CHALMERS

How to Change A Traditional Construction Company to Lean

Master of Science Thesis in the Master's Programme International Project Management

INJI SALIHI

Department of Civil and Environmental Engineering
Division of Construction Management
CHALMERS UNIVERSITY OF TECHNOLOGY
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ABSTRACT

After Lean was introduced in the manufacturing industry many other industries began to think of how they could adapt the same management system into their work. For the construction industry the answer was Lean Construction, a philosophy with the aim to improve work constantly, and minimize waste (amongst other things). Many construction companies have today heard about Lean construction, but they are cautious before adopting the principles into their operations. This thesis aims to understand what the reason behind this is, and what the most useful change management model is when converting a traditional construction company to Lean.

In order to do this a literature review took place, where both old and current literature was reviewed. Also a case study with an organisation that has managed to convert to Lean Construction successfully was investigated, and to support that, a questionnaire was sent out to different project managers working in several different construction companies. The literature review, case study, and questionnaire was then compared and analysed in order to understand where the theory differs from the reality.

The findings were that the main benefit for construction companies is that it enables organisations to improve their operations and the way they work. The main obstacle when changing to Lean Construction was the culture of resistance in the organisations. One way of dealing with that obstacle is to empower the employees and encourage them to take part in the change. This will make them motivated and decrease their resistance. It came through that there is no perfect model to use when changing the organisation, but that the change agents should themselves decide what to do in each phase that they think that the organisation is in. The change models that are available can be used as guidelines to decide what phase the organisation is in, and what to do then. Another finding was that a construction company is most often dependent on other subcontractors and cannot just change the way they work without

informing them. Therefore is partnering a suitable way of working when trying to convert to Lean. The organisations that are involved will get the most of the partnership, and always strive to become even better together, which is also one of the most important factors of Lean!

Key words: Lean Construction, Change Management, Culture and Partnering.

Att Förändra Ett Traditionellt Byggföretag till Lean
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SAMMANFATTNING

Efter att Lean först blev presenterad i tillverkningsindustrin började många fler industrier att tänka på hur de kunde tillämpa samma ledningssystem i deras arbete. För byggindustrin var svaret Lean construction, en filosofi som har målet att bl.a. förbättra arbetet kontinuerligt och minimera slösande. Många byggföretag har idag hört talas om Lean construction, men de är försiktiga innan de tillämpar principerna i deras arbetsrutiner. Det här examensarbetet har som mål att förstå vad orsaken bakom detta är, och vilket den mest användbara förändringsmodellen är vid omvandling av traditionellt byggföretag till Lean.

För att kunna göra detta har det genomförts en litteraturstudie, där både äldre och aktuell litteratur har blivit studerad. Det har även genomförts en studie av ett byggföretag som lyckades att framgångsrikt omvandla till Lean construction, och ytterligare ett frågeformulär har skickats ut till olika projektledare i flera olika byggföretag med frågor som rör Lean och förändringsarbete. Litteraturstudien, företaget och frågeformuläret har sedan blivit analyserade för att se var teorin skiljer sig från verkligheten.

Resultaten visade att den största fördelen för byggföretag är att Lean underlättar för företag att förbättra deras operationer och sättet de arbetar på. Det största hindret vid förändring till Lean var kulturen i företaget och motståndet som kunde uppstå ur det. Ett sätt att hantera detta är genom att ge de anställda mer ansvar och uppmuntra dem till att delta i förändringsarbetet. Det visade sig att det inte finns någon modell som är optimal vid förändringsarbete till Lean, utan snarare att företagen skall själva besluta vilket skede de befinner sig i och agera utefter det. Förändringsmodellerna som finns tillgängliga kan användas som riktlinjer för att kunna bedöma vilket skede företaget befinner sig i. Något annat som visade sig vara intressant i resultaten var att

byggföretag är som känt beroende av entreprenörer, och kan inte ändra på sättet de arbetar på utan att informera entreprenörerna. Därför är partnering ett bra alternativ att arbeta med vid försök att förändra till Lean. De inblandade parterna får ut det mesta av partnerskapet, och försöker hela tiden att bli ännu bättre tillsammans, vilket även är ett av de viktigaste faktorerna i Lean!

Nyckelord: Lean construction, Lean i tillverkningsindustrin, partnering och kultur

Contents

Preface

It is easy to find a subject for a dissertation when you know what interests you. Unfortunately for me I was interested in many different parts of project management, which made it difficult to select only one subject. It was in the middle of the semester during my studies in Northumbria University in Newcastle that I for the first time came across Lean, and fortunately for me it overtook my curiosity by far comparing to the other alternatives I was considering. The mission was now to consider how to connect Lean to Change management, which was my other strong opponent. Said and done, in January 2013 I went to a seminar about Lean Construction and came across a construction company that had managed to adopt the Lean Philosophy into their work, and were eager and happy to share their knowledge. What I saw during that seminar were over a hundred of participants who were all from the construction industry, and they were all very interested in Lean Construction. But with that said, the scepticism was large, and people were cautions when receiving the information. I there and then decided to write about Lean Construction, and how to change a traditional construction company to Lean, which I hope will help ease some of that scepticism!

Göteborg, April 2013

Inji Salihi

1 Introduction

1.1 Background

The construction industry is changing, and it is not the same industry as it used to be (Koskela, 1992). There is a need for a new management system, which will bring out the most of the projects. Many construction companies have noticed this need, and have started to adopt Lean in their practices.

In the 1940s Taiichi Ohno developed a new management system for Toyota cars, and reduced their average delivery time, production quality, etc. (Womack, Jones and Roos, 1991). This new management system became later known as Lean Management. Over the years Lean Management developed further and was finally introduced in the construction industry as Lean Construction (Jörgensen and Emmitt, 2000). Since there is no common definition for Lean Construction it has been difficult to explain the system fully, however, one can describe it as Lean Management with modifications to better suit the construction industry.

The academic literature is very positive towards Lean Construction and encourages companies to use Lean principles in their work (Jörgensen and Emmitt, 2000). However, there is still a resistance towards changing the way construction companies (Gadde and Dubois, 2008) works, and even though the academic literature is as positive as it is, the response from the construction companies were not as positive as expected (Howell and Koskela, 2000).

This Master thesis attempts to understand what the reason behind this resistance is, and what the most preferable change management system is when trying to convert to Lean Management. In order to do this a literature review of both current and past literature will be made. A case study of a Swedish construction company that managed to successfully transform to Lean Construction will be observed, and interviewed. Also a questionnaire will be sent out to project managers in Swedish construction companies, to get a fuller understanding of what the industry thinks of Lean and change.

1.2 Purpose

As has been mentioned above, there is a great academic interest in the field, and the literature praises Lean as a management system (Womack, Jones and Roos, 1991; Jörgensen and Emmitt, 2000; Howell and Koskela, 2000), however if it really is as good as the literature says, then there should be more organisations using it. There is a resistance towards change, and this thesis aims to understand why there is a resistance, and what the most suitable way of dealing with it is. Lessons will be learned from a Swedish construction company that managed to convert to Lean Construction successfully, and different project managers in different Swedish construction companies will provide the background to the work through an online questionnaire.

The purpose of this work is to investigate and understand where the problem lays in the change process when introducing Lean Construction.

1.3 Research questions

The questions that will be answered are:

- How do construction companies benefit from Lean practices in theory?
- How does the theory match with the reality?
- What are the main obstacles in converting the organization to Lean management?
- How can a traditional construction company change to Lean practices?

1.4 Research outline

Chapter 1

The first chapter consists of the introduction to the subject, where the purpose, background, research questions, and objectives are presented.

Chapter 2

The second chapter consists of a literature review, where both current and older literature regarding Lean and change management is reviewed. This is to get a better understanding for the subjects, and how they are built up. It is also the literature

review that will set the background for the interview questions that will come a chapter further on.

Chapter 3

The third chapter is the method chapter, where the method that has been chosen for this particular thesis will be rationalized. Also the choice of having an interview, observations and conversation in a case study organisation, and a questionnaire sent out to project managers will be presented. The data analysis process and limitations can be found here, along with the ethical considerations regarding the interviews and how the results will be found in the thesis.

Chapter 4

The fourth chapter will present the results from the interview and questionnaire, and they will be presented and analysed.

Chapter 5

The fifth chapter consists of results and discussions based on the literature reviews, interview/conversations and observations, and questionnaire.

Chapter 6

The sixth chapter consists of conclusions that can be drawn from the previous chapter of results and discussion, and a presentation of the main findings from this research.

Chapter 7

The seventh chapter gives suggestions for further research within the field.

Chapter 8

The eight and last chapter consist of the references that were used in the thesis.

2 Literature Review

2.1 Lean management and Lean construction

The construction industry has always had a tendency to be traditional and conservative. However, there is a need for a change, and this change lies in the fact that the environment the construction industry is working within has changed (Koskela, 1992). The Lean philosophy was first introduced in the Toyota factories in Japan between the years 1948 and 1975 (Womack, Jones & Roos 1991) and revolutionized the manufacturing industry in a way that no one could have expected. Toyota has been on a long journey and improved many parts of their work, however, the work is still far from finished. In 1992 Koskela (Koskela, 1992; Jörgensen and Emmitt 2000) considered the philosophy for the first time relative to the construction industry, however the response was not as enthusiastic as expected (Howell and Koskela, 2000). But in time the many positive characteristics of Lean produced positive results for some companies and the construction industry could no longer deny the benefits of Lean. As it is with Toyota and the manufacturing business, Lean construction still has a long way to go.

2.1.1 The brief history of Lean management and Lean construction

In the 1940s the car manufacturing company Toyota was facing obstacles, such as a poor economy, and workers that demanded better working conditions (Womack, Jones and Roos, 1991). There was also the problem with foreign car manufacturers that wanted to enter the Japanese market (Womack, Jones and Roos, 1991). There was a need for a change, and the engineer Taiichi Ohno began experimenting with different management systems. What he finally came up with managed to reduce the average production time from a day to three minutes, and he realized that smaller batches would be more beneficial in the long run. He also developed the way the employees worked with teams and team leaders. The final result came later to be known as the father to Lean management (Womack, Jones and Roos, 1991).

The actual term Lean was coined by one of the researchers involved in the study which was the basis of the book “The Machine that Changed the World, The story of Lean Production”, Womack, Jones and Roos in 1991 (Holweg, 2007). By eliminating wastes and maximizing the activities that will give value to the client, the best results

will come out. In short, one can say that Lean is to "Do Less for More Value" (Simons and Mason, 2003)

In 1992 Koskela first introduced the term Lean to the construction industry (Jörgensen and Emmitt, 2000; Koskela, 1992). According to Koskela (1992) the construction industry had a lot to gain from the Lean principles, amongst others, the work space, workforce, investment in tools and the engineering hours, will all be cut in half. There were certain factors such as time waste, storing inventories and travelling times that were not considered in the traditional critical path model, which is designed to predict the time scope of the project (Koskela, 1992). However, Koskela does not name the new method Lean construction, but rather The New Production Method.

2.1.2 What differs Lean construction from Lean manufacturing

Lean is more commonly known as Lean Construction in the construction field, as it has derived form Lean Manufacturing, but modified to better suit the construction industry. One might claim that this is something that is not possible, and the two fields should be held separately as the construction field consists of unique projects, and since Lean is about continuous improvement, the uniqueness in the projects makes it impossible to be implemented.

However, Jörgensen and Emmitt (2008) claim that the original concept of Lean that derived from the east has been changed by the west through our own interpretations, and that what we mean by Lean in the west is not the same Lean as in the east (Jörgensen and Emmitt, 2008). This can be seen in the suggestions from articles that say that Lean manufacturing should be interpreted and only after that implemented into construction (Bertelsen and Koskela, 2004). This is also something that Liker (2004) states, that one cannot just take the methods from Toyota and apply them, but one must adjust them and modify them to better suit the situation and needs.

Koskela and Bertelsen (2004) claim that Lean construction has managed to move beyond from the Lean that that Womack and Jones write about in "The Machine that changed the world". They claim that Lean Construction has managed to evolve further, as there has been more interest in the field and therefore more research has been made about it. However, Paez et al (2005) claim that the technical perspective

influences the only difference between the implementation of Lean in the two fields, and that Lean can in fact be implemented in the construction field.

Salem et al., 2006 points out that there are theories and practices in Lean manufacturing that cannot be implemented in Lean construction, however, through the help of other techniques meant for construction, Lean can be helpful to help move the organisation forward (Salem et al., 2006). So Lean can be implemented in construction by thinking outside the box, and changing the way we think about construction, one example is standardizations (Howell and Ballard, 1998).

As have been concluded (Jörgensen and Emmitt, 2008; Pekuri et. al., 2012) there is no common definition for Lean construction. In order to get an understanding for it, Peluri, Aapooja and Haapasalo (2012) have broken it down into layers, and they are the following:

- Principles and Culture
    - Client first; The five principles of Lean by Womack and Jones (2003)
    - Continuous improvement (or kaizen); Eliminating wastes that does not add any value to the work, and at the same time making continuous improvement of the activities.
    - Respect for people; Respecting your co-workers is an essential part, along with developing and empowering people. One should make use of the knowledge and skills of people. This will increase the motivation and help people to feel more involved.
- Practices
    - Eliminating waste, unevenness and overburdening: There should not be a variation of products and processes. The inventory should be kept to a minimum (Liker, 2004)
    - A cultural transformation: A culture where new practices are welcome.
    - Standardization: Standardizations will save time and will in the long run become a competitive factor.
    - Visual Management: More attractive options of communications should be used, in order to increase the use of it in the organisation.

The aim with this is to create a transparent organisation where mistakes and etc. can be detected earlier.

- Tools and Method

    - Lean Production: Originated from Toyota, and has many similar and sometimes exactly the same practices. The techniques that are included are amongst others: Just in Time, Kanban, Single piece flow, and 5S. The aim with Lean production is to reduce the production time.
    - Lean Product Development: By using skilled people, the advantages will be set in an early stage. Different tools that can be used to achieve these are Co-location, QFD and Supplier involvement.
    - Lean Construction: The tools that can be used to ease the work in Lean construction are for example BIM, Last Planner^{R} System and Relational Contracting.

(Pekuri et. al., 2012)

2.1.3 Criticism regarding Lean

The literature regarding Lean is most often very positive (Womack, Jones and Roos, 1991; Jörgensen and Emmitt, 2008; Ohno, 1988; Howell and Koskela, 2000; Thomassen et al., 2003) however, there are still some opponents to Lean, and they claim that the researchers that have written about Lean so far are ignoring the criticism and only accepting the positive results (Green, 1999)(Green, 2000). Holweg (2007) claim that the positive welcome that Lean received can be explained through the history of which it derived from. As was mentioned earlier Lean was first introduced in the Toyota factories in a time of crisis, and a change was welcome as there was a great need for it (Holweg, 2007). Lean construction has received the criticism that Lean was mainly designed for the car manufacturing industry and is therefore not applicable in the construction industry (Howell and Ballard 1998). But Howell and Ballard (1998) argue that Lean can be applied in the construction industry, however with some modification. They claim that there needs to be a different way of thinking as some parts of Lean production, such as standardizations, would not work in the construction industry (Howell and Ballard, 1998).

2.1.4 Lean seen as a philosophy

According to Liker (2004), Lean is more than just a management or production system, its rather a philosophy and a way of being. It is only when each and every member of the organization, from the senior managers, to the workers on the floor, works towards the same goal together, that the organization can call itself fully Lean (Liker, 2004). By calling it a philosophy one has to act in a way that is according to Lean, to be able to fully take advantage of the benefits (Liker, 2004; Bhasin and Burcher, 2006). Liker (2004) never uses the term Lean but rather the philosophy. Respect and understanding is, according to Liker (2004) essential for the works. Liker (2004) therefore states that many organizations that today calls themselves Lean, are in fact not, as they have only accepted the procedures into their work, and not the actual philosophy. The change needs to come from within the organization itself and therefore the organization culture must change with it (Bhasin and Burcher, 2006).

2.1.5 Why is Lean suitable in construction?

As Liker (2004) stated, Lean should be seen as a philosophy rather than a tool. The information and tools that have been used in the construction companies have so far been implicit and therefore it has been difficult to map out the practices (Koskela and Vrijhoef, 2000). The information needs to be explicit to be able to improve the techniques and practices.

According to Amaral et al. (2012) Lean can be used to optimize the management capacity of organisations in a shorter time period, and also to reduce uncertainties in the decision phases.

In most construction companies the activities are not linked in such way that the problems can be detected early on in the project, and most often the problem is detected after that activity is finished and other activities have started (Koskela and Vrijhoef, 2000). Since the information is most often implicit, the mistake in the first activity is done again and again in different projects, and one does not learn from the mistakes. This is where Lean becomes very handy.

Since Lean is about linking the different activities together and making the organisation transparent (Pekuri et. al., 2012; Howell and Ballard (1998) this problem can be avoided. Lean is, amongst other things, about continuous improvement, it

forces the organisation to map out their activities, and go through them. As Womack and Jones (2003) states, Lean is built up by the following five principles:

1. **Specify Value;** can only be defined by the client.
2. **Identify the Value Stream;** all of the actions that are required to deliver the project are defined and mapped. All of the parties that are involved must communicate to not create any extra actions.
3. **Flow;** create a flow through the different steps and activities. Eliminate steps that are not adding any value.
4. **Pull;** Produce only when the client wants the product; let the client "pull" it from you.
5. **Pursue perfection;** Go through the project to see what could have been improved and take that knowledge with you to the next project.

(Womack and Jones, 2003)

The actions that are presented above required the organisation to go through their operations and document them. This is something that construction companies are not so good at doing, but by using these actions, the first step towards a more transparent organisation has been taken.

2.1.6 What can organisations do to become Lean?

According to Howell and Ballard (1998) construction companies must change the way they work and think about construction. They also propose five steps that the companies must follow to be able to adopt Lean, and they are the following:

- Stopping the line
- Drilling the product forward
- One piece flow
- Synchronize and align
- Transparency

(Howell and Ballard, 1998)

2.2 Change Management

Change management is something that has been on the agenda of most organisations that are facing a crisis, or major change, that requires a change in the management system. There is a need to evolve and learn other way of doing things, and Buchanan and Huczynski (1985) define learning as "the process of acquiring knowledge through experience which leads to a change in behaviour". This means that all learning will result in a change and that all change will result in learning. However the organisation must be ready to implement the change, and be able to accept it. It is only when the acceptance has occurred that the organisation can reach the desired result. There are many change management theories, it is however the most commonly known theories that will be presented and investigated in this section.

2.2.1 The three phase model by Lewin

In 1951 Lewin designed the first change management theory, and it was called the Three Phase Model. The Three Phase Model has many times been the output model when other new models were designed. According to Lewin an organisation goes through three different phases, from the initial change to the final phase when the change has stuck.

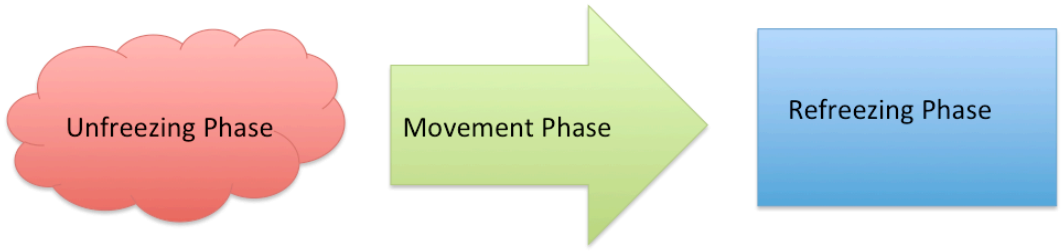

Fig. 2.1 The Three-Phase Model by Lewin (1951)

1. **The unfreezing phase** – The organisation prepares itself for the change and gets ready to move from the current comfort zone that it is in.

2. **Movement phase** – This phase is more similar to a process than a phase. This is most often the most difficult phase to go through, as this is the phase when the actual changes occur.

3. **Refreezing phase** – This phase begins when all of the changes that need to be implemented have been implemented. The refreezing phase means to make the changes stick, and become a natural part of the organisation

(Lewin, 1951)

2.2.2 The eight step model by French, Kast and Rosenzweig

French, Kast and Rosenzweig developed in 1985 the eight-step model. The eight step model derived from the three step model by Lewin (1951), only it further described the several different steps that is not spoken in the second phase of Lewin's model, the movement phase.

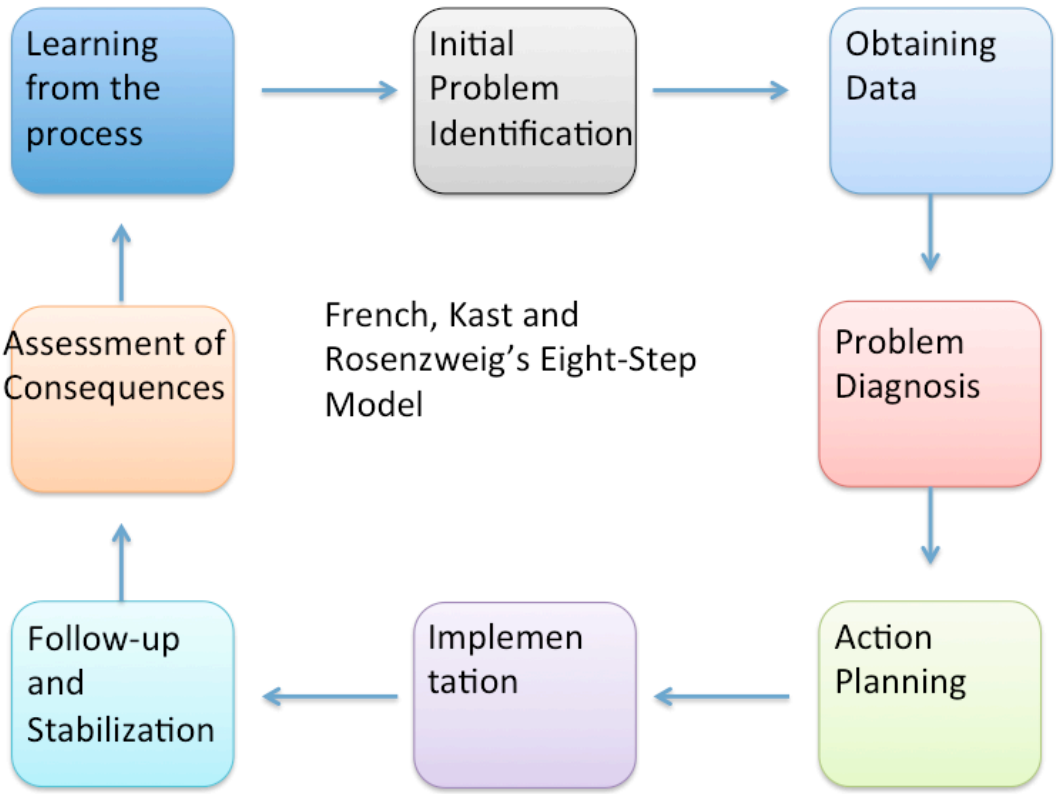

Fig. 2.2 French, Kast and Rosenzweig's Eight Step Model

1. Initial problem identification
2. Obtaining data
3. Problem diagnosis
4. Action planning
5. Implementation
6. Follow-up and stabilisation
7. Assessment of consequences
8. Learning from the process

French, Kast and Rosenzweig (1985) have added another step to the original model by Lewin (1951), and that is the final step: Learning from the process. This is an important step, as it allows the organisation to take the knowledge from this particular change to the next one. It helps to minimize the risks with the next change, as the organisation can learn from their previous mistakes, and know what to avoid the next time.

2.2.3 Kotter and Cohen's eight step model

Kotter and Cohen also developed an eight-step model; only this model did not contain a ”Learning-from-the-past” phase, as the previous model did. The eight steps that are included in the model by Kotter and Cohen (2002) are presented below:

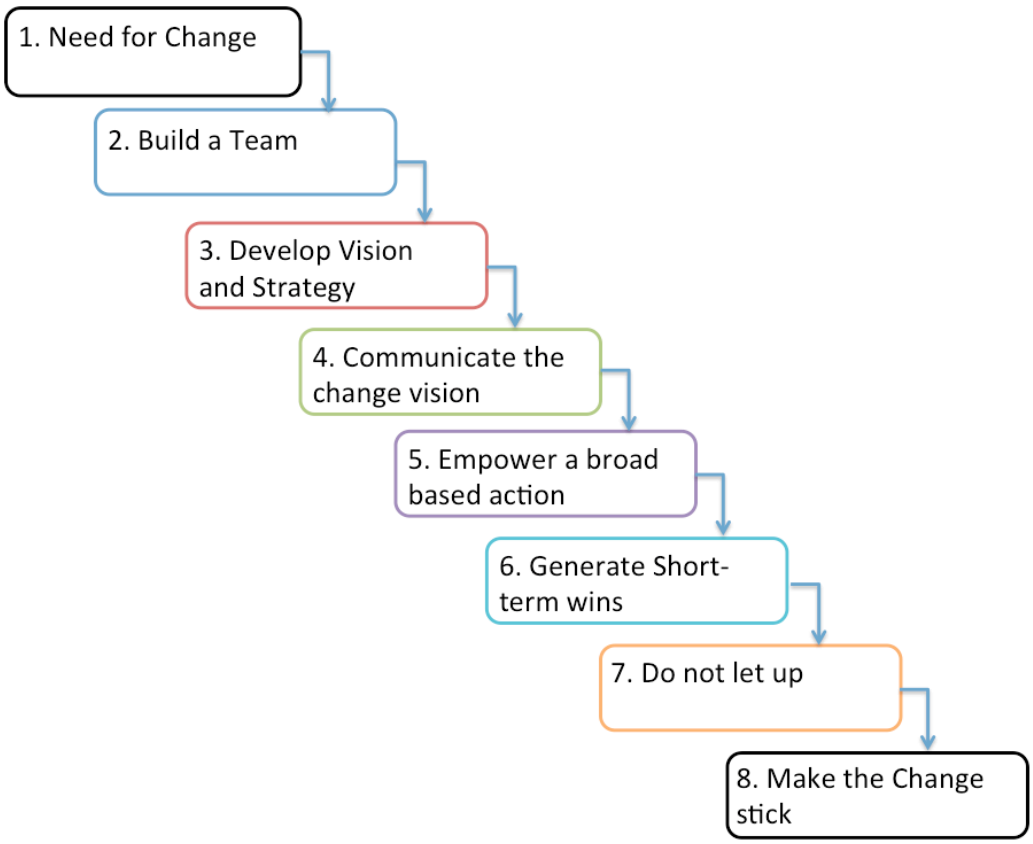

Fig 2.3 Kotter and Cohen's Eight-Step Model

1. Need for a change – There needs to be a need for a change, and if there is not a need for a change, the need must be created, through a crisis or similar to it.
2. Build a team – Teams will be built to use the skills and knowledge of the individuals in the most optimal way.
3. Develop a vision and strategy – With the change comes a need for a new vision and strategy.
4. Communicate the change vision – The change needs to be communicated to everybody involved, and everybody must understand the reason for the change, and the changes that it will require.
5. Empower a broad based action – Give the teams authority to make their own decision.
6. Generate short-term wins – By having short term wins the employees will be more motivated and work towards a common goal.
7. Do not let up – Stay focused and do not fall back on old habits because it is more comfortable.

8. Make the change stick – Make the change a part of the culture in the organisation, and the common way of doing things.

2.2.4 Criticism of the theories

According to Minzberg et al. (1998) there are two types of models: Prescriptive and Formal planning. The first ones of prescriptive nature describe *how to perform* a change; whereas the ones with a formal planning nature describe *how to implement* the prescriptive models.

Critics mean that Lewin's model from 1951 was only meant for top-down management, and is ignoring the bottom-up change (Burnes, 2004), and this is often the case in most organisations. The failure of change can sometimes be influenced by the management approach.

French, Kast and Rosenzweig (1985) thought that the last step was the most important step, the "Learning from the Process". This is however something that is hard to set time aside to in organisations today. Every hour spent on a finished project is stealing time from the next one, and this is something that most organisations may choose not to prioritize.

In Kotter and Cohen's eight step model for organizational change the first step is to create a feeling and need for change. This is something that is harder to do than one can imagine. In an interview (Wallace, 2003) Kotter said that this is the most difficult step in the process, and that it can be compared to asking a smoker to quit smoking (Wallace, 2003). Kotter said in the same interview, that one way of doing this is to touch people emotionally, for example, instead of showing papers of complaints from clients, a video of the angry client can give more results. The practical sense of the change that is needed must come through to the employees. Everybody in the organisation must be on board, understand and work towards the same goal. In 1969 when NASA was trying to send the first man every to the moon, the current president Lyndon B. Johnson asked the janitor in NASA what he was doing. The janitor responded, "I am helping to send a man to the moon" (Smith and Mireless, 2010).

2.2.5 Why some changes fail?

Some organisations have many theories and a lot of knowledge about how to implement a change. However, sometimes even the most well-read and knowledgeable organisations fail when implementing a change. Why is that?

There are different underlying reasons behind the failure of changes. First of all one must classify the different types of change that are required to perform an organisational change (Cameron and Green, 2012). The different types of change are listed below:

1 Individual changes

2 Team changes

3 Organizational changes

(Cameron and Green, 2012)

2.2.5.1 Individual change

The first step towards an organisational change is the individual change. This is often considered as the most difficult type of change, as it requires personal interest in the change. Kotter said in an interview (Wallace, 2003) that it is similar to asking a smoker to quit smoking. To better understand this type of change Maslow's hierarchy of needs can be used to explain it.

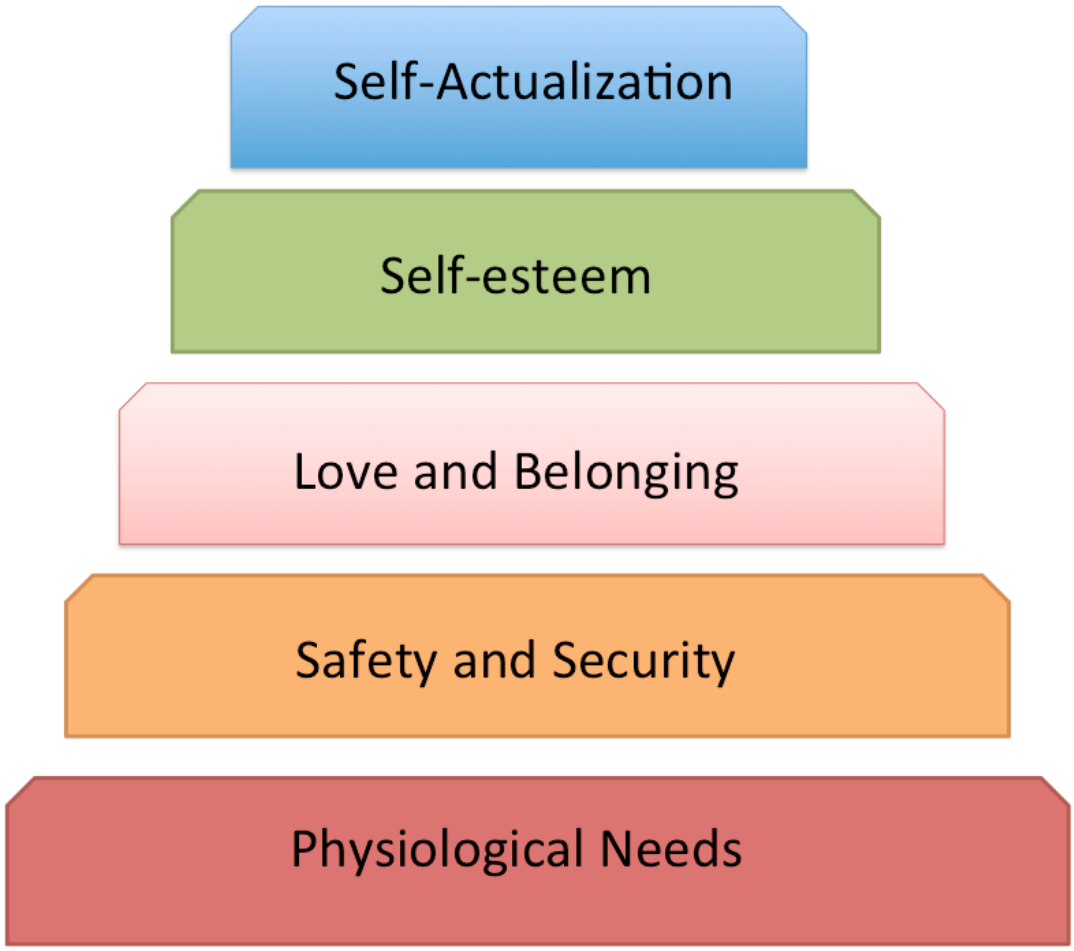

Fig. 2.4 Maslow's Hierarchy of Needs

As can be seen in the figure above the first needs are physiological, so food, water, shelter, etc. in other words, materialistic factors that are needed to be able to proceed to the next need.

The second need is Safety and Security. This need includes health, employment, social stability, etc.

The next coming need is love and belonging, where friendships, intimacy and family are included.

After that comes the need of self-esteem. According to Maslow a person needs to feel confident, and have the respect of others to fulfil this basic need. And it is only when these needs have been completely fulfilled that the person can continue to the next and final need that is Self-actualization. It is in this need that the person can

experience a purpose, and understand their meaning and inner potential. It is also in this need that the person can become creative and think outside the box.

If any of the needs below have not been fulfilled, the person cannot continue further up in the hierarchy. This means that if for example the physiological needs have not been fulfilled, it is almost impossible for the person to continue to the need of safety and security.

As can be seen in fig. 2.4 employment comes in under the need of safety and security. It is through our knowledge and skills that we get a job. Let us now say that there is a major change in the workplace, and the knowledge and skills that you have specialized in until now are no longer up-to-date. A reaction should be expected as the employee moves from what they know, to what they do not know (Wittig, 2012). There will be a dip in their knowledge (Cameron and Green, 2012). The fear of risking the employment, and thereby all of be needs that have so far been fulfilled above, and below, will cause a resistance towards the change. Rafferty, Jimmieson and Armenakis (2013) claim that there needs to be an individual readiness for the actual change, before the change occurs. This readiness will come through the employee's emotions and cognitions, communication and the employee's participation in the decision making process (Wittig, 2012). Therefore the attitude of the employee is essential for the change to be successful (Wittig, 2012).

Lewis (1994) claims that it is the behaviour of the individual in groups that is one of the main factors of failure in organizational changes. Lewis advocates that it is the behaviour of the individual that needs to change, but that the behaviour is something complex and requires for more than the culture in the organisation to change, for it to reach the desired result (Lewis, 1994). As Rafferty, Jimmieson and Armenakis (2013) concluded, the individual must be ready for the change.

2.2.5.2 Team change

When the individual has accepted the change it can proceed with affecting the teams to also accepting the change. A team is a group of people that has been put together by the management to fulfil a task, and they share responsibilities within the team (Maylor, 2010). One must differ team from groups, as they have different purposes and are brought together for different reasons (Cameron and Green, 2012). While

teams are brought together to fulfil a task, groups can be formed randomly, just for the sake of belonging. The responsibilities are not even in groups, and it can dissolve whenever, while teams can only be dissolved when the task is finished or the management decides to (Cameron and Green, 2012).

According to Belbin (1981) all team requires certain roles that need to be present, and it is only when these roles are filled that the team can move forward. The team roles are the following:

- Plants
- Resource Investigators
- Monitor Evaluators
- Co-ordinators
- Implementers
- Completer Finishers
- Team Workers
- Shapers
- Specialists

(Belbin, 1981)

Plants are the creative ones in the team; they are the ones that bring in new ideas and suggest what that most of the other team members would not be thinking of. However, the plants have a tendency to be forgetful and unorthodox.

Resource Investigators are the ones that will bring in the resources that are needed to fulfil a certain task for the team. They might however tend to sometimes forget about following up on a lead, and might thereby miss an important resource.

Monitor Evaluators are the ones that have a helicopter view over what the team is doing, and makes sure that the team is still on the right path. They usually want to

make everything correct, which can lead to being overly critical, and thereby slow on moving forward.

Co-ordinators (or Chair man) delegates the team members of what to do. This is important as someone needs to take the lead in a team, otherwise the other team members will not know what to do, and how to proceed. The risk with the co-ordinator is that they can over delegate tasks to the other team members and leaving themselves with little work to do.

Implementers are the backbone of the team, as they are the ones that perform most of the ideas that the other team members have. However, they can be slow on implementing the plans while they are waiting for more positive changes.

Complete Finishers makes sure that the team is doing what they are supposed to do, in detail. While the Monitor Evaluators have a helicopter view of what the team is doing, the Complete Finisher has a micro-view over it. Complete Finishers tend to be perfectionists, which can cause irritation within the rest of the team.

Team workers are the ones that the other team members most often do not take too much notice of, but they do however contribute with the positive attitude, and team spirit to the team. If there is a problem between two team members, the Team Worker can help dissolve the problem, but they can tend to be indecisive when unpopular decisions need to be made.

Shapers are the ones that get things done, and push the team forward. They can be perceived as aggressive and that can sometimes bring a negative feeling to the team.

Specialists are the extra hands that are needed to complete a specific task that none of the other team members have. They tend to know a lot about their own field, and not so much about others, which can cause a too narrow focus.

According to Belbin (1981), these are the team roles that exist in the team today, they are however not all needed to have a successful team, but there are certain key team roles that, when put together can perform the task equally successful (Bebin, 2010). The key team roles are, according to Belbin (2010) the Shaper, Co-ordinator,

Monitor-Evaluator, Team worker and Complete Finisher. It is therefore these that need to be mostly influenced in the team by the management to proceed with a change.

As Rafferty, Jimmieson and Armenakis (2013) states, other than individual readiness, there needs to be a collective readiness as well for the change.

2.2.5.3 Organisational change

Organisational change is the type of changes that Kotter and Cohen (2002), French, Rosenzweig and Roos (1985) and Lewin (1951) have made models for. There are however two types of change that can occur in the organisation, emergent and planned.

Emergent change is when there was no intention of applying change in the organisation, but either external or internal influences are effecting the organisation in such a way that it becomes forced to implement a change. Emergent change focuses on Bottom-up action rather than top-down (Bamford and Forrester, 2003). As the process of an unexpected change is most often very rapid and needs quick decisions, it is more suitable for the individuals or teams that are effected by the change to be able to make their own evaluation of the situation and implement the change that they consider necessary (Bamford and Forrester, 2003). The process of informing senior management and waiting for them to evaluate the situation and coming back with a directive of how to proceed would take too long time. As has been mentioned before, the change model by Lewin (1951) was criticized for this reason as it focuses on a top-down change process.

Planned change is the type of changes that Kotter and Cohen (2002), French, Kast and Rosenzweig (1985) and Lewin (1951) refers to when suggesting models for change. In fact, according to Bamford and Forrester (2003) planned strategy has its background in the three-step model that Lewin designed in 1951.

Planned changes require an action plan that will be presented to the effected staff. All of the actions that will take must be carefully considered in the plan and elaborated as much as possible. Examples of what can be included are schedules and budgets. The ones that are outside the actual planning may act, but they may however not interfere in the change process (Mintzberg and Waters, 1985). What needs to be clear is that

planned change is planned with the idea that everything will run smoothly, and nothing will interfere. However, that is only applicable in a perfect environment, and no such thing exists.

2.3 How to implement Lean in construction?

As Bertelsen and Koskela (2004) and Womack, Jones and Roos (1993) stated, Lean can be applied in all organisations, however it does need to be interpreted and only after that implemented into the organisation. Lean can be difficult to be implemented into all projects. However, the difficulty is usually in a psychological form, and is based in the attitude towards the change (Thomassen et al. 2003). This leads to the culture in the organisation as culture can be defined as the feelings, beliefs, values and basic assumptions of the members in the organisation (Lewis, 1994). A cultural change is therefore crucial for a successful change to Lean (Keiser, 2012). Since there has only been a little research regarding this matter in the construction industry, Keiser (2012) suggests that we should:

- Learn from other disciplines
- Develop the appropriate modification
- Apply them to Lean Construction.

(Keiser, 2012)

One must bear in mind that the construction industry is special in a way that makes it dependent on other companies and organisations. According to Gadde and Dubois (2008) more than ¾ of a construction company's total cost consists of bought services from other organisations and companies. This reflects the level of dependency that a construction company has on other companies. If one takes this one step further, one will realize that a construction company that wishes to perform a change in their own organisation, is dependent on that their subcontractors and other companies that they buy services from are accepting the change as well.

2.3.1 The construction industry

The construction industry often includes many different parties, which are all in one way or another dependent on each other. In order to get a better understanding for how different organisations and companies are dependent on each other, different forms of contract form will be presented, and finally the most suitable way of working when using Lean principles will be pointed out.

2.3.1.1 Total contract form

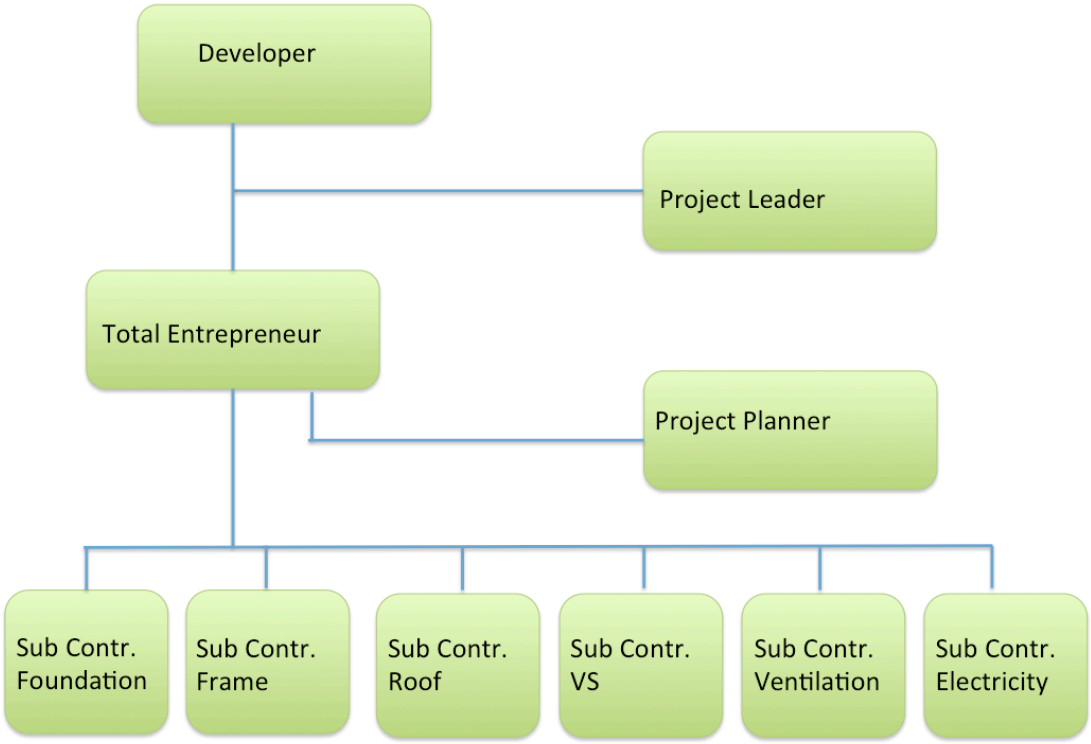

Fig.2.5 Model of how the different links are when working with Total Contract Form

One of the most common ways of working when wanting to build something in Sweden is through total contract form. The developer hires a total entrepreneur who is in charge of everything from the planning till the final product. The developer gives simple sketches and descriptions, and what functions they want the final product to have, and the project will then be in the hands of the total entrepreneur, who will interpret the criteria and form the technical solutions (Boverket, 2013). The total contract form is sometimes called functional contract form as the developer only describes the functions that are required, and the entrepreneur then does the rest of the work (Boverket, 2013).

2.3.1.2 General contract form

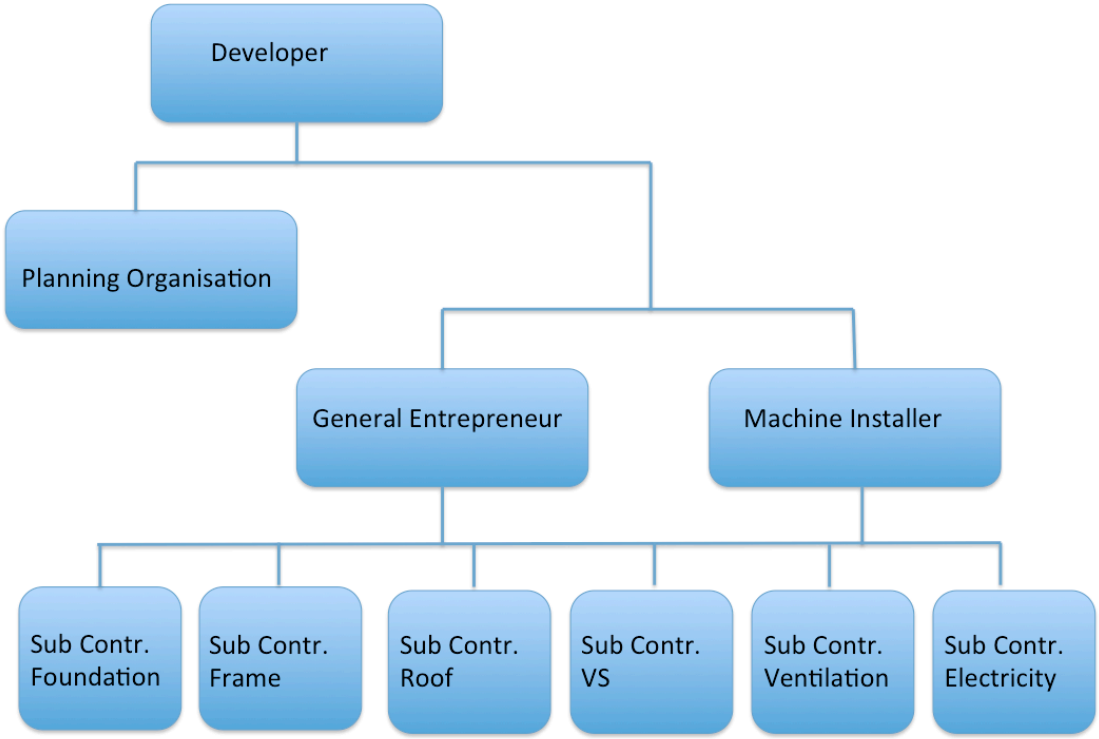

Fig. 2.6 Model of how the different links are when working with general contract form

General contract form is also one of the most common ways of working in the construction industry in Sweden. The developer has the main responsibility and hires a general entrepreneur who will hire the subcontractors (Boverket, 2013). The responsibility of the general entrepreneur is to organise the different subcontractors and make sure that the flow charts and time management is followed. The developer has more responsibility in this form of contract form. The developer must produce the documents that are necessary to receive building permits etc. with an architect or planning organisation. The developer then signs a contract with the general entrepreneur who will procure the subcontractors (Boverket, 2013).

2.3.1.3 Partnering

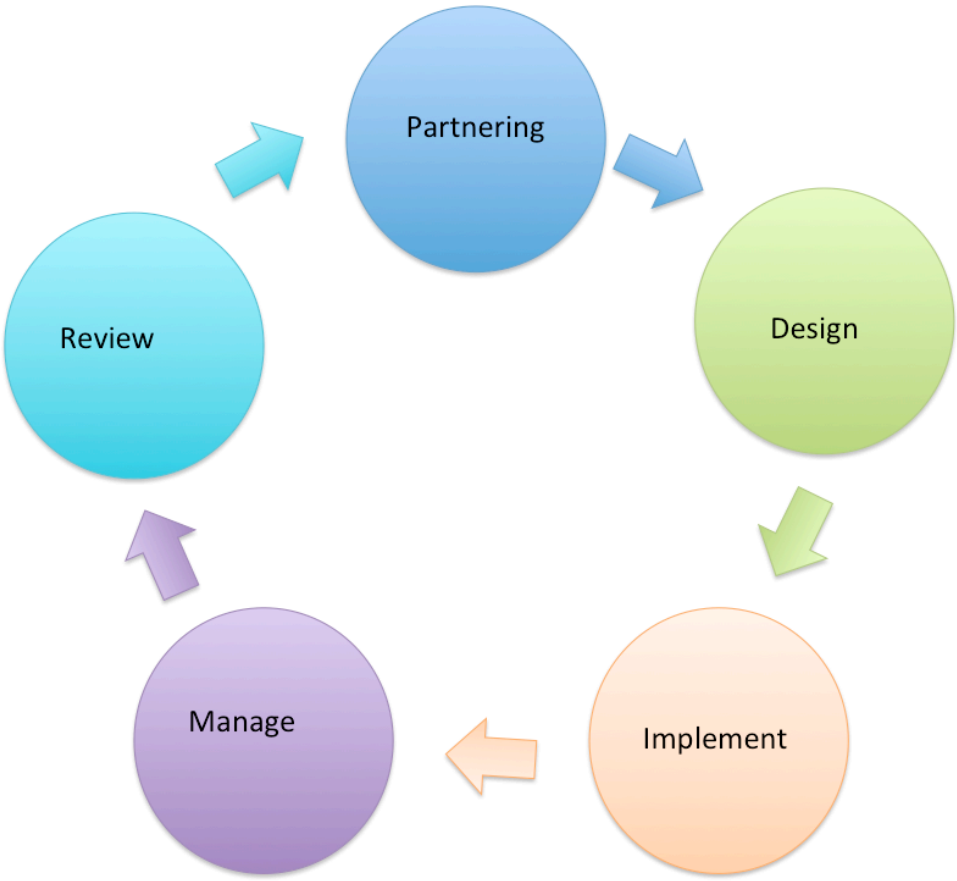

Fig. 2.7 Model of the construction process when working with partnering

Partnering is something that was first introduced in the construction industry about 15 years ago, and had evolved from the car manufacturing industry (Gadde and Dubois, 2008). It can be defined as "A management approach between organisations to achieve the specific business objectives of each participants resources" (Council, 2001).

In partnering the developer is most often very involved in the construction process, but also after the final product is finished. The developer works alongside the subcontractors, and there is a mutual interest in the project, as the relationships between the contractors are short or long-term based on the contract. Partnering is similar to the different contract form models that have been described above, however, the developer is most often the contract form company. As can be seen in fig. 2.7 partnering is rather a continuous process than a one-time event.

2.3.1.3.1 Benefits and disadvantages with partnering

There are two different types of partnering styles, short term (Project based) and Long term (Strategic Partnering). It is important to select the partnering partners with consideration to the overall goals and aims that the different companies have. By having this as one of the major factors when considering partners, the price of the services and products will then only become a simple factor amongst others, and not the only factor, when choosing partners. According to Gadde and Dubois (2008) who did a research with over hundreds of construction companies in Sweden, more than 2/3 of them wanted to collaborate with their subcontractors, however, when it came to it, none of them wanted to change the way they do their purchases.

When speaking of partnering in the construction industry today, it is usually the early phases of the project that one means (Gadde and Dubois, 2008), however it is important to discover the long term advantages that strategic partnering can result in. Strategic partnering will result in that both the buyer and entrepreneur will be able to adjust and improve their common practices (Gadde and Dubois, 2008).

Partnering is one way of operating that is suitable when working with Lean (Paez et al. 2005).

This research would like to suggest that Partnering could result in easier transformation to Lean practices in a construction company, as Lean in itself is, amongst other things, about continuous improvements and respect to our co-workers. By working with the same companies for a longer time period there can be improved data gathering and thereby better mapping of where there are improvements to make in the construction chain. There will be a common goal to work towards.

Inefficient processes that increase the total costs of the project have categorized the construction industry (Gadde and Dubois, 2010), and the need for a change in these processes is essential. In an article by Gadde and Dubois from 2010 they cite Bresnen and Marshall (2000, cited in Gadde and Dubois, 2010, p.254), who had identified the following benefits with partnering:

- Increased productivity and reduced costs
- Reduced project times

- Improved quality
- Improved client satisfaction
- Greater stability for the company

It is obvious that these are the same goals that Lean works towards, and ignoring the similarities would be a waste of resources and knowledge.

There are many parts to keep satisfied when dealing with construction companies, as construction companies deals most often with many subcontractors. However, these relationships are according to Gadde and Dubois (2010) most often project based, and can switch till the next project. One reason for this could be that construction companies are often working towards independency, as being dependant on other companies can result in being dependant on a single companies technical solutions and thereby always have to go through the same company in order to get their work done (Gadde and Dubois, 2010). Also the competition between different companies that will put the pressure on the prices will no longer be valid, and the construction company will no longer have the lowest prices possible in the market. This is often one of the main factors for construction companies not wanting to change the way they perform their purchases (Gadde and Dubois, 2008).

Construction projects are often known as unique projects, but by having different suppliers to each project, the projects becomes more unique than necessary. By having the same suppliers to all projects, one can avoid focus on the single project, and can instead look over several projects at ones. This will give space to improve the work, and not focus on the offer calculations, which according to Gadde and Dubois (2008) consists alone of more than 5% of the costs of a projects final cost.

However, a quick change to partnering is not possible, as there are many relationships that need to be handled, and many companies that are involved. As it is with a change to Lean construction, the change is rather a process than a one-off event. It should be considered as a journey, with many conversations.

2.4 Summary of the literature review

Since Taichii Ohno for the first time introduced the new management system in the Toyota factories, there has been a long process until reaching the construction industry. Today most of the people working within the construction industry has heard about Lean in one way or another, however, not many are keen on using the same practices as this would require a change from their side.

Even though many researchers have claimed that the manufacturing and construction industries should be held separately, there are still many benefits to gain from interpreting the Lean manufacturing practices into Lean construction.

But as Paez et al (2005), Jörgensen and Emmitt (2008) and Salem et al. (2008) states, Lean can in fact be applied in the construction industry, however it does require different technical solutions. Lean will help to make the information that is available more explicit (Koskela and Vrijhoef, 2000) and since Lean is amongst other things, about continuous improvements, this will force the organisation to archive their documents and results.

As there is no common definition for Lean Construction, the different layers by Peluri, Aapooja and Haapasalo (2012) will help understand what Lean construction is, and they are the following:

- Principles and Culture
- Practices
- Tools and Methods

(Pekuri et al., 2012)

Lean should be considered as a philosophy rather than just a management tool, and the change to Lean must come from the inside of the organisation, and thereby the organisation will change with it (Bhasin and Burcher, 2004). There are however many obstacles to overcome before completing the change, amongst those are the culture in the organisation and the individual change that this will require.

There are many change management theories available, but the most known ones are the three-phase model by Lewin (1951), the eight-step model by French, Kast and Rosenzweig (1985) and Kotter and Cohen's Eight Step model.

In order to perform a change, one must first determine what type of a change it is that is desired, individual, team or organisational change (Cameron and Green, 2012). When it comes to changing to Lean, all three levels of change are equally important. There are many obstacles to overcome when implementing a change, and according to many researchers, this obstacle most often lays in the culture of the organisation (Keiser, 2012; Keiser, 2012; Bamford and Forrester, 2003; Weick and Quinn, 1999; Lewis, 1994).

In the process of changing a traditional construction industry to Lean Construction learning from other disciplines can be helpful. Learning from other industry's experiences, and developing the suitable modifications can apply them into the construction companies (Keiser, 2012). An important factors that needs to be considered is that construction companies most often works with several different companies during a project (3/4 According to Gadde and Dubois (2008)), and these companies must also accept the change before the change can be fully successful.

One way of ensuring that the other companies will accept the change is to work with partnering, which is about long and short term relationships that organisations have between themselves. Partnering can be extra suitable when working with Lean, as partnering supports many of the principles that are included in Lean. However, one must keep in mind that a fast transformation is not possible, as partnering, much like Lean, is a process. However there is a distinct difference, and that is that partnering can have a final process, whereas Lean is an on-going process that never ends.

3 Method

3.1 Introduction

In order to get a better understanding for the subject of Lean and change management data was gathered from three different sources; academic literatures, observations, conversations and interview in an organisation used as a case study, and a questionnaire that was sent out to different project managers in three different large construction companies in Sweden.

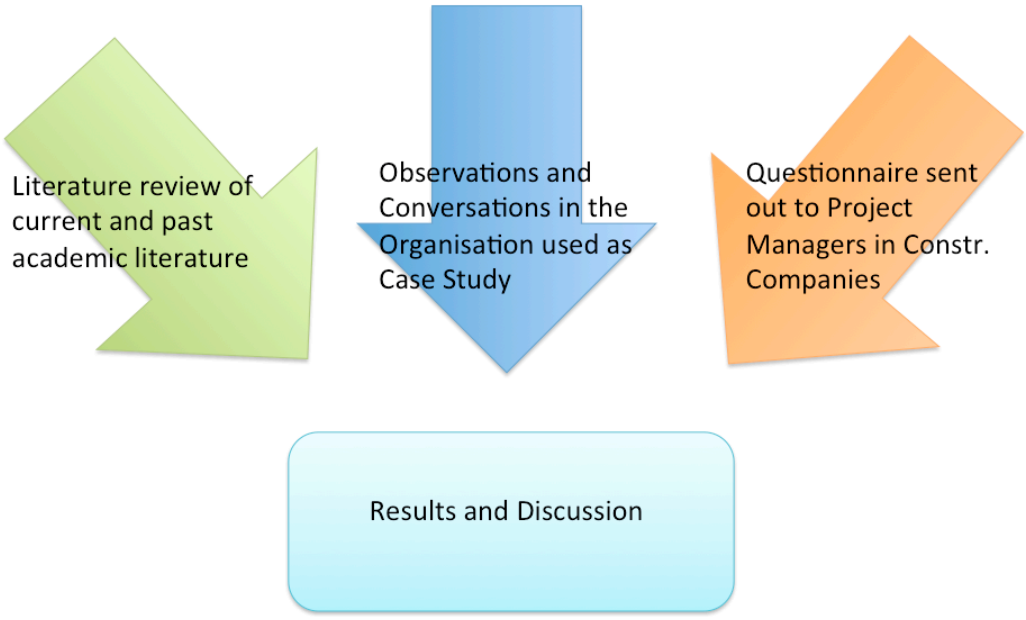

Fig. 3.1 The information gathering process.

3.2 Research approach

When choosing the appropriate method to perform the works there are several things that need to be considered. As Wing et al. (1998) concluded, the most important factor to consider is that the chosen method must be appropriate to the research. For example, if the research is about how the methods are in construction work in Sweden, there is no point in interviewing construction companies in China.

The methodological approach that was chosen to this thesis work is triangulation, which, according to Denzin (1978) is; "The combination of methodologies in the

study of the same phenomenon", in other words a combination of several approaches. The approaches that have been chosen to work with in this work is of quantitative and qualitative nature. Triangulation method allows for more than one aspect to be investigated, and the work will be based on more reliable sources (Todd, 1979). The method has however been criticised for not always having the response rate that is desired (Curtin, Presser, Singer, 2000). And, as Remenyi et al (1998, p. 75) states, one must be cautious when citing works and other people's words, as they may not always speak the truth, or be misleading. A researcher must always be critical to the works of others before including them in their own work. The different approaches that were used to gather information for this work were (as mentioned above) a literature review of both current and past academic literature, a case study of an organisation that managed to integrate Lean Construction into their work successfully, and a questionnaire that was sent out to project managers in three different large construction companies in Sweden. The three approaches were chosen to get a more full understanding of the subject and grasp as many parts of the subject as possible.

The literature that was used came from different databases and libraries in both Sweden and England. The literatures were in the form of articles, conference proceedings, books and interviews. This wide range of variety will allow the final work to have grasped different angles and approaches. It will also lay the background to the interview and questionnaire questions that will be answered by the interviewee and participants of the questionnaire in the next chapter.

By first examining Lean and Lean Construction, and then change management practices and methods, it is possible to compare the two, and see what one can learn from them.

3.3 The case study and questionnaire

The interview and conversations that took place in the case study were according to Creswell's (2012, p.10) suggestions, and the process is as follows:

- Identify and Select participants
- Receive their permission

- Gather information (Through questions or observations)

To get a better understanding of how the construction industry thinks regarding Lean construction, an organisation in Sweden, Gothenburg was interviewed in person, and observed.

The questionnaire had the same process as above, only the information gathering part was through questions that were sent out to the participants through email, and they were answered anonymously.

3.3.1 The interview, conversations and observations in the case study

A construction company outside Gothenburg in Sweden won the 2012 Lean Award, presented by Lean Forum (Lean Forum, 2013) for managing to implement Lean into their work in such a way that even though they are a small actor in the industry, they can still manage larger projects. Through simple methods they managed to primarily change the culture in the organisation, but also minimize their wastes and enhance the value in their work. The organisation was visited and an interview with the CEO of the organisation took place. Also conversations with employees and subcontractors took place during the visits.

Observations were in the form of visiting the construction site, and participation in the feedback session that was held after a project was finished. During the feedback session many of the subcontractors were present, and ready to answer to questions.

3.3.2 The questionnaire

The questions were in the form of "open" questions, which means that the questions have another answer than just a plain yes or no (Häger, 2007) (Fransson, 2002). The participant must then think through the question and only then can answer to it. The answers will then be more nuanced, and the impact of the interviewer will be less on the answers.

Leading questions, such as "Do you prefer the first option, over the other one" were avoided, since the participant then will subconsciously answer yes to the question,

even though they might not think so (Häger, 2007). This will in return affect the results of the interview, and not reflect the actual truth.

The questionnaire was sent out through email to the participants, and permission was given from their side before receiving the link to the questionnaire. Emails were used to save time and reach as many people as possible, which would have been more difficult if the questions would have been asked in person. Most of the participants are also very busy, and meeting in person would have taken more of their time.

The answers were of qualitative nature to later be able to compare the results of the participants and gather information that would further on be used to see if the literature regarding Lean and Change management reflects the reality. The questions were based on the findings from the literature research regarding Lean and change management. Mostly the questions were direct, and asked questions such as "What management system do you use today" and "Have you ever heard about Lean?", but some questions were also suggestive, as Garven et al. (1997) concluded that suggestive questions sometimes provides with extra information that would not have been provided by the interviewee otherwise. Examples of suggestive questions that were used are "How would you chose to implement change in your organisation? Ex, Hire consultant, Use a specific model etc". The research by Garven et al. (1997) was mainly on children but it showed that also adults are recipient to suggestive questions.

Hanson et al. (2011, p.320) writes that the results from the interview might affect the final results if the interviewer knows the interviewee. In this case the interviewer did not know any of the participants personally, so the risk of affecting the results due to a personal contact were thereby eliminated.

3.4 Data analysis process

The information that was provided during the literature research, interviews, observations and questionnaires were now to be analysed and evaluated in order to proceed with comparisons between them. Firstly the literature research was analysed and different models and other theory that were considered to be of importance for the research were selected.

Later the results from interviews, observations and questionnaires were analysed and the important factors were selected and highlighted through comparisons between them.

3.5 Limitations and deviations

There are different factors that need to be considered when writing a master thesis, and one of the most important factors is the limitations and deviations. How should the structure of the research be, how many interviews are needed to gather information, how much time is there, are different questions that one needs to consider. Things do not always go as planned, and time needs to be set aside for miscalculations etc.

It would have been preferable if the questions that were asked in the online questionnaire that was sent out to the different project managers and strategic planners would have been asked in person. That would have given space to extra questions, or explaining further what the participants mean in their answers. However, due to time restrictions this was not possible, and it was considered that sending the questions through email to the participants was the best option.

The participants in the questionnaire were all from the construction industry, and they were all project managers within their organisation. They were geographically spread out in Sweden; however, some of them came from the same organisation. They were from in total three different organisations, which was one of the limitations that this research had, as there was a time constriction. There was a difference in the knowledge of Lean between the participants, and the majority of them were men.

The questionnaire was sent out to twenty different project managers in total, and seven different answers were received, this response rate could have been higher, and the reliability of the work would have increased significantly.

3.6 Ethical consideration

The participants in the questionnaire were informed of the purpose of the study and permission was given from their side before answering the questions. The interview that took place in person a consent form was asked to be signed by the interviewee, to

ensure that they have understood the purpose of the study, and that they are agreeing upon being interviewed and giving information to be used in the study. The consent form also asked if they would wish to read the final work before it being public, to ensure that the information that were gathered from their interview was truthful.

4 The case study and questionnaire

4.1 The case study

In order to get a better understanding to how an organisation can practically use the Lean principles a construction company outside Gothenburg, Sweden, was interviewed and observed. The company received in 2012 the Lean Award by Lean Forum in Sweden (Lean Forum, 2013), and is often used as a role model for other traditional construction companies that are considering using Lean in their work as well.

4.1.1 General information about the organisation

The organisation was founded over 40 years ago outside Gothenburg in Sweden. It is has always been family owned, and now owns over 150 000 sqm of facilty around Gothenburg. It is environmental certified by the city of Gothenburg and has started to build Green Building certified buildings. The first one opened in February 2013.

The organisation has always worked in ways that are similar to the Lean principles, however it was not until the year of 2009 that the senior management of the organisation decided to formally introduce Lean to the rest of the company. The company worked with Partnering and most often used the same subcontractors. However, until 2009 the philosophy of "Quick and Wrong is okay as long as we get the job done" was very common, and also there were a lot of new employees and rising costs, so there was a need for change. The management of the company decided to go on a Lean course in the university, and their thesis was an implementation plan of how to continue with the work in their company using Lean principles. Since then they have gradually improved their work and won in the year of 2012 the Lean Award that is given out by Lean Forum in Sweden, which is an organisation who has the goal to be the leading inspirational information provider in the society, by maximizing value and minimizing wastes (Lean Forum, 2013).

4.1.2 The change process

The employees were aware of that the owners of the company took the course about Lean construction in the university, and with the help of a consultant that was specialized in change processes, they invited the employees of the organisation and all

the sub-contractors that they usually work with, to a kick off event. In this event they produced together a situation analysis and concluded what they thought that they were good at, what they could improve and what it is that they wish to accomplish. A lecturer was invited to speak about Lean and what Lean means, and different Lean games were played to get a bit more practical understanding of what Lean is. The games consisted of simulations of productions and the people were formed into teams that were asked to make improvements in each stage of the production.

After the kick off the CEO gave the different teams in the organisation different tasks that they needed to perform, there were different options to choose from and each team could choose for themselves what they wanted to do. By not using final solutions of what to do the employees became more interested in the change.

Also during their morning meetings they now go through everything that the employees find important. It can be anything from it being messy in the construction site, to an idea of how to improve a certain part of the production. They have a board on which the employees can write up a problem, or something that is missing on the site, and then they try to find a solution to this matter together. This way there will be small improvements in the production and organisation, which together will add up and make a difference.

4.1.3 The resistance

In the first initial phases of the change it seemed that all of the employees accepted the change, and welcomed it. However, as time passed and the need for individual change arose, the resistance began. The employees started to divide into those who wanted the change, and those who did not. This was during a period that the demand in the construction industry was higher, so the company lost some employees that preferred the old way of working. But it also resulted in new employees that had heard about the way they worked in this company, and wanted to be a part of that change, who searched their way to the company. According to the CEO of the company there had never been as many spontaneous job applications until then. When this process was reaching an end the company managed to replace the employees that were not happy with the new way of working, with others that accepted it and wanted it.

According to the CEO of the company a major reason why companies fail to implement change is due to the fact that not everybody is on board on what is going to happen, and do not understand it fully. By ensuring that everybody has understood what is going to happen, the risk of failure will be minimized. This was something that the company worked with a lot, and through the help of the consultant, communication between the employees and senior management was increased and conversations that would otherwise be avoided were encouraged in order to move forward.

4.1.4 The partnering

The company works with partnering, and has done so even before the years of Lean practices. Observations during a feedback meeting of a closed project with the company and their subcontractors showed that this was the only company the subcontractors worked with that used Lean in their practices. It also showed that this fact did not prevent them from working with traditional procurement processes with other companies, and the subcontractors were satisfied with this situation.

According to the consultant that was met during the feedback meeting, the fact that the company works with partnering, could be one of the reasons why it was easier to transform to Lean, and could avoid problems that other companies that do not have the same practices might experience.

The CEO of the company pointed out that partnering is based on a mutual trust; a trust that he was not certain of that most of the companies that uses traditional procurement has for their subcontractors.

4.1.5 Continuous improvements

As Lean is more a philosophy rather than just a simple management tool, the most suitable way of working with it is through continuous improvements, which is something that the company works actively with. As the CEO said during the interview; *"We are only in the beginning of our journey and still have a long way to go"*. This indicates that the management of the company has understood the purpose of Lean, and uses it to gradually move the company forward through simple methods. One example is standardization. The company has developed their own standardized way of handling the electric cables when building a new building that both saves time

and energy. Another example is the continuous meetings that the organisation has where every employee of the organisation is encouraged to highlight what needs to be improved, and then everybody becomes involved in the process of improving it. This is something that becomes more obvious in the feedback meetings that the organisation has together with the subcontractors after each project is finished.

Everybody that was involved in the project will be invited to a meeting where they will discuss what they did well, what they could have done better, and what knowledge they can bring with themselves to the next project.

The environment that they are working within is encouraging and the simplest suggestions are welcome. Through the observations of the organisation it was obvious that everybody were committed and engaged in the process, most of all the management, which is most often the key to successful change processes.

4.2 The questionnaire

The participants who answered the questions in the questionnaire were carefully selected with consideration to their position in the company they worked within. Project Managers were prioritized. The participants worked in large construction companies, which some had adopted Lean into their practices in some parts of the company, and others that had never worked with Lean in that particular company. In total three different companies were used for the questionnaire and twenty project managers were contacted whereof seven individual answers were received. None of the project managers were from the case study organisation. Since the questionnaire was anonymous it is impossible to know which answer came from which project manager in which organisation.

In total there were eight questions that the participants were asked to answer and they are the following:

- What type of Management system do you use today?
- Have you been part of any organisational change initiatives in your career so far? If so, what?

- Have you heard about Lean before? If so, where?
- Could you describe Lean in your own words?
- Have you thought about implementing Lean into your practices? If so, how?
- How would you choose to implement a change in your organisation? (A specific model, hire consultant, etc)
- What do you think is the main obstacle when implementing a change?
- How would you choose to handle that obstacle?

It was obvious that all of the project managers had heard of Lean before, however, most of them interpreted Lean as a tool to minimize waste. One of the participants answered that Lean is "The right thing, at the right time, in the right place". None of the participants were working with Lean today, but some of them had done so previously, either in other organisations, or as one of the participants had; in the same organisation. The Lean initiative had not worked, and they chose to continue working with their traditional tools and methods.

Some of the project managers that had worked with Lean previously tried to implement it into their current projects as well, and/or try to get the team to think Lean through different methods and tools. Others of the participants had chosen not to work with Lean at all.

To the question of how they would choose to handle a change most of the participants answered that the main importance lies in having the support of the employees. They said that it is important to make the employees understand that the change is not just a trend, but also rather something that is there to improve their work. A participant answered that consultants can be good tools during the change process.

The main obstacle when trying to implement a change lies, according to the participants in the questionnaire, in the culture of the organisation. Also the leader and

leadership style will greatly influence the entire change process. If you have these factors against you, you need time to change them. If there is a lack of time, and the need for change is urgent, one must consider changing the management and working with workshops with the employees to get their involvement. By showing the improvements the employees will be motivated and will work harder.

5 Results and Discussion

This chapter will present the research questions and results, to further discuss them in order to get a better understanding for the outcomes.

5.1 How can construction companies benefit from Lean in theory?

According to the theory there are mostly benefits to gain from converting to Lean (Jörgensen and Emmitt, 2008; Ohno, 1988), but there are also some criticism that says that Lean was originally meant for the manufacturing industry and therefore cannot be applied to the construction industry (Howell and Ballard, 1998), however as Keiser (2012) concludes, one can learn form other disciplines, develop the appropriate modifications and then apply them in the construction industry.

The main benefit for construction companies is that there is a greater chance to improve their processes and the way they work. This is a result of the transparency that Lean requires. Every step in the chain is well thought through and only the steps that add value are included. The production times will decrease and thereby the prices will be minimized. According to the organisation in the case study the work place becomes more convenient and pleasant to work within, which will result in happier co-workers.

As construction companies are known for their traditional way of working, the change to Lean can seem drastic and unnecessary, however the benefits are too many to be ignored.

5.2 Comparison between the theory and questionnaire/case study

What was obvious was that many of the project managers that participated in the questionnaire had earlier experienced change in their organisations, however, not all of them were convinced of a particular method to use when doing so. In the case study the organisation had chosen to start the change with a kick off meeting to introduce what the change would mean and require from the employees and subcontractors. This is similar to the first step in Lewin's three-step model (1951) unfreezing, where the organisation prepares itself for the change. The employees and most common

subcontractors got to experience what the change would mean through games and etc., and a notion of what to expect was thereby created. This is something of great importance as the employees are only now becoming aware of the reality of the change. Until that point there had only been conversations about the change, but it is now that the implementation phase is initiated. The employees should during this phase be encouraged to take part of the change process and of the learning processes, as changes most often require new knowledge to be taken in. By supporting the employees from the initial phase, the employees will feel more secure and the resistance might decrease.

The second phase in Lewin's Three-step model was the Movement phase. If looked carefully at this phase it is obvious that it contains more sub steps, and this is where the other models are more evolved and can contribute with more understanding to what to do. As has been mentioned earlier, the organisation in the case study used many of the steps that are included in different models, and they did this with no consideration to the particular order that the model suggested, but rather according to what they considered to be of benefit for the organisation. This is something that should be applied in every project, change, or whatever the act is in an organisation, as each act is usually unique in some way, and the models should be interpreted and only after that applied. The models should only be considered as guidelines and not absolute truths as they may not always be suited for the specific act.

Another similarity between the literature review and the case study was that Partnering could be beneficial when working with Lean. It encourages the construction company to keep better records of every act, and documentations is of high importance to both ease the procurement, but also to later use when Lean is to be implemented. As the literature showed, there are many construction companies today that need to improve their handling of documentations, and Partnering may force the organisation to do so. The change process to Lean will later be smoother, and the parts of the construction process that needs improvement will be easier recognisable, and thereby easier to consider what action to take.

5.3 Main obstacles when converting a construction company to Lean

Through the literature, case study and questionnaire it became obvious that the main obstacles when there is a change in an organisation lays in the culture of the organisation. There are three different types of change that the organisation will go through, and they are the individual, team and organisational change (Cameron and Green, 2012). The employees most often find it difficult to move from the known to the unknown and then start from the beginning with something again. There is a resistance to change attitude, and this resistance will make it more difficult to apply the change.

The group and team culture can influence the change process both negatively and positively, and this was something that was clear in the case study, where there were some employees that chose to leave the organisation after them not being satisfied with the change. The leadership during a change is therefore very important, as it is otherwise easy to fall back on the old ways of working if met with resistance. The leader must believe in the change, and be motivated, in order to motivate the employees.

Another aspect that is of great importance when trying to apply a change in a construction company is that a construction company is most often very dependent on other organisations and companies, and has many sub-suppliers who have a need of mutual satisfaction. If the organisation decides to apply a change, the sub-contractors must be aware of this change, and give their approval if it in the end also affects them. Partnering is one way of making this change smoother, as partnering is about a commitment over a time period that will allow the different parties to evolve together and get the most of the partnership.

When looked back at the principles that are required to be fulfilled according to Womack and Jones (2003), the fifth and last step of the five principles is to pursue perfection. In a practical sense this can be accomplish through feedback meetings in the end of projects. What have been good, what could have been better, and what to carry on to the next project are different questions that can be discussed. However, the environment that we live in today is a fast and result demanding environment where there is not much time left for a feedback session after the project is over. “Time is

money" is a well-used phrase that many organisations follow. But what one should not forget is that the time that is saved on not having the feedback session will be wasted in the next project on mistakes that could have been avoided by learning from the past. Therefore it is important to not only think about the short time wins, but also the results that will come in the future.

5.4 How can a traditional construction company change to Lean management?

Keiser (2012) suggests that the easiest way to change to Lean construction is by:

- Learning from other disciplines
- Develop the appropriate modification
- Apply them to Lean construction

(Keiser, 2012)

One of the main modifications has been mentioned above is partnering, and this is a modification that in the end will result in less costs, increased productivity, improved client satisfaction etc. If looked at the car industry during the 1980:s most car manufacturers had thousands of suppliers (GM had 3000, Volvo had 800), whereas Toyota had totally 164 suppliers (Gadde and Dubois, 2008). So there are still more to learn from the car industry. This small number of suppliers was possible through the help of partnering, and should be considered even more in the construction industry as well.

A good start is to begin with an action plan and think through the entire organisation. The action plan will also enable the organisation to think through their entire processes and see where they can make the initial improvements. Expert help through a consultant would decrease the risks with the change.

5.5 The most preferable contract form when working with Lean construction

In the literature review several different approaches to contract form where presented and described. With the information that was gathered from the organisation in the

case study it became obvious that the most preferable way of working would be Partnering. All of the parties that are involved have a mutual interest in having an as successful project as possible, and this is reflected in the way they work. The many characteristics of partnering are similar to the ones of Lean Construction and the both are processes that are continuous and ease the working procedures. Also partnering allows the organisation to gather information and have them on paper, which is something that many construction companies have problems with today. This will in its turn make it easier to adopt the Lean principles in the organisation. As it is with Lean Construction, Partnering should be considered as a process, one that takes time and experience. The time and skills that are invested in it will later save time and costs for the organisation.

6 Conclusions

There are today many benefits to gain in the construction industry from Lean Construction and the main benefit is that Lean enables organisations and companies to improve their processes and the way they work. When a construction organisation changes to Lean it is obvious that there is no final model that is the most preferable one. Through a comparison of the models that were presented in the literature review, the questionnaire, and the organisation used as case study, it became clear that the organisations had not followed any particular model during change, but had rather done what was required in each phase. This shows that there is no model that is perfect, and that the change agent should consider what is important to do in each phase. As not all change is received in the same way, not all organisations will experience each and every step of the change models that are available.

The main obstacle in a change process lays in the culture of the organisation, and this has its background in that the employees are moving from what they know to something new, and this might seem frightening for them. The most suitable way of dealing with this resistance is through conversations and immediate actions. By encouraging the employees to take part of the change process they will be motivated and interested in the change. An important factor of Lean is to empower the employees, and this empowering will decrease the resistance towards the change.

Another aspect that needs attention is that a construction company is most often dependent on other subcontractors and cannot just change the way they work without informing them. Therefore is partnering a suitable way of working when trying to convert to Lean. The organisations that are involved will get the most of the partnership, and always strive to become even better together, which is one of the most important factors of Lean.

7 Further Studies

If there had been more time, it would have been preferable to study the links between partnering and Lean Construction further. A possible alternative for research would be to investigate exactly how partnering affects Lean Construction. The organisation used in the case study in this thesis had used partnering for years, and according to them it made the conversion to Lean Construction more smooth, however, it would be interesting to see if other organisations have had the same experience, or in fact the total opposite.

Another interesting alternative would be to see if it is possible to develop the most suitable change process when changing a traditional construction company to Lean Construction. As had been concluded in this thesis the models that were presented were not optimal, and should only be considered as guidelines and not absolute truths. It would be of high interest to see if there is a model that would be able to use in all change processes when converting to Lean.

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