



CHALMERS
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A Lean Perspective Analysis of the Design Phase in a Swedish Construction Company

Master's Thesis in the Master's Programme Design and Construction Project Management

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ABSTRACT

The construction industry is fragmented and often described as slow and inefficient. Furthermore the industry is constantly introduced to new demands due to fast changes in technology, higher levels of uncertainty, an increasing housing shortage and more competitive actors on the market. The ability for construction companies to continuously improve and develop their business is therefore crucial to its survival. Moreover, previous research has highlighted that the success of a project and delivered customer value often is determined by decisions made during the early stages of a project's development, in the design phase. Despite this, business development concepts have mainly been applied on the production phase, leaving the design phase to be an area that would benefit from more attention.

The case study has been performed according to a qualitative method and is based on a theoretical framework about process based development, Lean and collaborative practises, seen from the perspective of the Swedish construction industry. In addition, the case study is based on interviews with 9 employees at the case company. The company is a private multifunctional construction company in Gothenburg Sweden that holds both an in-house client organisation and a construction department that together produce multi-dwelling buildings. From the client perspective and foremost the project managers', the study aims to identify improvement areas in the design phase of those in-house projects and moreover what improvements that can be recommended by using a lean perspective.

The study identified a number of improvement areas related to the extensive and controlled process, as well as to lack of transparency, trust and consensus in the organisation. It is considered that applying lean philosophies to the design phase would be beneficial for the company. Lean emphasises flow in process, by reduction of waste and focus on value creation and along with more collaborative practises Lean is considered to be a suitable approach for improving the design phase. However, Lean is emphasising a holistic view and the philosophies should therefore preferably be applied to the whole project process, as well as to all functions, both internal and external.

Keywords: Construction Industry, Lean, Lean Design, Process Development, Process Flow, Standardisation, Value Creation

Lean i projektutvecklingsfasen – En fallstudie på ett svenskt bygg- och fastighetsföretag

Examensarbete inom masterprogrammet Design and Construction Project Management

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SAMMANFATTNING

Byggbranschen är en fragmenterad bransch som ofta får kritik för att vara långsam och oeffektiv. Samtidigt ställs branschen ständigt inför nya utmaningar i form av ny teknik, nya lagar och bestämmelser, en ökande bostadsbrist och fler starka konkurrenter på marknaden. Byggföretagens förmåga att ständigt förbättra och utveckla sin verksamhet är därför avgörande för deras överlevnad. Forskning har visat på att ett projekts framgång och levererat kundvärde ofta beror av beslut som fattas i de tidiga skedena. Trots detta så har koncept inom verksamhetsutveckling, så som till exempel Lean, huvudsakligen applicerats på produktionen vilket innebär att projektutvecklingsfasen är en fas som är intressant att titta närmare på.

Fallstudien har utförts enligt kvalitativa metoder och baseras på ett teoretiskt ramverk inom områdena processbaserad utveckling, Lean och samarbete i byggbranschen. Studien baseras också på intervjuer med 9 anställda på det studerade företaget. Företaget är ett privatägt multifunktionellt bygg- och fastighetsföretag i Göteborg som består av både en beställarorganisation och en produktionsavdelning, vilka tillsammans arbetar med nyproduktion av bostäder. Utifrån beställarens perspektiv, och framförallt utifrån projektchefernas perspektiv, har projektutvecklingsfasen studerats med fokus på att identifiera förbättringsområden och analysera hur dessa kan utvecklas utifrån ett Lean perspektiv.

Studien har identifierat ett antal förbättringsområden relaterade till en kontrollerad och omfattande projektutvecklingsprocess, samt bristande transparens, förtroende och samsyn i organisationen. Genom att tillämpa Lean i projektutvecklingsfasen anses företaget kunna nå bättre resultat i projekten. Genom att förbättra flödet i verksamhetens processer samt genom att minimera slöserier och fokusera på värdeskapande aktiviteter anses projektutvecklingsfasen kunna effektiviseras. Lean betonar dock vikten av att förbättra processer utifrån ett helhetsperspektiv och därmed skulle framtida studier gynnas av att inkludera ett projekts alla faser, samt både interna och externa funktioner.

Nyckelord: Byggindustrin, Lean, Lean design, Processutveckling, Processflöde, Standardisering, Värdeskapande

Contents

ABSTRACT	I
SAMMANFATTNING	II
CONTENTS	III
PREFACE	V
1 INTRODUCTION	1
1.1 Purpose	3
1.1.1 Research questions	3
1.2 Method	4
1.3 Thesis outline	4
2 THEORETICAL FRAMEWORK	5
2.1 Process based business development	5
2.1.1 Defining processes	5
2.1.2 Standardisation of processes	6
2.1.3 Process mapping	7
2.2 What is Lean?	8
2.2.1 Defining Lean	9
2.2.2 Risk of ‘trendiness’ and ‘method fundamentalism’	10
2.2.3 Value creation and customer satisfaction	10
2.3 Lean in construction	12
2.3.1 Why Lean in construction?	12
2.3.2 Lean in the design phase	13
2.4 Collaboration and interaction	16
2.4.1 Trust	17
2.4.2 Communication	19
2.4.3 Knowledge and learning	19
2.4.4 Management and leadership	20
3 METHODOLOGY	22
3.1 Identifying the problem	22
3.2 Literature review and theoretical framework	22
3.3 The case study	23
3.3.1 The case	23
3.3.2 Interviews	24
3.4 Result and analysis	25
4 RESULT	27
4.1 The present situation	27

4.2	Identified improvement areas	28
4.2.1	The Process	28
4.2.2	The Collaboration	35
5	DISCUSSION	38
5.1	Theoretical framework	38
5.2	Result	38
5.3	Further analysis and interpretation	39
5.3.1	Creating flow	40
5.3.2	Collaborative practises	42
5.4	Possible hindrances and limitations	44
6	CONCLUSIONS AND RECOMMENDATIONS	46
6.1	Creating flow	46
6.2	Collaborative practises	46
6.3	Recommendations	47

REFERENCES

APPENDIX 1

Preface

This master thesis of 30 ECTS has been performed during the spring of 2015 at the Department of Civil and Environmental Engineering at Chalmers University of Technology. Throughout the work with this master thesis there have been several persons that have contributed to the result and that we would like to acknowledge, in no particular order.

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To us this thesis represents the end of our five years at Chalmers University of Technology and we are thankful that all of you wanted to be part of it and that you enriched our knowledge about construction and project processes.

Gothenburg, June 2015



Marie Falk



My Wallberg

1 Introduction

The construction industry is fragmented and complex in terms of large, unique and costly projects involving many different actors over several years (Warsame, 2009; Tilley, 2005). The industry has been criticised for being slow and inefficient due to many construction projects not being completed on time and to the predicted cost, leaving client and end customer dissatisfied with a product not matching the expected quality (Bröchner, et al., 2002; Dave & Koskela, 2009; Fulford & Standing, 2014). In addition, the construction industry is constantly introduced to new demands due to fast changes in technology, new laws and regulations, an increasing housing shortage and more competitive actors on the market (Ljungberg & Larsson, 2012). Hence, the ability of construction companies to continuously improve and develop their business is crucial to its survival (Dave & Koskela, 2009; Ljungberg & Larsson, 2012).

Today, most companies conduct some form of business development where the goal is to make their business more structured and efficient (Ljungberg & Larsson, 2012). Process Based Business Development is the term for various types of development concepts that aims to continuously identify, map, analyse and develop the work actually performed by the organisation; the business processes. Ljungberg and Larsson (2012) defines a business process as “a chain of activities which in a recurring flow creates value for a customer”, where value is something that the customer has a need for and hence is willing to pay for. Business processes can also be seen as a flow of information and material that are comprised in the product that the customer buys (Winch & Carr, 2001). By mapping and analysing what actually happens in the business processes and comparing the result to protocols of what is supposed to happen, it can be identified to what level the organisation meet the customer needs. Differences in work actually performed and work intended to be performed by the organisation, illuminate areas of improvement and possibilities of process redesign.

To be able to continuously improve a process, some form of initial standard has to be set (Sörqvist, 2013). A standard should represent the best, easiest and safest way to perform an activity and be designed based on previous experience in order to eliminate errors in the process (Santos, et al., 2002). Sörqvist (2013) stress that by introducing uniformed ways to perform the activities, a standardised process is established as a base for future improvements. Standardisation is sometimes faced by resistance since people don't like to be standardised and managed in detail, but instead want to work freely. To create acceptance for the standards it is important that the people performing the work also are allowed to influence the development. Additionally, standards should not be seen as a constraint but rather as guidelines and in a business, like the construction industry, where every project is unique, only standardised systems that allow some kind of managerial freedom should be implemented.

Business processes, especially in the fragmented nature of the construction industry, consist of several activities that are linked together. Ljungberg and Larsson (2012) argue that cost, delays, errors and inflexibility in a process often comes from the connections between activities rather from the individual activity itself. Therefore, Ljungberg and Larsson (2012) together with Sörqvist (2013) state that businesses can only achieve the required levels of productivity, profitability and quality by viewing

their organisation holistically. Furthermore, in order to remain competitive, construction companies need to manage their processes effectively and efficiently, making sure that customer value is created throughout the whole project life cycle.

As construction projects are becoming more and more complex, the functions in a project extends beyond a single firm and involves relations with several other actors (Warsame, 2009; Tilley, 2005). Thus the organisational structure in a project is shaped by the interaction of these actors (Warsame, 2009) and a more thorough planning is required to control the process and steer the whole project team in the same direction (Tilley, 2005). Construction is also an information intensive industry where the numerous participants are communicating a large amount of information throughout the various project stages (Dave & Koskela, 2009). Consequently, good collaboration is becoming increasingly more important in order to reach project objectives. Moreover, relationship-oriented partnerships are claimed to help create efficient and long-term collaborations that reduce uncertainty for both parties, hence allowing a more efficient use of resources and opportunities to add value (Sarkar, et al., 1998).

Fulford and Standing (2014) argue that construction companies would benefit from more collaborative practices. At the present many relationships in the supply chain is characterised by conflicts, short-term thinking and lack of trust. Stronger relations between the actors in construction projects would increase the sense of obligation and accountability. As a result, the quality of work would improve and hence the project outcomes would be optimised. Moreover, many problems arise around project scope and cost, often leading to cost overruns. Productivity improvements could therefore be gained by improving the financial management in projects. For example, Bygballe and Jahre (2009) suggest that companies can improve their accounting system to provide a better incentive for taking the whole project into account. Changing to more collaborative practises and open culture that focuses on teamwork rather than individual performances is also claimed to improve project efficiency, in terms of time, quality and cost.

According to Tilley (2005) the elements of traditional management do not seem to consider the unique organisational problems associated with construction projects, as for example the project manager being dependent on people not included in the own organisation. Moreover, the different roles in the construction industry often imply contradictory needs, which indicate that competing logics exists in construction, both in individual companies and in the industry as a whole (Bygballe & Jahre, 2009; Tilley, 2005). These competing logics can often be clearly related to different groups with different interests. Hence, most construction companies take different needs into consideration and apply different logics in order to create value. Depending on how construction companies handle tensions between multiple logics with different cost and value drives, project results will vary. Additionally, construction companies often struggle with the traditional silo thinking, where each unit is only concerned of their own tasks and budgets and do not pay enough attention to the project as a whole. To handle these problems measures that take all interests into consideration need to be established. Thus, through removing barriers, improving trust, communication and information sharing and acknowledging common goals, integration of competing logics in the design and construction phase can take place and thus value can be created.

Lean is today a well-known process based concept that emphasises a holistic view, process flow and value creation (Modig & Åhlström, 2013; Sörqvist, 2013). A process consists of several flows represented by for example material, products, information or people (Sörqvist, 2013).. In construction, information flow and material flow often exist and interact simultaneously; hence the holistic view is important to avoid suboptimisation. By value creation, Lean literature refers to activities performed within the organisation, that through refinement of the product or service, directly provide value for the customer. Hence, Lean is about creating a flow throughout the whole organisational chain by continuously removing non-value adding activities and thereby generates value for the customer (Womack & Jones, 1996; Modig & Åhlström, 2013; Sörqvist, 2013; Winch & Carr, 2001).

In a construction project, the lead-time from start of project design until the start of production is labelled *design phase* and time in this phase is needed to identify user needs, develop ideas and design, understand these and plan the project (Josephson & Chao, 2014). Research has highlighted that the success of a project and delivered customer value often is determined by decisions made during the design phase (El Reifi & Emmitt, 2013; Emmitt, Kirk-Christoffersen, & Sander, Implementing Value Through Lean Design Management, 2004). Additionally, shortcomings in project management as well as poor communication between project members, poor control of the design phase and deviant information has shown to have a negative impact on the construction process, in terms of reduced efficiency and overall performance as well as waste generation and contract variations (El Reifi & Emmitt, 2013; Fulford & Standing, 2014; Tilley, 2005). El Reifi and Emmitt (2013) argue that despite the very important fact that decisions in the design phase are most central for the total project outcome, focus has mainly been put on finding improvements within the construction phase, leaving the early stages, including the design phase, unchanged. For example, initiatives such as Lean have been frequently applied on the construction phase trying to solve problems and deal with challenges that should have been handled already during the design. Hence, within Lean literature, much attention has been put on the construction phase but only little on applying Lean to the design phase, leaving this to be an area that would benefit from more attention (Thyssen, et al., 2010).

1.1 Purpose

The purpose of this study is to analyse the construction project design phase using a lean perspective. By studying a multifunctional Swedish construction company, the aim is to identify possible improvement areas in the design phase.

1.1.1 Research questions

The purpose and aim is fulfilled through answering the following research questions:

- How can lean philosophies be applied to the design phase in construction projects?
- What improvements can be recommended by using a lean perspective?

1.2 Method

This thesis is based on a case study performed at a Swedish multifunctional construction company. The study was initiated through an exploring interview with the head of the Housing Department where possible areas of improvement within the design phase were discussed. An initial overall literature study considering the topic of Process Based Business Development and Lean together with discussions with supervisors from The Company and Chalmers University of Technology lead to the aim and research questions being determined. A case study was performed including qualitative interviews with six employees representing the Housing Department and three employees representing the Construction Department. A literature review was conducted in order to explore already existing research on the field of process development, Lean, Lean design, value creation, and collaboration, forming a theoretical framework. Results from the interviews were analysed with the theoretical framework and discussed in order to answer the aim and research questions. Areas of improvement were highlighted and suggestions for further development were presented.

1.3 Thesis outline

This thesis consists of six chapters. The first chapter is an introduction to the thesis, putting the topic of the study into context. The second chapter provides a frame of reference, which covers previous research within the areas of process development, Lean and collaboration. The method used for this thesis is described in the third chapter while results based on interviews and observations are presented in the fourth chapter. In the fifth chapter, the research questions of the thesis are elaborated and, together with the analysis of the theory, formed into the discussion. In the sixth chapter identified areas of improvements are concluded and presented together with recommendations for further studies.

2 Theoretical Framework

This chapter aims to introduce a theoretical framework to the subject, representing a basis for interpretation and analyse of the result. The chapter has been divided into three main parts where the first part describes the nature of processes including process based business development and standardisation of processes. The second part introduces the concept of Lean focusing on value creation, process flow and Lean in the design phase. The third part presents collaborative practices such as trust, communication and management that are all necessary for successful process development.

2.1 Process based business development

In a world characterised by rapid change, constantly shifting prerequisites and aggressive competition, a company's or business's ability to continuously improve and develop is crucial to its survival (Ljungberg & Larsson, 2012). Today, most professional companies and businesses conduct some form of business development where the goal is to make their business more structured and efficient in order to gain competitive advantage. Process based business development is an umbrella term for various types of development work that aims to continuously identify, map, analyse and develop the work actually performed by the organisation; the business processes. By studying and developing business processes, the goal is to ensure that value and customer satisfaction is created in every part of the process at the same time as the resources and knowledge of the organisation is used in the best way, generating a more efficient organisation.

2.1.1 Defining processes

The word process derives from the Latin words *processus* and *procedere*, which means "to bring forward" or "continue, advance" (Ljungberg & Larsson, 2012; Modig & Åhlström, 2013). Within a process a unit is being refined as it flows through the organisation (Modig & Åhlström, 2013). Sörqvist (2013) argues that most flows in a business can be seen as processes and describes a process as "a limited amount of coordinated activities that together serve a definite purpose". Furthermore, Sörqvist (2013) suggests that a process can be seen as the journey from customer need to customer satisfaction. Similarly, Modig and Åhlström (2013) define a process as "a collection of activities that together refines flow units", where a flow unit in the service sector is represented by a customer whose needs are satisfied through various activities. However, Ljungberg and Larsson (2012) define a process in a somewhat more complex way: "A process is a repetitively used network of collated linked activities which uses information and resources, based on an identified need, to create the value that satisfies the need", but also introduce a more simplified definition which has been adopted for this thesis; "a process is a chain of activities which in a recurring flow creates value for a customer".

To describe the importance of applying a process view, Ljungberg and Larsson (2012) in their work quote the guru of process thinking, Michael Hammer, when he states that "cost, delays, errors, and inflexibility come from the connections between pieces of work rather from the individual work pieces themselves". Thereby Hammer declares that businesses can only achieve the levels of productivity, cost and quality

required for survival of a business today by looking at their organisation holistically. Likewise, Sörqvist (2013) stresses that seen from a narrow perspective, a solitary activity often appears to work well and fulfil its internal purpose, but seen from a holistic view, focusing on overall flow and value for the customer, the activity might not be as well-functioning. Due to lack of coordination, sub-optimisation and organisational interfaces that disrupt the natural flow, the process as a whole is far from being as efficient and effective as each activity alone. Hence, there is a great desire by organisations to improve, develop and streamline their business processes, resulting in a great number of different business development concepts being introduced to the market.

2.1.2 Standardisation of processes

In its efforts to make its business more efficient, many companies try to create an operational system by structuring and defining their internal processes and activities. To create a system involves identifying and selecting the best ways to perform process activities and create conditions necessary for the work of the organisation to be carried out this way (Sörqvist, 2013). By introducing uniformed ways to perform the activities, a standardised process is established which then serves as a base for future improvements. The term standardisation was introduced to the construction industry in connection with the Latham Report (1994) and Rethinking Construction by Egan (1998) being published, both stressing the fact that the industry needed to become more efficient and streamlined and hence learn from the manufacturing industry and its standardised processes (Cooper, et al., 2005). Santos et al. (2002) emphasise that standards aim to minimise the risk of problems occurring in the process and thereby minimise waste in the process, therefore these standards should be designed based on previous experience. Santos et al. (2002) further suggest that a standard should represent the best, easiest and safest way to perform an activity. Moreover, it should be used as a reference in evaluating the performance and serve as a base for both maintenance and improvement activities.

The stage-gate model is a management tool developed from the theories of standardisation with the aim to ensure that projects are managed in a smooth flow towards completion (Gudmundsson, et al., 2004). The stage-gate model is widely used by companies and organisations today, focusing primarily on the early stages, briefs and design, where the model supports the project manager throughout the project lifecycle. The model divides the project development process into different phases with a stage-gate at the end of each phase (Cooper, 2008). The gates aim to control the process and at every gate the project is evaluated. For the project to be allowed to proceed to the next stage, certain documentation is required for each stage-gate, i.e. expected rate of return or a completed checklist. Once all required documentation has been presented, a decision for further activity is made (Cooper, 2008). According to Cooper (2008), there are three different decision possibilities; *Go*, which allows the project to proceed to the next stage; *Recycle*, which means that more information or documentation is required before proceeding; and *Kill or Hold*, which forces the project to be stopped. Cooper (2008) emphasises that the stage-gates aim to ensure project quality.

Although standardisation of processes and management tools such as the stage-gate model has shown good results when it comes to making businesses more efficient, Sörqvist (2013) elucidates that in practice it has often been difficult to implement this

way of working. According to Gudmundsson et al. (2004), there are four key elements that an organisation must consider before implementing a standardised platform; current and future needs of customers, the core competence of the organisation, effects on the supply chain of suppliers, and dominant technologies built into the products. Sörqvist (2013) on the other hand, points out the individual as the limiting factor since people do not like to be standardised and managed in detail but instead value to work freely and flexibly. Organisations have experienced this when their employees, despite extensive documentation of directives and procedures, often choose to do things "their own way", resulting in organisational deviations. One reason for this might be that individuals do not fully accept the standards, since they had no chance to influence them. To prevent this from happening, Sörqvist (2013) suggests that standards, to a greater extent, should be developed based on the experience and ideas of the employees in order to create a wider acceptance for the routines. Moreover, Santos et al. (2002) argue that a reason for standardisation not being easily implemented is the lack of teamwork between top management and employees. Additionally, Josephson and Saukkoriipi (2007) call attention to the fact that managers in the construction industry, since almost every housing project is unique, need some level of freedom to perform their tasks in a successful way.

Standardisation of processes and procedures and the use of tools such as the stage-gate model can, if implemented and communicated in a good way, support an optimisation of the overall process, increase efficiency of the organisation and make sure projects are delivered on time (Cooper, 2008; Sörqvist, 2013). However, a specific standard might not always be the most efficient way of performing a task for every individual, e.g. due to disabilities. Hence, standards should not be seen as a constraint but rather as guidelines. Furthermore, it is of great importance to avoid creating a system that does not allow any kind of managerial freedom in a business where every project is unique.

2.1.3 Process mapping

As to understand how value is delivered to customers, an important management tool that has become considered important in recent years is *process mapping* (Winch & Carr, 2001). Business processes can be seen as the flow of information and material that are comprised in the product that the end customer buys. By mapping processes it can be identified how the organisation meets the customer needs. Process mapping can be distinguished into two different types of mapping, first, by mapping what actually happens in the organisation and second, protocols of what is supposed to happen. The difference between these two can be considered identified areas of improvements leaving room for process redesign. By identifying dams and backwaters in the process flow the management can develop smoother and more direct information and material flows for the mapped process, to reach the point where they want to be.

The construction industry, in for example UK, has expressed interest in developing a generic process protocol, including common definitions and procedures for all companies in the industry, for the work to run smoother. However, this is criticised by Winch and Carr (2001), who claim that the main incentive for companies to improve and redesign their business processes is to become more competitive. Additionally, the construction industry is designed so that the companies in it are competing mostly

on the way they handle the project process, such as how to structure things, the management of supply chain and the ability to motivate skilled labour. By creating a basis for the industry procedures and processes this competitive advantage would be reduced and the profit levels lowered. A generic process protocol is therefore considered to inhibit the competition in the industry. Winch and Carr (2001) therefore point to the fact that process mapping and the development of process protocols should be placed in the appropriate context and suggest that standardisation of processes is best done in separate supply chains. Although, it is said that the construction industry can benefit from a more common methodology, that can provide a framework for how to shape project-specific processes. Moreover, another point highlighted in the article by Winch and Carr (2001) is that mapping, and hence developing project processes, is important as to make sure resources are not wasted in generating, transmitting and interpreting unnecessary information, but instead focus on a level of information flow that meet the requirements.

Apart from the nature of the project and unpredictable external impacts, the choice of procurement route has a great impact on the shape of the project process (Winch & Carr, 2001). As well, the risks associated to each project process are shaping the process in different ways. Therefore, when exploring project processes, it is important to keep in mind the understanding of what risks that has formed that process.

2.2 What is Lean?

Today, Lean is a well-known business development concept practiced by companies and organisations all over the world (Modig & Åhlström, 2013; Sörqvist, 2013). The main idea of Lean is that all activities and resources should provide value for the customer. Activities which absorbs resources but do not provide value should be considered as a waste and should therefore be eliminated (Womack & Jones, 1996; Modig & Åhlström, 2013; Sörqvist, 2013; Winch & Carr, 2001). Lean is about creating a flow throughout the whole organisational chain by continuously removing non-value adding activities and resources, generating value for the customer. Lean is not a new concept; in fact it has been around for more than 20 years (Sörqvist, 2013). The concept derived from the Japanese manufacturing industry (Womack, et al., 1990) which, after World War II, was forced to rebuild their business with very limited resources available. This forced the Japanese industry to focus on quality improvement and customer demand since it could not afford producing products that no one would want to buy (Modig & Åhlström, 2013; Sörqvist, 2013). When a problem occurred, the reason for it was immediately identified and eliminated which made the Japanese industry rise step by step.

One of the Japanese companies that managed to improve their business during this time was Toyota (Sörqvist, 2013). Toyota developed its own successful production system based on the belief that success will only be accomplished when every member of the organisation strives to constantly improve the process and eliminate all activities that are not creating any value for the end customer. The Toyota philosophy stressed the importance of standardised working methods, visual management and smooth processes. Two main ideas were developed to be the foundation of the Toyota production system; *jidoka* and *just-in-time* (Modig & Åhlström, 2013). *Jidoka* stands for the immediate identification and elimination of a problem and *Just-in-time* represent the ambition to create flow throughout the production by getting rid of stock

and gaps. As a result of the lack of resources in the country, the importance of *doing the right things* and *doing things the right way* was highlighted. Doing things right mean that the company only should produce due to demand and make sure that there always was a buyer of the product. By doing things the right way, the aim was to speed up the refinement of the product in order to avoid being immobilised. The production process developed by Toyota was flow effective and it was this process that Western observers came to call Lean.

The phrase *Lean production* was first established in the 1980's by John Krafcik, a member of the International Motor Vehicle Program (IMVP), a research program set up to identify the success factor of the Japanese car manufacturers (Ballard & Howell, 2003; Sörqvist, 2013). The phrase then got widespread via the book *The Machine That Changed the World* (Womack, et al., 1990) that was published by some of the researchers of IMVP in 1990. The authors of the book pointed out four principles that Lean stands for; teamwork, communication, efficient use of resources including elimination of waste, and constant improvements. In Sweden, the concept of Lean spread quickly during the early 1990's, mainly within manufacturing businesses (Sörqvist, 2013). In the early 2000's, Lean also became popular within service companies and public organisations and the concept developed from previously only focusing on production to now focus on product development and streamlining of the entire business and its processes.

2.2.1 Defining Lean

Even if Lean still is closely associated with Toyota, the concept has now spread and been adapted to other industries and functions such as health care, marketing, construction, product development and even to national sports teams (Modig & Åhlström, 2013). Thousands of books and articles have been published trying to describe what Lean is. Some choose a more abstract way of unfolding the concept, describing Lean as an approach, a philosophy, a culture or principles while some describe Lean in terms of methods, instruments and tools.

As for many of these 'fashion' concepts, there is today no commonly accepted definition of Lean, leaving users confused. Additionally, Modig and Åhlström (2013) point out that a problem with today's definitions of Lean is that they are far too trivial, only providing knowledge that is already obvious to the user and therefore do not add any value. In their book *This is Lean*, Modig and Åhlström (2013) have chosen to see Lean as a business strategy since Lean, according to them, is all about how an organisation produces value. Hence, the authors give us the following definition: "Lean is a business strategy that prioritises flow efficiency rather than resource efficiency". Sörqvist (2013) agrees on the lack of a commonly accepted definition of Lean and he, as well as Jørgensen & Emmitt (2009), suggest that the reason for this lies within the fact that business concepts, such as Lean, are constantly developed and thereby always leave room for interpretations. In his book *Lean: Processutveckling med fokus på kundvärde och effektiva flöden*, Sörqvist (2013) defines Lean as "a way of looking at, operating and managing a business based on resource efficient, flexible and fast processes which are operated based on the customers current needs". Both the definition by Modig and Åhlström (2013) and the definition by Sörqvist (2013) lie within the more abstract view of Lean, as an approach, philosophy or way of thinking which means that knowledge and understanding is significant. Since the definition by

Sörqvist (2013) also puts focus on Lean providing customer satisfaction and customer value, this is the definition adopted for this thesis. Furthermore, in this thesis, Lean is viewed as an approach used to critically analyse the processes of the business rather than as a set of tools and methods applied to the business.

2.2.2 Risk of ‘trendiness’ and ‘method fundamentalism’

Lean as a business development concept has continued being popular, and in recent years Lean tools and techniques has been implemented in all kinds of businesses (Modig & Åhlström, 2013; Sörqvist, 2013). Since business development is now performed in almost every organisation, it tends to go a ‘fashion’ among the different concepts in the field (Sörqvist, 2013). Organisations that have been successful in their implementation of a concept and presents great results and engaged co-workers, off course entice their competitors to do the same. Everyone wants to be part of the success story. The risk is that organisations, due to lack of time and deeper knowledge about the concept, only tries to copy the tools and methods of the successful organisation in detail, often resulting in great disappointment when their business do not exhibit as good results as the model. Sörqvist (2013) states that in these cases the problem is not the concept or the method, but rather the implementation itself. For a company to simply try to copy the success of other organisations’ practices, this can lead to devastating consequences since prerequisites such as situation, business culture and current problems may imply that these methods are not the best suited. Although most of these concepts include good and useful methods, the concept itself often gets watery when methods are being used separately without being able to bring about any measurable business success.

Another risk is when, what Sörqvist (2013) calls ‘method fundamentalism’ occurs. This is what happens when supporters of a particular concept specialising in only this concept, claiming that all tools and methods that are not a part of the concept are wrong and thus should be ignored. Consequently, the method becomes more important than the company’s actual needs and the development of the company is therefore likely to be confined by the concept. Modig and Åhlström (2013) indicate that focusing on the goal creates flexibility while focusing on the means creates limitations. This kind of ‘trendiness’ and ‘method fundamentalism’ has also affected Lean and the concept has endured some criticism. Sörqvist (2013) therefore stresses the importance of each organisation carefully analysing their own needs and the prerequisites of the organisation and based on that, choose a strategy and a business development concept.

2.2.3 Value creation and customer satisfaction

Creating value is one of the main objectives of the Lean philosophy (Ljungberg & Larsson, 2012; Modig & Åhlström, 2013; Sörqvist, 2013). By value creation, Lean wielders refer to activities performed within the organisation, that through refinement of the product or service, directly provide a value for the customer (Sörqvist, 2013). The value is something that the customer has a need for and for which the customer thereby is willing to pay for. In the Lean literature, an activity that does not provide value or by any other reason is necessary to fulfil the needs of the customer is considered a waste and should be eliminated.

When speaking about Lean, value creation and customer satisfaction is said to be the main characteristics (Ljungberg & Larsson, 2012; Modig & Åhlström, 2013; Sörqvist, 2013). Despite this, Sörqvist (2013) declares that when implementing Lean in a business, these characteristics often come in second hand as focus more lies within efficiency, productivity and shortened lead times. Furthermore, Sörqvist (2013) highlights the fact that areas such as sales, market and development, which are all essential for determination of customer needs, seldom are included in Lean implementation. Both Sörqvist (2013) and Modig and Åhlström (2013) suggest that to make Lean more customer oriented, it is necessary to continuously identify customer needs and then make sure that all activities in the business process serve to fulfil these needs in a time- and cost efficient way. Otherwise, the variation of customer needs and demand risk to be a burden for the organisation. Hence, to make the implementation of Lean successful, an organisation first of all need to identify; *Who is the customer?* and *What are the customer needs?*.

Sörqvist (2013) defines the customer as “everyone that in some way is affected by the business and/or the product and services produced and provided by the business” which implies that there is both internal and external customers in an organisation. The internal customer can be co-workers, managers, central functions or shareholders, all dependent on information and delivery performed by people in the organisation. To satisfy the internal customers it is important to have a transparent organisation based on clear communication and expressed expectations. The external customer, such as the end user or buyer, is of course very important to satisfy since the business itself is dependent on their willingness to buy their product or service. The term *value creation* often refers to the ability of the organisation to create value for the external customer, but for the organisation to have flow in their processes and thereby be able to create the external customer satisfaction, satisfying the internal customer is equally important.

According to Sörqvist (2013), the satisfaction of a customer is the mental subjective experience of the customer which is based on the customer’s apprehensions and attitudes and affected by its needs and expectations. The perceived satisfaction of the external customer is dependent of the outcome of the product or service, the expectations of the customer and the quality of competing alternatives. Different customer needs require different value offers, which in turn affect the design of a company's processes (Ljungberg & Larsson, 2012). The satisfaction of the customer then depends on the customer's expectations. If the customer expects quick service, low price and a specific standard of the product or service, a standardised process is likely to serve the customer satisfaction, while the same standardised process probably cause dissatisfaction of the customer who expects a unique experience and also is willing to pay for it. Customer satisfaction also depends on other factors such as the level of service from the staff and the surrounding environment.

Emmitt et al. (2005) consider value to be the end-goal of all construction projects and emphasise a holistic and integrated approach to design and construction. Within a lean framework, it is all about getting the customer values as right as possible already from the start, thus minimising the risk of costly revisions later in the production process. By giving more time in early phases, Emmitt et al. (2005) claim that the construction phase subsequently is shortened. However, this can also be seen differently, as expressed by El Reifi and Emmitt (2013), who claim that more time in the design

phase not necessarily is the key. In many cases it is more central to make better use of the time available.

To strive for greater cooperation and reduced conflicts in construction projects it is important to establish common objectives and common values for the project and the project members early on in the project (Emmitt, et al., 2005). Establishing value parameters at the outset of a project is also said to be the key to achieving improved productivity and stakeholder satisfaction, hence the whole process is consensus based from the start. In the early phases of a project, before construction starts value creating activities should be emphasised. Later in the construction phase, when the design is set and the value is to be delivered, focus is addressed to deliver that specified product with minimal waste.

2.3 Lean in construction

Construction is typically separated into design and production, which in general is considered to be problematic. Moreover, it is often argued that design and production should benefit from becoming more integrated (Jørgensen & Emmitt, 2009). In addition to integration, Lean is being promoted as a way to improve the construction supply chain. Considering the value aspect of Lean, it could have a great potential in better integrating design and construction activities.

2.3.1 Why Lean in construction?

Lean construction has since the 1990s emerged as a concept within the construction industry, both within construction management and in production (Koskela, et al., 2002). Lean construction has been embraced in the debate about construction improvement and are said to be a “new understanding of the construction process” that could improve both performance and stakeholder satisfaction (Jørgensen & Emmitt, 2009). Koskela et al. (2002) claim that two differing interpretations of Lean construction have emerged. One focus on applying different methods of Lean production to construction and the other sees Lean production as a theoretical inspiration for a new, theory-based methodology for construction. The latter interpretation is claimed to be the dominant one when referring to Lean construction in literature. Koskela et al. (2002) suggest that by adapting Lean production principles and view construction in terms of “production”, rather than the for the moment most common “Transformation” view, the concept of “Lean Construction” can improve the total construction process efficiency, by improving how construction projects are managed. Compared to the Transformation view, Lean is adding two additional aspects; first, the importance of eliminating waste from flow processes and second, the view of production as value generation, where the basic goal is to generate the best possible value from the customer’s point of view.

Today, construction projects are often managed by being broken down into separate activities that are individually time and cost estimated and to be delivered by different teams (Koskela, et al., 2002). This is creating an environment where those responsible for each activity work to improve and secure their piece, but tend to forget about the overall project objectives. As many projects today are complex, uncertain and time-pressured due to changing demands from clients and technology, schedules controlling a series of project activities are not enough to meet customer demands, as

they ignore the flow of work within and between the activities. Despite for example team building activities in projects commercial contracts, cost and schedule control and optimisation of separate activities will lead to sub-optimised projects with several existing business objectives unaligned with the client. Furthermore, value in this situation is often understood as meeting the original design, cost, time and quality limitations (Koskela, et al., 2002). Change is not at all considered possible and is difficult to manage when early decisions are forced and local optimisations are made. Identifying failures of present project management helps define requirements for a new approach.

A lean approach to project delivery integrates all three theories and goals; transformation, flow and value (Koskela, et al., 2002), in contrast to the traditional design-build contracts that are claimed to only pursue the transformation goal for project delivery. Traditionally, projects are understood in terms of phases but in Lean project delivery the relationship between phases and the participants in each phase are different. For example a variety of project members are included already in the design phase in order to consider more aspects as early on as possible. Also, the practice in Lean construction is to make selections and decisions at the last responsible moment. On the basis of the supply chain being streamlined, later selections provides more time for design and value generation and therefore reduce rework and turbulence due to conflicting criteria and decisions of different specialists.

Implementing a lean approach in organisations is hard work (Koskela, et al., 2002). It requires change in individual behaviour as well as change on a more broad organisational level in order to overcome traditional practices that are contradicting the new one. Changing procedures, such as techniques, is said to be the easy part whereas changing minds is the real challenge. Shifting from trying to optimise the performance of each activity to optimisation at project level is a big difference in traditional and lean approach. Since Lean is a different way to think and act, learning by practice is recommended in this situation. By demonstrating and getting people involved in doing things, the change is started and can also be sustained.

2.3.2 Lean in the design phase

Principally, Lean promotes an integrated approach to designing and making, however Lean design has been far less discussed than Lean construction and production issues (Jørgensen & Emmitt, 2009). The basic elements of Lean, to focus on increasing customer value and to reduce waste from the system, are appealing to both design and production processes, even though the application of a lean approach can differ.

A study by El Reifi and Emmitt (2013) shows that some of the most common reasons to project delays and budget overspend are procurement methods, poor project management and inaccurate project design. One reason for this is claimed to be that clients rush into projects, and hence not making sure to establish a framework before design or construction starts, leading to failure in making decisions that causes late approvals and communication issues. Another reason hindering success is poor design management, meaning last-minute redesigns, inefficient flow of information and overly complex designs (El Reifi & Emmitt, 2013) as well as, unbalanced resource allocation and lack of coordination between disciplines (Tilley, 2005). Furthermore,

poorly allocated design time is claimed to be the factor that most hinder the development of design value (El Reifi & Emmitt, 2013). Other factors are lack of early contractor involvement, poor communication and management, the attitudes of design team members, the ability to fully understand the complex goals of clients, demotivation due to design changes and commitments on other projects.

Design can be seen as covering both product design and process design (Ballard & Howell, 2003). Product design means deciding what is to be produced and used, while process design determines how to produce it or use it. Process design means among others to structure the project organisation and to decide how to perform specific design and construction operations and how to operate and maintain a facility. Some critical design management skills mentioned in the article by Ballard et al. (2003) are how to promote design iteration, how to differ between positive (value generating) and negative (wasteful) iteration and how to minimise negative iteration. Likewise, the value concept in Lean Construction can be described as product value and process value (Wandahl & Bejder, 2003). The end-user mostly cares about the product value. However, process value considers the project participants' personal aspects of value, such as good cooperation and communication in the project. A construction project should have a common set of values, though, that can be difficult due to the participants' own set of values. To reach a common understanding of the project values there are barriers to overcome. First, congruence is needed between the individual and his/her respective organisation, secondly between the individual and the project organisation and thirdly between the organisations.

Research has shown that organisations commonly do not use any specific approach to improve project performance, but rather base their work on experience (El Reifi & Emmitt, 2013). As a way to advance, adopting a lean approach to design management can be beneficial in improving material and information flow, as well as generate customer value and minimise waste (El Reifi & Emmitt, 2013; Ballard & Howell, 2003). As Ballard et al. (2003) put it "*The challenge is to overcome the tradition of first designing the product, then throwing it over the wall to someone else to decide how or if it can be built, operated, alerted etc.*" A lean approach implies that project phases cannot be seen as separate parts (El Reifi & Emmitt, 2013). Therefore a key to good project outcome is claimed to be better integration of the design and construction process. Additionally Lean design is emphasising an integrated design of product and process, which means considering and deciding *how* to build and use something at the same time as considering *what* to build, in contrast to traditional process exemplified in the quote above (Ballard & Howell, 2003; Forbes & Ahmed, 2010). To make the most of the construction team expertise, and hence develop cost effective solutions, is considered more difficult after the design phases as reviews in the design becomes more difficult and costly, as well as resistance to change increases (Forbes & Ahmed, 2010).

In Lean design management value is generated in a more methodical and thorough way as to identify challenges and clarify customer and stakeholder needs (Ballard & Howell, 2003). In addition, it is considered that time spent in the pre-construction phase reduces waste generated in the later project stages, eliminates cost overruns and hence results in an efficient and qualitative production (El Reifi & Emmitt, 2013; Forbes & Ahmed, 2010; Tilley, 2005). Applying a lean approach to construction does not necessarily mean that the design takes less time, however a more efficient use of

time in the design phase is likely to result in shorter production time and hence the total project time may be shortened (El Reifi & Emmitt, 2013).

One aspect included in Lean design management is a so-called set-based design, meaning that decisions should be deferred to the *last responsible moment*. Traditionally, a freeze of design is demanded at an early stage in the design phase as alternative designs are narrowed down to one option (Koskela, et al., 2002). Although this can be considered a quick process it often results in rework due to conflicting interest and criteria of the different specialists involved, as well, value can be lost as the options are not given time to be elaborated. By bringing along multiple design options in the design phase more time is given for analysis and in that way a better design is found in Lean management (Forbes & Ahmed, 2010; Koskela, et al., 2002). Of course there is a time limit and so the decision has to be made so that the option can be realised on time (Koskela, et al., 2002). Additionally, by streamlining the supply chain, more time can be spent on design and hence value generation.

Target value design is another factor identified within Lean that aims to create flow in processes, minimise waste and deliver value. Target value design is a standardised process designed to overcome the traditional design problems caused by the different disciplines developing the design on their own, with little cross-functional collaboration, resulting in non-executable designs, budget overspend and delays (Forbes & Ahmed, 2010). Target value design recommend for designers to build in constructability to the design from the start, as opposed to first designing and then evaluating the constructability. Furthermore, it also prefers a concurrent design with the various disciplines rather than periodic reviews causing rework. Moreover, target value design put a lot of emphasise on holding design conversations, meaning that all disciplines actually meet and continuously discuss the proceeding of the project design. The design conversation also means that the design team should develop a method for estimating costs of design alternatives while the design is developed, as a way to reduce waste. This works contrary to the traditional way where a major part of the design is finished and then followed by estimations showing that the design is too costly and that revisions are needed.

An inefficient flow of information can cause waste and/or decreased attention from consultants as they are waiting for information, leading to rework in projects as new information is revealed successively (El Reifi & Emmitt, 2013). Design managers is said to be able to reduce waste by paying more attention to the characteristics of the information flow and by sharing information in a lean way and thus improve value. Consequently, minimising waste alone does not guarantee overall project success, but El Reifi and Emmitt (2013) emphasise the need to understand each element of value, as value is different for each project, client and end-user. Lean emphasises minimisation of negative iteration, as it does not add any value. One strategy to manage iterative loops is to encourage frequent and open sharing of incomplete information throughout the design phase, to enable each party to make better judgments about how to proceed (Ballard & Howell, 2003). Generally, both tradition and fear of liability constrain an open flow of information among designers and engineers, which again indicates that the key obstacle likely is to overcome these old habits. To do so education and frequent reminders is suggested.

Furthermore, to improve organisational performance and minimise waste collaboration and communication needs to improve, as a suggestion through workshops (El Reifi & Emmitt, 2013). Specific tools are often said to be defining Lean, however, Tilley (2005) states that a project environment that encourage good personal relationships to develop is the key success factor in Lean design management rather than the tools commonly associated with it. A good project environment is crucial in the way that it makes for good relations between team members that leads to increased motivation and flexibility and in turn good ability to handle change, which is important as change is an inevitable part of construction projects. Forbes and Ahmed (2010) are also emphasising how work flow is dependent on that the parties keep promises to carry out assignments, in order to enable others to continue their work and not be forced to paus. Moreover Tilley (2005) lists some certain attributes needed to create a good project environment and good relationships; *collaboration, cooperation, commitment, coordination, certainty, communication and trust*. However the two later ones can be considered most important as open and effective communication enables the others to occur. At the same time trust can be seen as “the glue that holds it all together” as it influences a person’s ability to rely on stated future performance, as well the willingness to collaborate and cooperate is reduced and will lack validity and work flow if there is a lack of trust.

2.4 Collaboration and interaction

Fulford and Standing (2014) is pointing to the fact that a more collaborative and open culture is needed in the construction industry in order to reduce waste and improve project outcomes. Project teams should preferably put emphasis on teamwork and group effort rather than individual performance. Two types of relationship standards are pointed out as preferable basis for good collaboration. First are strategic relations that require effort and investment in management, time and communication and are preferable for some relationships. Second, for relationships that have either low level of requirement or low level of capability, or both, Fulford and Standing (2014) suggest those can be standardised in terms of relationship management practises. Thus, this is a second way to create good collaborative relations, here through timely information and a common understanding. In both cases trust and collaboration is improved.

Likewise, Baiden and Price (2011) state that team integration should be an aspiration for all project teams as it leads to more effective teamwork and a more efficient delivery process and thus eliminating waste and lowering costs. As team competitiveness and project profitability increases, the organisation can deliver more value for money and better meet the client needs. It can also help improve teams in aspects such as coordination, innovation, communication and flexibility. With time this altogether can result in a favourable spiral that keeps increasing team competitiveness as a result of an improved ability to deliver value for money as well as better returns on investments.

Moreover, Thyssen et al. (2010) are highlighting the importance of a common understanding of the project goals. For example the client organisation usually considers a number of different stakeholders in the dialog with the contractor, in addition to themselves. Such as for example end-users, the surrounding society and legislators, that all has different roles and responsibilities and thus make the situation complex. This may result in that values and needs taken into consideration in the

design phase are likely to change during the development of the project due to the many stakeholders as well as to other uncertainties associated with the process, such as the temporary project organisation and available resources. Project teams that fail to create a common understanding of client values and hence the project goals often end up with communication difficulties and irrational behaviour. So, to create trust and in turn, good collaboration, it is essential to take time to identify and understand client needs and establish good communication from the outset of the project and thereby create a common understanding of the mutual goals of the project.

2.4.1 Trust

Trust is a subtle concept, not easy to describe or understand and therefore difficult to manage (McDermott, et al., 2005). Trust is argued to be the willingness to rely upon the actions of others, to be dependent on them, and thus be vulnerable to their actions (McDermott, et al., 2005; Chandra & Limanto, 2014). Chandra and Limanto (2014) point out three benefits of trust within project teams that is, reduced uncertainty, reduced risk and problems being resolved more quickly and flexible. Trust can be built in several ways and Chandra and Limanto (2014) suggest experience, shared goals, problem solving and reciprocity as part of the trust building process. The construction industry is, due to its variability of demand, fragmented with disparate supply chains (McDermott, et al., 2005). As well, the ambition to create simplicity and controllability within the organisation often form areas of responsibility and delimitation which result in processes also becoming more fragmented where separate activities only are linked together by people, thus collaboration is vital important (Sörqvist, 2013).

Moreover, relationships between people who work together are argued to be driven by trust (Khan, et al., 2011), as well as all ways in which people engage with each other are seen to be pervaded by trust (McDermott, et al., 2005). Hence, good relations between different actors in construction projects are crucial for projects to run smoothly and be successful. Kadefors (2004) stresses that a higher level of trust would improve project performance in the construction industry and that relational trust is vital for a close collaboration between parties. Relational trust develops between individuals who repeatedly interact over a longer period of time with team building processes, project-wide transparency and communication supporting this.

According to McDermott et al. (2005), trust within construction can be put into different layers of context; industry context, organisational context, project context and interpersonal context, each driven by its own issues. In the industry context, the fragmented structure of the industry is emphasised as a problem in developing trust and, within the organisational trust context, trust is driven by shared values and norms of the organisation. McDermott et al. (2005), state that trusting organisations are those that support a no-blame culture and trust their own staff. Organisations that are trusting give individuals within the organisation the authority to act and respond freely to other parties in the project, which improve the level of trust. In a construction project, different actors are working together in order to deliver the project, hence this requires organisational cultures to be conjoined and for people who work in them to develop trustful relations. For a project to be successful, mutual goals are a key factor. According to McDermott et al. (2005), problems of differing requirements and expectations of a project can be addressed by clearly enunciating individual, organisational and project goals. By doing so, potential conflicts and

damage to trust can be avoided. Further issues concerning trust within projects are issues of transparency and certainty regarding the financials since trust and money are inseparable linked. Likewise, Kadefors (2004) emphasises that close monitoring of contractor performance and detailed contractual specifications can be interpreted as a sign of mistrust and thereby hinder collaboration and interaction between client and contractor.

Trust between individuals is called interpersonal trust and is of great importance for project success (McDermott, et al., 2005). To manage trust issues in the project context and interpersonal context, workshops in the early stages of the project can help creating relationships. This can be done through teambuilding and clarifying goals and expectations while the use of open books, guaranteed maximum price and a transparent economy can address uncertainty issues between construction project parties. McDermott (2005) stresses the fact that a holistic perspective is necessary when managing trust within project team relationships, otherwise there is a risk that trust between individuals in the project that would otherwise been positive, gets damaged due to organisational or project factors.

Trust is often related to factors such as communication, commitment, reliability and credibility (McDermott, et al., 2005). The nature of transmitted communication is of great importance for building a trustful relationship, thus communication will be further elaborated in the following chapter, 2.4.2. Additionally, McDermott et al. (2005) argue that commitment is a fundamental part of a trusting team since it can be seen as the compliment of shared values and the willingness to fulfil common goals of the project. Reliability can be considered a self-evident factor of a trustful relationship, because if the parties cannot be sure that the other parties deliver what they promised, at the right time and to agreed quality, trust will be damaged. Moreover, if reliability is not present, the trusting individuals are taking a great personal risk which is vital to building trust. Credibility is closely connected to reliability and is based on expertise and trustworthiness. Additionally, Chandra and Limanto (2014) argue that openness comes with effectiveness in problem solving, making projects run smoother.

Managing cooperative relations can be difficult as it involves a level of interdependence, uncertainty and vulnerability for the parties involved (Lui, et al., 2006). To handle these difficulties it is common that organisations exercise coercive and punitive actions towards the other party as a conflict resolution strategy. In their study Lui et al. (2006) conclude that trust bridges the characteristics and outcomes of a partnership and more specific, that a higher level of trust in relationships means a lower level of coercive strategy. On the contrary, relations where one party invest more in specific assets tend to exercise a higher level of coercive strategy as a way to protect their own investments and thus trust is based upon rational calculations. However, this does not necessarily affect the level of interpersonal trust as that is said to build upon other factors, such as social network of individuals. Depending on the level of trust companies structure their activities and mobilise their resources accordingly. Trust is therefore claimed to be vital in solving problems related to interdependence and uncertainty.

Kadefors (2004) states that the level of trust in traditional construction projects is low which result in work not being as efficient as it could be and the level of project

performance being inadequate. Construction projects, especially projects with high level of uncertainty, would therefore benefit in developing trust between project parties in early phases in order to increase the level of efficiency, problem solving and the willingness to deliver the very best for the project. Additionally, a trustful working environment naturally result in a more positive and allowing working climate, encouraging individuals to take initiatives, be creative and come up with new solutions.

2.4.2 Communication

Communication is vital for any team if they are to deliver good performance (Dainty, et al., 2007; Emmitt & Gorse, 2006; Baiden & Price, 2011). In construction projects, communication between the actors and the handover of information is crucial since projects involve people from different organisations and with different knowledge that are grouped together temporarily creating a complex situation. The quality of all tasks performed is therefore dependent of how well the information is delivered between the actors. Also collaborative practises that support integration of teams in different phases is promoting an environment where information is freely exchanged amongst everyone involved, overcoming traditional barriers and improving project delivery (Baiden & Price, 2011). Hence, if information does not flow efficiently between the parties the design solutions are not able to develop properly (Tilley, 2005).

As mentioned above, the way communication runs is of great importance for building trustful relationships (McDermott, et al., 2005). Honesty, timeliness, integrity and openness are key factors for confidence-building communications. These issues concern the importance of accurate and clear information being provided at the right time and to everyone who might need it. In the construction industry, many costly decisions are based on the information transmitted between the parties, thus inaccurate information can cause great problems and costs for the company resulting in conflicts and mistrust between the parties. Openness in communication brings transparency into the project team, resulting in everyone knowing what the other team members are doing; hence also knowing what is required by themselves in order to support the project.

Furthermore, a study by Gluch and Räsänen (2009) is highlighting the importance of the sender of information being aware of how the choice of mediating tool is affecting the receiver and thus how the information is being perceived and handled. The communication culture and mediating tools applies to the way people talk and act as well as the choice of IT-based or other technical mediating tools. The fact that the many involved parties in construction projects are likely to have different communication cultures that can clash is rarely considered when exchanging information in projects. Gluch and Räsänen (2009) mean that some ways to communicate are inefficient for some contexts and situations and that this is seldom regarded and thus creates communication difficulties between parties, such as resistance and/or misunderstandings. The choice of mediation tool is therefore an important factor to consider when wanting to improve collaboration and communication in projects.

2.4.3 Knowledge and learning

Knowledge has been identified as one very important resource for companies to handle the fragmented nature of the construction industry and the dynamics of

projects (Dave & Koskela, 2009). Additionally, knowledge can be considered a competitive advantage. Furthermore, Lean is emphasising the importance of constantly learning new things to improve on a daily basis. It is considered a challenge to capture and reuse valuable knowledge that is gathered during a project. Although, as critical mistakes are commonly repeated from project to project due to lack of knowledge sharing, it is an essential aspect to improve in order to reduce waste in projects. Reuse of knowledge gained from earlier experiences can both cut time in problem solving as well as improve the quality of work. As a fact, the industry has already spent a lot of effort on systems trying to capture explicit project related information, however that has not been very successful in capturing tacit knowledge. With regards to tradition and the unique nature of projects a lot of knowledge is therefore lost from one project to another, as knowledge is not successfully shared from one project team to the rest of the organisation, Thus this is causing waste, having to “reinvent the wheel” over and over again. Dave and Koskela (2009) suggest that that knowledge is best shared and captured through collaborative practises, especially tacit knowledge that is said to be the type of knowledge used to create competitive advantages.

Dave and Koskela (2009) present three keys to manage knowledge in construction projects. First, organisations need to enable knowledge to transfer from one phase to another, for example enable knowledge to flow from design to estimation to construction and so on. Second, organisations need to capture and reuse project knowledge and third, they point to a better communication between stakeholders. Due to the fragmented process described, with the different phases and many parties involved, the communication between stakeholders is traditionally weak, which often results in contractual and economical disputes as well as rework. As the knowledge and experience that people possess are considered to be the biggest asset of the industry, it is further suggested that the best way to manage knowledge in project-based organisations is trough social interaction and collaboration, for example via IT-based communication tools where knowledge can be shared in an open and informal way. Moreover knowledge sharing is happening most efficiently when there is a level of trust existing between the project participants.

2.4.4 Management and leadership

Since a process based organisation brings about new ways of performing activities, it also requires new ways of leading the performance (Ljungberg & Larsson, 2012). The concept of *process based leadership* or *Lean leadership* resembles the *modern leadership* in which a motivational and inspirational leadership is advocated in combination with empowerment of the individuals (Ljungberg & Larsson, 2012; Sörqvist, 2013). Furthermore, to be a leader within a process based organisation requires good collaborative skills and the ability to show confidence in the employees (Ljungberg & Larsson, 2012). Due to the fast changing environment of today’s businesses, decisions has to be made faster, leaving no time for information to be collected down in the organisation, transferring it upwards for the decision to be made, reporting it downwards again and finally acting. Instead, Ljungberg and Larsson (2012) state that the process based organisation should consist of cross-functional teams based on trust and with the power to make decisions throughout the whole process.

Working in teams is substantial for a process based organisation since it requires a holistic view at the same time as the tasks become more extensive and complex (Ljungberg & Larsson, 2012), hence the team leader holds a widely important role. Lean literature advocates a supporting leadership that embraces constant improvements and flow development (Sörqvist, 2013). Moreover, Lean focus on the individuals and the conviction that people want to do a good job and also have the will to influence and improve their work. Hence, by empowering individuals and letting them be involved in the work of constant improvements, commitment and motivation is created. Listening to the employees and encouraging them to critically question the way to work and come up with new ideas is central to Lean leadership (Sörqvist, 2013). By doing so, errors and defects are detected and subsequently corrected, resulting in a smoother and leaner process.

Lean leadership is also about making the employees understand the purpose of the work and provide them with a sense of comprehensibility and meaningfulness (Sörqvist, 2013). Thus, it is important for the leader to visualise the process and the tasks performed within it. A present leadership is also supported by Lean literature since this creates conditions for relationship being built between leaders and employees. A present and visible leader also acts as a role model, influencing the employees and creating trustful relationships.

Though the implementation of a process based organisation aims to develop and improve the business, implementation always comes with change which in turn often result in a natural reaction of individual resistance (Sörqvist, 2013). Improvements often requires people to adopt new ways of working, change their way of thinking and even change work positions, thus it is of great importance that change is being managed in a well thought out way to make implementation positive. Thus, Sörqvist (2013) emphasises that it is important for the leader to create a common understanding for the need of change as well as clearly communicate the goals and visions of the change to the employees. Moreover, engagement and commitment of the individuals combined with a visible leader that shows the way is sufficient for the implementation to be successful. In summary, Lean leadership is a supporting and humanistic leadership, based on trust and respect, which emphasise individual motivation and engagement and encourage constant improvements and new ideas (Sörqvist, 2013).

3 Methodology

This chapter presents the methodology of the thesis and has been divided into four parts; identifying the problem, literature review, the case study, and result and analysis. The methodology represents a qualitative inductive research method based on nine interviews combined with every-day observations.

3.1 Identifying the problem

This master thesis was initiated through an exploring interview with the head of the Housing Department at The Company in Gothenburg, to get a deeper understanding of how the business, processes and everyday work is performed. Based on theories of process development, Lean, Lean design, value creation, standardisation and collaboration, different challenges that the department face during the project design phase were discussed and briefly analysed. Material from the discussion together with a brainstorming session on possible theories and approaches formed a first draft of the aim for this master thesis. To further delimitate the aim, an initial overall literature study was conducted considering the topic of Process Based Business Development and Lean. Additionally, a brief study of the operational supporting system of the Housing Department was performed to achieve knowledge of how the project design phase is carried out at The Company. Supervision and consultation with the head of the Housing Department and with PhD Martin Löwstedt at Chalmers University of Technology, together with initial studies of literature and business systems and finally a brainstorming session lead to the research questions being determined.

3.2 Literature review and theoretical framework

After defining the purpose of the study, a more extensive literature review was transacted in the area of Process Based Business Development, Lean, and collaboration within construction to get an overall view upon already existing research made in the field. According to Bryman and Bell (2013), this is important since it is a way of legitimising the new study being performed. The book “Detta är Lean” by Modig and Åhlström (2013) helped the researchers to get a general introduction to the concept of Lean and formed the basis for further research on the Lean concept.

By defining keywords such as process development, process flow, standardisation, Lean, Lean design and value creation, articles covering the subjects were collected and analysed in order to gather necessary knowledge in the research area. Sources were selected considering specifics as number of citations, source of publication and extent of references. The articles were sorted by relevance in A-, B- and C-group with the A-group representing articles most relevant and the C-group representing articles least relevant. Articles sorted in the A-group was then read thoroughly and summarised in short paragraphs forming the basis of the theoretical framework. Articles sorted in the B-group were skimmed through and articles that were considered interesting were summarised in the same way as the ones in the A-group. Remaining articles in B-group and articles sorted in the C-group was then put aside in case of ulterior interest. Analyses and comparisons of the material induced further refinement of the purpose of the thesis. The process of the literature study can be considered

iterative, since theory evolves in parallel with the collection of the empirical material (Holme & Solvang, 1997), contributing to a deeper understanding of the studied phenomena.

3.3 The case study

Holme and Solvang (1997), declare that this type of research method is hermeneutic, meaning that the study and the origination of result appears in constant correlation between theory and empirics. A qualitative mini case study design based on literature by Yin (1994) and Bryman and Bell (2013) has been chosen since the purpose of the study is to examine a process and explain the complexity of relations and processes within its context. Qualitative research aims to create a deeper understanding for what causes peoples actions and decisions rather than explaining what these actions and decisions are. According to Yin (1994), case studies are a common choice of method when research is done within organisations. Moreover, case studies are well suitable in explorative studies were the researcher aims to elucidate and interpret why certain things happen and certain effects occur. The explorative study helps to answer the questions of “why” and “how”. Yin (1994) defines the case study as:

“A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.”

An inductive qualitative research method is preferable when the study aims to emphasise uniqueness and personal experience (Bryman, 2011). In qualitative studies the researcher herself is situated in the social reality that she studies and the collection of data takes place in parallel with observations of the context (Bryman, 2011). Hence, the interpretation of the researcher is central. In quantitative research, on the other hand, the focus lies within finding statistical generalisations, which is not in the purpose of this study. When using a deductive method a hypothesis is formulated and tested. For this research, the prior knowledge necessary for formulating a hypothesis was insufficient. Hence, an inductive method, which implies observations of the reality interpreted through a theoretical framework, was chosen for this research. An in-depth analysis of a single mini case study is a form of the inductive research. The focus of the case study lies within studying the project process itself and relations between the people involved in this process. The case study is also a current situation study, implying that the researchers investigate a phenomenon and its context when it is happening (Yin, 1994).

3.3.1 The case

The case study is performed at a private multi-functional construction company in Gothenburg Sweden, further referred to as *The Company*. More specific, the study is researching the design phase from the Housing Departments point of view. The focus of the study is to find possible improvements areas in the design phase by mapping the process through interviews with the employees. The Housing Department at The Company is an in-house client organisation that is producing multi-dwelling buildings in the Gothenburg area. The department holds employees in property development, marketing, sales, interior and project managers. This case study is focusing on the design process from the client perspective and foremost the project managers' point of

view. The project managers are simultaneously responsible for 2-3 projects at a time and are the ones ultimately responsible for the progress of the project and the end result. The Construction Department at The Company is the executing part of the company and works with both in-house multi-dwelling building projects and external construction projects of varying kind. The department holds among others design managers, calculators and the site organisation, such as the site manager and construction workers. All the projects managed by the Housing Department are executed by the Construction Department, so these businesses are always in-house projects where the Housing Department is the client and the Construction Department is the contractor.

The researchers were situated at the Housing Department when performing the study, resulting in consistently observations of the people working within the studied context. Bryman and Bell (2013) relates this to ethnography where researchers participate in the social life of the individuals that are studied. Throughout the study, general observations were performed on daily basis, consisting of overheard conversations between colleagues, discussions of interesting topics during coffee and lunch breaks and direct knowledge sharing between employees and researchers. This kind of continuous observations contributed to a deeper understanding of the complexity of the studied processes among the researchers and a more holistic view was adopted.

3.3.2 Interviews

According to Bryman and Bell (2013), interviews are commonly used in qualitative research to collect empirical data. Hence, interviews have been carried out with people linked to the Housing Department and the Construction Department at The Company to collect data for this research. Initially, one explorative interview was carried out with the head of the Housing Department. This was an open interview with the purpose of the researchers getting an overall view of the organisation, the processes and possible hindrances in the everyday work. Secondly, five interviews were conducted with project managers at the Housing Department and as a complement, three interviews were conducted at the Construction Department represented by one design manager, one head of department, and one business manager. The interviews were so called respondent interviews, which according to Holme and Solvang (1997) signify to interviewees being a part of the studied phenomenon.

Trust between the interviewee and the questioner is of great importance when doing qualitative interviews. Holme and Solvang (1997) state that only when the interviewee feels that the questioner takes his opinions seriously a meaningful conversation will emerge. On the basis of trust, all interviewees participated in the interview on free will and were thoroughly introduced to the purpose of the study. To further create a trustful relationship, the researchers made an early choice to station their thesis work at the office of the interviewees and the department of the study. By sharing office with the interviewees, natural relations were created between respondents and researchers. Moreover, daily conversations in an unconstrained context made the interviews almost resemble a normal conversation. This, together with the promised anonymity, resulted in very honest and direct answers from the interviewees and many vivid descriptions of the reality of their work.

In qualitative interviews, the selection of interviewees is not randomly but systematically made from consciously formed criteria (Holme & Solvang, 1997). In this case, such criteria represented the work role, availability and knowledge about the studied problem. The first five interviews were conducted with the project managers at the Housing Department to identify perceived areas of improvements in their daily work. During these interviews, several hindrances in the design phase were brought up and this in turn led the researchers to carry out interviews with people from the Construction Department. In total, three interviews were performed with people from the Construction Department. The interviewees represented one design manager, one head of department, and one business manager. All interviews were held in a conference room at the Housing Department and each interview took about one hour.

To minimise the risk of the researchers influencing the outcome of the qualitative interview, non-standardised and open interview guides were used (Holme & Solvang, 1997). The guide was formed in a semi-structured way based on topics and questions important for the study. When using a semi-structured method, according to Bryman (2011), all topics/questions should be covered during the interviews but the disposal of the questions is not central. Instead, the interviewee should be encouraged to talk freely, reflect and elaborate around the topic brought up by the questioner. By doing so, the interview is steered by the interviewee, providing the researcher with knowledge about what is important due to the respondent (Bryman, 2011). Hence, the interview guide served as a support during the interviews making sure that all areas of interest were covered, but the sequence of the questions were adjusted based on how each interview proceeded. The questions in the interview guideline were formulated based on the aim of the study, the research questions, and with knowledge assimilated through the literature study. Before the interviews were held, the interview questions were discussed with our supervisor at Chalmers University of Technology and reevaluated to a final guideline, see Appendix 1.

During the interviews, both researchers participated, one being responsible for leading the interview and making sure all questions/topics were covered and the other being responsible for taking notes and asking follow-up questions. By the recommendations of Bryman and Bell (2013), all interviews were, with the approval of the interviewees, digitally recorded to function as memory notes. This was done in order to ensure that no information was lost.

3.4 Result and analysis

Qualitative studies result in large amount of data which brings on an extensive and often time-consuming analysis. The recorded material from the interviews was transcribed and printed in order to perform a first cut. They were then read thoroughly and parts containing information and interesting thoughts and standpoints relevant for answering the research questions were cut out. The researchers formulated around ten main categories that the cut material was sorted under.

After the first cut, a brief discussion was held in order to question the categories in terms of relevance for answering purpose and research questions of the thesis. Similar categories were merged together and new, more precise, topics were formulated. The number of categories was slimmed down to two main categories; The Process and

The Collaboration, holding a total of eight headlines. Interesting material from the eliminated categories was then sorted in under these headlines. The material was then read through once again and quotes significant for the thesis were coloured and parts redundant or irrelevant for the research was eliminated. Subsequently, the structured material was compiled into a digital document where it was translated carefully from Swedish to English. Vague comments and quotes were removed and in those cases where one interviewee had expressed an opinion more than once, the clearest and most descriptive quote was selected. On the basis of this material, the result for the thesis was formulated.

Inspiration for analysis and discussion has been collected during the whole research and the every-day dialogue with individuals working at The Company has played an important role in this process. During the interviews, the researchers learned a lot about the construction industry as a whole and embraced new knowledge and understanding for how processes in the industry are linked together. This allowed the researchers to see the thesis from a different perspective, resulting in new thoughts and conclusions regarding the problem. In addition to this, the researchers also participated in a workshop initiated by the Construction Department regarding the collaboration between the Housing Department and the Construction Department where the project development process was discussed in order to identify possible hindrances. The workshop focused on collaboration and transparency between client and contractor, which was of great interest for this thesis. For the researchers, conversations and dialogues from the workshop further contributed to deeper understanding of the processes and activities performed at The Company and how these are all linked together.

4 Result

The Company's design process has been analysed in order to identify possible problems or hindrances and to find out why the process at the present is time-consuming and perceived as non-smooth and inefficient. A number of possible improvement areas have been identified through the interviews with project managers, a design manager, a project developer and heads of department and are presented in this chapter.

4.1 The present situation

The, from the case study point of view, interesting parts of the project process at The Company is briefly described in Figure 1. The design phase (in red) stretches from when the company controls the land to when the production can start. The process today can be described as divided into three stages, whereas in the first stage the design team produce a basic material or suggestion that serve as a brief project design. This is handed over from the project manager to the Construction department in order to form a first estimation of the production cost, called the B-estimation. In the second stage the product is revised with regards to the B-estimation and the design is developed together with consultants resulting in the project design being more or less completed in the end of this stage. This material then serves as the foundation for the final estimation of the production cost, the A-estimation. According to that the design is revised and finalised in stage three. In between the stages there are also stage-gates meaning that the material and estimations has to be sent to the company board for approval to continue to the next stage. The aim is for the A-estimation not to differ too much from the B-estimation and therefore the revisions in the final stage should be small.

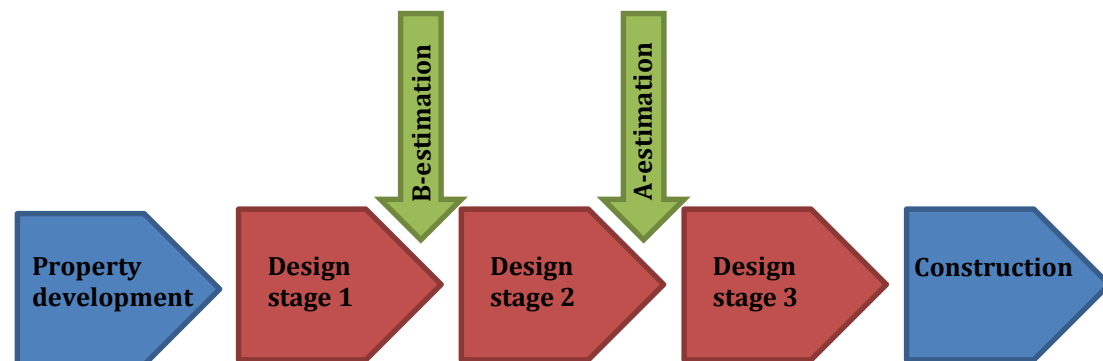


Figure 1 A brief description of the project process

The design of the present process is a result of the earlier process, among other things, not considering the economic aspect until very late in the design phase. As the project design was nearly finished when first calculated, huge revisions often had to be made due to the calculated project cost being too high. Revisions this late in the design process resulted in customer value being removed, as it was the only way to lower the cost, unless the whole design process was going to start all over again. A too costly process not delivering the wanted quality resulted in a new design of the process. As described above, the process today exists of three steps with stage-gates in between, in order to secure quality and minimise risks. However, as shown in the results below

the process and the actual execution do not correspond, additionally the process is considered to be very time-consuming.

4.2 Identified improvement areas

From analysing the result two general areas of improvement was identified, below referred to as “The Process” and “The Collaboration”.

4.2.1 The Process

The first general area of improvement presented, covers possible improvements related to the procedure and the operational system, in other words the way things are to be performed according to The Company policies and operational system.

Extensive work in each stage

The project managers were during the interviews expressing a frustration about each design stage being very extensive. The process is perceived as inefficient, holding three designs in a row and therefore taking very long time. The second stage is said to be the most extensive one where the design is more or less set. The initial thought about the third stage only including small revisions for the final design does not seem to stand. Some project managers expressed the following about this fact:

“We actually design three times over, stage 1, 2 and 3. We work pretty far in the second stage, which takes a lot of time and a lot of the consultants’ time as well...”

“Such as The Company has decided we should work, almost everything in the project is decided in the second stage and when the second stage is finished the design is very set. Therefore it is so bad when you have to make major changes in the third stage because then everything is undone. The solutions are set and the revisions of the project therefore get so extensive.”

“The second design stage gets very detailed and then you add a lot of time to study the blue prints, and there is a lot of blue prints... and that’s a cost too, handling all the blue prints. Then it is said that when we reach stage 3 it should only be a matter of a final approval of the blue prints, however that never happens because there is always new things to add.”

Moreover the perception of the interviewees is that the shape of the design process is related to risk management and that the clearly set up stages and tasks in the operational system are likely intended to minimise risk. One project manager expressed the following quota:

“I feels like too much focus has been directed to the risk minimisation in relation to the value creation and therefore I feel we have to move the emphasis more in relation to what is value creating and not only minimise risks.”

One interviewee continues this discussion by saying that the aim of the process is of course correct since the time spent on the design is well paid compared to making mistakes later on during construction. However, considering the extension of the process it could be shortened without lowering the quality of the product. The later

was actually expressed by several correspondents, who also suggested an adjustment of the process to a slightly less governed or controlled procedure.

Decision making

The interviewed project managers all agree on that the old design process was inadequate so a change in the shape of the process was welcome; however, the process at the present is considered very extensive and therefore time-consuming, as expressed above. In addition, it also holds built in pauses or gaps related to the stage-gates. Each stage-gate means that the project manager has to wait for a decision or approval from the company board in order to continue the process. This is claimed to be very time consuming for the moment and is limiting the project advancement. There is also an uncertainty related to the waiting as the project managers do not know how long time it will take to receive the confirmation. Neither do they seem to know what is going on while waiting for the decision, why it takes so long or why it differs from time to time. Project managers about the situation:

“There is a constant talk about shortening the project times but one thing that isn't helping is the decision making procedure.”

“We need quicker decisions from the top management if the stage-gates are to work. I don't mind the stage-gates, I think they are good but this has to be handled in a better way than it is today.”

The project managers also express a feeling of being disrespected and mistrusted. The fact that someone else goes over the results of your work is not problematic but the situation that occurs in this case rather holds a control of whether the estimated economical results is fulfilled. As the top management are claimed not to have enough time or information to do any deeper research of material, the project is approved as long as the numbers presented by the project manager are good. Still, the project managers have to wait long for an approval that it affects the project advancement, which results in them feeling ignored and in turn frustrated. This part of the process seem to lack transparency, as no one is communicating what happens once the papers are sent from the project manager to the top management.

“Sometimes you are just waiting for the decision to proceed... and you don't know, should we close the site down or what. Then you have to demand a decision, “or it will cost us this much” but they have no respect for that...”

“As they don't explain it to us, and they haven't in several cases, we lack understanding for why the decision making takes so long.”

“We cannot sit here and wait for them, we don't do that. We go on anyway, otherwise we will be criticised for everything taking too long.”

“The stage-gate decisions take so long... I mean they have to trust the project managers.”

Cost transparency

During the design phase the project managers are dependent on being well aware of how the project economy are doing, this in order to be able to control the design of the

project and make conscious choices that results in value for money. However, the results indicate that cost control and estimation procedures are inadequate and that there is a lack of cost transparency in the organisation.

“The construction cost is the biggest cost, the one to focus on. Of course we have to control our costs and times as well, but it’s the construction cost that makes the difference.”

“Construction themselves think it works but me and the rest of the project managers don’t think so. It’s like holding your breath till the A-estimation and then see how it all turns out, because you don’t have that safety during the process and that affects the whole project design.”

“We are transparent towards Housing and show them prices and profits but Housing don’t let us in on their budget... it should be both ways.”

The project managers consider the B-estimation to be insufficient and the first specified or ”real” estimation, the A-estimation is not delivered until the start of the third stage, which is considered to be too late. This is commonly also the first time the production manager is involved and adds their experience, as discussed above. The estimation work does not rime with what was initially planned as the design process was revised to correct the flaws in the old process. Due to the estimation being insufficient the first time it is delivered, the team still ends up with major revisions once the final estimation is presented as the design is more or less set by that time.

“It’s too bad, we should be able to improve the B-estimation as it affects everything... We are not professional and it’s not controlled...”

“That’s the business... if we don’t know the project cost in an early stage... we know the revenues but we don’t know the costs, then how can we build?”

“It’s like; now we’re finished, and then we estimate the costs, which usually results in very costly revisions... like; we can’t afford this, why was it so expensive? We need to create the opportunity to make decisions with regards to the cost.”

“Once we know that the B-estimation and the A-estimation differs the design is about finished, so then we have to do a lot of revisions that costs us both time and money... and it might even end up delaying both the sales start and the construction start... and then there is the real-estate, accumulating interest day by day... so there are several consequences. Then in the end you remove something from the project but actually, that money has been spent on something else. Although, that doesn’t show.”

At the present there is only one person from the Construction Department that have enough experience and knowledge to deliver the B-estimations, considering how it is performed today. It considered a very rough estimation that is made of key figures from this individual’s personal experience and is presented as one total figure, meaning there is no way for others to know what is considered in the estimation or what different things cost. The B-estimation is considered important, as it is the foundation of the project design in stage 2, where, as mentioned before, most of the design is set. The expectations on the B- estimation seem to differ compared to what

is actually delivered. Altogether, this is most likely why the interviewees consider the B- estimation to be insufficient. Project managers:

“He/She is never into details... you never know what has been priced. He/She might just say; that’s not included. Okay, how would I know? That creates uncertainty, to never get a specification, it’s just a sum and we don’t know if the risk is included...”

“We still haven’t received a real B- estimation and that creates uncertainty... and that uncertainty means we don’t create the optimal project as we don’t dare to. Or you think you do and then it turns out you crossed the line. That’s unprofessional cost control.”

“In a lot of projects, when we start the design, there is a rough estimation made of key figures, the B- estimation. The Construction Department doesn’t take it seriously. Then we keep on designing in the second stage, for another 4-5 months, then the A- estimation is estimated only 8-10 weeks before the sales start and something different/new is presented. For The Company it’s a disaster not being able to trust the figures delivered throughout the process.”

Furthermore, the results indicate some other possible reasons for the B- estimation to be considered insufficient, such as competence, consensus and need of material.

“It’s not supposed to be any difference in the A- estimation but there always is... they can’t blame it on the blueprints, they are good... I think it’s about competence, about hiring the right people as calculators.”

“If we haven’t done any brief design with the architect early on, it will differ a lot (between the estimations). I see one image, the client one and the architect a third one. ”

“We were supposed to do a more detailed B-estimation in the last project, but Housing didn’t give us a sufficient material...”

An inadequate estimation at this time results in difficulties in developing the optimal product. It is said to be more or less impossible to make conscious choices, by prioritising and weighing one thing against another with respect to the cost, when there is no sufficient estimation, e.g. comparing different facade or roof materials with respect to function, design and cost. Also, another example:

“We do discuss what the most important thing for the customer is, is it a big balcony or a walk-in-closet or an extra WC... and we can go on discussing those things but we don’t know how it affect the cost whether we chose one thing or the other...”

A design produced under these circumstances often leads to costly revisions once the A- estimation is handed over, as that is the first time details in the project are considered. As well, it is the first time a specification of what is included in the price and the separate costs are presented. One example of this is customer value being removed.

“You reach a certain point where you can’t change the structure or the span or what floor structure you prefer or how to build it and then you remove the wrong type of things, you actually remove customer values, cause that’s the easiest things to remove this late in the process.”

To handle the situation and avoid some sort of surprise or unreasonable difference in the B- and A- estimation most interviewees are requesting a successive estimation throughout the process, which is supposed to create cost-consciousness by knowing what the cost drivers are, as well as minimising the gap related to the estimations. In total you may say that it is all about creating conditions to make the best possible product within the limited budget. Interviewees:

“We have tried to get them to calculate successively, so that it’s clear what changes we do and how it affects the price. At the time we cannot do that, as there is no specification.”

“We don’t know what the cost drivers are. -It gets more expensive. -Well okay but how much? -Well, it gets more expensive. -Okay.”

“The costs are a common responsibility, to work parallel with the costs. I mean, cost control doesn’t really exist, it’s in our mind but there are no tools for working with it professionally.”

The design manager as well, is requesting changed estimation routines, as he/she is requesting a situation where he/she can ask the estimators how certain changes affect the price, for example changing from one type of window to another. At the present this possibility does not exist, as there is only one person who knows the content of the B- estimation. This is considered by the design manager to be a major hindrance for his/her in performing his/her works.

Gaps

The occasional estimations along with the slow decision-making procedure is causing gaps in the design phase and are unanimously considered to be the major flaw in the process. The waiting time is resulting in a work pause for the project team, that leads to an uneven flow in the process as team members are exchanged and information forgotten.

“This creates gaps in the process and the design is paused, the project team is changed, people forget what was said and done and consultants have to work with other projects meanwhile. The process doesn’t flow smooth and there is a great uncertainty about how long time this will take.”

The gap between stage 2 and stage 3 is caused by the A-estimation and the stage-gate decision. As no estimation work has been done meanwhile the estimation takes some time. Additionally, the estimation serves as material for the tender documents that also is created by the Construction Department in order to be sent to subcontractors. Once these are returned from the subcontractors, the Construction Department can hand over a price to the Housing Department and the stage-gate decision procedure can start. These so called “planned” gaps in the design process are perceived as inefficient and slow and for the project team time is standing still.

“There is a big gap between stage 2 and 3 where nothing happens and then when you start again the consultants from before cannot get involved as they have new projects going on. So then everybody has to start all over again and I have forgotten what has happened.”

Involvement of other parties

As written above the gaps in the process are causing a pause for the consultants, which in turn are causing demotivation and lack of engagement and interest. Another source of the demotivation is the fact that the consultants are purchased for one stage at a time and are not guaranteed the work in the next stage of the design process.

“... it means that the consultants we purchase are careful/observant about what they deliver, they don't prepare anything they just deliver what they have to for the time, as they don't know if they get the work in the next stage.”

“A lot is about the engagement of the project... if you, as a consultant are purchased to only work with the brief design/concept and you are only involved for three months you only go here and do your job and that's it.”

“The engagement from the consultants in this early stage is a bit so-so because it is a very small job for them, compared to them being promised to join the whole project. So that's a possible improvement, to involve them earlier, all the way.”

At times when there is a change of consultant firm during the design phase there is often a lot of revisions needed, as the different consultants do not agree on how things are to be designed. Furthermore, there is a request from the project managers to involve the consultants in an earlier stage of the process in order for the consultants to contribute with their knowledge and experience and for the team together to shape the product and so that the design also is possible to execute on site.

“That is why we prefer design-build contracts because then the consultants are given a general responsibility for what they design, it actually has to work to. But the problem is they are involved in a very late stage. Also, if we involved them earlier in the process we could minimise the total project time.”

As The Company today use more 3D modelling in the design they are getting more dependent on the architect than before and it was stated that in problematic projects lately, the choice of architect has been of great matter. However, there is a debate about when in the early stage other consultants should be involved. One interviewee state that another reason that the design process is time-consuming is that the team is too slow in first deciding on what product that should be designed and that too many people are involved directly. Preferably, at first a smaller group is to decide on the preconditions for the product in order to start the design process. Too many people involved in this early stage is said to be a waste of time.

The shortcoming of late involvement of consultants can be referred to the production as well, as the production team are not involved until very late in the process. One project manager expresses that the view of production, the value of their experience and know-how has to change. The production managers should be seen as any

consultant that has to be involved in an early stage in order to optimise the product. Otherwise, once the production manager is involved they often demand changes as the design are not optimal or even impossible to execute, from their point of view. This is causing revisions or sub-optimised solutions that in turn disturb the process flow, causes delays and also increases the cost. Additionally, not involving other parties until late in the process is decreasing the team spirit and causing a lack of interest and engagement.

“As well as you purchase consultants that are expert on other areas you need someone who is an expert in production, in an early stage, someone who assures that the design is possible to execute so that it is not just a theoretical paper product that doesn't work in practise.”

Just as the project managers the design manager expresses a frustration concerning the production team being involved too late in the process; however it is clear that from his/her point of view it does not depend on the design team not letting them, contrary they request it but the production managers claim they do not have the time. Still, once the design is more or less completed and they do take time to understand the project they complain about several solutions. The design manager consider it to be too late to have any opinions then, that ship has sailed, anyway they have to make some revisions that takes time and increase the cost compared to if they would of shared their opinions and experience earlier on. As he/she expresses it:

“They have to get engaged at the right time.”

Apart from lack of time, one reason to why the production gets involved too late is because the production manager and site manager is announced very late, commonly not until stage 3. So in the beginning of the design process there is no one but the chief of department/project developer to turn to for answers and as presented above most of the design is set already in stage 2. From the other point of view, one interviewee considers the production managers to have a small possibility to influence the design team and that the product is already set once the production is involved. From that point the production team have to change the design to make it possible to execute. This exemplify that there are many aspects of one problem and that there is a lack of transparency in the organisation, however this situation is affecting the process flow.

Project uniqueness

As The Company is organised in the way that the Housing Department always contract the Construction Department, the interviewees question why they are still treating every project as unique. From the responses it is considered to be possible to find routines in order to take advantage of always repeating the same organisation from project to project. It is also clear that one category of employees do not deliver the same things so it is hard to know what to expect from that work group. It is claimed to be no standard or one way of working, one project manager delivers one thing in one project and in the next project another project manager delivers something else.

“I think that in-house... we don't have one process, we treat every project as unique, even though the people in place. We should be more skilled in having one process, a

standard. I mean how do we otherwise improve it. Today we are very dependent on the ones employed for the moment...”

The interviewee continues this comment by saying that it gets very hard to improve the process and the result due to the variation. If for example one project manager improve his/her way of working or the process, it just creates yet another way of doing the work, it does not improve the process in total. Rather than to understand the process, standardise it and then knowing what to deliver and so forth.

System inertia

Some of the interviewees express a frustration over the fact that suggested improvements are hard to implement and include in the operational system. As perceived by one of the interviewees, every possible improvement or modification in the process is rigorously researched in order to find the perfect solution that can be implemented, which results in the operational system being perceived as very slow. Instead, the interviewees prefer to encourage constant improvements, small things that can be improved each day, which will result in a more continuous development of the process and likely also a better result than if done as first mentioned. As the design of the operational system is creating a strictly controlled process, the respondents request more flexibility, as for example skipping a step as not all steps are considered necessary for all projects. Project managers:

“To constantly make progress, I think trumps of finding the perfect solution.”

“Now there are no iterative improvements, instead they say; in two years we are going to revise the system. But I mean two years, that’s forever! We are supposed to get better tomorrow and tomorrow and tomorrow!”

“The operational system serves as the basis for the projects in-house, but it means a lot of command-and-control, you SHALL do this and so on... They don’t trust people to do things better and quicker...”

4.2.2 The Collaboration

A conclusion from the result displayed above is that the Housing Department is heavily dependent on other organisational members in order to perform their work, such as the Construction Department and the top management. Therefore collaboration is determinant for how the project is proceeding, how the process runs and if the activities in the process are creating value for the end customer. So, in addition to the improvements areas related to the process, the second general area of improvement concerns possible improvements that are related to the collaboration and transparency within the organisation.

“We are able to wrap all projects together but I think the result could of been even better, a bit more customer adapted so that we would of chosen to do this because this is the key factor, or we remove this because this is not important but we don’t have that management control.”

In addition to the lack of making active choices, some project managers express that the Construction Department do not seem to prioritise customer value the same way they do as client.

“The Construction Department is quite good at removing customer value but I don’t consider it to be the details that settle the project economy but we always ends up in that discussion...”

“... we don’t want to end up there... when we are removing obvious customer value, then it is really bad, then this whole cooperation process is done wrong.”

Trust

As stated above, regarding decision-making and economy, there is a lack of transparency in the organisation. For example one doesn’t always know what the others do and what they need from each other in order to do it. There is also a situation where groupings have emerged in the organisation that sometimes causes an “us and them” atmosphere. Both those situations can to some extent be related to a lack of trust in the organisation. However there are differing aspects about that matter.

“This company has a management culture that is very much “command and control” meaning that in contrast to trusting each other, we have lots of documents, checklists and protocols that has been built up over time as a response to the suspicion weather everything will work out.”

“People trust each other... it would be a disaster if they kept 3 million from us. Then I would immediately raise every bid until I had the money back, so it builds on trust. I realise I have a situation of extortion against them as well as they have against me so therefore trust is needed.”

“It’s too bad there is this us-and-them climate. People blame each other and almost actively search for mistakes.”

“That’s the great flaw, there is too much of “us and them”, from everybody and that’s because people only care about their own economy... and of course you have to do that or we wouldn’t be efficient but you have to consider what is best for the whole company as well.”

“We need more team spirit... I think relationships encourage effort, as perhaps doing things beyond your job description... it is all about engagement.”

Furthermore, a couple of interviewees point to the fact that, in order to improve the end result, everyone should consider the project results rather than their separate result in every decision that is made. Today that is not obvious in the organisation.

“I think the value of respecting each other is crucial, what I do is important for the one who is next in line. What department that concerns is not of interest. Today there is formations; as long as I manage my part they can manage their part and then I’m fine.”

Quite recently a new collaboration contract was designed for all the in-house projects. The contract is based on how the project in total is doing economically and not what

result the different departments deliver. It is founded on a set profit, in percentage, that every project should reach and if that level is reached the departments get to split the profit more than that. However, the set level is claimed to be quite high and therefore some projects, due to circumstances, cannot reach that profit level no matter how hard work the employees put in. In those cases the incentive in the contract is useless in improving the team members' engagement. The interviewees therefore have mixed feelings about this contract and some mention that other type of incentives than economical ones, is to prefer. For example incentives instead could be based on the customer satisfaction in the project, if the result of the customer satisfaction survey reaches a certain level, then all the project members get to enjoy a dinner or trip together.

In projects that do not have the economical preconditions to reach the set profit level the Construction Department can only make a certain minimum profit no matter how the project are doing in total. Then, as Construction gives Housing a fixed price, they do not want to risk a profit below the minimum level and therefore include buffer in the fixed price. So in this case the contract is resulting in less trust and an almost decreased engagement rather than improving the collaboration.

Furthermore the result shows that the communication between the team members does not always run smooth and that information does not always reach everyone concerned. As we have touched upon earlier there is also a lack of consensus or common ground and a lot of unspoken expectations seem to be floating around. This is causing misunderstandings and uncertainty about what is to be delivered from one person to another.

“The knowledge is not forwarded, maybe they don't have the time or the knowledge, I don't know... but in many cases it results in additional costs for The Company. It is all about every piece being passed on to each level, to the site manager, the construction worker and so on. That is what we have to improve... to make everyone strive for the same goal somehow.”

“Sometimes I don't think they (the Construction Department) understand our wishes.”

“Has everyone understood what we actually have to do in this process? What roles do we have? That is pretty unclear I think. A lot of us think the others know and in most cases you just have project experience rather than process experience, which results in unspoken expectations and then there is bicker.”

5 Discussion

In this chapter the theoretical framework is used to interpret, analyse and discuss the results. The chapter has been divided into three parts where the first part aims to describe the link between process based business development and Lean in terms of creating a flow throughout the business processes. The second part highlight the identified areas of improvements within the design phase that are then elaborated in the third part based on theories of Lean and process based business development.

5.1 Theoretical framework

Most organisations today search for ways to make their business more effective and profitable and according to Ljungberg and Larsson (2012), Sörqvist (2013) and Winch and Carr (2001), this should be done through process based business development. Process based development represents development works that aims to continuously identify, map, analyse and develop the business process and by doing so, ensure that value and customer satisfaction is created in every part of the process (Ljungberg & Larsson, 2012). One concept that falls within the theory of process based development is Lean. During the last twenty years, Lean has become a well-known business strategy within manufacturing and production industries (Sörqvist, 2013). There is no common definition of Lean but due to its focus on creating flow it can be considered to fall within the frame of process based development. Lean is a concept that emphasises a holistic view, process flow and creation of customer value. Likewise, both Ljungberg and Larsson (2012) and Sörqvist (2013) stress the importance of the business being viewed holistically, since process flow comes from the connections between pieces of work rather than from the individual activities themselves. As the connections between activities are highly dependent on the individuals performing them, this thesis emphasise interactional components like trust, communication, knowledge sharing and leadership to be vital important for a successful implementation of Lean as business strategy.

The construction industry is typically fragmented, in terms of projects, phases, activities and actors (Warsame, 2009; Tilley, 2005). Traditionally the industry has focused on improving separate activities rather than improving the overall process; hence the fragmented nature of the industry can be interpreted as one reason to why construction processes lack flow. Efforts to improve construction efficiency has mainly been done within the production phase even though research has highlighted that the success of a project and delivered customer value is often determined by decisions made during the design phase (El Reifi & Emmitt, 2013; Emmitt, et al., 2004). Thus, the design phase would benefit from more attention.

5.2 Result

The results from the interviews indicate that the design phase at The Company today is considered to be very extensive, inefficient and time consuming. Also, the interviewees describe the design phase as controlled and strictly managed. Interviewees perceive that the reason for this is that too much focus has been put on risk minimisation, creating a comprehensive process that through a stage-gate system

based on control documents aims to handle every possible risk, leaving little room for managerial freedom of the project.

All the interviewees perceive the decision making process, related to the stage-gate system, as slow and non-transparent and referring to projects often being put on hold while waiting for decisions to be made by the top management. Today, cost estimation by the Construction Department is made first when a design draft is completed, meaning there is no successive cost estimation done during the development of the design. In addition to the decision-making, this is causing gaps in the design phase leaving the project team waiting. In turn, the waiting results in project team members often being replaced either caused by step-by-step procurements or due to other projects' need of attention. Having to restart the design several times during the process leads to knowledge and experience being lost. Additionally, the result indicates late involvement of other parties, such as consultants and the production team, hence causing revisions, time delays and cost overruns due to their knowledge not being considered in time.

Analysing the result indicates that parties of the design phase do not fully understand the intentions and aim of the process. As this is considered unclear, it is likely to be a reason for why expectations on handed over material within the process differ dependent on who are the receiver and the sender. Thus, even if The Company has developed a controlled process projects are dependent on the team members whom, in this case lack consensus, resulting in every project to some extent being perceived as unique. The process is perceived as controlled due to all the activities that has to be fulfilled, e.g. extensive documentation or the B-estimation being delivered, however, the members of the project team does not agree on what each activity should contain. For example, the Construction Department seem to think that a total sum is enough as a B-estimation, while the Housing Department seem to be expecting more detailed cost estimation. Different expectations on what are to be delivered leads to disappointments from team members. Additionally, insufficient material leads to complications in further developing product value. In the case of inadequate cost estimation, this leads to lack of cost control and hence difficulties in developing the best possible value for money. The fact that the process is somewhat unclear can also be a reason to why the interviewees find it hard to influence the process in terms of changes and improvements.

Further analysis of the result shows that collaboration between the Housing Department and the Construction Department can be improved to gain better project outcome. As interpreted by the authors of this thesis, insufficient communication and lack of trust between the parties are two elements related to the identified hindrances/problems in the process. On the one hand, lack of trust and scarce communication is contributory to the above mentioned problems; on the other hand the way that the process itself is framed contributes to a culture of mistrust and poor communication.

5.3 Further analysis and interpretation

The results of the case study show that there is room for improvements in the design phase in projects at The Company. Further below it is elaborated how lean philosophies in terms of a process based business strategy can improve the identified

improvement areas in the design phase to develop the business and make it more competitive.

5.3.1 Creating flow

When trying to improve the design phase The Company tend to add extra steps in the process to increase control and eliminate risk, for example more forms and documents to be filled in and approved. On the contrary, Lean is stressing that by removing waste and focus on value creating activities process flow is created (Sörqvist, 2013; Modig & Åhlström, 2013). To achieve this slim process, a standard process that represents the minimum effort level should be developed.

A standard process, as interpreted in this thesis, does not necessarily require standard products. As the market asks for a variety, a standard product is not really considered an option for The Company. Also, each construction project to a certain point is unique, thus it is important to allow product uniqueness in the standard process. The interviewees expressed frustration about treating each project as unique and mean that they have to reinvent the wheel for each project. However, it is believed that this can, to a high extent, be avoided by using a standard process.

Considering the fact that construction projects overall are a complicated business, where each project to some extent have different requirements, the standard process preferably is designed with regards to the minimum level required for all projects, rather than trying to cover every possible event. As some projects are more complex than others, it is then possible that some projects require additional work, compared to the standard, e.g. producing additional material to fulfil the basis needed for proper decision-making and further development. From translating lean philosophies this is preferable, rather than having a standard that tries to cover every possible situation. As the result indicates, the later situation has become the case at The Company today. Thus, having to deliver unnecessary material in the less complicated cases or having to make deviations from what the system requires can simply be seen as waste.

Adopting the concept of Target Value Design is also emphasising flow. As estimations then would be done successively throughout the project development, the occasional major estimations would be removed and hence the waiting time related to this would be eliminated. Target Value Design also leads to an increased cost control and ability to make conscious choices and prioritisations and thus projects can be steered in the desired direction.

In addition to make room for specific project requirements, there has to be room for a certain level of managerial freedom. As Sörqvist (2013) states, individuals do not like too much standardisation, thus a certain level of flexibility is needed in the process. As well, as pointed out by McDermott et al. (2005), problems of differing requirements and expectations of a project can be addressed by clearly enunciating individual, organisational and project goals. Therefore one way to balance flexibility and standardisation to gain efficiency can be for the team members to agree on the required material that form the input and output, see Figure 2. If one can expect a certain material to be delivered to them and one certain material to be handed over to the next person, then room is left for the work in-between, e.g. the development of the

product/material, to be performed with regards to the preferences of each individual and to the specific requirements of each project or situation.

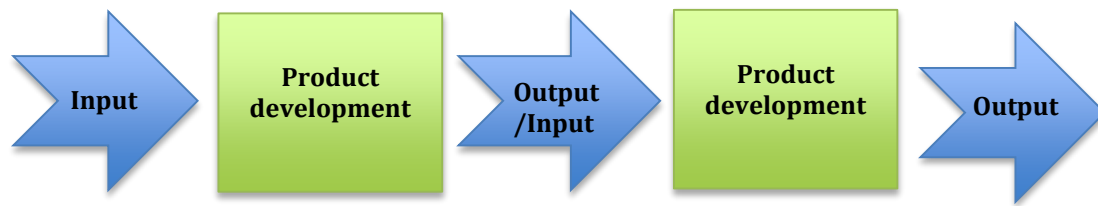


Figure 2 Product developments in terms of required input and output

Different expectations by team members on what are to be delivered in the project process and lack of common ground leads to disappointments which drain the relationships. In addition to the work climate being affected, delivered material that is perceived as insufficient by the receiver will likely also lead to complications in further developing product value. Furthermore, the results indicate that The Company has not been very successful in reaching out with changes in the organisation and create understanding of why things have changed. For example, there have been process changes in recent time but they do not seem to have rectified the flaws that caused the need of change, such as calculating too late in the process. This is probably, to some extent, depending on that the team that redesigns the processes have not sufficiently included the ones who actually work in the process when planning the changes. Therefore, once implementing, the changes are not anchored throughout the organisation and people lack the understanding of why things has to change. For example, one interviewee expressed the phrase “Such as The Company has decided we should work”, which implies that the process is not designed by the ones actually performing the work, but by someone else. Hence, the changes are well work through in theory but still, they are not applicable either due to lack of understanding or due to that they might not really match the perceived need of change.

Hence there are several reasons to incorporate the employees in the decisions and changes. Involvement, participation and possibility to influence the work, lead to engagement and increased will to develop and improve. As well, it leads to improved collaboration, clearer interfaces and reduction of the “us and them” atmosphere. Thus, this does not only relate to the actual organisation but also to the fact that it is preferable to involve specialists as early on as possible to gain maximum value.

The fact that the process is somewhat unclear can also be a reason to why the interviewees find it hard to influence the process in terms of changes and improvements. As expressed in the result the interviewees perceive that the process in The Company is very hard to change. The change process is slow and the room for improvements is limited. To be able to standardise the process it is preferably to map the actual process, to know how and when, as well as by whom, things are performed at the present. The result is then used to identify waste as well as value creating activities and thus to design a process that is conformed to what is requested to happen. Once the process is mapped, the identification of waste and value preferably is done by the employees themselves to change and improve the process,

Several interviewees actually pointed to the fact that a more standardised process, based on their actual experience would mean more consensuses, in the meaning of both clearer interfaces and expectations, as well as increased focus on value creation. For example the fact that extensive work is more or less repeated three times over in the design phase would likely be helped if the employees themselves would develop the process. Additionally, taking all participants into consideration, encourage collaboration and reach of common ground.

Project improvements tend to only apply to the specific project situation and the experience rarely reach the rest of the organisation as it might not be applicable for their specific project and once they get a new project where it is applicable the information is already forgotten. Hence, improving the process applies to all employees and all on-going projects as well as upcoming projects. Therefore, as processes are in constant need of improvements to increase quality and stay competitive, it is important to have routines for how to continuously share knowledge and learn from each other. A standard process, developed by the employees themselves, as well as good relationships, is likely to be a good take-off point for this.

5.3.2 Collaborative practises

Workflow is dependent on relations and the employees being able to rely on others to keep promises and deliver what was agreed. As well, good relations are important to be able to handle change (Tilley, 2005; Forbes & Ahmed, 2010). Many of the problems identified in the result can to some extent be claimed to depend on the lack of trust in co-workers and other team members and partners. As this is penetrating the organisation, it is also mirrored in the shape of the processes, for example the level of control and way to handle risk can be seen as a result of lack of trust. This is a paradox that hinders improvement of the organisation and the process. Trust has to permeate the whole organisation for changes to be applicable as well as for the new way of working and thinking to be sustainable and continuously improve.

Similarly, as discussed in the article by Lui et al. (2006), the case study result indicates that different levels of trust co-exist. When talking about a lack of trust in the organisation we actually refer to lack of organisational trust. The level of individual trust, on the other hand, seems to be more or less satisfying among the interviewees. However, as stressed by McDermott et al. (2005), a holistic perspective is necessary when managing trust within project team relationships, otherwise there is a risk that trust between individuals in the project that would otherwise been positive, gets damaged due to organisational or project factors. Thus an interpretation is that The Company do not seem to get any further in developing the organisation, processes and outcomes by only relying on individual trust, but actually has to improve the level of organisational trust to develop and to take the organisation to the next performing level. The departments, as well as informal groups that can be identified in the organisation, have to merge in their teamwork and develop a more strategic relation to optimise the work.

As perceived today, design and construction is not integrated but comes one after another. Due to this all areas of expertise is not considered and even though it is in some cases, it is done too late and hence causes revisions that affect both time and cost. This is also affecting the possibilities to have a good teamwork and is again

indicating lack of trust. Lack of trust can also cause lack of engagement, which can be exemplified in the way the company manage the consultants by hiring them for every phase. When the consultants are not being trusted in finishing the work they have started, this makes them feel less engaged and thus the result is thereafter. However, as the process is fragmented it can be hard to overcome organisational bridges as well as traditions and attitudes. But as discussed above, a key factor to get team members engaged is to involve them and let them influence both the product and the process. The way people communicate can be seen as a result of not trusting each other but how to communicate can also by itself hinder trust. As mentioned before, the choice of mediation tool can be very important when communicating, although it is not reflected upon very often (Gluch & Räisänen, 2009). For example the decision-making related to the system of stage-gates can be elaborated. The material that flow in the decision making process, is run through several people and shared via email, which seem to be causing more frustration than necessary. For example when questions are raised they have to travel all the way back and forth in the email chain to be both asked and answered and the risk for misunderstandings are high. Instead it may be preferable to share information and knowledge by interacting in real time and through a better opportunity to communicate improve the relation, which additionally also will eliminate the wait.

Related to the sender and receiver one may also question why there are so many middlemen in the decision-making process and what value is added by letting one person approve, to send to the next, to approve and so forth for several stages and then once the final decision-maker says okay the outcome of the decision has to travel all the way down in the exact order again. This is an example of when organisations can improve by asking themselves what activities that are creating value. The activities that do not create value, are according to Lean literature considered as waste and should thus be removed.

Another thing that can be exemplified by studying the decision-making process, as well as the estimation routines, is the lack of transparency in the organisation. For example, differing expectations and lack of knowledge in what other team members do, as well as why they do it. It can even be perceived that some do not want to share their work with others. This is likely rooted in that the industry traditionally do not embrace collaboration, and due to resistance, the investment in improving relationships do not always pay off and thus it can be hard to see the benefit of sharing information and knowledge. Also it is likely rooted in a lack of trust and unclear goals, leading to uncertainty in what actually is to be performed.

Contrary to this, Lean is embracing a holistic view, both for business itself, such as integrating activities and phases (for example design and construction) but also for the project organisation, referring to groups of people. The need to improve project results has been heavily debated in the construction industry (Egan, 1998) and to cure the problems, integration of both groups and project phases has been stressed (Bygballe & Jahre, 2009; Tilley, 2005). Moreover, the need of overcoming barriers, improve communication and create a common understanding of project goals has been pointed out as key factors. Additionally, it is stressed that to reach project success, a common understanding of the project goals has to be created at the outset of a project (Emmitt, et al., 2004). Creating a common understanding of project goals demands transparency and team effort but is a condition for the team to reach

common ground. That is, if the team agree on what goals to strive for and how to work to reach them, optimal projects can be created and maximum value can be delivered.

The overall objective for the whole company is to have satisfied customers but that does not align with the current situation, as the different departments seem to have different goals in mind. The client cares more about the end customer and that does not really seem to have rubbed off on the Construction Department, who mainly have an economical focus, which of course complicates the collaboration. Thus, The Company can ask themselves what they build their relations on. Are they based on trust or on rational business? The theory on trust and coercive strategies caused by specific assets investments can be associated with the situation of multifunctional construction companies with in-house client organisations (Lui, et al., 2006). The client-contractor relation can mean a somewhat complex situation, since the client organisation have no other choice but to always hire the in-house contractor. Hence, that situation or relation can lead to that coercive strategies are being used as problem resolution in order to “protect” the own business. To avoid this, it can be considered important to build sustainable relationships within the company that is based on trust and not foremost on economical business factors.

Not having a good collaboration or a smooth process naturally makes it hard to create optimal projects. When the product reaches the market the customer will not know what they might have lost or what they could have got if the project had been run better, for example regarding design or equipment. However, if the company had worked to create the optimal project and been able to create the most value for money, then imagine how satisfied the customer would have been. This might seem as an illusion, but is not the urge for any private company to be the best on the market and thus to offer the best available product for the customer.

5.4 Possible hindrances and limitations

The fact that The Company has both the client and contractor organisation in-house does not seem to be taken fully advantage of. The collaboration between the departments seems to work just as any other client-contractor-relation in the industry. This might be due to tradition and that they are stuck in the same routines as before they introduced an in-house client organisation and hence the departments treat each other as they used to. Another fact to be considered is that the construction industry, as such, is fragmented. Improving a business' processes and way of working therefore also require a lot of effort from other parties. As others are used to the traditional ways of handling things it will likely be hard to get them on-board even if they are let in.

Lean has by some been criticised for being a fashion concept. Having that in mind when using Lean to analyse the result and elaborate about possible improvement in the process according to lean philosophies, it can be questioned if Lean really is a clear concept or if it is just common sense. There are many research areas included in organisational development, such as standardisation, trust, communication and leadership. Hence, Lean can be seen as a fashionable and sellable concept, putting a label on some of those areas and the way they are to be run. However this does not necessarily mean that Lean is an unserious concept. It can be a good way to draw

attention to companies who need to change to remain competitive, especially since so much criticism is directed to the whole industry and hence most of the companies in it strive for improvements. Maybe a concept like Lean is what the industry is asking for and hence that is why it is served to them; common sense and overall business improvements in a nice and easy understandable package. Also, companies might think that a concept that is backed up by both researchers and management consultants is worth trusting when deciding how to develop their future business.

One limitation in this study is that the authors have only researched the design phase, in contrast to the holistic view that Lean is emphasising. Also the take-off-point of the study is the project managers'. That means that to fully adopt Lean and gain the most value from it, the whole project process should be considered, both other phases of the project process, such as production, but also other groups, such as sales, marketing and top management.

6 Conclusions and Recommendations

This chapter aims to sum up the thesis, presenting the main findings of the study and answer the aim and research questions. Recommendations of improvement areas that would benefit from a deeper analyse and more research are also presented in this chapter.

6.1 Creating flow

Too much focus on risk minimisation along with lack of trust in co-workers has formed a very controlled process in the design phase, which due to this has become extensive and time consuming as a result of trying to hedge any possible risk that can occur in this very complex business. Applying lean philosophies in terms of a process based strategy that emphasises flow and value creation, is likely a suitable way to improve the design phase and the process of project development, as the business is dependent on satisfying customer needs.

Flow can be created through standardising the process. Contrary to the present situation, trying to cover everything, the new process should hold a minimum level, that is, what is least needed for all projects. This means eliminating waste and focus on value creating activities rather than adding control procedures. Thus it is preferable to add extra work when needed, such as in complex projects, rather than having to do more than enough in the less complex projects.

Adopting the concept of Target Value Design is emphasising flow. As estimations then would be done successively throughout the project development, the occasional major estimations would be removed and hence the waiting time related would be eliminated. Target Value Design also leads to an increased cost control and ability to make conscious choices and prioritisations and thus projects can be steered in the desired direction.

Still flexibility and managerial freedom is needed in the process, as people do not like too much standardisation. If all team members agree on input and output, then there is room for freedom in-between for each individual to achieve the output as preferred. This means the employees are trusted in being good at doing their job. Also, through clearer interfaces there are more consensuses.

Moreover, a key factor is to incorporate the employees in the change processes. Involvement, participation and possibility to influence the work, lead to engagement and increased will to develop and improve. That also means it is preferable to involve specialists as early on as possible. If the organisation maps the actual process, then the employees together can identify wastes and thus remove those. At the same time they can agree on what is value creating and focus on that. Hence the process is standardised by input from the employees themselves.

6.2 Collaborative practises

Furthermore, the authors believe that the organisation would benefit from more collaborative practises and try to overcome the barriers that the authors claim exist on

different levels within the organisation. The authors also observed indications on different levels of trust in the organisation. The individuals claim to trust each other, however the level of individual trust does not seem to be enough as the lack of trust between the departments and groups, on an organisational level, seem to hinder further development. Therefore, it is important for The Company to try to overcome the barriers between different groups to make room for improvements.

The authors believe that trust is vital for collaboration. If there is a lack of trust it becomes very hard to practise good communication and to share information and knowledge. Trust between co-workers is also important in the aspect of new implementations to be sustainable and to enable further development. As well, the decision makers must signal trust in the project team to reduce friction in the organisation. A crucial element to succeed in overcoming barriers and establish collaborative practises is to embrace transparency as well as to establish common goals in order for the teams to achieve common ground.

6.3 Recommendations

Recommendations for further research are to focus more on end customer needs and how end customer satisfaction and customer value is created. Also it is suggested to adopt a more holistic view, applying a lean perspective on the whole project process, including both internal and external factors.

To sum up, this study implies that The Company can benefit from applying Lean to the design phase in their construction projects. And since the improvement areas can be identified with the construction industry overall, Lean can be a beneficial way for many companies and actors to improve results in the industry. Also, it is important to emphasise that the use of Lean is most beneficial when applied to the whole project process.

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Appendix 1

Interview Questions Exploring interview

1. Kan du beskriva hur NCC Boendes arbete ser ut från anskaffandet av mark till byggstart?
2. Kan du beskriva vad en projektchefs huvudsakliga syfte/uppgift är?
3. Vad anser du är värdeskapande för NCC Boende?
4. Finns det några speciella aktiviteter/processer (av det som görs idag) som du anser skapar värde för NCC Boende?
5. Vad anser du INTE är värdeskapande för NCC Boende?
6. Finns det några speciella aktiviteter/processer (av det som görs idag) som du anser INTE skapar värde för NCC Boende?
7. Vilka aktörer är NCC Boende beroende av från anskaffandet av mark till byggstart?

Interview questions project managers

Vi tittar på NCC Boendes projektutvecklingsfas TG2-TG4 (från *mark under kontroll* till *orderanmälan*) i syfte att hitta eventuella hinder, flaskhalsar, tidstjuvar, krävande relationer, möten, dokumenthantering eller icke värdeskapande aktiviteter. Vi planerar att intervjua alla fem projektcheferna för att identifiera den här typen av hinder men även delar av processen som flyter på bra. För att sedan fördjupa oss i något av de upplevda problemen och se om det finns möjlighet till förbättring. Alla intervjuer kommer att behandlas anonymt.

- 1. Vill du börja med att berätta om dig själv, din bakgrund och dina tidigare erfarenheter?**
- 2. Vad är det viktigaste du gör i ditt dagliga arbete?**
 - Varför är det viktigast?
 - Vad innebär det? Ge exempel?
 - Görs det på bästa sätt?
- 3. Läger du tid på rätt saker?**
 - Vad är det för saker? Ge exempel?
 - Varför lägger du tid på det (om du inte tycker att det är viktigt)?
 - Finns det något du gör som du inte förstår meningen med?
- 4. Vilka andra aktörer/personer är du beroende av i ditt dagliga arbete?**
 - Är några relationer extra viktiga?
 - Hur fungerar samarbetet?
 - Vad fungerar bra/mindre bra? Varför är det så tror du?
 - Hur samarbetar du med de andra på avdelningen? Jobbar ni projektchefer tillsammans, över projektgränserna? Vad tycker du om det? Bra/dåligt?
- 5. Finns det några aktiviteter/händelser i projektutvecklingsfasen som du anser kan förbättras, (så som vi tidigare beskrev den)?**
 - Vad innebär det? Vad får det för konsekvenser för dig/projektet/processen/för andra?
 - Varför behöver det förbättras?
 - Vad är viktigast att förbättra/förändra?
 - Hur tycker du att det kan förbättras?
 - Varför tror du att man gör detta? Vad är grundtanken?
 - Vilka mål arbetar ni mot?

Interview Questions Construction Department

I vårt examensarbete tittar vi på Boendes projektutvecklingsfas, dvs från det att NCC har marken under kontroll till orderanmälan i syfte att finna eventuella förbättringsområden. Vi har nu intervjuat alla projektcheferna på Boende där alla påtalat vilken viktig roll Construction har i deras dagliga arbete. Och det är därför vi nu vill intervjua dig som (chef för projekteringsledarna/ projekteringsledare/ affärsutvecklare) kring hur du upplever arbetet i den här fasen. Intervjun kommer att behandlas anonymt.

- 1. Vill du börja med att berätta lite kort om din bakgrund, tidigare erfarenheter och din nuvarande roll?**
- 2. Vad anser du att Constructions roll i projektutvecklingsfasen är?**
 - Vad är det viktigaste du gör i den här fasen?
 - Varför är det viktigast?
 - Vad innebär det? Ge exempel?
 - Görs det på bästa sätt?
- 3. Vad är Constructions mål i de interna projekten?**
 - Vad tror du att Boendes mål är i de interna projekten?
 - Vem är slutkunden för Construction? Boende/kunden?
- 4. Upplever du att det är någon skillnad i att jobba i externa projekt jämfört med interna projekt?**
 - Vad är det för skillnader?
 - Vad tror du att det beror på?
- 5. Finns det några aktiviteter/händelser i projektutvecklingsfasen som du anser kan förbättras?**
 - Vad innebär det? Vad får det för konsekvenser för dig/projektet/processen/för andra?
 - Vad är viktigast att förbättra/förändra?
 - Hur tycker du att det kan förbättras?
- 6. Hur skulle du beskriva samarbetet med Boende?**
 - Hur tycker du att överlämnandet mellan olika uppgifter fungerar?
- 7. Vi har förstått att det är du som är huvudansvarig för kalkyleringen i projekten. Kan du beskriva hur kalkyleringen går till? (Ställdes till affärschefen.)**
 - Vad är syftet med succesiv kalkylering?
 - Uppfyllelse/Konsekvenser?