 9037 Tromsø. Tel: +47-77 64 43 36. nsdmaa@sv.uit.no

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 42025

Utvalget informeres skriftlig om prosjektet og samtykker til deltakelse. Informasjonsskrivet av 26.02.2015 er godt utformet.

Personvernombudet legger til grunn at forsker etterfølger Høgskolen i Buskerud og Vestfold sine interne rutiner for datasikkerhet. Dersom personopplysninger skal lagres på mobile enheter, bør opplysningene krypteres tilstrekkelig.

I informasjonsskrivet til utvalget er det oppgitt at forventet prosjektslutt er 15.06.2015. Ombudet har justert dato for prosjektslutt i henhold til dette. Ifølge prosjektmeldingen skal innsamlede opplysninger da anonymiseres. Anonymisering innebærer å bearbeide datamaterialet slik at ingen enkeltpersoner kan gjenkjennes. Det gjøres ved å:
- slette direkte personopplysninger (som navn/koblingsnøkkel)
- slette/omskrive indirekte personopplysninger (identifiserende sammenstilling av bakgrunnsopplysninger som f.eks. bosted/arbeidssted, alder og kjønn)
- slette lydopptak