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Agile project management in the construction industry - An inquiry of the opportunities in construction projects

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Master of Science thesis

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Abstract

Project management is today a current and highly discussed area. How projects within the construction industry are managed has not changed significantly during the last decades. The construction market, the number of different actors and the way that projects are procured today has however changed. This has led to a gap between the managerial view on how construction projects should be conducted today and how they actually are executed. This is reason enough to question this conservative industry and look into what possibilities there might be in the future.

The Agile project management approach evolved from the software industry where it has grown and developed through empirical progress. It is suited for large complex projects where it is difficult to specify the product in advance. It is today used in different industries but mostly in the software business where the customer detects their needs through means of repeated tests and improvements to a prototype.

This thesis has researched what opportunities there might be in implementing the Agile project management approach in the design phase of construction projects.

The major advantages found with implementing the Agile approach is an increase in the client's involvement. The Agile approach almost forces the client to increase their participation in the project compared to the situation today. It can also decrease uncertainty and improve risk management. By the use of time management and specific meetings it will also be beneficial for keeping track of the project's progression and status.

Sammanfattning

Projektledning är idag ett högaktuellt ämne som diskuteras intensivt. Sättet projekt inom byggbranschen styrs och leds har inte förändrats nämnvärt under de senaste decennierna. Byggmarknaden, antalet aktörer och hur projekten upphandlas idag har dock förändrats. Detta har lett till en spricka mellan ledarskapssynen på hur byggprojekt skall utföras idag och hur de faktiskt genomförs. Detta är skäl nog att ifrågasätta denna konservativa bransch och titta närmre på vilka möjligheter till förbättringar som kan finnas i framtiden.

Den Agila projektledningsmetoden har utvecklats inom mjukvarubranschen där den har vuxit och förbättrats genom empiriska framsteg. Den är lämpad för stora komplexa projekt där det är svårt att ange och definiera produkten i förväg. Den används idag i olika branscher, men främst i mjukvaruindustrin där kunden upptäcker sina behov med hjälp av upprepade tester och förbättringar av en prototyp.

Denna avhandling har undersökt vilka möjligheter till förbättringar som kan finnas i att använda Agila projektledningsmetoder under projekteringsfasen i byggprojekt.

De största fördelarna som finns med att använda den Agila metoden är en ökning av kundens engagemang och involvering i projekten. Den Agila metoden nästan tvingar kunden att öka sitt deltagande i projektet jämfört med hur situationen ser ut idag. Metoden kan också leda till minskad osäkerhet och förbättrad riskhantering. Genom användning av ”time management” och särskilda möten kommer de Agila metoderna också att vara till nytta för att hålla reda på projektets framåtskridande och status.

Preface

This master thesis is conducted within the program area of Architectural Design and Construction Project Management and has been made in collaboration with the Swedish consultancy firm Grontmij AB. It is the result of my last semester at KTH (Royal Institute of Technology) in Stockholm, Sweden. The idea for the topic and research question of this master thesis is based on my interest in management and organisational structures. During this semester, through my research and in the writing of this thesis, I have gained a broader perspective of the construction industry but most beneficial for me has been the insight in a new interesting management method.

After I had completed the research for this master thesis I got the opportunity to interview the project manager (or scrum master) for a construction project in Sweden that uses Agile project management. To my knowledge this is the only project in Sweden who has already implemented this approach in their project. It gave me more contextual awareness on the entire subject and aided me in completing this thesis.

First and foremost, I would like to thank all the interviewees for your participation. Your answers have been an essential part of this thesis and it would not have been finished without you.

Secondly, I would like to thank the employees at Grontmij AB for a semester I will never forget. More specifically I would like to thank Ulf Myrin, who has been my supervisor at Grontmij AB, for the support, interesting discussions, directions and for helping me with practical stuff. Furthermore I would like to thank Matilda Marklund, Andreas Andersson, Emma Agneborg, Sara Björlin-Lidén and Leif Bertilsson at Grontmij AB for the great experience this semester has brought me.

Last, but not least, I would like to extend a big thank you to my supervisor at KTH, Tina Karrbom Gustavsson for wise thoughts, ideas and support. This thesis would have ended up differently without you.

Stockholm, June 2012
Mattias Yllén Johansson

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1 Introduction

This chapter will introduce the reader to the background and the problems associated with the topic of this thesis. It will also briefly present the Agile project management approach and explain the purpose, delimitations and clarifications used in this thesis. All this to give the reader a general understanding of the topic and ease the following reading.

1.1 Background

"*Project management is today a current area undergoing intensive development.*"

(Tonnquist, 2006, Preface), (Author's translation)

Finding the optimal way of managing, control and coordinate projects is a constant challenge (Tonnquist, 2006). Adjusting working methods, clarifying roles, simplifying project reporting or visualising the project-status through new user-friendly management tools are examples of how this challenge can be met. Project management today often concerns the entire organisation whether it is a small private company or a larger public business.

"*If you think about it, the whole idea of a tradition causes us to turn off our brains. […] Just blindly follow the past so you don't have to do the hard work of critical thinking in the present.*"

(Linkner, 2011)

The traditional way of managing construction projects has been around for half a century and is still the basis on which construction business relies. The way that projects are actually conducted has, however, changed. The gap between an old view on managing construction projects and a new way of actually conducting them creates an uncertainty and anxiousness within the business and its employees. People in the construction business today are at times aware that they are working in a way that is not always according to the managerial view causes confusion. To examine and define the way projects are actually managed and conducted today may ease the uncertainty and confusion. Another option might be to investigate the possibilities of using an already defined and tested management approach, which is the topic of this thesis. Whichever solution one chooses to pursue there is a need to question the traditions of the construction industry and look at the possibilities of the future.

It the beginning of a project, when the amount of money spent in the project is at its low point, the possibilities of influencing the design and the direction of the project is at its highest (Gould & Joyce, 2009). This is illustrated in Figure 1, which also shows that the ability to influence the project decreases with time while the amount of money spent increases. Once the project has initiated the construction phase, changes made can become very costly both in time and in actual money spent.

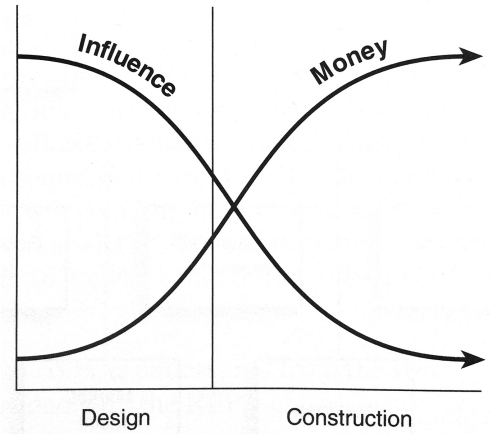

Figure 1 While the money spent in a project increases the ability to influence it decreases. (Gould & Joyce, 2009)

Furthermore, there are projects in which the time during the initial phases is a restricting factor when producing the required documents and investigating the necessary components. Therefore the material produced during these phases can include mistakes and errors. These will only be amplified the further one get into a project before they finally surface, at which point it may be too late or costly to correct it.

1.1.1 Agile project management

"*The agile methods are a reaction to the processes that look good in theory but that do not hold up in practice. The agile methods are therefore described as empirical – they are based entirely on practical experiences and work methods that are proven to work.*"

(Softhouse, 2012, pp.9)

Agile project management has its roots in the system development industry, and has developed and grown through empirical progress. This, however, does not mean that this methodology's uses are limited to that industry. The Agile methodology is a set of values, attitudes and principles, which can be embraced in other industries as well. Furthermore, the methodology includes different methods and tools to use when conducting a project, which will aid in the mission to follow its values and principles. Two main concepts within the Agile methodology are adaption to change and collaboration between people (Agile Sweden, 2012).
Agile project management uses an interactive process that helps customers define their needs and requirements. The Agile approach is suitable for complex projects where it is difficult to specify the product in advance. It is widely used in the software industry where the customer detects their needs through means of repeated tests and improvements to a prototype.

1.2 Problem

Large sums of money and a lot of time are put into a construction project. These among other aspects, such as the fact that many construction projects actually shape our society, are reasons why different stakeholders in a project are interested in its success. Construction projects throughout history have been overall mostly successful, and this in combination with it being a conservative business generates few incentives of changing the way a construction project is conducted today. It is, however, necessary to accept the fact that the market is constantly changing and the construction business need to take countermeasures in order to keep up.

Creating a more flexible and adaptive way of proceeding with the planning and design phase may generate more communication between the different actors in a project. This would hopefully result in a more precise prototype and design, which all actors have agreed upon. A prototype with fewer errors before the production starts will lower the risks for expensive changes during the production phase. It is cheaper and easier to make changes in the earliest stages of a project and it is therefore important that the planning and design phase is efficient and streamlined so that it produces a flawless prototype that can go into production.

There are most certainly different ways of improving and streamlining the design phase of construction projects and there is also most certainly a need for it. This master thesis will investigate what the Agile project management approach can contribute in the mission of developing a more efficient design phase.

The construction business can be conceived as a conservative business and has not changed significantly in the past decade. Because of this there are difficulties in trying to change the way a construction project is conducted today. The Agile project management approach is foreign to the construction industry, making it particularly interesting for close examination in relation to the industry. However, it might also be more difficult to get it accepted in this conservative business. What might ease the implementation, compared to other approaches perceived as unknown, is the fact that the Agile approach has similarities with the Lean philosophy, which is a concept already introduced in the construction business.

1.3 Research question

The research question and the topic of this master thesis is as follows:
What opportunities and benefits will come from implementing Agile project management in the design phase of construction projects?

For it to be possible to answer the stated question above, the following question first needs to be investigated:
What possibilities are there to implement Agile project management in the design phase of construction projects?

1.4 Purpose

The purpose of this thesis can be divided into three parts. It is partly to *introduce* the Agile management approach to the construction industry in general. Partly to *compare* it with the construction industry to see what advantages there may be and partly to specifically explore what Grontmij AB might gain through the use of agile project management during the design phase.

1.5 Delimitations

The area of this thesis has been limited to the design phase of construction projects. Opportunities, downsides or other possible affects that might exist in other types of projects or other phases of construction projects have not been taken into account. It has also been limited to benchmarking the Agile project management approach with the traditional approach found in the construction industry. No other approach has been investigated further.

The research question implies that the implementation of Agile project management is also investigated. The subject of implementation is briefly discussed in the theory chapter and also in the analysis and conclusions. To change an organisation and implement a new management method is, however, a large topic that needs to be more thoroughly investigated and elaborated on and has therefore only briefly been discussed in this master thesis.

This master thesis has been conducted during a period of 20 weeks, corresponding to 30 ECTS.

1.6 Disposition

Firstly the research method chosen will be explained and commented on. Thereafter follows the theory chapter. This chapter will first explain the theory behind some relevant aspects of the construction industry and will then continue with shortly mentioning the Lean concept because

of its connection with both the construction industry and Agile project management. Following this is the main part of the theory chapter that will elaborate on and explain much of the theory behind the Agile project management approach. The last part included in the theory chapter is concerning organisational change. This is included to assist when answering the research question. The entire theory chapter acts as the base for the analysis when its compared to the empirical findings from the research conducted within this master thesis.

Thereafter the empirical result collected during the research is presented and has been divided into the most frequently occurring topics. This chapter is then compared to the theory, analysed and commented on. The thesis then ends with presenting the answer to the research question, other conclusions based on the analysis and recommendations for Grontmij AB.

2 Method

This chapter will present and explain the research method chosen to answer the question of this thesis. It also includes reflections on the chosen method and research ethics.

2.1 Chosen research method

The research method for this thesis is qualitative. Semi-structured interviews have been conducted to find out how the process of planning and designing is executed today. These interviews have been conducted with project managers and/or responsible architects at four projects at Grontmij AB that were active within the time span of the design phase. Two of the projects were in the late stages of the design phase while the other two were in the middle of it. In three of these projects, representatives of the client have also been interviewed, in order to get their opinions on how the design phase is managed and executed. The reason for the fourth project not being examined from the client's side was that there were negotiations going on, and was not an appropriate time to investigate the project participants' experiences.

Before and during the interviews a study of literature has been done. Before the interviews the main focus of this study was to gain theoretical knowledge of how the design phase is managed and executed, and to learn what the Agile management approach means. The interviews aroused new subjects that needed to be included in this thesis, which is the reason for the literature study being prolonged.

Constant guidance from both a supervisor at the Royal Institute of Technology and a supervisor at Grontmij AB has taken place during the entire time span of this thesis. Seminars concerning research methodology and the process of a master thesis have been attended on a number of occasions.

2.2 Reflections on the chosen method

The qualitative research approach was chosen because it is useful when one needs to gain understanding of the issue at hand (Ghauri & Grønhaug, 2010). It tends to be less structured and more exploratory than the quantitative approach. It is considered suitable when studying organisations, groups and individuals.

The research process chosen has allowed for exploration of new areas that are relevant within the topic of this thesis. A thesis, however, needs delimitations and due to this some areas has not been included or elaborated on. Some of these subjects are mentioned in chapter 7 *Future research areas*.

2.3 Data

In the making of this thesis both primary and secondary data has been used. The primary data being results from the case study and the interviews conducted and the secondary data consisting of literature reviews and knowledge gained from scientific reports.

2.4 Interviews

As mentioned above the interviews have been of the semi-structured type, which is common in the qualitative research approach (Ghauri & Grønhaug, 2010). This mean that the questions were predetermined but the interviewee could formulate and answer with his or her own words. It also allowed for raising elaborative questions, which were not predetermined, during the interview. The reason for choosing this type of interview was to create a more discussion-oriented interview and this is not possible when utilising a structured interview approach. In comparison to an unstructured interview in the semi-structured interview the interviewer is allowed to ask more direct questions.

Furthermore, the interviewees were informed of the topic and purpose of this thesis before the interview. They were not, however, told what the Agile project management approach is and means. This is because their answers should only reflect on how they are presently managing and working during the design phase and should not be influenced by how they could or might do instead.

2.5 Choice of interviewees

In all four investigated projects the project manager for the specific projects at Grontmij AB have been interviewed. In one of the projects the responsible and assisting architects were also included in the interview, and in one of the other projects the assisting project manager was included. The aim was to include the project manager *and* his or her closest (responsibility and authority wise) associate in all of the interviews in order to achieve the discussion-oriented interview mentioned above. This was not possible in two of the projects because of scheduling difficulties matching the participants' calendars and these interviews were hence only conducted with the project manager.

When deciding what person should be interviewed within the client's organisation, the project managers at Grontmij AB were asked whom they thought would be of most interest. The aim was to interview the person representing the client who was responsible for the affair with Grontmij AB and whom they have had the most contact with. This person's role, position and responsibilities have therefore differed between the three projects. It was also of interest to include this person's closest (responsibility and authority wise) in the interview. In two of the three projects this was possible but in the third, only one person representing the client was interviewed. As previously mentioned, it was only possible to interview three out of the four clients.

2.6 Result from the interviews

All seven interviews have been conducted in person and have been recorded. Notes have also been made during each interview and the recordings have acted as a support in the analysis of the material gathered from the interviews. The results from the interviews have been used to investigate how the interviewees experience the overall design phase. The obstacles, difficulties or flaws that exists in the design phase of a construction project conducted today were examined. Also the possibilities there might be in improving the execution of the design phase were investigated. In the analysis, the results have been studied in relation to the theory about the

construction industry, Agile project management and the other relevant subjects raised within the theoretical framework.

2.7 Case study

As this thesis has been conducted in collaboration with the technical consultancy firm Grontmij AB, a case study has been done. It has been done through *participant observation*, which means that the researcher to some extent takes part in the situation he or she is observing but acts restricted in order to influence it as little as possible. When collecting first-hand information in its natural environment participant observation is an effective way (Ghauri & Grønhaug, 2010). It is also a useful complement to interviews because it gives insight in what people actually do and think and not only what they claim to. The collaboration with Grontmij AB, and the possibility to work at their headquarters with access to their intranet, different documentation and office chit-chat, has contributed to the contextual awareness of the result of the study and the interviews.

2.7.1 Grontmij AB

Grontmij AB is an international technical consultancy firm that has operations in a range of disciplines, such as Planning & Design, Transportation & Mobility, Water & Energy, Monitoring & Testing (Grontmij AB, 2012). The company is one of Europe's largest technical consultancy firms, has around 9 000 employees in approximately 350 offices worldwide. In Sweden, Grontmij AB acts nationwide and are located at 20 different locations. In total they have approximately 800 active consultants in Sweden.

2.8 Literature review

One of the purposes of the literature review was to gain knowledge on what benefits and possibilities that come with Agile management but also what constraints and weaknesses that Agile management can bring to the table in comparison to the traditional way of conducting projects. Another aim has also been to gain a more theoretical knowledge on how a construction project is conducted and managed and what related aspects are important to include and refer to within the topic of this thesis. Furthermore, the literature review has been an essential part in the analysis when comparing it to the empirical data in order to later on answer the question for this thesis.

There is little written academic literature on Agile project management which has been a restricting factor. Therefore one academic main source has been chosen to describe the approach. This source explains the approach in a broad and general way that makes it understandable to different industries. It has, however, been complemented by other sources found on the subject.

2.9 Validity, reliability and generalizability

In order to gain more validity, reliability and generalizability in the empirical data the choice of interviewing not only representatives from Grontmij AB but also their client was made. The combination of the notes taken during the interviews and the recordings has also minimised the loss of the empirical data gathered. The fact that both the interviewees and the projects are anonymous has hopefully contributed to more honest and accurate answers and thus more

trustworthy empirical data. However, since the interviews have been conducted with employees at Grontmij AB and their clients the answers might still have been affected in a restricting way even though the interviewees were told that it would be anonymous. Furthermore the projects will not be presented nor explained in this thesis in order to enable introduction of the common findings for the four different projects together and present a more general picture of the situation instead of a project-specific one.

This study has investigated the possibilities of implementing Agile project management in the general construction business, and then more specifically at Grontmij AB, which is one of many technical consultancy firms, it can be applied to a broad perspective.

During the writing process of this master thesis two independent master students have reviewed it twice to in order to check for implications, trustworthiness, amongst other aspects. Both a supervisor at the Royal Institute of Technology and also at Grontmij AB has likewise reviewed it.

2.10 Research ethics

The interviews have been anonymous in order to allow the interviewees to speak freely and not feel restricted for fear of upsetting the employers, co-workers or client. The interviewees were told before the interview that it was going to be anonymous. This was also done because the focus of the empirical data should not be on who said what and why, rather on the findings itself and how that can be of use in the research process and answering the topic of this thesis. Furthermore, the projects investigated will not be explained, as the focus should not be on which project the findings originate from. This allows the focus to instead be on the combined experiences from the four projects studied and not on a specific project's situation.

2.11 Clarifications

Some of the quotes in this thesis have been translated into English by the author from non-English references. These quotes have been marked with "Author's translation".

3 Theoretical framework

The purpose of this chapter is to lay the foundation of the thesis. This will be the base when answering the question at hand. It starts of with explaining one of many traditional management approaches and then continues with elaborating on relevant construction industry aspects. The Lean philosophy is then briefly explained because this is a concept know to the construction industry and it has many similarities with the Agile project management approach. To fulfil the purpose of introducing the Agile approach to the construction industry this approach is then explained and elaborated on more thoroughly. The chapter ends with briefly explaining theory on organisational change that can be related to implementing a new management method.

3.1 Traditional/Waterfall Management

There are many different management methods used today and many of them are quite old. This is a brief introduction to one of these traditional management methods also known as Waterfall management. This introduction is given to ease the understanding of the more traditional way in which the construction industry is managed.

In traditional project management there are distinct phases throughout the project life cycle (Hass, 2007). In this approach, an important part is the disciplined planning and control methods. The activities are performed in planned and orderly series. In order to perform such extensive planning the projects following this approach have the assumption that the project's future is predictable. Once a phase is completed it should not be revisited. There are of course both advantages and disadvantages with this approach as there are with any other approach. One advantage is that it is very structured and easy to follow. It also emphasizes the importance of the client's requirements. On the other hand it is very seldom that a project can fully follow the series as planned, since the conditions usually change over time and also it is difficult for the client to specify in detail all requirements at the start. This traditional approach is also referred to as the Waterfall approach and an example of it is illustrated in Figure 2.

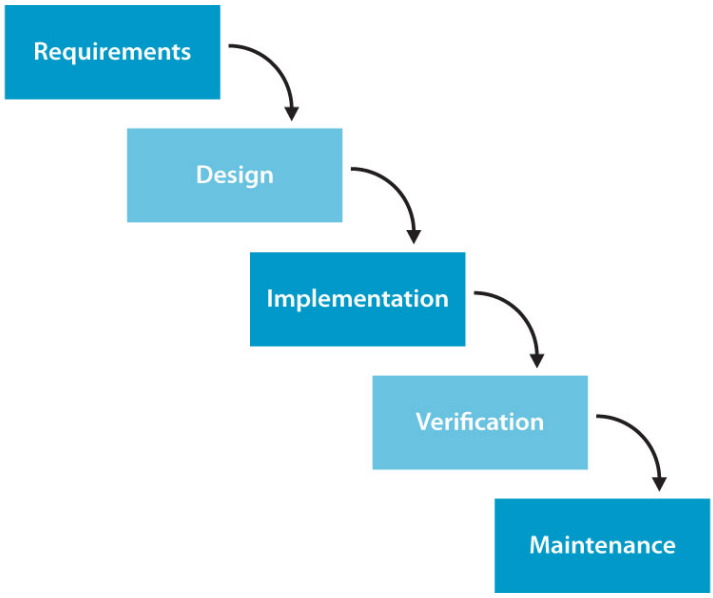

Figure 2 An illustration of an example of the Waterfall management approach. (http://www.waterfall-model.com)

3.2 Phases of construction project

A construction project consists of several different phases. In the book Construction Project Management the authors explain that a construction project starts off with a feasibility analysis (Gould & Joyce, 2009). This phase is an investigation on an economic basis. The aspects that are most important to analyse is the cost, the time schedule, the budget and the market demand. If the feasibility analysis then show that the project will generate return, a decision to proceed with the project is made. The search for financial means begins and a procurement process for the design of the project is initiated. The design of the project can be procured with different contract forms, for instance the entire responsibility can be handed to one company or the different disciplines can be procured from different companies. The design phase will be described in more detail in section 3.2.1. After the design phase there is sometimes another procurement process depending on what type of delivery method was chosen during the first procurement process. The different delivery methods will be described in section 3.3. The next step is the construction phase and this, as the name indicates, is when the decided design is actually realized and constructed in its physical form. When the construction is finished the project is handed over to the project owner including all necessary documents and instructions.

3.2.1 Design phase

Gould and Joyce (2009) explain that the design phase can be divided into four different stages. The first is *programming,* the second *schematic,* the third *design development* and the last *construction documents*.

In the first stage a program is created. This is a document where the requirement of the building is stated. It describes for instance the functions of the building, what particular spaces are needed and so on. The authors clearly state the importance of involving the user in the writing of the program because they have unique and specific requirements for that particular project. Furthermore, the owner's understanding may vary when it comes to the building process, depending on their original business. Those owners who seldom occupy themselves with building projects often need guidance and assistance from the professionals hired to produce the program and the design. The owners that are familiar with the building process do not need as much assistance since they are already familiar with it. This does not, however, mean that this process is less important in those cases. In the cases with inexperienced owners, the professional may need to take more initiative in involving the owner.

The complexity of the project is also an important factor to consider (Gould & Joyce, 2009). The more complex a project is the more time and resources need to be dedicated to the project in order to make sure that the program becomes as accurate and descriptive as possible. At the end of the programming stage there should be a detailed program and usually an estimate and a time schedule. With this information the owner then decides whether to proceed with the project or cancel it.

The next stage is the schematic design (Gould & Joyce, 2009). At this point the actual design of the project begins. Usually a team of architects develop several different designs that more or less fulfil the requirements stated in the program in order to find the best solution for the project.

Then they decide on a few and present them to the owner who, in turn, has the power to choose one or more to develop further. If the owner is not satisfied with the concepts presented, this would be the time to mention that so that the architects can start on new concepts without losing time. One can often save time and effort by including the construction professionals in this stage, since they can give advice on construction feasibility of the concept design. When this stage is completed the owner once again decides to either proceed with or cancel the project.

If the owner decides to continue with the project the next stage is then the design development. At this point the owner has also decided on a single design and the purpose of this stage is to develop this design further and in much more detail. Different technical specialists are involved and according to Gould and Joyce (2009) it is usually the architect who coordinates their involvement in order to make sure their work is compatible with the design. The users should also be included at this point, in order to get the end product as user-friendly as possible. Now that the design is decided on, the users should be asked to specify the different needs, such as the amount of electrical outputs, special services for specific equipment and so on. Cost estimates are revised and at this point one can get more accurate numbers since the information pertaining to the numbers is more detailed than before. If the stages before this have been executed properly and thoroughly, the new cost estimates should not differ so much that the owner must abandon the project because it will be too expensive. The owner, however, still faces the concern whether the project will generate any return or not, should they continue with the project or cancel it before it is too late. The further the project has been developed the more money and time has been dedicated to it and the likelihood of abandoning it is constantly decreasing.

The final stage in the design phase, according to Gould and Joyce (2009), is the production of construction documents. These documents are what the bid for the construction is based upon. These are the documents that the contractor will follow and build according to. So if they are disagreeing with the program criteria or the design agreed upon in the schematic phase it could lead to problems during the construction phase and may cost the owner a lot of money and time.

3.3 Delivery methods

Delivery methods describe how the entire project process will be managed and in what steps the project will be delivered (Gould & Joyce, 2009). They explain the relationships between the owner, architects, contractors and so on during each phase of the project. It is the responsibility of the owner to choose the most appropriate delivery method for the specific project. Sometimes, however, the design professional is involved in the project before this choice has been made and in that case the designer usually assists the owner in making this choice. The biggest dilemma in choosing between the different methods is price versus performance. Projects require different methods depending on the complexity. Using the correct or most appropriate method can decrease time and cost.

The delivery methods do not say anything about the price tag of the project; this is discussed and explained in the contracts between the different actors. The delivery methods and the contract types complement each other and together they generate the specific prerequisites for the project.

The most common delivery methods are *design/bid/build, design/build* and *construction management*. The last of these will not be explained since it has no relevance to the empirical data collected.

3.3.1 Design/Bid/Build

If this delivery method is chosen it means that the owner begins with hiring a design professional to design the project, including the complete contract documents (Gould & Joyce, 2009). With these documents and information the owner then proceeds with either tendering for the construction part or negotiating with a specific contractor. The hired contractor is then responsible for delivering the project as is described in the contract documents. The contractor can in turn choose to hire subcontractors but the overall responsibility of the deliverance is still with the contractor hired by the owner. There is no contract between the architect and the contractor. The contracts are between the owner and architect, and the owner and contractor.

The most significant benefit with this method is that it reduces the level of risk and uncertainty (Gould & Joyce, 2009). It has well-defined relationships, procedures and contractual rules of conduct, which are well-known for most professionals in the business. Furthermore, this method protects the owner contractually from, for instance, risk for cost overruns. The owner already knows most of the final costs quite accurately before the construction, but if the contract documents are not accurate and complete there will be changes that will probably increase the owner's costs considerably. This method also gives the owner the benefit of an open market tendering, where the competitor with the lowest price is usually chosen. This gives the owner the lowest market price for the project and a better economic efficiency.

There are also negative sides to this method and one of these is that the contractor who will construct the building is not involved in the design phase and can therefore not check the design for constructability and so on (Gould & Joyce, 2009). This problem can be avoided through hiring pre-construction consultants. Although, it is always most effective to have the contractor who will actually construct it to review the design.

Furthermore, this traditional approach does not allow the construction phase to begin before the design is completed (Gould & Joyce, 2009). The project will be conducted in sequences, the design always needs to be completed before the tendering can begin, and thereafter the construction can begin. In recent times, the use of this approach has been declining because of time pressure. Since the parties work separately and on different stages of the project, there is little room for teambuilding and interaction between the participants. This can lead to major relationship problems. Unforeseen conditions can also add to difficulties in the relationship.

3.3.2 Design/Build

This delivery method means that the owner chooses a firm to have the overall responsibility throughout the project (Gould & Joyce, 2009). This firm is responsible for the design and then, without a tendering process in between, the construction. The contracted firm can either have the resources for these tasks in-house or hire external firms to perform the work, but the responsibility for project always remains with the contractor hired by the owner. Design/build is preferred in certain industries such as industrial construction. As an example, building oil refineries and power plants are often so complex that this delivery method is preferred.

One of the major advantages with this delivery method is the possibility for good communication between the design team and the construction team (Gould & Joyce, 2009). Another benefit is that the design/build company can create a smooth flow between the design phase and the construction phase, which can cut down on the overall scheduled project time. This is due to the possibility of starting construction of one part before the rest of the building is completely designed. The fact that the construction team is already involved in the project during the design process allows for construction input that can help the accuracy of the design in order to avoid costly changes later on in the project. If changes due to unforeseen conditions should occur anyway, it is usually easier to incorporate these since they are organised within the same contractual unit. The owner can keep its resources in the project to a minimum since it is the responsibility of the design/build team to manage the day-to-day work including problem solving, communication and so on.

Less involvement on the owner's part can also be a disadvantage (Gould & Joyce, 2009). If the owners do not involve themselves enough throughout the project there might be situations where they have to make a decision without fully understanding the issue. The owner needs to be on the same page as the project because the project might go in a direction that is not desired.

There are little possibilities for setting a fixed price for the project since no design has been made before hiring the design/build firm (Gould & Joyce, 2009). This means that in the beginning of a project there is only a conceptual budget that should be adjusted as soon as possible. Setting the price too early in a project can, on the other hand, be risky since the design team must fit the scope to the price and with that comes a risk of lower quality. A more accurate price might not always be available until some parts of the building, such as the foundation, have already been constructed. This means that even if the price is too high for the owner, they have already spent a lot of money and might not want to cancel the project.

In the design/bid/build method there is a complete set of contractual documents, created by the design team, that are the base for evaluating and checking the performance of the contractor (Gould & Joyce, 2009). In the design/build method the contractor produces these documents themselves. This may be a problem since the design and construction professionals might be put in situations where they have to criticise their co-workers. In the design/bid/build method the design and construction professionals are often from different firms and can critique each other. In comparison, the design/build delivery method might sometimes lead to less open critique and because of that a risk of losing time and money later on in the project.

3.4 Aspects of project management

3.4.1 Level of Specialisation and Authority

Gould and Joyce (2009) mention that it is important to make room for people to specialise in their specific area of expertise. They say that this is because the fewer issues a person needs to concern themselves with, the more effectively they should be able to produce results. The level of specialisation needs to be controlled because an organisation consisting of only different experts will slow down the communication and decision-making, and in turn the project pace. One needs

to keep an appropriate level of specialisation both within the organisation but also within specific projects.

Gould and Joyce (2009) continue with saying that in combination with the right level of specialisation, the level of authority is also of the essence. If a person is responsible for a task but do not have the authority to accomplish it that person will not be motivated to perform it. Therefore it is the manager's duty to match the level of responsibility with the right amount of authority with all involved in the project.

3.4.2 Flexible management

A construction project needs flexible management. Gould and Joyce (2009) says that construction projects can be very unpredictable and management needs to be able to cope with daily changes. They need to adapt to the flow of the project, the weather, the mood of the project team and so on. A construction project goes through the different phases described above and has therefore a continuously changing workflow and different cultural settings. Management needs to adapt to these changes and at the same time keep the home office updated with the progress of the project.

3.4.3 Communication

Gould and Joyce (2009) also address the importance of the quality of communication. They say that communication is not a one-way street but needs to be both delivered *and* received. This means that the person who wants to communicate information needs to pay attention to the receiver. In practice this means that, for instance, a leader needs to carefully choose the time to, for example, critique somebody.
There can also be such a thing as too much information since a person cannot receive an infinite amount of information at once. This could mean that if the information is not explicit and concentrated enough, important parts could be overlooked because the receiver was distracted by all the other information. Most people do not need the big picture, they will work better if they only get the information they need in order to perform their task.

"Timely and precise communication can correct a problem before it becomes serious."

(Gould & Joyce, 2009, pp.67)

Communication is today not used as an asset in our work, we do not use it for planning and we do not use it as a resource (Segerfeldt, 2002). It might seem like communication occurs once information is produced and delivered, it is not. There is a big difference between information and communication. Information is one out of many different work tasks while the second one is a way of working.

In the end communication always comes down to planning, how people should be informed or how communication should happen. This needs to be planned ahead in order to be efficient and to fulfil its purpose. In many cases people consider information to be enough because of old habits, routines, or a lack of time for communication. For communication to occur, four key aspects needs to be fulfilled and these are that the employees:

- Feel safe,
- That they feel involved,
- That they get responsibilities, and;
- When there is interaction and consensus between co-workers.

Segerfeldt (2002) points out that it is important to be honest when considering whether it is enough to only inform or if communication is warranted. The decision to inform instead of establishing a communication can sometimes be based on lazy preparatory work.

"*Change that comes with negative surprises is the result of bad preparations.*"

(Segerfeldt, 2002, pp.57), (Author's translation)

In preparing for changes, the communicative approach is to be honest and trust in the employees' ability and capacity. This is achieved through communication between top-level management and employees. The employees in turn take the thoughts in consideration and proceeds with the process. By doing so, the employees are involved and can confirm the *need* for a change, and what that need actually is, instead of the top-level management presenting a *result* they want at the end of the change. The latter approach is often encountered by resistance. Even though a communication plan for the change is set up and followed, it is still important that the flow of information exists. Everyone who is affected by the change should at all times receive updated information on occurrences and events.

3.4.4 Meetings

"*To mismanage the meetings is to mismanage the business.*"

(Segerfeldt, 2002, pp.104), (Author's translation)

In the quote above there is no mistaking that if meetings take place in a company, they should be held and managed properly and not just exist for the sake of existing. There are three prerequisites that need to be fulfilled in order for the meeting to serve its purpose (Segerfeldt, 2002):

- The meetings needs to be a part of the company's business idea and strategy, they can not be allowed to have its own life and purpose
- The meetings should be an approach integrated into the operations
- The meetings should show measureable results

If these three conditions are not fulfilled then the meeting should not be held, the outcome would not be worth the hours and expenses it requires.

If the conditions are fulfilled and the meeting is held there a couple of aspects one can consider in order to get the most value out of the meeting. First of all it is important to have a clear purpose and goal with the meeting (Hawkins, 1997). What should the outcome of the meeting be? Why is it held? When the purpose is clear the question whether a meeting is the best way of reaching this goal still remains and should be answered.

Furthermore Hawkins (1997) explains that it is important to only invite the right people to the meeting. He is referring to the people who own the problem; the ones who will get most affected

by the outcome of the meeting, subject matter experts, problem-solvers and idea people. He also stresses the fact that the wrong people should be excluded from the meeting. People should, for instance, not be invited to a meeting because of political reasons or their title. If those people need to be informed it might be more efficient to do this during a separate meeting.

Another issue that makes meetings inefficient is the problem with maintaining focus. Hawkins (1997) suggests that the meeting is scheduled just before lunch or at the end of the day because these are moments when people are usually hungry and this becomes a great incentive of being efficient and keeping the time frame of the meeting. He also suggests that the meeting is held standing up because this keeps the attendees focused on the agenda and the purpose of the meeting.

Other actions that Hawkins (1997) suggest in order to increase the productivity of meetings is to prepare a prioritised agenda, appoint a facilitator, keep group notes and to encourage fun.

3.5 Lean

Depending on the industry, and sometimes even what company within that industry it is used in, Lean goes under different names. Lean Production and Lean Development are two examples but Lean Construction is a name that is more familiar to the construction industry, which originates from the manufacturing industry (Gould & Joyce, 2009). With the Lean principles applied to the construction industry it has allowed for designing both the product and the process of production simultaneously. The construction scheduling has become more reliable when shifted from improved productivity to a different system of workflow that creates continuous work for work crews. In comparison to the traditional approach review and analysis of the design is now integrated at an earlier stage and a wider range of specialists are involved.

The Agile project management approach, explained further down, has in a way evolved from the Lean philosophy and there are many similarities in the two philosophies (Berteig, 2012). The major difference between Lean and Agile is that the latter includes tested working methods and specific tools to aid the user in following the philosophy.

The Lean concept originates from the production industry where Toyota developed the Toyota Production System (TPS), which is today also known as 'Lean production' (Poppendieck, 2002). The principles of Lean can, however, be applied to almost any business and if applied appropriately will result in improvements. One of the main principles in Lean thinking is to find and eliminate waste. All activities, steps, time and people that do not add value are eliminated.

"*Companies that re-think the value chain and find ways to provide what their customers value with significantly fewer resources than their competitors can develop an unassailable competitive advantage.*"

(Poppendieck, 2002, pp.2).

When trying to find out what waste is in a business, one first need to understand what value is in that specific business. The next step is to define which activities and resources are required to produce that value. It is waste if one can do without it if one works differently and it is waste if

does not directly add value. When applying the Lean approach, team-oriented organisational structures where the focus is on the flow of value instead of functional expertise is preferred above traditional structures.

The second principle of Lean thinking is to center on the people who directly add value. For example, the programmers in a software project or consultants designing in a construction project. In order for this to work properly there is often a need to, through training and apprenticeships, upgrade the skills of these programmers. Because they, as a group, are supposed to develop their own processes and manage complete problems. Their managers then in turn serve the purpose of support for the group rather than telling them what to do.

The third principle of Lean thinking is to flow value from demand (Poppendieck, 2002). This means that one do not produce anything based on forecasts, only on what has been demanded. The term 'Pull' is used to explain that flow of value should be pulled from a demand, which means that one do not commit to anything before the demand exists and it is clear what the client wants. One of the major advantages with Lean thinking, Poppendieck (2002) explains, is that there are no hidden problems that might pop up and put a lot of stress and pressure on the project. When using Lean one do not try to forecast the future and instead constantly tries to expose all problems and solve them as fast as possible.

The fourth principle is to optimise across organisations (Poppendieck, 2002). This principle means that one cannot sub-optimise a smaller part of an organisation nor can one use different performance measurements for the different departments. Instead Lean thinking says that one should structure the organisation around the flow of value and to organise departments and teams so they can maintain the responsibility for overall business value. This would mean that one skips the intermediate measurements and instead make sure that everyone knows the importance of the overall business value and not only the department's specific value. Another way of handling this problem is to consider the client as a downstream department and the intermediate performance measurement is the satisfaction of this internal department.

The principles explained above have the common aim to streamline the value chain and thus improving the results. To be able to improve something one needs to have something to improve. At Toyota they have therefore made standardisation of working methods an essential part of their organisation (Liker, 2009). The standardised process then acts as the source for improvement, innovation and development of the employees. Without this standardised way of working it would become difficult, if not impossible, to improve the working methods. Trying to improve a process that has not been defined and standardised will only generate different versions of the same working method.

Just as in the Agile approach, the aim is for smaller incremental deliveries that are usually developed during the project rather than in the beginning (Poppendieck, 2002). This can sometimes become a contractual problem since the client probably prefers to know what he of she is paying for. So both the Lean enterprises and the Agile enterprises sometimes face a challenge and that is to structure contracts so that they support the not pre-defined incremental

deliveries and at the same time guarantee that the client will be handed business value in accordance with their investment.

3.6 Agile project management

The following sections are mostly based on the book "Agil Projektledning" (author's translation: "Agile Project Management") by Tomas Gustavsson (Gustavsson, 2011). Scrum is one of the most commonly used Agile methods to date and its components such as roles and time management tools permeates the Agile approach. Therefore specific sources on Scrum (amongst others as well) has been chosen and referred to as a complement to Gustavsson.

3.6.1 History of Agile methods

In the 1990's the scientist Roland Gareis mentioned in his book "Handbook of management by projects" that the number of projects conducted was increasing but at the same time the number of participants within each project was decreasing (Gustavsson, 2011). Despite these changes, project managers were continuing to use the same traditional management methods, and were only educated in new methods that were based on trying to parallelize tasks in order to decrease the lead-time. This, however, did not have the wanted effect. The tasks most often needed to be executed in a sequence, which led to few benefits in using parallelization. The software developers responded in a different way. They considered the traditional management methods present at that time to be slow and static and they felt more hindered than supported by these methods. The software developers were searching for methods that were more supportive and at the same time would let them produce IT-systems with good quality in an effective way. This is how the Agile methods started to take shape.

During the 90's a lot of different new methods that, today, are gathered within Agile project management were developed. For instance, one of the most popular methods today is called Scrum and it was created in 1995. Before February 2001 there was no name under which all these new flexible and adapting methods could be gathered, they had up until then been called lightweight. However, in the small ski resort Snowbird in Utah, USA, 17 method developers who represented different Agile methods gathered because they felt they needed a common name and common values for all their methods. Different names were discussed and one of them was "Adaptable" but since this more or less means that actions are taken retroactively the name was rejected. The name "Agile" was considered to be a more accurate description of these methods and was hence chosen.

The common values that were discussed and agreed upon during the meeting in Snowbird became the "Agile Manifesto" and include four main values (Beck, 2001).

Individuals and interactions	over	processes and tools
Working software	over	comprehensive documentation
Customer collaboration	over	contract negotiation
Responding to change	over	following a plan

The Agile manifesto means that while there is value in the elements on the right one should value the elements on the left more in order to fully embrace the meaning of the Agile way.

3.6.2 Agile Manifesto

The Agile manifesto explains how one should prioritise the value of the different aspects mentioned above (Gustavsson, 2011). Many proponents of the Agile way are saying that today's project management methods are lacking the rules and structure to make these priorities. For instance, people differ in that they may value correct language over context in a document, or vice versa. If one is following the Agile manifesto the prioritisation is clear in this case. If the language in a document was terrible it would be more difficult to comprehend, but according to the Agile manifesto the context of the document would still be the most important thing.

3.6.2.1 Individuals and interactions over processes and tools

This idea in the Agile manifesto basically means that the project members carry a responsibility to modify and apply the best process for the specific project. The opposite would mean that the project members had a more or less standardised process and tools for every project and they could just follow that plan. If the project then fails they can just blame the plan. This does not necessarily mean that a project cannot follow a pre-set of processes and tools within the organisation. It means that the project team is obligated to modify the process and sometimes deviate from it, choose the best set of tools and then apply it to the specific project.

3.6.2.2 Working software over comprehensive documentation

As the title indicates this part of the Agile manifesto is very much linked to the software development industry - and for good reasons; it is the industry from which the Agile methods originate. This does not, however, mean that it cannot be applied to any other industry (Gustavsson, 2011). It can be re-written into "Useful project outcome over comprehensive documentation" (Author's translation) and this makes it easier to understand what it would mean in other industries.

The meaning of this part of the manifesto is to throughout the project deliver smaller useful results, instead of setting up a goal to deliver the result of the entire project at one point somewhere in the far future. The process is divided into short cycles and at the beginning of each cycle there is an opportunity to both review the past cycle but also thoroughly plan the upcoming cycle. At the end of each cycle a useful part of result is presented. How early in a project these parts actually become useful depends on the type of project. By actually closing each cycle and review what has been produced, there are throughout the project possibilities to decide whether the project has been completed or if it needs to be cancelled before completion because of various factors. It becomes a tool of monitoring the progress of the project that naturally includes opportunities for decision-making.

3.6.2.3 Customer collaboration over contract negotiation

Throughout the history of project management it has been a well-known fact that a good relationship between the client and the supplier is of the essence for a successful project. The thing is that before the Agile management approach methods one did not really know *how* to achieve a good relationship. Since the process is divided into smaller parts, in Agile, with review and presentation between each of them the client has (and should take) the opportunity to see, discuss and decide whether the present plan should continue or if something should be changed. These presentations are held with, at the most, a month's interval, which makes it possible for the

client to be involved throughout the project and make changes, if necessary, before the issues get too large.

3.6.2.4 Responding to change over following a plan

Within Agile management one accept the fact that it is a waste of time trying to predict the future. One realize that the plans created in the beginning will most likely need to be adjusted when the project grows and the market around changes. So instead of spending extra time planning every last detail, the Agile methods embrace change through the project process. How to embrace these changes, however, needs to be organised and controlled. Therefore, in between every cycle the client has the opportunity to change the direction of the project with the intention of improving the end result. If the cycle is short enough, usually less than a month and preferably one or two weeks, the client can let the project team work efficiently without being disturbed during that short time.

3.6.3 Timeboxing

This concept is one of the fundamentals in the Agile methodology (Gustavsson, 2011). It means that one decides upon goals within a certain timeframe and then lets the time be the most important factor that cannot be altered. This means that the project members constantly need to prioritise which goals or tasks are most important during that cycle. In some cycles the case might be that everything runs smoothly and one can actually execute more tasks than expected but during cycles when there is not enough time to perform every task the project team need to choose which tasks are the least important and perform those during the next cycle. Since the client is only allowed to change the requirements and direction of the project between each cycle it is important that the project team knows which tasks are the most important and useful ones during each cycle.

"*Scrum does not allow a delivery date to be altered! If you are behind, you delete items in the Scrum Team's Sprint Backlog and if you are ahead you can ask the Product Owner for more tasks.*"

(Softhouse, 2012, pp.11)

This might at the first glance seem like a strange way of managing a project since the product that is supposed to be delivered to the client should include all the tasks and parts that the client has ordered, which means that tasks cannot be skipped just because there is not enough time. But the tasks that were not performed during a cycle because of lack of time will still be executed in the next cycle or later in the project, so all tasks that are required will eventually be performed (Gustavsson, 2011). By setting the time as the most important factor one will realise early on in the project if it is lagging behind and tasks are skipped during some cycles or if it is going according to the time plan. If it is noticed that the project is lagging behind there are three different actions available:

- The project can be assigned more resources in order to be able to complete the tasks set for each cycle
- Some of the tasks, functions or parts that are planned to be performed later in the project can be deleted
- The project team can warn the recipient (the client) that the project (in total) is going to take longer time than expected.

The most important aspect of time management within Agile project management is the cycles. If a cycle is set to 30 days then it should be 30 days, no more, no less. However, how the project as a whole is affected by these lags is up to the client to decide. The client can either decide to push the end-date forward, reduce the requirements ergo the amount of work or assign more resources to the project and thereby increasing the cost.

"*Too many late hours makes it easy for us as humans to think wrongly or too choose the simplest solution that comes to mind without questioning if it is appropriate or not.*"

(Gustavsson, 2011, pp.16), (Author's translation)

In a project where everybody is struggling to get all the tasks done on time, even though there is actually not enough time do manage them all, the quality of the product can sometimes suffer. The Agile approach responds to this problem with frequent deadlines. This benefits the quality in the way that every task is performed properly. It also reduces the negative effect if some requirements are not completed in time since the next deadline is only a few weeks away.

3.6.4 Success factors of Agile management

In his book about Agile project management, *Agil projektledning,* Gustavsson (2011) explains that there are several companies that have increased their productivity by simply choosing to work Agile. He continues with saying that there are a couple of factors that characterise Agile management and that some of the most important ones are; *Managing change, More utility for the client during the project, A motivated project team, An even and reasonable workload, An airplane cockpit for projects* and that *It works in many businesses.*

With *managing change* he means that since there are always changes occurring in all projects one need to have an approach that will let one adapt the project to these changes as smoothly as possible. The Agile management approach includes methods that will make it easier for a project manager to handle the changes than it would be using traditional project management, he explains.

When Gustavsson (2011) says *more utility for the client during the project* he means that because the project is divided into cycles of one to four weeks and that at the end of each of these cycles something will be delivered to the client he or she is forced to be involved and make decisions. Through these constant checkpoints between every cycle the clients do not have to worry about whether the project is going in the right direction or not since he or she is constantly updated.

A motivated project team seems like an obvious aspect to include in a management strategy and it is included in the traditional management approach as well. The reason for it being mentioned as a characteristic for Agile management is the way that the project team is motivated. In Agile management the project team should be self-governed and able to make decisions since it is the team members who have the most detailed knowledge about the specific project. Thus the team is motivated through been given responsibility and authority, which also frees some of the project manager's time so he or she can focus on the more administrative issues and keeping the team away from external disturbances.

Gustavsson (2011) says that many years of studying projects have concluded that the result of a project can suffer from quality deficiencies if the project team is forced to work unreasonable hours and has to hand over work that could have been significantly improved with more time. This is why *an even and reasonable* workload is important in projects. The concern is avoided in Agile management by letting everybody in the team make their voices heard and that they at the end of each cycle get to present their work and get feedback from the client. This also makes them more motivated and feel respected, he explains.

In many projects the status of the project is an issue, how the project actually is progressing is a reoccurring question. Therefore there is a set of tools to help one keep track of the status of the project in Agile management. It can be seen as *an airplane cockpit for projects* with all the different instruments showing that current status.

Gustavsson (2011) explains that Agile management is used in such a wide variety of businesses such as event projects, call center companies and departments within the army. So that even though it was born and has grown in the IT industry *it works in many businesses*.

3.6.5 Group constellation and roles

The project team and its constellation is an essential part of the Agile management approach. Gustavsson (2011) mentions that one Agile promoter named Ken Schwaber compares the Agile team to a rugby team and that he does this because both teams have some common principles. Characteristics for an Agile project team is:

- *Self-governance* – it means that even though the captain of the team has the overall responsibility, every single position in the team has his or her own specific responsibilities and authorities.
- *Clear goals* – everybody in the team has the same goal, to get the ball over to the other side of the field and win the game.
- *Collective responsibility* – no matter what specific responsibilities your position might involve, everybody is responsible for helping the team score and win the game.

The size of the Agile team is important, and as long as one can gather the entire team at a table and have a conversation with each and every one of the members it is not too big. Gustavsson (2011) says that a proper size for a project team is somewhere between five and nine members. If a project requires more resources, it should be divided into several groups with different areas of responsibilities. Schwaber and Sutherland (2011) say that the three members is the minimum number because fewer participants would lower the creativity and the possible interactions within the group. They also say that nine participants is the maximum number because larger groups require much more coordination.

Most project teams have probably experienced the feeling that they need more resources in order to finish in time, and then usually includes more resources since they do not want to miss their deadline. Gustavsson (2011), however, points out that including new resources into a project team is an action that actually requires resources. The new members needs to be informed and

get up to speed on the project before they can actually become an asset. So the Agile way is not to reject new resources, but to respect the fact that it is a resource-requiring action to include new resources.

3.6.5.1 Expert functions

Another important aspect of the Agile way is to create a working project team that consists of people with cross competence and lower the amount of expert functions. Many times a project team is held up because they are waiting for external decisions to be made. That is why the project team should include as many of the competences needed for the project to flow smoothly without having to wait for external decisions (Gustavsson, 2011). The benefit with having people with cross competence is the flexibility of every member in the team being able to help wherever it might be needed.

In some projects it might be a bit contradicting to have a team consist of people with cross competences if the project demands a lot of approvals from experts. For instance an architect probably needs to approve a suggested design, a security expert needs to approve the security solutions proposed. Some experts are even required by law, such as a safety officer on the construction site. It is necessary for an organisation to either lower the amount expert functions or try to include them in the project team in order to get an efficient use out of implementing Agile methods. To minimise the impact of the expert functions that cannot not be excluded one need to be clear on how to handle these functions in the project. Gustavsson (2011) says that questions such as; does the project team need to get an inspection and an approval from the security expert every week? Is it possible for the project to wait until Tuesday every week for an approval without any risk of delays? need to be answered, documented and accepted by the organisation.

3.6.5.2 Project-specific tester

An Agile project should also appoint a project-specific tester. This person is someone who will constantly review and be critical of what has been done so far. This tester is important from a quality assurance point of view. If the project is performed on behalf of a client it is an advantage if this person comes from the client's organisation. If, however, this is not possible or if it is an internal project the tester should be a person from outside the project team because it can be difficult to criticise what you have created yourself. Gustavsson (2011) says that some might argue that it is easier to have someone test the complete product at the end of the project because it is often difficult to keep a tester for an entire project. This, he says, is to go against the Agile principle of constantly being able to deliver usable results, because if nobody's is testing it then, in theory, it might be completely wrong.

To test the delivered results is, however, not a full-time job especially in the beginning of a project when there is probably very little material to test. So there are a couple of other tasks that also should be delegated and performed by the tester.

- *Clarify the project requirements for the project manager* – since the tester has the knowledge of how the results should and will be tested, he or she can be used to describe and clarify the requirements.

- *Prepare a testing environment* – the tester might need to prepare some of the tests through gathering relevant information, technology or laboratory equipment depending on the project.
- *Prepare for the handing-over* – since the tester has a wide knowledge of what the project result will be (or at least should be) he or she can prepare an operating and management operation before the completed project is handed over to the client.

Since an Agile project team should be autonomous and self-governed, people argue that no tasks will be performed. They motivate this opinion with the fact that if a task is not delegated to a specific person there is a big risk that everybody thinks somebody else will or should perform it. Gustavsson (2011) says this is solved by appointing one person for each task who will be responsible for making sure that task is performed. So consequently the project team share the responsibility for the overall project but not the specific responsibility for each task, which instead is divided between the members.

3.6.5.3 Scrum master

Scrum is only one of the different Agile methods but it is one of the most popular ones (Gustavsson, 2011). Most of the different roles in Agile projects originate from Scrum and the self-governed group is a central part in this specific method. As mentioned the line between different roles in Agile projects are quite blurry, there should not be any specific roles because one work as a team and help wherever help is needed. There is one role, however, that is specific and is important for an Agile project. That is the so-called Scrum master. If one compare this role to a project manager in a traditional management approach one find the big difference in that the Scrum master should act as coach and not as a chief or leader for the group. The Scrum master is not supposed to decide what the team should do, but instead support and help the team to act autonomously and as efficient as possible. For instance, if one or more of the team members has two options to choose between in an issue, the scrum master should not tell him or her what to choose but instead guide him or her to the correct person and maybe help set up a meeting with somebody if necessary. The Scrum master should act as a snowplough and create a smooth and easy way for the project team.

There is, however, one thing that the Scrum master can and should decide about, and that is the process. He or she should, for instance, decide that the review meetings are to be two hours instead of one because the one-hour meeting is to short. He or she should further decide what is on the agenda for the meetings, if more resources should be included in the project, the length of the cycle and more.

So, to clarify, the Scrum master should only support the team in the daily work and make them work autonomously. He or she should not decide, for instance, what technical solutions to chose or who should perform what task, but he or she should decide upon all issues concerning the process of the project. Figure 3 below illustrates the decision-making in a traditional project compared to an agile project. The role of the product owner will be described further down.

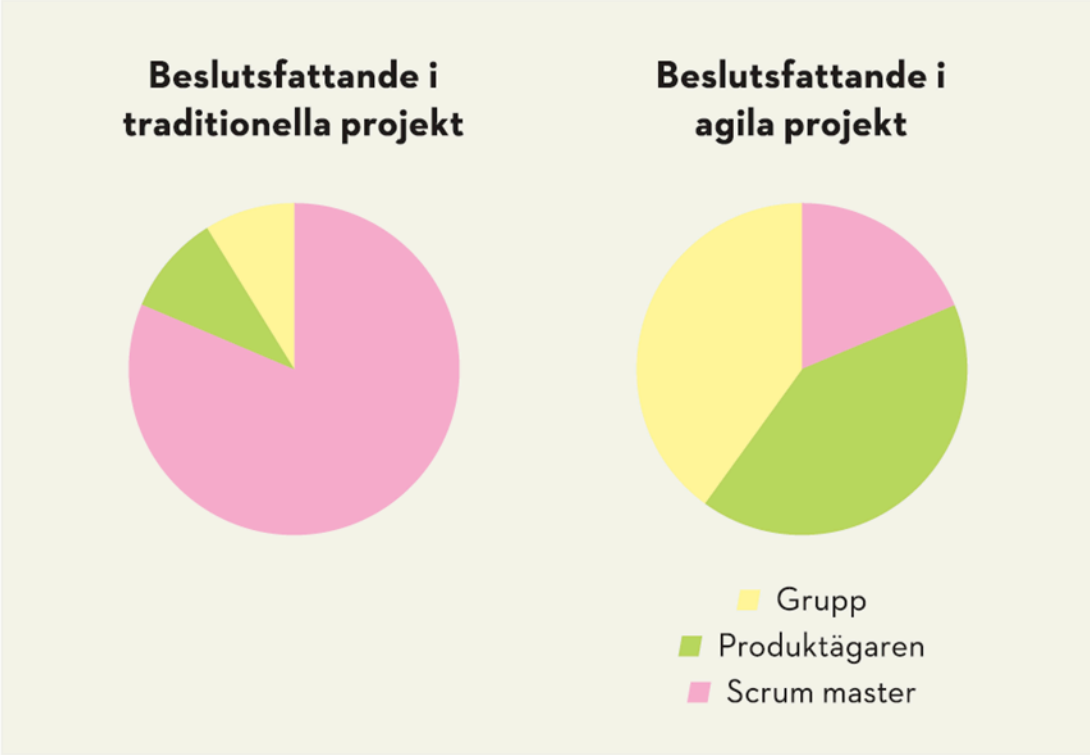

Figure 3 The diagram to the left describes the amount of decision-making power in a traditional project while the diagram on the right describes it in an Agile project. The yellow part represents the project group, the green represents the product owner and the pink represents the scrum master. (Gustavsson, 2011)

Someone in the project still needs to be responsible towards the client and handle the contractual and economical decisions. Some Agile projects allow the Scrum master to be responsible for this as well while other projects have a Scrum master who acts as been described above *and* includes a project manager who is responsible for the administration, such as economical or contractual issues, of the project. The project manager in these cases will act as a link between the Scrum master and the client.

In Agile management the Scrum master has been relieved from his or her authority to decide over the team members and is because of this unable to lead the team with a stick. Instead the Scrum master needs to encourage the team using a carrot. Gustavsson (2011) explains that many experienced project managers often say that the Agile way of delegating the decisions to the team is nothing new, that that is actually how they manage their own projects. Non-experienced project managers, however, often have a need to control what happens in the team and what decisions they make because they are not sure that they can trust the team to make the right choices. The Agile approach lets these project managers act as experienced ones from the very beginning.

In order for the Scrum master to be able to coach the team and not just delegate it is necessary for the team members to be active, have opinions and take responsibility for their tasks and work. It is his or her duty to motivate the group and make them engaged in the project and if a team member does not comply with this it is the Scrum master's obligation to remove that person because he or she will be an obstacle for the team. In general one can say that a Scrum master's job can vary from project to project. When working with a very well-greased team that works autonomously his or her main duty might be to keep the team motivated and inspired while in a team with many different wills the Scrum master's main task might be to manage the conflicts.

Gustavsson (2011) continues with explaining that a Scrum master should be dedicated to one project at a time and that in the beginning he or she should put all their energy into getting the team to work autonomously and efficiently. Later in the project the Scrum master should have 50 percent project management tasks and 50 percent project-specific tasks, but still dedicated to only one project. If, however, there are different groups within the same project who depend on each other it might be better to have one Scrum master for all these groups since this person has a better holistic view of the entire project.

3.6.5.4 Product owner

In an Agile project the product owner plays an important part, Gustavsson (2011) says. The person taking on this role in a project needs to be acquainted with the client's business and interests in the project. This is because the product owner is the one responsible for the client's requirements and demands concerning the project outcome, and needs be able to answer detailed questions as well as prioritise the requirements. One might say that the product owner is the person representing the client in the way that he or she, sometimes in collaboration with the project manager, lists all requirements as detailed as possible and then prioritises them.

The requirements are gathered in what is called the *product backlog*, which is explained further down. According to Schwaber and Sutherland (2011) the product owner is responsible for managing the backlog and this includes the following duties:

- *Clearly expressing Product Backlog items;*
- *Ordering the items in the Product Backlog to best achieve goals and missions;*
- *Ensuring the value of the work the Development Team performs;*
- *Ensuring that the Product Backlog is visible, transparent, and clear to all, and shows what the Scrum Team will work on next; and,*
- *Ensuring the Development Team understands items in the Product Backlog to the level needed.*

(Schwaber & Sutherland, 2011, pp.5)

Agile projects often depend on the commitment and involvement of the product owner. If he or she is too occupied and cannot devote enough time to the project it might fail. It is, however, also important that the product owner is not a part of the project team since he or she might make decisions too fast so that the requirements and maybe even the scope of the project will change without the resources being able to keep up. The project team should from the very beginning set up a demand that the product owner will devote X number of hours to the project.

A demand could for instance be that the product owner should be available at least one hour every day in order to enable the possibility for the team members to ask questions and get answers efficiently.

Gustavsson (2011) also says that it is important to define the roles in the beginning of an Agile project, both when it comes to responsibilities but also authorities. If one notices that the definitions of the roles are not clear enough they should be redone at the end of the cycle and implemented in the next cycle.

If the project depends on external suppliers or deliveries of some sort from external sources Gustavsson (2011) explains that one should try to choose, if possible, the suppliers that accept two important principles. The first one is that the supplier can present and deliver partial results frequently and the second is that they can agree upon constant and short reconciliations.

3.6.6 Phases of an Agile project

According to Gustavsson (2011) an Agile project consists of the phases *feasibility study, planning, implementation, handing-over* and *closing*. These different phases can be found in projects that are not Agile as well but what might differ from other projects is the way the different phases are executed.

3.6.6.1 Feasibility study

The *feasibility study* in an Agile project should contain three important steps (Gustavsson, 2011). The first one is to make a thorough stakeholder analysis in order to map which person in what organisation will be able to answer different kinds of questions. This analysis focuses more on communication rather than documentation; one need to establish this analysis fast and with visible results.

The second task is establishing a document of the vision. This document should visually and distinctly explain the vision of the project, what needs to be done and why. It should also include the scope of the project, the time frame and budget. It should be as short as possible but still specific, preferably consisting of both text and pictures. It cannot be too elaborate because it needs to be communicable and understandable. By not explaining the smallest detail in the project and making the documentation more clear one also keep a lot of options open in how to reach the vision. If the explanations in the documents of what the product should include and how to get there are too detailed, the door to finding better solutions in the future is closed.

The third task is to develop a communication plan because it is important to, early in a project, establish how one should communicate (Gustavsson, 2011). One of the principles in the Agile manifesto is to prioritise communication over documentation, but for this to be possible and for it to be effective one needs to establish the ground rules of how the information in the project should be transferred. Agile management always promotes physical meetings where the relevant people actually meet face-to-face. This is because it is more efficient to have discussions in person and this also minimises the risk of misunderstandings. Furthermore, it is important with continuity in the sense that if a meeting is scheduled every Monday at eight, people will be aware of this and will not double-book or have some other excuse for missing the meeting. They know

at what time it is every week and should attend. It is, however, also important that one really think about how to communicate in the project. Even though the use physical meetings is promoted it is very inefficient if there is no purpose or if the wrong people are forced to attend. Many projects also suffer from information overload and this makes it important to establish which person needs what information so that from the beginning one limits the confusion that occurs when everybody gets all the information.

3.6.6.2 Planning

Every project needs to be planned ahead; the question is how far into the future the project should be planned, Gustavsson (2011) explains. The biggest difference in planning between traditional management approach and the Agile is the timespan of which one plan ahead. In traditional management it is often said that the success of a project is in how detailed the entire project process is planned. In Agile management, however, one consider the fact that it might not be possible to predict what will happen so far into the future. What is done instead is that one create levels of plans and with each level the plans become increasingly more detailed and covers a shorter time into the future. These levels are:

1. Vision
2. Roadmap
3. Deliverance plan
4. Cycle plan
5. Daily plan

The *vision* has been described, in section 3.6.6.1, and acts as the broadest plan. The next level is the *roadmap* and its function is to visualise which separate part-results are required for the success of the project and in what order it is necessary to perform them. Gustavsson (2011) says that two tools are useful in developing the roadmap and those are a product breakdown structure, or PBS, and logical network. A PBS is more or less the same thing as a WBS (Work Breakdown Structure) with the difference that the latter focuses on the work and what tasks are required to reach the goal while the PBS focuses on what results should be delivered. This, as both the names implies, then means that the product or work is broken down into smaller more manageable parts until an appropriate level of detail has been reached. The logical network, between the manageable parts, then helps one find the order in which these parts of result (or work) need to be delivered. The roadmap should also include approximate dates; it can be within a month or within a quarter depending on the size of the project.

The next level is the *deliverance plan* and this one should include exact time limits and specific dates. It should only describe the time frame that the project can in any way benefit from elaborating on at the moment. It should also, within the set time frame, include all milestones set on specific dates.

We then have the *cycle plan* which is similar to the deliverance plan in the way that it should not describe a longer time than is necessary. It should stretch up until the next milestone and describe how many and how long the cycles up until that milestone will be. Each of these cycles should produce some sort of useful result so it is important that the cycles are neither too long nor too short. A cycle should not be longer than six weeks and not shorter than one week. The founders

of Scrum, Ken Schwaber and Jeff Sutherland (2011), says that the aim should be at a 30-day cycle, so this is a starting point if one does not know how long a cycle should be.

The last level is the *daily plan* and its purpose is to plan what should be done during the upcoming day and who will responsible for each task. The daily plan as well as the deliverance plan and the cycle plan are recreated during the project while the vision and the roadmap is only established once, at the beginning of the project.

3.6.6.3 Implementation

As with every other project, Agile projects have a process, how to work, and then also the practical part - tools that support that process. Gustavsson (2011) explains that one of the most important tools in Agile projects is the project board. The purpose of this board is to visualise how the project is progressing by placing the different activities in one of the three columns *not started, started* or *finished*. In the beginning of every cycle all activities is placed in the first, not started, column. Every project member than moves the activity that is most prioritised and which they are responsible for to the second, started, column. One can expand the use of the board by adding, for instance, red post-its that, if the activity encounters problems, explains why an activity has not been completed yet. Another step is to include a forth column between started and finished that is called *ready for testing*, which indicates that the activity placed in that column has been completed but needs to be reviewed or tested by the best suited person.

There is another more elaborate kind of project board and it is called Kanban. The biggest difference compared to the board described above is that it includes more columns. Instead of just the second (started) column it might have three that, for instance, can read analysis, design and development. This will even more explicitly explain the steps an activity needs to pass through in order to be completed. The main purpose of the more elaborate Kanban board is to get all activities completed faster by making it even clearer as to what step the activity is currently in.

In the Agile management approach there is a daily meeting, which originates from the Agile method Scrum (Gustavsson, 2011). It is, within this method, called the *Daily Scrum*, which purposely does not include the word meeting since that word is often associated with prolonged and inefficient get-togethers. Three questions are to be answered during these meetings:

- *What has been accomplished since the last meeting?*
- *What will be done before the next meeting?*
- *What obstacles are in the way?*

(Schwaber & Sutherland, 2011, pp.10)

The purpose of these meetings is not that all project members should report to the project manager if they performed as good as they promised, because this will only create a bad atmosphere in the project and the team. These meetings are aimed at the team updating each other on the progress and how they can help and support each other in the future. Gustavsson (2011) also explains that in reality it can often be the case that the team members are actually only part-time in the project, which means that the daily meetings might be difficult for everybody to attend. An option here is to schedule these meetings maybe two or three times per week instead,

the important thing is that it is scheduled and that everybody has agreed upon the time. The founders of Scrum, Schwaber and Sutherland (2011), recommends that these meetings are held standing up in order to keep focus but also that they are kept quite short, about 15 minutes.

Daily Scrums improve communications, eliminate other meetings, identify and remove impediments to development, highlight and promote quick decision-making, and improve the Development Team's level of project knowledge. This is a key inspect and adapt meeting.

(Schwaber & Sutherland, 2011, pp.11)

At the end of every cycle a presentation is held (Gustavsson, 2011). At this presentation the project team presents the result of a specific part that has been completed during the recent cycle. The demonstration should focus on the actual result and not a well-developed presentation that the team worked too many hours on. If the result is abstract and difficult to present then the team can discuss the work they have done and how they performed during the last cycle. These presentations keep the team motivated since they constantly get feedback on their work, but it also keeps the stakeholders informed of the project's progress and what will be delivered next. This gives them the opportunity to modify or even stop the project before it gets out of hand. Since there are different stakeholders at these presentations it is important that one establish beforehand what authorities each stakeholder has. Is a stakeholder allowed to make decisions that will affect the project or is he or she only allowed to argue for his or her cause.

There is another meeting held at the end of each cycle and that is the review meeting. At this meeting, which should not take longer than 30-60 minutes, the project team reviews the recent cycle and answers the questions *what went well* and *what can be improved*. How all the meetings described above are connected is illustrated in Figure 4 below.

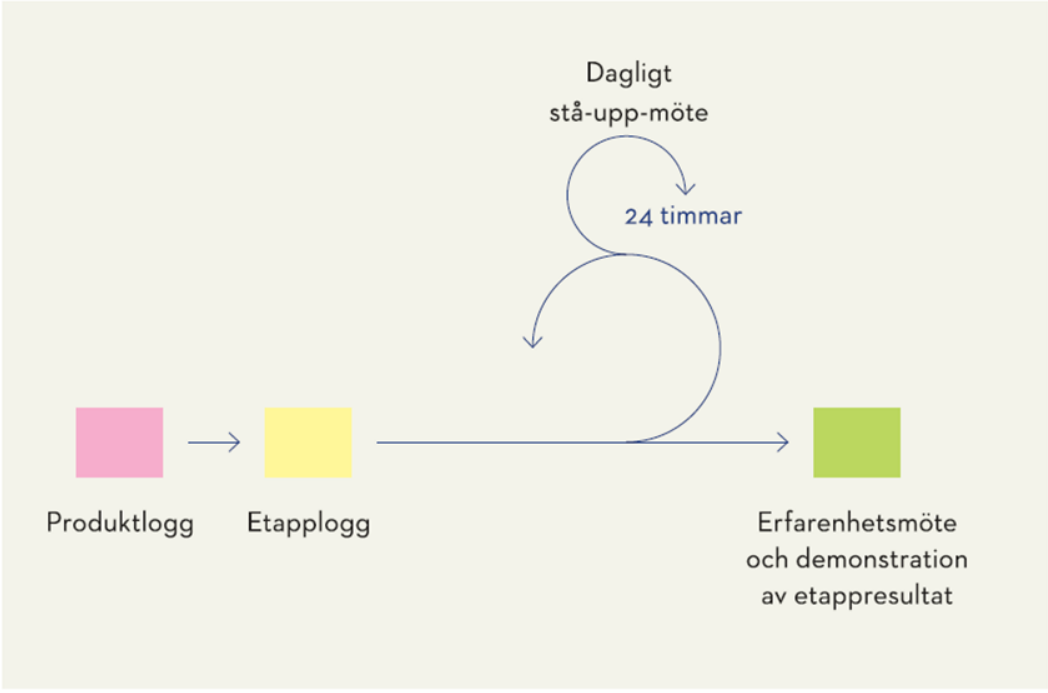

Figure 4 An illustration of the Agile cycle that lasts between 1-4 weeks. The big circle indicates that the cycle is repeated and the smaller circle illustrates the daily stand-up meetings. The pink illustrates the product backlog, the yellow the cycle backlog and the green illustrates the review meeting and presentation of the incremental result produced. (Gustavsson, 2011)

Gustavsson (2011) explains that the practicalities, such as the physical working environment, in a project can often be a crucial issue of the success of the project. For instance, how the project team is located can affect the effectiveness of the team. If the team is scattered all over the office then some questions might not be asked because "it is too far to walk" or for some other reason. If the team, however, is situated in a project-specific room or at least close to each other there is a greater chance that work will flow better.

Other practicalities that can affect the efficiency of a project and its team can, for instance, be to set up some ground rules for the team on how to act, such as always use silent mode on cell phones or to always take the time to answer a co-workers question because it is for the greater good of the team. Another thing is the transparency of the project, to constantly visualise the progress of the project. A great example of this is the project board that has been described earlier.

3.6.6.4 Handing-over & Closing

Gustavsson (2011) explains that the phases handing-over and closing of an Agile project is not very different from those phases in other projects. What can be different is that since during an Agile project part-results are constantly delivered, reviewed and approved, it might be easier to hand-over the project since the receiver is probably better prepared.

3.6.7 Product backlog

In Agile projects there is a prioritised list over the requirements that the client has regarding the project and it is called the product backlog. On the contrary to what the name "backlog" might indicate this is a document that will aid in the planning of the project and will thus not act as a list of thing that has not been performed. According to Gustavsson (2011) the list should only cover the time span that is relevant at the moment, which, for smaller projects, might mean the entire project and for larger projects only a part of it. However, he continues by saying that one can, even if it is a large project, have a product backlog containing all requirements of the project but keep those that are not relevant at the moment more general and not go into detail. Then, whilst the project is progressing, the requirements that become relevant with time are elaborated and specified in more detail. The parts of the product backlog that are relevant and have been specified should include not only the requirement but also the deliverable that comes with it. The requirement is the expectation that the project result should fulfil while the deliverable is the actual result that should be delivered in order to fulfil the expectation.

"*A Product Backlog is never complete. […] The Product Backlog is dynamic; it constantly changes to identify what the product needs to be appropriate, competitive, and useful. As long as a product exists, its Product Backlog also exists.*"

(Schwaber & Sutherland, 2011, pp.12)

This list is developed in collaboration between the project team and the client where the latter sets up a requirement and the project team presents their solutions and deliverables for that requirement (Gustavsson, 2011). The client then approves one of these solutions and it goes on

like this until the list is completed. This way of developing the product backlog also motivates the project team since they get to influence the product and how to reach the project goals.

One of the most efficient ways of getting a well-developed product backlog, according to Gustavsson (2011), is to produce it through a workshop. If all the relevant persons dedicate one or two days to only developing the product backlog, starting with the highest priorities, the project team will be able to start producing useful results based on a trustworthy requirements list.

3.6.8 Cycle backlog

The cycle backlog is also a list of requirements and deliverables but is only specified for the next cycle, nothing more or less (Gustavsson, 2011). Before each cycle the product backlog is reviewed and the client chooses and prioritises the requirements that should be fulfilled during the upcoming cycle. However, the project team also needs to be involved in this because it might be more efficient for them to produce other deliverables that the client did not choose during this cycle, which in the end might be better for the project in the long run. The requirements and deliverables that everybody agrees upon are then transferred from the product backlog to the cycle backlog. It is now the project teams responsibility to break the requirements down to actual tasks and decide who will be responsible for each task. It might sometimes be efficient to plan for more than one cycle ahead if, for instance, the team works faster than expected or the amount of work was overestimated. Since the cycle backlog is prioritised everybody involved knows what order the work should and will be produced. This makes it possible for the client to actually change the cycle backlog during a cycle if the work has not already been done. This is not something that is recommended but the option exists, if it can be supported. During each cycle the client is responsible for updating and, if necessary, reprioritising the product backlog before the next cycle begins.

There is a tool to help both the client and the project team to prioritise all the requirements and it comes from the Agile method DSDM (Dynamic Systems Development Model). It is called MoSCoW and the capital letters each represent a prioritisation level. In descending order:

- M - *Must have*
- S - *Should have*
- C - *Could have*
- W - *Won't have this time*

Time is an important aspect in Agile management. It is very seldom that one change the time limits, instead one changes the amount of work included in those frames of time. There is a way of helping a project team and its members estimate how much time will be required or how much time is still left of a task. At the beginning of a project the team can agree on a specific number of hours, for instance 16 hours (two working days), that a task is allowed to take. This does not mean, however, that tasks that will take more than 16 hours should not be performed, it just means that those tasks should be broken down into smaller parts that will take fewer hours. Other methods that can be used are Planning poker or Counting bananas but these methods will not be elaborated on in this thesis.

3.6.9 Good and bad conditions for using Agile management

Gustavsson (2011) explains that there are project conditions that are suitable for using the Agile approach and some conditions are more suitable for other approaches. He says that if there is a *vague and unclear image of the requirements* for a project than it can be beneficial to use the Agile approach. This is because the Agile way will allow for starting producing from the requirements that are clear enough while the rest of the requirement list is continuously specified and updated. A risk with this is that one might start producing something that later becomes redundant. Also some projects fail because of the fact that it took too long to specify the requirements.

Another circumstance when the Agile approach would be beneficial is if the *conditions for the project are constantly changing*. With a traditional approach one would plan the project very thoroughly in the beginning of the project and if the conditions then changed one would not get much out of that planning. In the Agile approach one do not plan very far ahead, which means that if the conditions change it is easier to adapt.

If the *project's goal is complex* it might also be beneficial to go with the Agile approach. It means that if it is difficult to picture what the end-product should look like and what specific functions it should have or if there is several solutions for reaching the overall goals the Agile approach would be useful.

In a project where *results need to be produced fast* the Agile approach can also be useful. For instance, if there is suddenly an opening in the market and one needs to act fast in order to get the market share, using the Agile way one can produce fast, specific results.

There are, as mentioned, also conditions where the Agile approach might not be the best way to go. *Cultural differences* are today the biggest obstacle for the Agile management approach (Gustavsson, 2011). With cultural differences he means, for instance, that the Agile project team might depend on either other non-Agile teams or maybe non-Agile suppliers of some sort. There is also the risk that the client does not want to work Agile but wants to keep the traditional approach. If that is the case there is going to be different views on, for instance, how much time should be sent on the planning and specifications. This does not make it impossible to have an Agile team, it just means that it would be even more important to specify the interface between all the actors. It is also important for the Agile team to reduce the amount of external factors that they will be depending on and at the same time be very aware of those dependencies that are remaining.

Another issue that is relevant to assess whether the Agile approach will be useful is the *cost of change*. This is referring to how much it will cost to change something during the project's progression. For instance, it would be relatively cheap to make changes in a project which goal is to develop a new organisational plan while it would be very expensive to change the design of a road when the asphalt has already been laid.

Fixed contracts are also something that should be respected if one wants to use the Agile management approach. If everything has been specified in detail and been signed early in the project it does not leave much room for changes later on. Gustavsson (2011) says that the client

might often think that the project will be exactly as the specification says and therefore would want to sign a detailed contract early because they do not want to pay for something unwanted. Public procurements can sometimes be difficult for an Agile project since the end result often needs to be very specific in the beginning of the project so that the most appropriate actor can be selected through the tendering process.

One can, however, adapt the Agile way of constantly being able to change requirements and such to the more traditional way. This compromise can be reached by saying that the cost of the changes that are made in an Agile project will be treated as it would be in the traditional way. This means that it will either be the client who will pay for it or the project team depending on whether the change is something that should be added to the original order or if it is due to lack in planning.

The culture of an organisation is very important to consider when implementing Agile management or any, to the organisation, new method. This is especially true when the projects grow larger because it might be difficult to keep the Agile values within the entire project and follow its principles if the rest of the organisation is not on board. They might even be resisting the change (Gustavsson, 2011). It is not an easy task to change the culture of a company but there are two things that one can focus on when implementing the Agile management approach because these two will probably change. The first one is *how you make decisions* and the second one is *how you communicate* within the organisation.

Since the decision-making in Agile projects is delegated down to the self-governed team, it is very important that all different teams in a larger project have understood and embraced the Agile values and what this means for the individual team. If the project is so large that one needs several self-governed teams that have their own daily meetings where they review and plan, then the information needs to be shared between the teams. Scrum of scrums is basically a scrum meeting where the different scrum masters attend to check the status of every group. A way of lowering the need for these scrum of scrum meetings is to allow and encourage project members to attend other teams daily meetings to keep his or hers team informed and updated.

3.6.10 Suitable types of projects

Gustavsson (2011) mentions the following different types of projects; product development projects, internal change projects, marketing projects, client ordered projects and event projects. He says that the Agile approach is suitable for product development projects since this business is where the approach originates. He also says that it can often be suitable for client ordered projects but here the contracts and agreements can have big impact on how useful the approach will be. It would also be a beneficial approach for event projects since there is a set end-date and the conditions of the project are often continuously changing over time. When it comes to the projects aimed to change the organisation internally it might be difficult to use the Agile approach because the communication and information flow is very important in these projects and should be very well planned and structured in the beginning of the project.

3.7 Organisational change

There are five different models of how organisational change happens within companies (Jacobsen, 2011). These are *planned change, change as lifecycles, change as evolution, change as dialectical process and struggle for power* and *change as coincidence*. When considering the possibilities of implementing a new management approach such as Agile, one need to plan ahead. Therefore, only the planned change will be elaborated on in this thesis.

3.7.1 Phases of a planned change

The central phases of a planned change are *diagnosis, solution, implementation* and *evaluation*. The first phase means that an investigation is conducted, with the goal to see if there is a problem or if there are any opportunities that would require a change. It the outcome reveals that a change might be needed the organisation undertakes the responsibility of completing the change, including time and resources.

The second phase, solution, includes a description of the purpose and goal of the change and also what measures need to be taken to get there. An analysis of the problem is conducted and the reasons behind the problem are documented.

In the third phase, a time schedule is produced that includes all the activities that will be performed, at what time they should be performed and by whom. After this the real implementation begins through, for instance, different working groups, hired specialists or education or training.

The last phase, evaluation, means that the results of the change are analysed and appraised. Did the organisation reach their desired goals? Why or why not? If the change was successful then it is important to stabilise the change, which basically means that the employees and the top-level management strengthen the change. In practice, this could mean modifying the reward system, organisational structures and procedures to match the changes.

It is important to remember that every project often faces new conditions over time, which makes it difficult to plan a long and complex project. This means that even though a planned change is executed, it may not have the desired outcome if conditions change.

3.7.2 Motivators for change

There are different motivators behind every change (Jacobsen, 2011). These are *changes in the market, technological changes, political changes, changing competitive conditions, changing ownership, mass media, demographical changes* and *cultural changes*. All of these motivators can cause reason for change and can be of different importance for different groups or employees in the organisation. This means that some ideas for change can come from a motivator that is only of importance for a small group in the organisation and might not make it a top-priority. For the people managing the change, this becomes a delicate situation since they need to identify and register the motivators that are of most importance to the organisation. They then need to develop solutions or plans on how to manage the change, and implement these changes. It is also important to remember that just because there is a motivator, or an impulse, for change it does not necessarily mean that one should change it. It should be seen as an indicator, and a further investigation can be conducted.

When facing a change it is also important Jacobsen (2011) says, to consider *what* will change. Maybe the required competence or skills of the future employees will change or maybe the group constellations in the organisation will change. The level of centralised or decentralised decision-making might also change.

The organisational structure is often considered easier to influence and change, than for instance its culture (Örtenblad, 2008). This is the reason many reorganisations start off with changing the structure of the organisation and then continue with other parts, such as the culture. The motives for rearranging an organisation can be many but a few of them are increased efficiency, improved working conditions, motivated personnel, trends or to be unique.

3.7.3 Why group constellations work

There are a number of reasons why some groups work better than other groups (Örtenblad, 2008). An explanation why one group might work better than another is that the group includes all vital functions for that group's purpose. This is based on the assumption that a group should be able to work autonomously without needing help from the outside. The group is put together solely based on their occupation or skills, and not their ability to cooperate. This has been and still is the most common way to put together a group.

Another reason, according to Örtenblad (2008) is what he calls "the scapegoat explanation" (author's translation). This means that if something goes wrong, the easy way out for the group is to select a scapegoat and blame everything on him or her. There are then three reasons why a group will function well under these circumstances. The first reason is that the group does not take the easy way out, instead they handle the problem without choosing a scapegoat. The second reason is that the group discarded the scapegoat, and they can continue working. The last reason is that the group is working well, thanks to the scapegoat because they have someone to put all the blame on.

The group needs a distinct and common goal or vision. The different group members will most likely have their own views and interpretations of the goal or the vision. This is why it is important that all these members, as a group, get a common and well-explained goal that they all can relate to so that everybody is working toward the same direction. Örtenblad (2008) points out the importance of not forgetting other reasons why a group might work better. A distinct and common goal is probably very important for the group's efficiency but hardly the only reason.

A different measurement of how well the group is doing is to look at the atmosphere of the group. The most common mistake made when considering the atmosphere of the group is that it should be harmonious. It should, but it should also be able to handle conflicts. In a group where conflicts are welcome and maybe even encouraged, the level of creativity is usually higher than in others. This is because everybody has their own interpretation of the task at hand and if they all discuss and cooperate they can develop it further. This is a way of measuring how well the group is doing, but unfortunately it is difficult to influence or change the atmosphere in a group.

Another reason why a group might work well is that it is a democratic group. This, as the name implies, means that the group members act on equal terms, no one is the leader. The members of the group decide together what tasks are top-priority and who should perform them. This also puts responsibility on the group members because they need to make decisions democratically and not be apathetic. A risk with this explanation is if someone in the group takes on the role as a leader. This might be even worse for the group than having chosen a leader from the very beginning. However, a group with a strong leader can also work well together. This puts a lot of responsibility on the leader since he or she needs to be in the centre all the time and make decisions for the group that they can act on. The leader also needs to make sure that everybody in the group is working comfortable. The group needs to be able to rely on the leader and if they cannot they will not work up to their potential.

4 Empirical findings

This chapter will present the findings and results from the interviews performed. It is divided into two sections with one referring to the interviews with the employees of Grontmij AB and the other one referring to the interviews with the clients. Each one of these sections is then structured according to what topics most frequently occurred in the findings from the interviews. Some topics were only mentioned once or twice and are therefore gathered within the headline Additional findings.

4.1 Interview responses

Unless otherwise is stated, this chapter is entirely based on the empirical findings from the interviews and the case study. Since the interviews have been conducted in Swedish and the spoken language at Grontmij AB in Stockholm is Swedish the following text is translated into English by the author.

All the interviews have been based on the same subjects and questions, this means that both the client representatives and the employees at Grontmij AB has been asked the same basic questions. The findings, however, differ and this is partly because different attendant questions were raised on behalf of the different topics that occurred during the separate interviews. It partly also shows that the client representatives and the employees at Grontmij AB does not always experience the projects progression in the same way. This is also the reason why the Grontmij Ab and the client sections below have been structured with different headlines, since different topics occurred.

All the answers gathered from the interviews have been included in order to express the complexity and the many different aspects that take part in construction projects. This means that even findings that will not be commented on later in this thesis has been included anyway for this complexity to appear.

4.2 Grontmij AB

4.2.1 Meetings

Internally in one of the studied projects at Grontmij AB, they had design meetings every other week that included the different disciplines. The protocol from these meetings where sent to the design management firm who in turn responded with feedback. The project manager says that he usually gets up and walks around the office and asks all disciplines how they are doing and if they need anything, he tries to do this two or three times a week.

Once a month there was a project meeting down in Gothenburg where all the other consultancy firms sat. On these meetings all the different consultancy firms, the design management firm and the client attended. The project manager says that he would have liked to have these meetings more often so that the meetings would be shorter and more concentrated. Now these meetings sometimes took an entire day but he also understands that it was a big cost to transport everybody to Gothenburg so it would be a bad idea to do it too often.

The internal communication for one of the projects was organised with design meetings. At these meetings overall questions were raised and it was decided what needed to be done up until the next design meeting. They also had smaller meetings every other week in which more technical issues were discussed and not all the different disciplines needed to be present, only the ones that the specific meeting concerned. In hindsight they said that the smaller meetings should probably been scheduled more often. The interviewees continue with explaining that a few projects at Grontmij AB use a project room in which the project manager, responsible architect and discipline representatives sit. They say the reason that there are only a few projects that do like this is that those projects are considered big and important enough to take those people out of Grontmij AB's main organisation and dedicate them to the project. The interviewees says that this is a valid reason but that smaller projects that for instance only last six months also should do like this because it would be more effective. Their current project should, because of its magnitude, also have used a project room since this would have meant that the smaller meetings would constantly occur and then one could focus on the design meetings and decide what to do next.

In the beginning of one of the projects they had steering group meetings once a month, but they became less frequent as the project progressed. The project manager says that they probably should have scheduled these meetings from the beginning and kept the schedule.

During those periods when the project was the most intense they feel that they sometimes should have gathered the team face-to-face instead of keep on communicating via e-mail.

In one of the projects the internal design meetings at Grontmij AB were scheduled every other week but they were sometimes postponed a week or so because of the amount of work needed to be done. At these meetings all active consultants were present, at the maximum 16 people. However, no review meetings were scheduled; there was seldom time for meetings. The project manager says that this is something that probably should have been scheduled early in the project since there was so little time for them later on.

In one of the projects there was every other Monday a meeting within Grontmij AB's organisation. On these meetings everybody was heard and updated on what was new in the project and how this could or will affect the project and their work. They say that these meetings could be held every other day because there is so much new information every single day in the project but first of all it is an issue of too much information and secondly it is difficult to gather everybody since they are all working in other projects as well. The interviewees, however, say that the most important information flow is that of the informal kind. The day-to-day chitchat is where most of the information flows.

4.2.2 Initial planning

In one of the projects Grontmij AB was involved too late according to the interviewees. In the project, many different firms had been hired and they had already started designing when the client realised that they needed somebody who could do the ground works and at this point Grontmij AB was involved. This meant that some design was already in place when they started the work. The work Grontmij AB was first engaged to perform was also quite small but rapidly

grew to ten times the size as it was from the start. This put a lot of pressure on the organisation within Grontmij AB since they first thought it was a small job but then suddenly needed more resources. This chain of events also became quite expensive for the client first of all because the other consultant firms needed to wait for Grontmij AB to get up to speed but also because they noticed that the ground condition was not as they had expected and therefore a lot of already made design needed to be remade.

Some lessons learned by one of the project managers at Grontmij AB from this project is that it is important to sit down in the beginning of a project and really think about the scope of the project and what disciplines needs to be involved and at what time. Also that it is important with delimitations so that you know exactly what your specific duties and tasks are. He concludes with saying that in his next similar project, he is going to set up an internal deadline a couple of weeks before the delivery date of completed drawings so that there is still time to review them and fix all that is not properly done.

In one of the projects the project manager had a start-up meeting with the client where the client presented their project organisation and the project manager got a chance to introduce his planned project team, a time schedule and how he thought communication of questions and information should be handled. The client had their own internal directions in how to handle documents and information within all their projects so the project manager had to adapt to this fact. In the end they agreed upon a way in which the client had one representative to whom Grontmij AB and the project manager should turn.

In the beginning of one of the projects the action description that Grontmij AB put together differed a bit from the design manual that the client had. Together with the client, they made some changes in order to make them more coherent but, the project manager explains, they should have put more effort into this matter. When the designing work begun there were a lot of questions popping up because the information the designers needed did not exist in the material handed to them.

When asked what experience the project manager had gained from this project and what he will take with him to his next project he mentioned a few things. First, he said, he would in the beginning of every project define much more thoroughly than was done in this project what Grontmij AB actually is supposed to deliver, what is actually included in the project and when everything is to be delivered and in what way. The main reason for this, he says, is that in this project the people who agreed upon what was supposed to be included in the project and what Grontmij AB should deliver went on parental leave. This meant that the project manager was left without knowing as specific as needed what Grontmij AB's duties and obligations were. He continues with criticising himself for not being as critical and questioning in the beginning as he probably should have. An early well-defined document containing the expectations on and from both parties concerning communication, delivery, delimitations between actors and so on would have been very helpful, the project manager concludes.

One of the projects is so vast that it is divided into sections and therefore the project was, at the moment of the interview, in the phase of developing both schematics and construction

documents. When Grontmij AB was involved the schematics for their part had already been completed by another firm so their main task was to develop the design and create the construction documents. When Grontmij AB started their work, however, they noticed that the existing schematics that had been done by another firm were insufficient. This meant that they needed to redo some material that they should have been completed before their involvement.

4.2.3 Roles and responsibilities

The project manager has tried to concentrate the external communication through himself, but when more technical questions were raised he guided that person on to the person who had the answers.

Some time before the deliverance of the construction documents there is an increased need for resources in the project, the interviewees explained. The level of detail in the documents is dramatically increased for this delivery and the time is often of the essence.

Sometimes the resources needed in order to make deliveries in time was not available at the home office in Stockholm, which meant that people from other Grontmij AB offices in Sweden were involved.

The organisation of the project is rather flat, the project manager at Grontmij AB explains. He says that the client has one representative to whom he communicates and he then has the consultants from the different disciplines directly below him. There is, however, a design manager for each technical discipline whose responsibility it is to make sure that the project is developed in accordance with the program and the tender. These persons are also in a way responsible for coordinating the work between the disciplines. These design managers are "ordinary" consultants and are selected for each project.

No specific communication plan was established in one of the projects but they did agree upon that the project manager from Grontmij AB should communicate with the client's representative and only if needed guide the question to the correct person. They noticed quite early in the project that the communication within the client's organisation did not really flow as it should but thanks to the early discovery no larger problems came out of it.

4.2.4 Team structure

The person who was in charge of putting together one of the projects' team at Grontmij AB was at the time business unit manager. He talked to the group leaders within his business unit about what resources would be needed in the project, and what resources were available. When he had done this he made an offer including that team to the client. This procedure is common at Grontmij AB but what happened next is not as common. The person in charge of putting together the team was promoted to division manager, which meant that he got new different responsibilities and that he would not have enough time to act as the project manager for this project as well. This meant that the assistant project manager needed to step in, but he was a bit inexperienced for such a vast project, which meant that another person came into the organisation as his mentor. Grontmij AB's part in the project was larger than expected so the mentor almost became the full-time project manager because the assisting project manager was

needed in the design work. In essence this means that the project is neither managed by the people nor in the way that it was first planned. The interviewees say that this has not caused any major problems it is just a lot of work to do.

Grontmij AB's involvement in one of the projects began before the current project manager hade even begun working for Grontmij AB. The people who signed the tender were not available when the actual contract was later signed. The program was already completed when Grontmij AB entered the tendering process. Since the current project manager was not even an employee at Grontmij AB during the tendering process he could not influence or change it. He had to proceed with the project with what was handed to him without having the possibility to affect it, which he found a bit troublesome. Even though he has earlier experience as a project manager he was a new employee at Grontmij AB and had therefore some trouble in putting a team together. At first the business unit manager had to take a part in the project before the consultants were available.

A problem for one of the project managers was that the project team including all different disciplines needed to be put together very fast since he was introduced late in the project. Another issue was that it seemed like the persons who signed the tender had not really understood the project. For instance one of the parts in the tender was a lot smaller than it actually was in the real project. This meant that the project was a bit behind schedule from the beginning. The project manager do not know why this happened but he thinks it might be because the client is important to Grontmij AB and they lost a tendering for a similar project, which meant that they might have gone in a bit low in this tender in order to be sure to get it. Another interesting thing is that none of the people who signed the tender remains at Grontmij AB, the reasons for this the project manager does not know.

4.2.5 Scheduling

In one of the projects a time schedule for the entire project had been made before Grontmij AB was involved so they needed to adapt their pace to that time schedule. The interviewees explain that the organisational structure will change over time because of various reasons such as people quitting or more/less resources are needed and this is no problem as long as you perform your tasks. The time schedule, however, cannot be overrun or changed. That document is a contractual document that will be very expensive to change, they say.

When talking about lessons learned and what the interviewees would do differently in a new project they say that they would make a more detailed time schedule based on a more detailed work breakdown structure (WBS). They also say that they would try to create a resource plan that does not vary as much as it does now because in this project the amount of people working can vary with up to ten persons and they do not think this is efficient, one can probably plan it so it will not vary more than one or two people they say.

In this project they ended up a bit behind schedule even though Grontmij AB themselves had established the time plan. The reason for this, they said, might have been that they did not have enough available resources during the schematic stage. In hindsight they should have been

tougher towards the discipline representatives in order to assure themselves that the resources needed really would be available.

4.2.6 Client involvement

The interviewees at Grontmij AB says that they think the client should have employed an internal project owner who could be at least 50 percent dedicated to the project and could then be involved and lead the tendering process. They admit that even employees at Grontmij AB has their flaws and can make mistakes or choose a way to go which might not be the direction the client wants the project to go. Under these circumstances it is always positive to have a person more or less dedicated to the project representing the client. In one of the projects the project manager at Grontmij AB is at the same time the "project owner" at the client, this makes for some contradictions in his responsibilities.

The interviewees explain that they cannot say for certain that the client at all times has fully understood the issues they have presented. They say that sometimes it felt like the client just agreed with what solutions Grontmij AB had presented without arguing or discussing. Now, with hindsight, they say that they probably should have pushed the client a bit in order to really make sure that they fully understood the problem or issue and what the different solutions would actually mean for the project. They explain that the architectural and design issues are not included in these reflections but the technical questions and problems of the project are.

In one of the projects, when Grontmij AB had any questions there was very seldom a long wait, the client was often very fast with answering.

Grontmij AB did not set any demands on the client's representative except that he or she should be present at all steering group meetings, which he has been.

When asked what challenges the project manager faced in the communication and the relationship with the client he explained that the biggest challenge probably was that it sometimes took too long to get an answer. He continued with saying that it might be because of heavy administration within the client's organisation since it is a governmentally owned company. As an example of this he mentions that the client's procurement of an external entrepreneur, the firm who will manage the building when it is completed, was delayed by three months. This caused even more delay when the entrepreneur actually was procured because they found some flaws in the design that the entrepreneur needed changed.

The client was constantly active during the project, one of the project managers explains.

4.2.7 Information and communication

Not many organisational documents existed in the project says one of the interviewees. There was a half-developed delimitation-list that was constantly updated and there was a CAD-manual. The project manager says that some other developed plans such as a communication and organisational plans would probably been helpful since Grontmij AB was involved late in the project. He continues with saying that there was a document that the design management firm had organised. In this document each discipline filled in what information they needed from what

discipline and at what time they needed it. They then sent it to the design management firm and they in turn made sure that the information was delivered; the document was not put in a database but emailed. After a while they stopped using this document since it was faster and more efficient to just contact the person who had the information they wanted directly.

When asked how the interviewees experience the communication towards the client they say that it had been excellent, no problems at all. However, they also say that the design management firm that has been hired by the client to organise and manage the design phase is not doing what the interviewees think they should. They explain that the design management firm is administering the design works instead of managing and leading it. The design works is however progressing and they say that one of the reasons for this is that all different consulting firms involved in the project knows what they are doing. The design management firm is leading the design works on delivery of completed drawings instead of what information different disciplines need from other disciplines and at what time they need it. Essential information needs to be controlled and managed long before a completed drawing is made. They continue with saying that in the production phase you build it one step at the time starting from the bottom with a foundation then pillars and so on. But in the design phase you build on more or less everything at once. During the design phase all different disciplines are doing their work simultaneously and need therefore certain information at certain times.

In one of the projects there was every other Monday a meeting within Grontmij AB's organisation. On these meetings everybody was heard and updated on what was new in the project and how this could or will affect the project and their work. They say that these meetings could be held every other day because there is so much new information every single day in the project but first of all it is an issue of too much information and secondly it is difficult to gather everybody since they are all working in other projects as well. The interviewees, however, say that the most important information flow is that of the informal kind. The day-to-day chitchat is where most of the information flows.

When asked at what point during the design phase they think that the communication has been most intense they answered "right now". They explain that they had their first delivery of completed drawings two weeks before the interview and that it is before all the deliveries that the communication and the actual work is most intense. They continue with saying that they will from here on have continuous deliveries, which means that it will be intense in the near future. They say that the current "block" in the building that there designing is nearly completed. The remaining part is the installations and when those are done they will have a reference block so that afterwards the work will flow smoother and the intensity will hopefully be lower.

In one of the projects they tried to guide all external communication through the project manager and design manager but if the issues get too technical and specific they connect the persons most suitable for that discussion directly.

The communication was most intense in the beginning of the project when they were trying to establish the client's vision and requirements for the project. There were two meetings where

Grontmij AB and the client sat down and from a blank page brainstormed and started developing the program.

They mentioned the problem of how one can get the correct information to flow but still limit it. The right people needs to be at the right meetings and the correct information need to reach the right person and in the right time, which is not as simple as it might sound, they say.

4.2.8 Additional findings

When talking about what lessons learned, the interviewees have from on of the projects they say that they should have put more effort into making a thorough internal risk assessment when it comes to time plan, budget and so forth.

In one of the projects the major issue the project manager faced in the relationship towards the design management firm was that they wanted drawings from Grontmij AB sooner than was possible. Since the project was behind because the late involvement of the ground works team (Grontmij AB) the design management firm wanted to move as fast as possible, which is understandable but they worked as fast as they could the interviewee explains.

The only checkpoint they had in one of the projects was the delivery date for the construction documents. The scope of Grontmij AB's work had, however, constantly changed, which means that they have at the same pace updated internally what needs to be done. In one of the other projects the only toll-gates were the delivery of the schematics and the construction documents.

In accordance with the time schedule Grontmij AB is supposed to deliver review drawings and they then have three to four weeks to turn them into complete construction documents. This arrangement goes for all Grontmij AB's different tasks.

In one of the projects an organisational chart was developed but has never been revised in spite of the fact that the resources assigned to the project have changed over time.

In one of the projects all the consultants have to keep a project journal, which means that even though protocols and similar documentations are important they are not as important as in other projects since one can always go back and check the journal for hours spent and activities performed.

One of the projects was won on a tender that was not as accurate as one would hope, this made it impossible to avoid changes in the contract. It became an even bigger problem since the project was won on a fixed price. The project manager says that most of the additional work they had to get approved from the client has been approved and, considering the circumstances it, most often, went quite smoothly. This is extra work that should not exist and can lead to relationship problems with the client, he explains.

4.3 Client

4.3.1 Meetings

Every Monday they have an internal meeting at which the design management team (five people), a representative from the client and the responsible architect attends. On these meetings they discuss what happened the previous week and what will and should happened the coming week.

The design manager distributes all information towards the different design firms. He explains that they had design meetings approximately every other week to which all disciplines attended but also the owner. The purpose with these meetings was to keep everyone informed in what was going on in the project overall and in the different disciplines more specific.

Every third week they had a steering group meeting to which the project manager and architect from Grontmij AB, technical engineer and the property manager from the client.

4.3.2 Initial planning

The most important lesson the design manager takes with him from one of the projects is to be more aware in the beginning to make sure that everybody who needs to be involve are. He says that the fact that Grontmij AB was involved late might be the major lesson for the owner, but he himself and his company also needs to take notice of this so they do not make a similar mistake in the future.

The client said that they experienced that the most intense periods of the design phase was the beginning when one need to get the big picture and narrow it down, but also at the end when everything needs to be very detailed the communication was intense.

When looking back on the progress of the design phase so far the interviewees said that the major problem was that they were involved too late. They think that they should have been involved before the tendering of the other design firms. An interesting thing that the client mentioned during the interview was that they were actually involved in the project after the other designing firms such as Grontmij AB. Furthermore, they also said that more people in the design management team would have been helpful, especially because of the information overload. Somebody whose responsibility would have been to organise and structure the information such as documents, project portals, drawings and so on would have been useful.

In one of the projects of the design manager at the design management firm said that Grontmij AB was involved too late in the project. He continues with saying that he thinks his own firm was also involved too late in the project. The owner had already more or less finished developing the program, which meant that the design management team did not have much to add to it, they just had to accept it and move on from that point. The design management firm was procured at the same time as the other design firms, except for Grontmij AB. This means that the only firm that the client could influence the procurement of was Grontmij AB, the other ones they just had to accept.

4.3.3 Client involvement

The project specific organisation on the client's side was quite easy to put together since there is only one person responsible for the different areas, such as property management and road/parks. This, however, means that they have a lot of day-to-day work but also a lot of different projects on each person. In some projects an older mentor has been included to support the ordinary personnel. The technical manager at the office has the end-responsibility for each project and it is also he who delegates the projects to the correct person at the office.

When it comes to the organisation at Grontmij AB the client has not involved him- or herself at all, they say that it was Grontmij AB's responsibility to make sure that they had enough resources to manage the project in time and within budget.

The client says that they did not really involve themselves in the way that they were constantly checking that Grontmij AB was doing their job correctly. They say that since they had design meetings every two weeks they either waited for these meetings or for Grontmij AB to contact them with questions in between. It was only at some points when the client was a bit concerned if the all the information had actually gone through to Grontmij AB that they contacted them to make sure that everything was as it should.

4.3.4 Information and communication

The interviewees experience that the major problem in communication is the amount of information flowing. Often there is an information overload and it is sometimes hard to screen what is actually important and what is not. There is, however, a communication plan developed, they say. It explains what on what routes the information should flow.

In one of the projects the design manager at the design management firm thinks that the owner should have, in collaboration with them, developed an overall communication plan for the entire project, but this did not happen.

The design manager has experienced the intensity of communication during the design phase overall high, it has been more or less equally intense during this period, he says. At the point when Grontmij AB was involved he says that it might have been at bit more intense because they needed to get them up to speed but the communication never suffered because of it. He continues with saying that one just needs to plan as good as one can and make follow-ups on how it worked out.

In the relationship and communication towards Grontmij AB the client explains that they felt it sometimes took too long before they got an answer to some questions. For instance, they mention an issue of how to shape and construct a specific part of the building took a couple of months during which period they had meetings every other week so the topic was up for discussion on a couple of these meetings. During these meetings new conditions concerning the matter where brought up from Grontmij AB and so the time flew by without a decision being made.

In one of the projects no communications plan was developed for the project since the client's organisation more or less only consisted of two persons. The ways of communication became natural so no agreements needed to be made.

The client thinks that Grontmij AB has been handling the feedback to the client poorly. They say that functions that the client was certain would not be changed suddenly had been changed in an updated design drawing. Most of these changes were motivated and logical but the fact that they had not been told beforehand was not appreciated, the client explains. It would have been better if they had been informed on what Grontmij AB was drawing and designing during their work and not after it had been done, they say.

4.3.5 Additional findings

The client expressed that even though they are responsible for organising and managing the design phase they are not the ones who set the pace and direction of the project, those guidelines come from the owner. The owner is also constantly trying to make the organisation work smoother and more efficient. One thing that they recently have introduced is that you only have ten days after you have gotten sufficient information before you need to make a decision, the interviewees explain.

The interviewees say that they created a time schedule that describes the deadlines when different disciplines need to be finished with specific parts of their work because other disciplines need that information. They manage this through a document that they call a schedule of decisions that they have put on a project portal. Every other week there is a time schedule meeting at which questions of deadlines are raised and the document updated.

In one of the projects the owner is very experienced in the construction industry and has therefore an internal project team. They also have a delimitation list of what is their own responsibility and what is the design management firm's. The owner had also said that they wanted one project manager and one design manger from the design management firm. The fact that they decided and did not let the design management firm offer an organisation is also an indication that the owner is an experienced one.

The interviewee says that, contractually, all the consultancy firms are under the owner's responsibility but in terms of communication they should go through the design management firm. He also says that since the owner is experienced it is easier to communicate with them.

The design manager at the design management firm says that in the beginning of Grontmij AB's involvement the communication could probably have been better organised and clearer. He says that it was sometimes unclear what was actually included in Grontmij AB's contract. The contract should have been written in more detail, he says. Another option would have been to use a contract form that would allow changes of the scope of Grontmij AB's work to be made more easily, now it became quite tedious when the scope grew, he explains.

According to the design manager for the design management firm the owner thinks that Grontmij AB's work has been too costly, it is noticeably higher than the other design firms. This,

however, can in part be because of the fact that their drawings are more detailed than the other firms', he explains. Though, he says, the design of the plumbing took a bit too long and was not executed professionally.

One of the design managers explains that you expect every discipline and design firm to take responsibility for their work and that they will do what they signed up for. He says that he does not think Grontmij AB kept the pace of the project, even considering the fact that they were included too late in the project. Maybe they should have made an even more detailed WBS in order get a more detailed time schedule with more frequent checkpoints, he says. That goes for the entire project and is not limited to Grontmij AB, he continues. He explains that they might have been able to achieve this through a schedule of decisions that one develop early with information concerning what discipline needs what information from who and at what point. This list would then constantly be updated during the project's progress.

The client said that they have learned that they need to be clearer with the economy and the budget of a project. Make sure to constantly ask for budget reports from Grontmij AB (or what other firm it might be) so they can get a good overview of how the project is developing. This also puts some pressure on Grontmij AB to actually keep a constant control of the project budget. They say that there has become a gap between what was actually supposed to be built and the budget for it and they think that Grontmij AB should have been able to review the program and made a better internal investigation so that in the end the budget would be kept.

One of the clients says that the design phase for the project has been prolonged too much; they think it could have been done more efficient.

5 Analysis and discussion

5.1 Client involvement

The main advantage with implementing Agile management in the design phase of a construction project seems to be the involvement of the client. In the end it comes down to the client's happiness and satisfaction with the end result, so if the client is constantly involved and able to make changes to the product while the project is growing, I think it would lead to more successful projects. We all know how difficult it is to have a vision, and then explain exactly how you are going to get from where you are today and reach your goal in the specific detail. We could all give a vague estimate but we all know it is almost impossible to predict what will happen in the future, and thus impossible to plan very detailed future steps. The larger and more complex the vision or goal is the more difficult it gets to plan the route towards it. The Agile approach lets the client think about the vision and the goal and most importantly about the details and specific solutions for the project during its progress. This, however, puts more responsibility on the client than in most construction projects today. It also demands more from the client because they need to dedicate more time and resources to the project than they are accustomed to.

Some of the employees at Grontmij AB said that they would have wanted a project owner within the client's organisation. This person should be at least 50 percent dedicated to the project, they said. The theory clearly explains how important the involvement from the client is. If the client does not involve themselves then the project may take a non-desirable direction because of the lack in communication. The client can also be motivated to be involved by the fact that it is their vision that is supposed to be fulfilled. According to the Agile theory the client should constantly be involved and has a duty to make sure that the requirements or product backlog is updated and prioritised. This opens up possibilities for the client to constantly make changes in the product to make it fit their vision even better.

Furthermore the theory clearly states the importance of the client's involvement and that a project might fail without it. In the Agile approach the client is more or less forced to be involved because the developing team will constantly need updates on the product backlog and the prioritisation of the requirements, but also constant reconciliations with the client.

5.2 Meetings

As mentioned, one can with Agile management work in cycles that last from a week to four weeks. Within one of these cycles, there are daily stand-up meetings in order to get fast and efficient check-ups on what has been produced the current day and things that need to be done the upcoming day. When reading the interviewees descriptions, it appears to be quite similar to the Agile strategy. One can set up cycles of, for instance, two weeks and at the end of every cycle have a meeting, a design meeting, at which the progress is discussed and the recent cycle is evaluated. Then either a new design meeting is held in order to plan the next cycle or these two occasions can be combined to a single meeting of evaluation and planning. The smaller meetings that do not include all disciplines can translated to the daily stand-up meetings in the Agile approach and will then occur more often than they did in the studied projects which is also what the interviewees think is necessary.

In combination with a project room, this could be an easy and effective way of executing a design phase. The biggest problem with all these meetings and the project room itself is that the consultants who are active in the project are often involved in other projects or might be at a different location. This would make it more difficult to take advantage of the project room and get everybody to be involved in the meetings. As explained in the theory of Agile project management this does not make it impossible to get use of the Agile approach anyway.

Overall the interviewees' attitude towards meetings is scattered. Some of them think it necessary and there should be more of them while other mostly consider them to be a hassle that should be avoided. According to the findings it seems that there is a need to have meetings but the reason that the opinions differ may be that some meetings are a waste of time because they are not well-organised nor are the right persons attending it. I think that the Agile approach can aid this problem since it uses a structured way of conducting and planning meetings. Through scheduling the daily stand-up meetings and to have a set time frame for each cycle that ends and starts with a review as well as a planning meeting a structured process is achieved. This also lowers the uncertainty in the project since all participants are periodically update on the progress and status of the project.

It seems like the daily scrums, or daily stand-up meetings, can contribute to lowering the uncertainty and risks in a construction project. The three questions that should be answered during each of these meetings, and especially the third question *what obstacles are in the way?* will contribute to constantly keep an updated view on what problems might occur in the future and they can therefore be managed in before escalating.

5.3 Communication

The interviewees often wanted the communication to pass through the project manager or the design manager. This is because they need to be updated in all matters that occur in the project and also because there might be questions that can be answered quickly by the manager. Within Agile management the scrum master's main responsibility is to keep the project team away from all external disturbances so they can work without being disrupted. By controlling the flow of information in and out of the project team the project manager can help keep disturbances to a low.

In the theory chapter the importance of a good combination of information and communication is explained. When reading what the interviewees have said one can find that it is very seldom that a communication plan has been established in a project and at many times they "blame" it on the fact that it is such a small organisation so the communication paths come naturally. Even though this might be true, a communication plan is meant to explain more than that. Another benefit with establishing a communication plan can be if new actors are being involved late in the project, as in some of the projects studied. At these points it would be easier for the new actor to get up to speed on the project and become an asset if they are informed on how they should communicate in the project.

The importance of correct and explicit information at the right time has been addressed in the theory chapter, and the findings above show examples of how important it is that the information is not only transmitted but also received. The communication between the different parties is of the essence in every project. The research made has given me the indication that the industry often focuses on information rather than communication. Sometimes this is of course the correct choice, but most of the interviewees also had negative experience concerning the communication within the project. The agile approach focuses on the people and the communication between them and this seems to be a subject where the construction industry could benefit from embracing the Agile approach.

5.4 Program and product backlog

Some of the employees at Grontmij AB experienced the program phase as the most intense period, which is a good indication since it is very important. If the programs for the studied projects were perfected or not is hard to tell, but if they experienced that period as the most intense there is good reason to believe that they put a lot of effort into it. On the other hand, in some projects, they did not keep to the time plan even though they produced a detailed program. They say it might have been caused by the lack of internal resources and bad communication. This shows the importance of distribution of information and communication since they had a thorough program but did not manage to communicate the importance of the availability of resources in the near future.

As explained earlier, there is a document called product backlog within Agile management, which is created at the beginning of a project. This backlog is developed in collaboration with the client and is similar to a program in the way that it also consists of the client's requirements. Since this backlog is the foundation of the entire project, and therefore also the base for all planning, it is of the essence to develop it as thoroughly as possible.

The interviewees mention that, before deliveries, there is a larger need for resources and that it can vary by ten people. One of the projects did not keep the time schedule and they explained that one of the reasons for this might have been that they sometimes lacked the resources to keep up with the time schedule. They also say that they do not think it is necessary for it to be like this, it is just a matter of better planning. The importance of the program, or product backlog in the Agile approach, has been explained in the theory chapter. With a better and more detailed program, or product backlog, one can at an earlier time know more accurately the amount of resources that will be needed at what points in the project and hence be able to secure those resources.

To produce a more accurate time schedule is another thing that many of the interviewees mentioned. Some of them said that this might be possible to achieve through a more elaborate WBS. The theory of Agile management explains the importance of developing the product backlog, or program. A backlog that is constantly updated and slowly implemented into the project can help establish more accurate time schedules.

5.5 Initial phases

In almost all cases the interviewees felt that Grontmij AB was involved too late in the project. The effects differ somewhat but it puts an emphasis on how important it is to, from the beginning, establish what parties needs to be involved and when, in the project.

A recurring opinion amongst the employees at Grontmij AB was that they felt they should have made more of an effort in the beginning of the project. Some of them say that this is one the lessons they have learned, to really elaborate on the scope of the project and define which disciplines need to be involved and at what time. Also to establish and define the roles and the delimitations between them as thoroughly as possible and as early as possible. These thoughts can be found in both the theory of Agile management and the theory concerning the construction industry. This is clearly something that is worth doing properly since the two theories both say so, and it is something that the interviewees themselves have reflected upon. In practise, however, it does not seem to be that prioritised. In the beginning of a project the Agile approach focuses on the developing a solid vision for the project and to establish a well-developed communication plan that includes scheduled and structured meetings so that the project starts off with a solid foundation.

5.6 Contractual form

One of the interviewees representing the client said that Grontmij AB was involved late in the project and after a contract had been signed there was a lot of changes to Grontmij AB's assignment. These changes led to extra administrative work and expenses. He said that it might have been avoided if the contract had been written in more detail or if the contract had been written in a way that would allow changes. A contract that would ease the administrative work and expenses of change. The first, more detailed, contract is something that is referred to in the theory chapter and is explained as an obstacle for implementing Agile management since one of its main principles is to embrace change. The other more flexible contract, would be of more use in an Agile project.

5.7 Constant improvement

In the findings one of the client interviewees says that it in the end always comes down to planning and then doing follow-ups on how it worked out. It is the last part that interests me because this is more or less what the Agile approach is about, to plan some time in to the future, do a follow-up afterward, learn from it, and then improve it in the future.

The Agile approach is beneficial in the way that a project can start off only using some of the approach's methods and then during the progression of the project either start using more of its methods, change the use of the current methods or maybe stop using some of the current methods. Because of the use of cycle were one, in between, evaluates, improves and change the process that is currently used allows the project to constantly improve its efficiency.

In the theory it is described that in order to be able to improve something one need to standardise it so one knows what to improve. From the findings it appears as there is often confusion in how to manage projects and what the process actually looks like. This is something

that definitely can be defined and standardised without the use of Agile project management but this approach is already defined and standardised which allows for improvements earlier than if one first need to standardised the current process. It also seems like the Agile approach can at the same time contribute with other benefits.

5.8 Time management

Another aspect in the Agile approach that can be of value in the construction industry is the way that it uses time management, with time as the most important factor that cannot be altered. Many construction projects nowadays use time management as well, but it is the specific way that the Agile approach uses it that can benefit the construction industry. Through clever planning at different levels with different time frames it all comes down to small tasks that only take a couple of hours to perform. This gives you a tool to more efficiently assess how the project is progressing, if it is lagging behind, or if it is going better than expected.

5.9 Differences

Something that needs to be taken into consideration is that the Agile approach in some ways differs quite a lot from the way construction projects are executed today. For instance the decision-making process will change if one switches to Agile management. Some of the authority for making certain decisions will be transferred from the project manager to the project members. This change might not agree with some of the project managers that will lose control over the projects. This is, however, only a question of trust and it requires some getting used to. Hopefully the project managers have the company's best interest in mind and should therefore do what it takes to improve the results.

The theory states that employees are motivated by been given an appropriate level of responsibilities but that is also matched with an appropriate level of authorisation so that they have the mandate to perform their own tasks. The Agile approach transfers some of the decision-making from the project manager to the project team members and this according to the theory will make them more motivated and dedicated to the project. This approach shows trust and respect and that can motivate anybody.

6 Conclusions

This chapter, as its name implies, will conclude this master thesis and answer the research question.

6.1 Question

What opportunities and benefits will come from implementing Agile project management in the design phase of construction projects?

6.2 Answer

The major advantage or benefit with implementing Agile project management in the design phase of construction projects is the increased client involvement. Through the way planning and executing an Agile project the client will more or less be forced to increase their participation in the project because the project developing team will require it.

Implementing Agile project management will also increase the client's satisfaction with the end result. This is because the way this approach manages the product backlog including the client's requirements on the project. The client is obligated to both constantly prioritise the existing requirements and also update the list with new and more specified requirements. This will lead to a product that the client in the end will be more satisfied with because they have been able to change their mind during the progression of the project and also adapt their product to the changing market or project conditions.

The way that the Agile approach uses time management will give the industry a tested tool in keeping track of the project's development, progression and status.

The Agile approach will also motivate the personnel since they are given more responsibility, but more importantly an appropriate level of authority. This can in the end lead to better developed projects and products since the people developing the project feel more motivated to perform it as best as possible.

The Agile approach may be easier to implement than other approaches since one can start off small and then constantly add to the amount or improve the current process and tools used.

The Agile approach also focuses on the earliest stages of a project where one really needs to get to the bottom of what the client is looking for. It focuses on developing a solid vision for the project and establishing a thorough communication plan.

To summarise the implementation of Agile project management in the design phase of construction projects can decrease the uncertainty and aid in managing the risks. It can help structure and organise the design phase by scheduling well-planned meetings, using time management and increasing both the client's involvement and the team member's motivation.

6.3 Recommendations

First I recommend Grontmij AB to educate a few dedicated people in the Agile philosophy. They should also be educated in key-roles such as the scrum master and product owner. These roles are especially important since they together can be compared to and replace the current project manager. The role of the scrum master is the most important to educate since the product owner can with benefits be chosen from the client's organisation. When testing the Agile approach for the first time, however, it might be better to keep that role within your own organisation since the client may not completely agree on the new working method chosen.

Grontmij AB is further recommended to start using the Agile approach in one discipline. In regular manners, a team should be assembled within this discipline. To aid the project team in their work a project room is also recommended. This, however, does not need in itself to be a physical room, it could also be an area in the office environment where the team can gather. At this area there should also be a project board, explained in the theory, where the team can keep track of prioritised tasks by using for instance post-its.

Grontmij AB should choose a project that is similar to a previous one, to use as a reference. They should use the Agile approach when executing the design phase. There is no reason to call it a pilot-project or a test-project because this will only be an excuse if the project fails. The project members may not mentally embrace the new philosophy completely if they think it is a pilot-project. Grontmij AB should just say that in this project we are going to work with the Agile approach and we are going to succeed.

The major advantage with the Agile approach, which has been mentioned, is that one can in a project start out with small changes and constantly include new methods or tools at your own pace. This makes it less risky to start the implementation of this approach since one, first of all, can stop using it and go back to the "normal" approach or can constantly improve the process one have started to implement.

7 Future research areas

In order to fully understand how the transition from today's way of conducting construction projects into the Agile way a "translation" from the Agile approach to the construction industry needs to be investigated and developed. It should firstly include the different roles and their responsibilities and authorities and how the way handling and conducting meetings will change.

The Agile methodology can be connected to usage of BIM (Building Information Modelling). This subject is, however, too large to be included in this thesis and is therefore not discussed but would be of interest to investigate further in the future.

As mentioned in the introduction of this thesis the subject of organisational change and implementation of a new management method is only briefly discussed in this master thesis and is therefore of interest to explore further and elaborate on.

This master thesis has discussed the subject of the use of Agile project management with a general and more holistic perspective. A topic for future research can therefore be to focus on a smaller part of Agile project management and what useful areas it might include when implemented in the construction business. Another topic can also be to focus on related subjects, such as customer satisfaction or efficiency, and examine if and how these can be improved with implementing Agile project management.

A delimitation of this thesis has been to focus on the design phase of a construction project. It can therefore be of interest to investigate further if other phases can benefit from implementing Agile project management.

Another interesting aspect to further investigate is the mind-set of the construction industry. Is the industry ready for a change or will any attempts of change be met with resistance and rejected?

There is today a contract form that favors partnership and uses a sort of coach to constantly make sure the different parties stick to the collaboration agreement that was signed in the beginning of the project. This contract form is used more and more used. It is also a contract form that would complement the Agile approach well and it might therefore of interest to investigate further.

8 References

8.1 Literary

Dainty, A. et al., 2006. *Communication in Construction*. Abingdon, Oxon: Taylor & Francis.

Ghauri, P., Grønhaug, K., 2010. *Research Methods in Business Studies*. Fourth Edition. Edinburgh Gate, Harlow: Pearson Education Limited.

Gould, F., Joyce, N., 2009. *Construction Project Management*. Third Edition. New Jersey, USA: Pearson, Prentice Hall.

Gustavsson, T., 2011. *Agil projektledning*. First edition. Stockholm, Sweden: Sanoma Utbildning AB. (Author's translation of the title: *Agile Project Management*)

Hass, K. B., 2007. "The Blending of Traditional and Agile Project Management". *PM World Today* Vol. IX, Issue V.

Hawkins, C., 1997. *First Aid for Meetings*. Sedona, AZ, USA: Seahawk Associates

Jacobsen, D. I., 2011. *Organisationsförändringar och förändringsledarskap*. Edition 1:10. Lund, Sweden: Studentlitteratur AB. (Author's translation of the title: *Organisational change and Change Management*)

Liker, J. K., 2009. *The Toyota Way – vägen till världsklass*. Malmö, Sweden: Liber AB.
(Original edition: Liker, J. K., 2004. *The Toyota Way: 14 management principles from the world's greatest manufacturer*. New York: McGraw-Hill.)

Poppendieck, M., 2002. *Principles of Lean Thinking*. Eden Prairie, MN, USA: Poppendieck.LLC

Segerfeldt, C-H., 2002. *Ledarskap stavas kommunikation*. Edition 1:1. Malmö, Sweden: Liber AB. (Author's translation of the title: *Leadership is spelled Communication*)

Tonnquist, B., 2006. *Projektledning*. Second edition. Stockholm, Sweden: Bonnier Utbildning AB. (Author's translation of the title: *Project Management*)

Winch, G. M., 2010. *Managing Construction Projects*. Second Edition. Chichester, West Sussex, UK: Wiley-Blackwell.

Örtenblad, A., 2008. *Organisationsfrågeboken – en bok som ställer frågor snarare än kommer med enkla svar*. Edition 1:1. Lund, Sweden: Studentlitteratur AB.
(Author's translation of the title: *The Organisational question-book – a book posing questions rather than giving simple answers*)

8.2 *Internet*

Agile Sweden, 2012. *Om Agile* (Author's translation: *About Agile*), http://www.Agilesweden.com/, (2012-03-07)

Beck, K., et al. 2001. *Manifesto for Agile Software Development*, http://Agilemanifesto.org/, (2012-03-08)

Berteig, M., 2012. *Agile Work Uses Lean Thinking.* Berteig Consulting Inc., http://www.berteigconsulting.com/ , (2012-03-26)

Grontmij AB, 2012. *Description of the company*. http://grontmij.com/Pages/design-engineering-management-consultants-grontmij.aspx , (2012-05-20)

Linkner, J., 2011. *The Downside of Traditions.*, http://www.inc.com/articles/201107/josh-linkner-downside-of-traditions.html , (2012-05-02)

Schwaber, K., Sutherland, J., 2011. *The Definite Guide to Scrum: The Rules of the Game.,* http://www.scrum.org/storage/scrumguides/Scrum_Guide.pdf , (2012-03-20)

Softhouse, 2012. *Scrum in five minutes.* Softhouse Consulting., http://softhouseeducation.com/material/scrum-fem-minuter , (2012-03-20)

8.3 *Figures*

Gould, F., Joyce, N., 2009. *Construction Project Management.* Third Edition. New Jersey, USA: Pearson, Prentice Hall., pp.119.

Gustavsson, T., 2011. *Agil projektledning.* First edition. Stockholm, Sweden: Sanoma Utbildning AB. (Author's translation of the title: *Agile Project Management*), pp.48, 129.

Waterfall Model, 2012. *Waterfall Model.* http://www.waterfall-model.com , (2012-05-04)