

The Optimisation of the Initial Phase of The Project Process

with a focus on information, communication

& requirement management

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Preface

This master thesis is an important step taken after my bachelor studies in Architecture. The experience together with what I have learned is very valuable and with no doubt going to be used in the future of my career.

I would like to thank everyone that has contributed to this work and for the muchappreciated help throughout the master thesis. Special thanks go to my examiner from Chalmers, Mattias Roupe, for all of your guidance, important support and motivation. I would also like to thank my supervisor, for the help with giving feedback and planning the interviews. I thank my family and friends for their moral support. Last but not least I thank all the interviewees for devoting time and effort into answering the interview questions as good as possible.

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Abstract

The initial phase is the first phase of the project life cycle and it plays an important role since it deals with vast amount of information and documentation, which becomes the evidence of the project. The initial phase has a great impact on the effectiveness of the project progress and the success of the project outcome. Inefficient and ineffective management of these three areas results in a high risk of project time delays and project over costs. Therefore it is the benefit to all stakeholders for the management of the initial phase to be as efficient and effective as possible.

This study looks into how the initial phase of the project process can be optimised through information, communication and requirement management. Furthermore this study investigates if there could be a defined structure to be applied in every project in order to achieve effectiveness. This study also looks into what challenges are faced in the Swedish construction market related to information, communication and requirement management. Furthermore, the matter is approached with a broad perspective and should be seen as a foundation and guidance for future detail studies. In addition, all relevant life cycle phases are overviewed with the belief that efficiency in the initial phase is achieved when it is consistent throughout the project life cycle.

The result of this study is based on 6 detailed interviews conducted with representative employees in a consultancy company. These employees are in various positions related to construction. By discussing the results with the comprehensive theoretical framework of this study, this study finds that the management of information, communication and requirements are dependent on various factors. The most dominant two factors are the client and the project manager. This study shows that the optimisation of the initial phase is possible by developing frameworks for the different conditions that the client and the project manager create. The idea of a defined structure to be used in every project is discussed and supported by various authors. The challenges faced in the Swedish construction market are identified and it is recommended to take these into consideration to gain quick and beneficial results in the company. It also recommended to study project delivery systems (design build and design bid build) and to develop management structures accordingly. Furthermore using the wide approach that this study presents of the matter to develop structures for optimisation is recommended.

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CHAPTER 1

Introduction

1.1 Background and problem description

The initial phase is the first and also the most information-processing phase of the construction project life cycle (Yunna 2007). Various amounts of information are collected and distributed between project stakeholders such as the client, the project team and other external stakeholders. The initial phase is important since project documents that are created are further on used as fundamental evidences for the project (Yunna 2007). Additionally the quality of the project progress is dependent on this phase since documentation structures, information distribution methods and communication channels are settled and used during the project. Furthermore, noneffective progress methods could result in time delays and over costs. It is therefore critical to manage the information and communication in an efficient way, however there are many difficulties and challenges faced during the process. For instance the large amount and complex project information are difficult to manage since it needs to constantly be in an exchange process due to upcoming changes and additions in the project (Yu & Shen 2013). Additionally information also involves to be communicated between stakeholders. It is also a challenge to ensure stakeholders correctly understand the information, since the documentations can be in different technical languages. Moreover the selected communication tools are of importance since verbal, non-verbal and tacit information needs to be communicated for a clear understanding (Jallow et al. 2014). Another difficult aspect that affects the effectiveness and efficiency of the project progress is the involvement and experience of stakeholders. For instance some projects that lack involvement lead to a higher risk for the project outcome to not be consistent with the initial project objective (Jallow et al. 2014).

The various aspects of the initial phase create situations that shape the progress of the project; moreover being aware of these aspects is a great deal in order to control the process. Although the initial phase is of great importance, in order to manage these aspects (e.g. information, communication) better it is necessary to overview all phases of the project life cycle, since effectiveness of the management of the initial phase shows itself throughout the other life cycle phases (Jallow et al. 2014).

1.2 Purpose

The aim of this master thesis is to investigate how information, communication and requirement management can optimize the initial phase of the project life cycle. This investigation is intended to guide the interviewed company for further efforts in optimizing the process handling.

1.3 Objective

The objective is to give an overall and clear understanding of the practical reality by approaching the matter with a broad perspective in order to ensure consistent effectiveness and project efficiency from the start and to the completion of the project.

1.4 Research Question

How can the initial phase of the project process be handled efficiently with information, communication & requirement management?

Can there be a defined structure to follow in every project in order to optimise requirement management of the initial phase?

What are the challenges of managing requirement, information and communication in the Swedish construction market?

1.5 Limitations

The interviews that the results of this study are based on contain the practice of the representative company employees. The practice involves various aspects and are somewhat perceived differently by the professionals. Consequently a limitation has been taken by selecting suitable employees to reflect the matter of this study as best as possible.

1.6 Disposition

The report begins with presenting theoretical framework, from which this study is based on. The theoretical framework starts by describing design and construction project processes and introduces two recognized project life cycles, one from international literature and one from Swedish literature. Thereafter a review of information management takes place and is followed by section of requirement management. Client requirements, which is an important part of the information of the initial phase is introduced. Afterwards the initial phase is presented more close and the challenges faced related to information, communication and stakeholders are presented. Thereafter, the methodology chapter is presented, where it is described how the study is conducted and the methods used to obtain the results that will answer the posed questions. The results and discussion chapter presents the results conducted from the interviews. The chapter is divided according to the interview questions and every result is followed by a brief discussion. Following this chapter comes the general discussion. The chapter of general discussion discusses the results by using the theoretical framework presented in this report. The study concludes with some summarizing conclusion where the reports main points are presented and with recommendations for further research and for the company.

CHAPTER 2

Theoretical Framework

This chapter presents four major sections. The first part, present the design and construction project process and two recognized project life cycles, one from international field and one from the Swedish field. In the second part theory about information management and requirement management is presented, by including client requirements with the purpose to view the relationships of the concepts in the project life cycle. The third part presents the initial phase in more detail and views the challenges found in theoretical literature. The last part presents BIM and requirements shortly to address how the discussions connected to BIM are made through this report.

2.1 Design and Construction Project Process

A construction project is complex and includes various levels of details of information and different phases (Baldwin & Bordoli 2014). The complexity is more or less because of the physical constraints, the size of the project, the technical complexity, the contractual agreements, the range of client-consultant contractor relationships and the general 'one-off' nature of the project (Baldwin & Bordoli 2014). The 'one-off' nature means that every project is unique. During the different phases of a construction project, from start to the completion and handover of the project, a big number of interests of the stakeholders are affected (Olander 2007). Therefore the selection of processes to proceed with in the construction project is vital. What is more important is the selection of stakeholders, since working together as a team affects the delivery's quality and success. Managing a successful project is easier with stakeholders working together with well known responsibilities (Oberlender 2014).

A design and construction project process develops by going through more or less three phases (Oberlender 2014). These phases are project definition, design and construction. Nevertheless there are more stages in a total project such as the business planning stage that happen before design and the operations and maintenance stage that happen after construction. The project definition phase (also mentioned as project initial phase) includes the procedures to understand, identify and follow project requirements and project limits. The main focus is on the client's requirements and limitations. Moreover the designer and the contractor have the responsibility to collect and manage client requirements and limitations. The assessment phase of the requirements and limitations leads to a project description and has a role in identifying a plan for budget and time in terms of delivering the project (Oberlender 2014).

2.1.1 Project life cycle

When planning a project the main aim is to run a project successfully and to get successful results. In order to reach the goals that leads to success the tasks need to be clarified, progress needs to be monitored and the objectives of the project needs to be determined. The steps for achieving these goals are all part of the project life cycle. A cycle consists of various phases, from beginning through completion to operation. The specific characteristics of these phases, the duration and the total time spent for the whole project varies according to the type of industry and the type of project. The exact number of phases and the start and end of the phases depends on the organisation that has created the project life cycle framework (Baldwin & Bordoli 2014). The project life cycle in construction generally involves three main actors; the owner (also referred as client), the designer and the contractor (sometimes referred as constructor). Each actor's responsibilities throughout the life cycle vary depending on the type of project plan and the contract form (Project Management Institute Inc 2000).

Two recognised project life cycles, one from Swedish literature that is Bygghandlingar 90 and one from international literature that is The PmBok Guide, are chosen and described. Furthermore, the PmBok Guide is used by the company.

2.1.1.1 The PmBok Guide

The PmBok Guide draws attention to the fact that the project life cycle phases vary depending on the project delivery systems, which are design-bid-build and design-build (Project Management Institute Inc 2000).

a) Design-bid-build (DBB): The owner or the representative of the owner prepares plans and specifications that any contractor would understand when reviewing. A contract is then signed with the lowest cost qualified bidder.



Figure 1: Typical DBB Project lifecycle *only client/owner involved **owner/client & contractor involved (Project Management Institute Inc 2000)

b) Design-build (DB): The owner or the representative of the owner prepares half done plans and specifications and then recruits a contractor to complete the design and to construct the project. The design is often continuous while construction is in progress and this type of project delivery system may come in different forms such as build-operate-transfer (BOT) and design-build-operatemaintain (DBOM). The main advantage with DB is an earlier completion date.



Figure 2 Typical DB Project lifecycle *only owner/client involved **owner/client & contractor involved (Project Management Institute Inc 2000)

Most of the project life cycle phases consists of five main phases and each of these phases can be viewed as a project themselves since they involve many operations. These phases are (Project Management Institute Inc 2000);



Figure 3 PmBok project life-cycle process (Project Management Institute Inc 2000)

- 1. Concept phase: This phase is also referred as the feasibility phase, and it ends with completion and approval of the project.
- 2. The planning and development phase: The concept, which is defined with more detail, and basic drawings are provided together with a schedule, budget plan, work plan. The client (the owner) approves these and therefore the basis structure for the project is provided
- 3. The detailed design phase: All the design details, drawings and specifications are completed and ready for construction. It is decided at this phase is whether the DB project delivery system or DBB project delivery system is used.
- 4. Construction phase: The construction happens in this phase
- 5. Startup & Turtnover: When the construction of the project is completed the startup operations for final testing happens at this phase and afterwards turnover to the owner/client (Project Management Institute Inc 2000).

2.1.1.2 Bygghandlingar 90

Bygghandlingar 90 chapter 8, addresses the phases under four categories by stressing that the related activities may overlap and change order depending on the nature of the project (Swedish Standard Institute 2008).



Figure 4 Project life-cycle process of Bygghandlingar 90 (Swedish Standard Institute 2008)

1. Pre-study phase

The clients, whom in some projects are the users, define their needs and wishes at this stage. The client provides the project manager all relevant information about the requirements and their business. An activity program and a spatial program are created. The activity program contains the required functions of the building and the spatial program addresses the space needed for the business. Thereafter a cost estimation of the project is performed.

2. Design phase

The information collected in the pre-study phase serves as a foundation for creating a framework for the design. The level of detail of the information develops through the phase. A tender enquiry document is created from the reviewed and coordinated documents. The contractor reviews the documents and presents all necessary information for the stakeholder that is responsible for the construction.

3. Construction phase

At this phase a contractor develops a time schedule, a budget, a list of quantities and a cost estimation. This guides the purchase and selection of materials and services. If a change is required in the design, the design team and the contractor update the information.

4. Operational phase

This phase involves the management and the activities for the maintenance of the completed construction. The time span of this phase depends on how long the construction is going to be (Swedish Standard Institute 2008).

2.2 Information Management

The construction process usually involves a large amount of information, including project requirements, with a high level of detail. Additionally, a big number of contractors and subcontractors constantly shares information and design in large construction projects (Jallow et al. 2014). The information is in forms of drawings, specifications and bills of quantities generated in paper. As a construction project is complex it is also difficult to receive, allocate and manage the big volume of information. Experience to a level is required together with professional skills. The responsibility, which is needed for a successful and satisfying construction project, is firstly establishing well functioning communication methods that all the actors know how to use and when to use. Secondly it is creating and operating change control procedures and thirdly it is to follow up all decisions that are taken through the project and check if it's consistent with the program (Jallow et al. 2014).

The construction project is a living process, in other words it is a process that includes many decisions-making meetings and changes that needs to be done. It is vital to document every detail in order to ensure that no information is absent and that information is easy to find, because the documented information is very useful when it comes to feedback procedures, claims and risk management. There are various methods and tools to collect and document information however the amount and type of information depends on the building type (Kiviniemi 2005).

2.2.1 Requirement Management

A part of the vast amount of information that is dealt with in construction projects are requirements. Requirements are the definitions of "what is required" and "why it is required" (Kamara et al. 2000). Requirements often come from clients or end-users, in other words stakeholders that are in possession of reasons and resources to start a construction project (Jansson et al. 2013). However there are also governmental regulation related requirements that come from the municipality.

There are often changes in a construction project process and these changes can lead to over-cost and time delays. According to Jansson et al. there are several benefits of requirement management (2013). Requirement management allows handling the process so that the changes are minimised and the working team are integrated. Requirement management controls the transparency for different design alternatives against the functional requirements (Jansson et al. 2013).

There are various projects and depending on the project type the requirements involve information in bigger or smaller volumes. However requirements can be sorted into 7 different groups, as shown in the Table 1 (Kamara et al. 2000). This helps understanding the requirements and how to manage them. Some examples of the requirements such as net area, activities, security, desired materials, conditions such as daylight, lighting, temperature and sound level (Kiviniemi 2005).

Requirement types	Definitions
Client requirements	Requirements of the client that describe the facility and satisfies the client's business needs. Includes end-user requirements and those of other interest groups
Site requirements	These are the characteristics of the site on which the facility is going to be built (e.g. ground conditions, existing services)
Environmental requirements	These describe the immediate environment surrounding the proposed site for the facility, such as climatic factors
Regulatory requirements	Building, planning, health and safety regulations and other legal requirements. These influence the acquisition, existence, operation and demolition of the facility
Design requirements	The requirements for design that are a translation of the client needs, site and environmental requirements. They are expressed in a format that designers can understand and act upon
Construction requirements	The requirements needed for actual construction
Life cycle requirements	These requirements are for operating and maintaining the facility, including those for disposal or recycling.

Table 1: The different requirements represented in a construction project (Kamara et al. 2000)

In a real project it is seen that it is difficult for all the stakeholders to be aware of all requirements and keep track of them. Moreover it is challenging for the project managers to know the connections of the requirements to each other and the relationships to the design solutions. The difficulties are mainly due to these characteristics of requirements in a construction project;

- The amount and complexity of project information
- The duration of projects
- The need for designers to work simultaneously on many projects
- Changing stakeholders in different project phases
- Shifting design focus, e.g., moving from overall problem solving to detailed technical solutions (Kiviniemi 2005).

2.2.1.1 Client Requirements

The client is one of the stakeholders who have a purpose with the construction project and with this purpose the client is motivated to start the construction project (Jallow et al. 2014). In the construction industry the client requirements are the goals, needs, prospects and expectations of the client. They are client's resources and intentions for a construction project to happen (Kamara et al. 2000). In other words it is the "voice" of the client, which incorporates the wishes and desired outcomes to be delivered and accomplished at the end of the project. The information collected from the client, in other words the statements from the client becomes the client requirements of the project and forms the basis of the project that will serve the expectations and business needs of the clients (Kamara et al. 2000). The information is then transformed into an architectural design and later on into a completed facility (Jallow et al. 2014).

Kometa & Olomolaiye states that the client's organizational factors have impact on the client's decision whether to invest in a project or not (1997). It is therefore important to be aware of the different perspectives of the client in order to manage the client requirements in a better way (Zeisel 1981). Moreover a constructed building is a building that satisfies (or not) the business needs of the client. Therefore understanding the client requirements means to translate the client's business needs into construction terms (Kamara et al. 2000)

2.3 The Brief and the Briefing Process

The client requirements become the foundation for the design, construction, operation and maintenance of the facility. In order to understand, collect and analyse the client requirements meetings are set up between the client and the stakeholders that will run the process. The process of collecting the client requirements is called the briefing process and the documents where the requirements are recorded and described are called the brief. The brief addresses high detail information about the client requirements (Jallow et al. 2014). The brief is a resource containing information that will be needed at the design phase, construction phase and throughout project life cycle. The briefing process is equal to the Pre-study phase by Bygghandlingar 90 and to the Concept and Planning/Development phases of the defined project life cycle by the PmBok Guide.

Nowadays in the construction industry the briefing process is partly merged with the whole construction and project management activities, in contrast to older days where the briefing was only seen as a step of the early phases (Jallow et al. 2014). Table 2 describes briefly the briefing process (Kamara et al. 2000). Briefing is also described as architectural programming in the USA. It is also described internationally as the initial and most important step in the design process. The major agreements of resources are made and the building project is defined (Jallow et al. 2014). Briefing has two stages that help clarify the process itself and the collection of the client requirements. These stages are:

- 1. The Strategic Briefing: During the strategic briefing, the decision making process forms its basis by creating a broad and clear understanding of the client's own business and anything else that has to do with the building industry. The foundation of the project is developed in this stage, therefore it has a big impact on the future process (Yu et al. 2007).
- 2. The Project Briefing: The technicalities of the project are clarified at this stage. These technicalities are the results of the client requirements that were collected in the strategic brief. The project brief transforms the strategic brief into construction terms, stressing on performance requirements in detail for each of the elements of the project. The project brief provides the foundation for the design to progress (Yu et al. 2007).

Briefing process	Definitions
The stakeholders involved	Administrators (managers), architects, development managers, engineers (building services, civil, structural), planning supervisors, portfolio managers, project managers, quantity surveyors, design professionals (e.g. architects)
Stages in briefing	Briefing merges with design, such as conceptual and scheme design. There are usually no distinct stages in the process and briefing information becomes more detailed as design progresses
Collection & documentation of information	Various methods are used for collecting information, such as interviews, workshops, and evaluation of existing facilities. Documentation is done in formal formats, such as letters, faxes, emails, minutes of meetings, sketches and drawings. These documents are usually not stored in the brief and the design recollect verbal communication with the client when it is needed.
Processing of information	Trial and error processes occur through sketches and drawings to clarify client's problem or process briefing information. Additionally there are projects where client commission requirements before the design
Decision making in briefing	Decision making involves the resolution of competing interests between groups in the client's organisation and between

	professionals with contrast perspectives Value management are an example of a technique used to assist decision making
Management of the briefing process	Changes to requirements are managed by recording them as corrections on sketches and drawings, which are the main medium for representing the brief Changes are also discussed in meetings and decisions recorded in the reports (minutes) of those meetings

Table 2 Briefing process and the definitions (Kamara et al. 2000).

A good brief's point of departure is to communicate and allocate the client requirements to the other stakeholders (Shen et al. 2004). A good brief contains very precise descriptions of the functionalities required for the building project, with the aim for the descriptions to be in consistency with the stakeholder's expectations. The punctilious descriptions and a well grasping of the requirements will benefit all stakeholders (Shen et al. 2004).

2.3.1 Challenges with the Briefing/Initial Phase

It is essential for all the stakeholders to proceed and result successfully in the construction project, since time, money and effort are put into the project. In order to do this various information that involves client requirements needs to be managed throughout the whole life cycle phases and between client and designers. Nevertheless there are many challenges that occur during the process, that causes inefficiencies in managing the information (Jallow et al. 2014).

The challenges of the initial phase of the project life cycle have been grouped into three categories. These are communication, information and stakeholders. Each category is described briefly and at the end of each category a summary is mentioned.

2.3.1.1 Communication

The design and construction project involves many different stakeholders. These stakeholders are professionals with different educational backgrounds and different expertise. It is a challenge for the actors in the constructions process to exchange information about the requirements when there is a lack of a common language (Jallow et al. 2014). Due to the lack of a common language between the actors difficult situations such as misinterpretations of 2-D drawings and misunderstandings of the intent of the designers possibly occur (Yu & Shen 2013). Additionally the client can experience difficulties to appreciate the drawings and the intent of the designers, which leads to a communicational gap between the participants (Kamara et al. 2000). The communicational gap then leads to more hours of work and higher cost to compensate for those hours.

The selection of the communication tools is vital when it comes to communication in the construction project. Because if the selected communication tool hinder the transparency of the exchanged information, it would become more complex to manage the already hard manageable information. For instance in a construction project where telephone is used as a communication mechanism, corrections to requirements and information are verbally communicated. Therefore it is a challenge to trace the verbally communicated information because there is a lack of transparency. In other words it is a challenge to manage the complex process (Yu & Shen 2013).

Another challenge is the unstructured and non-clarified approaches for communicating requirements of the client in the construction industry. It is therefore important to inform the teams and stakeholders that manage the project of what structure to follow when it comes to exchanging information, requests of change and corrections of requirements (Yu & Shen 2013).

In summarised points the challenges are:

- Lack of common language
- Inadequate selection of communication tools
- Unstructured and non-clarified approaches for communication

2.3.1.2 Information

In construction projects a large amount of information is constantly in an exchange process. Similarly the client requirements are constantly exchanged, corrected and added. It is a challenge to manage the client requirements when the information is manual and paper intensive, since it takes time to read manual information and it is ineffective to search for something particular in paper intensive information (Jallow et al. 2014).

The requirements and the client requirements are collected and corrected during different phases of the project, additionally in different contexts. For instance a client that changes his or her mind about a feature of the project informs the design team with the new relevant requirements. It requires more work and more time when the there are additional requirements collected later than the briefing phase (Jallow et al. 2014).

It is a challenge to have access to the requirements when there is a lack of a central storage mechanism, where stakeholders can easily find, store, update and manage the requested information (Jallow et al. 2014). If there is a central storage system that all actors have access to in the project there is a better management of the information due to the constant change and need of allocation of information. A challenge of using the central storage system is its connection to the change management system. In order for the system to work efficiently, there needs to be integration and interoperability between the central storage system and the change management system. Because sharing and exchanging the requirements between the systems are difficult for actors who do not

have access to both the systems, who do not have knowledge of both systems and it is difficult since the exchange has to be done manually and there is a risk for information to be lost along the way (Jallow et al. 2014; Kelly & Duerk 2002).

The initial project phase where the client requirements are collected are often interpreted to be a phase that starts but also ends before the next phase, as showed in figure 5 (Kiviniemi 2005). However this perception of lineer phases is false. Connected to this falce perception, confusion occurs and a consistent defined, structured and standardised approach to effectively handle information collaboratively throughout the building lifecycle tend to be inadequate (Jallow et al. 2014). Furthermore figure 6 shows that the initial phase/briefing continous in parallell with other phases (Kiviniemi 2005). It is furthermore argued that it is necessary to structurise and standardise the information management process since it is generally manual and time consuming and therefore it is needed to reduce the time and cost (Jallow et al. 2014).



Figure 6 Parallel phases in process (Kiviniemi 2005)

Another challenge related to information is inefficient methods to identify and represent the requirements during the whole development process (Yu et al. 2007). This may be due to various reasons such as insufficient time to work out a good structure for the requirement management process and to project managers that do not have enough experience of different client characters and identifying and collecting the requirements (Yu et al. 2007). There are various ways of how to manage changes in projects, such as table 3 is showing. The difficulty that lies within managing changes is that it is generally not clarified for the stakeholders of how to proceed when there is a change and due to inefficient documentation of changes, such as emails, it is difficult to understand the

Change request channels	Description
Telephone	Requesting a change by calling, however
	a formal change control form will have to
	be included
Online e-forms	Using an internet-based form to request a
	change
Email	Sending an email with all change request
	details
Meetings	Requesting a change during design or
	project progress meeting
Face-to-face (individually)	Meeting with an individual and verbally
	requesting a change but a formal change
	control form have to be included
Paper-based	Using hardcopies of change order forms

reason for the change and therefore difficult to do an impact analysis of the change (Jallow et al. 2014). Examples of change request channels are:

Table 3 different change request channels (Jallow et al. 2014).

The original brief, which is created initially at the briefing phase, is not transmitted throughout the project phases and often not updated with reflections, changes and additions. This causes difficulties through the process because changes to requirements are recorded as corrections and additions to sketches, drawings and other documents, and not on the initial original brief. This leads to difficulties to trace the original requirements, change of histories and lessons learned during the project. Traceability is the possibility to understand and identify a requirement in project history, which is why it is a crucial for managing change and dependency (Yu & Shen 2013; Jallow et al. 2014). As a consequence of the absence of requirement history, the original goals, needs and requirements of the client tends to transform and shift to other requirements which are in weak relation to the clients original brief, as can be seen in figure 7.



Figure 7 Illustration of the challenge of shifting end result(Kiviniemi 2005)

Another challenge found in the construction industry regarding requirement management is that there is a lack of review and feedback to the client brief and to the project team (Yu & Shen 2013). With no lessons learned and knowledge of how to increase the process efficiency, the project team tends to repeat mistakes and patterns of previous projects (Jallow et al. 2014).

In summarised points the challenges are:

- The original brief not carried along the process
- Lack of a defined approach to manage requirements and changes
- Lack of a central storage mechanism
- Lack of integration and interoperability between systems
- Manual and paper-intensive documents
- Lack of review and feedback
- Inadequate identification of needs and requirements during development process

2.3.1.3 Stakeholders

Project stakeholders are individuals and organisations that are intensely involved in the project. They may influence the project and it's results and may get influenced by the project results and completion (Project Management Institute Inc 2000).

The construction project process involves constant communication and exchange of information between stakeholders. Thus the involvement of the stakeholders is of essence in order to avoid misunderstandings and errors during the phases of the building cycle (Jallow et al. 2014). If the representatives of the design team, clients and other stakeholders are not present at the meetings it is a challenge to keep everyone on the same track and informed about updates. In such a situation, decisions are made without notice and therefore if the decisions are not consistent with the requirements the risk for re-doing a job is higher. Re-doing tasks and missions take more time and also become

more costly in terms of employment hours. Another group of stakeholder whose involvement is important are the end-users. In similar cases where the end-users lack of involvement and the project brief lack clarification about their needs, the possibility for the construction project to be successful is lower. This is because once the construction is completed and the project is handed over to the operation team, the end users starts using the building. Furthermore, the end-users might find the design of the building not responding to their functional needs (Yu & Shen 2013). This leads to recruiting a design and construction team again to reformulate the building inconsistency to end users needs, which leads to additional costs for the owner of the project.

Depending on the project type, process and stakeholders in the construction project there could be a situation for changing a stakeholder or more stakeholders during one of the project phases. Changing one of the stakeholders could be due to many reasons such as not enough knowledge for the project type, not enough budget to run the project, lack of experience or change of project concept. This causes difficulties throughout the project phases since the stakeholders that are new are in no possession of knowledge or information of the project's history, the information is in a form that makes it too complex to understand and it takes too much time to assess the information, which also leads to a higher cost (Yu & Shen 2013).

Inexperienced clients of requirement management are challenging because a gap of knowledge are formed between the different professionals. For instance the clients with few or none knowledge of engineering may have problems understanding the processes about the structure of the building industry and the technicalities of the buildings (Yu & Shen 2013). Moreover, inexperienced clients tend to take inadequate decisions that might lead to project delay, over run of budget and an unsatisfied client. It is additionally stated that a wish-list syndrome is seen with inexperienced clients that do not know their real needs and therefore depends on designers to sketch their expectations (Kelly & Duerk 2002). The "wish list syndrome" is when client's demand very high requirements and state complex expectations with the expectation to be bargained down from them by the project managers (Yu et al. 2007)

In summarised points the challenges are:

- Lack of stakeholder involvement
- Inexperienced clients
- Changed stakeholders in different phases
- Need of end-users not clearly stated
- The wish list syndrome

2.4 BIM and Requirement Management

The objective of requirement management is to address, analyse and clarify requirements in a systematic way during the project development process (Kamara et al. 2000). There is a large amount of qualitative and quantitative information. Therefore in order to ease the requirement management and to provide automation the construction industry claims it is important to develop IT tools (Baldauf et al. 2013). The functions of IT tools ease many challenges faced with requirement management in the construction industry. Challenges such as maintaining information up to date, storing various types of requirements from different stakeholders and capturing both implicit and explicit requirements. IT tools help handling these challenges throughout the project life cycle phases (Baldauf et al. 2013). BIM stands for Building Information Modeling and it serves various functions to support the management of requirements (Baldauf et al. 2013). One of the functions BIM serves is that it connects various types of information to the production models. This assists the transferring of information and the allocation of information. BIM additionally aims to simplify the process in order to increase the efficiency, deliver construction information in an accessible and understandable way, minimise the risk of excluding information and minimise the risk of inconsistent information (Baldauf et al. 2013). BIM also helps to ensure that the project coordination is used in the optimal way and it facilitates on going simultaneous work of many professionals involved in the design and production phases of the project (Baldauf et al. 2013). BIM supports the technical requirements at the detailed design stage, however it also supports the early design stages by controlling information on space requirements (Baldauf et al. 2013).

CHAPTER 3

Methodology

3.1 Research approach

The method applied in this thesis work is of qualitative nature. Qualitative research has been chosen as a method since it takes people's experiences, the formation of their decisions and the effects of their experiences on their decisions into consideration (Merriam 2014). In other words qualitative research look into understanding how people make sense in their world and the experiences they have in the world. The context of this thesis is consistent with Merriam's (2014) definitions. Furthermore, this thesis studies information and communication management in early phases of the project, which involves the experiences of the individuals working in projects.

3.2 Research Procedure

The procedure of the study followed four main phases. The initial study phase, the theoretical review phase, the interview phase and lastly the data analyse phase. The content of these phases are explained separately in this section.



Figure 6: Process of study procedure

3.2.1 Initial study

The company was chosen with a primer interest in project management and with a motive to learn the project process and the roles of the project manager, project team and the external stakeholders such as the architect. During the initial meeting between the company representative, the supervisor from Chalmers and the student, a brainstorming session was held and the context of the thesis that relates to all three parties was discussed.

3.2.2 Theoretical Review

Literature study was conducted by searching international and national articles in order

to gain a broad understanding. Moreover books, eBooks, PhDs theses, master theses, and journals were collected from Chalmers library database and Google Scholar database. In addition, the company representative provided access to the Pmbok. Thereafter the collected data were thoroughly studied and the basis for the theoretical review was founded.

3.2.3 Interviews

The interviews form the basis of the results and discussion of this thesis. The process of the study method is divided into two steps, which the first one is preparation for the interview and the second one is performance of the interviews.

3.2.3.1 Preparation

There are 10 main questions with additional relative questions prepared for the interviews. 7 questions are about managing the information of the project process and 3 questions are about managing the communication of the project process. The questions were prepared in English and then translated to Swedish to be used in the interviews since the interviewees daily language is Swedish and the interviews is considered to proceed efficiently. All questions are presented in Swedish and English in the Appendix A and Appendix B as "Interview questions".

The questions have various purposes. Some questions are prepared to map the challenges that are faced in the project processes and to overview the structure and frameworks of the information and communication management. Some questions are prepared to gain an insight of how project management are structured and how the interviewees approach are to particular circumstances. However the main aim with the questions are to realise ways and structures to improve and make the initial phase of the project development more efficient. The purpose of each question is explained initially after each heading in the results section. To sum up the questions are formed in a way to examine:

- Challenges of managing information
- The structure and methods
- Overlapping challenges of literature and practical experiences
- Organisation of projects
- Challenges of managing communication

The interviews were prepared according to the methods of semistructured interviews. Gillham (2008) presents the characteristics of semistructured interviews as questions that are thoroughly prepared for each target group and aims to guide the interview to achieve the interests of the study. Furthermore each interview's duration is approximately similar and the questions are formulated openly so that the interviewees are given the possibility to give broad answers. Semistructured interviews also allows the possibility of additional questions to be asked outside the planned framework (Gillham 2008). This method was chosen since it is in accordance with the purpose of the interviews, such as to get an insight of the interviewee's experiences.

3.2.3.2 Performance

There were 6 persons interviewed. The interviewees are current employees at the company and they were chosen by the company representative, serving the aim to have interviewees with different positions and different working experiences in order to gather as broad perspectives as possible. Their positions in the company are project managers, team managers and department managers. Some of the interviewees have worked in the company for more than 10 years, while some interviewees have worked less than 3 years. The age range between the interviewees is from 30 to 50 years.

Every interview took 50-70 minutes and the interviews were voice recorded in order to focus on the answers during the interview and later on to have the chance to listen and ensure every detail is concluded. The interviews were transcribed and the foundation for the results section was created. 5 of the 6 interviewees heard and answered the questions for the first time at the moment of the interview, however 1 interviewee preferred to read the questions and prepare answers before the interview happened.

3.2.4 Data Analyse

After transcribing the interviews the work of analysing and relating the findings to the theoretical review and the research questions started. The data collected from the interviews were not assessed with any relation to the interviewees experience, position and age however this information is given for the readers to know the interviewees a step closer. The interviews have been interpreted with a hermeneutic perspective, which indicates that the writer puts oneself in the context of the interviewee and tries to find the exact meaning of the answers given by the interviewee (Bryman 2002).

3.3 Methodology Reflection

The performed semistructured interview is the most adequate method mainly due to its nature of relating to the interviewees experiences. The advantages of interviews are that they take place in face-to-face meetings, which eases the communication between the interviewee and the interviewer because facial expressions and gestures are added to the verbal answers. Moreover additional questions are asked on spot, which takes the communication to a more efficient level. However the disadvantages that comes with interviews is that the answers of the interviewees are formulated from their experiences and therefore affected by their own personalities, which is not taken into consideration when reviewing the results. Moreover the interviewee might answer differently at another time and place depending on different experiences and knowledge or on other factors. Additionally the person holding the interviews, in this case the student, asks additional questions based on his or her interpretations, which affects the results by making them more personal. Furthermore, in this case, 1 of the 6 interviewees preferred to prepare for the interview before it took place. This brings the possibility of this

interviewee's answers to be different if they had been introduced to the questions only on spot.

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CHAPTER 4

Results & Discussion

This part presents and discusses the results of the study. The results are divided into two main parts; information and communication management. Each part presents the results by grouping the questions into relative topics, then explaining the purpose of each question and thereafter discussing the results with the theoretical review. All the questions asked in the interview have specific purposes, however they also have common purpose. The common purpose is to gain broad understanding of the process by focusing on the practical experiences of the interviewees. It is worthy to mention that the information, communication and requirement management are regarded as parts of the whole life cycle process and not only the initial phase of the project, since only then continuous efficiency of the management can be achieved (Jallow et al. 2014)

4.1 Information Management

This part introduces questions related to information management, which also includes questions about requirement management.

4.1.1 Framework for Requirements

The first question is "Do you follow any framework or a plan to collect the requirements during the meetings and throughout the building life cycle? " The PMBOK management structure is the defined and determined model to follow decided by the company. The purpose of this question is to find out if the PMBOK management structure is practically useful or not. The second and the third question is "Do you have a pre-fixed list of questions to ask or do you improvise?" "Do you re-use the requirements collected from project to project?" These questions aim to overview the management of the requirements. They also aim to understand if it is beneficial to have a pre-fixed question list to collect the requirements and if re-using requirements is an efficient method to use in the projects. Finally the questions aims to identify if the challenges found in the theoretical review, such as lack of a defined approach to manage requirements and changes (see section 2.3.1.2) exist on the market that the interviewees work in.

4.1.1.1 Results

*Do you follow any framework or a plan to collect the requirements during the meetings and throughout the building life cycle?

Do you have a pre-fixed list of questions to ask or do you improvise? *Do you re-use the requirements collected from project to project?



Figure 7: Number of respondents who mentioned each answer.

The interviewees stressed that the structure followed for project planning and development varies depending on factors such as the project type, the client's current knowledge about project development, the client's experience with similar projects and the project manager's preference of process structure. The interviewee's implied that the framework for collecting and documenting the requirements is an improvised process that is guided by these factors. One interviewee stated that for instance if the client is from a municipality they usually have established concrete frameworks before coming to the consultancy company. In other words they would likely consult the project manager with a prepared and fixed set of requirement list, since their project is already determined through their own internal meetings and their objectives are already clarified. The interviewees stated that they either use their own brief document which is prepared on Microsoft Excel or Microsoft Word or they follow the protocol that are collected from the company's database. The protocol are in a sample form and continuously written on the computer during meetings and then saved as a PDF.

There is a possibility for the requirements to be re-used from project to project. However the interviewees stressed that to re-use requirements is practical when working with the same client, because the client will likely prefer to repeat their construction and design preferences in the project. Another aspect brought up was that some requirements such as municipality requirements, fire regulations and environmental regulations are usually re-used in projects, even if the projects are similar or not, since they are the type of requirements that are valid and obligatory to follow for every project.

4.1.1.2 Discussion

The theoretical review states that lack of a comprehensive framework leads to inefficient methods used in the project process and ineffective communication between the project team members (Yu et al. 2007). Furthermore when there is not a clear and defined guideline of how to approach the management of the requirements then it takes more time to customise an approach for every project and it is not sure if the selected approach is appropriate for that project, therefore it could also lead to higher cost (Jallow et al. 2014). The results from the interviews show that the PmBok structure book is not mentioned by any of the interviewee. Moreover it is stated that the project manager's preferences of process structure depend on the type of client that they work with. For instance if the client is a government related client then the documentations are already fixed and established. The theoretical literature states three different client-project manager relationships that shape the process. These are;

- 1. Purchase-of-expertise: This means that the client knows exactly how to proceed and recruits the project manager for help but for tasks other than consultation.
- 2. Doctor-patient: This type of relationship is when the client is aware that something is not correct and needs the project manager to identify it and thereafter solve it. Therefore the client becomes dependant on the project manager is only active when the project manager requires it.
- 3. The process: The client and project manager works as a team with identifying problems and solutions (Schein 1978).

Furthermore, Jallow et al. discusses that by being aware of these three relationships it is possible to have a management structure for collecting information (2014).

4.1.2 Collecting Information

The first question is "How do you ensure that the client mentions all the relevant information?" This question aims to map the methods used for managing information in cases where the client is the source of giving information. In other words the question aims at understanding how much relevant information the client shares and if there are any actions taken in order to control the information flow in circumstances where the client is not sharing all relevant information needed for the project. The second question is "Do you plan in-depth discussions with the client?" This question's purpose is to find out to the relationship between the client and project manager and to identify what tools and structure are selected to control the information flow. The last question is "In literature there is a term called 'the wish list syndrome'. Do you come across this syndrome?" The aim is to understand how the project managers approach high project outcome expectations and difficult requirements wished by the client and if this situation cause challenges. Finally the questions aims to identify if the challenges found in the theoretical review, such as unstructured and non-clarified approaches for communication (see section 2.3.1.1) and the "wish list syndrome (see section 2.3.1.2), exists on the market that the interviewees work in.

4.1.2.1 Results

*How do you ensure that the client mentions all the relevant information? **Do you plan in-depth discussions with the client? ***Do you come across 'the wish list syndrome'?



Figure 8: Number of respondents who mentioned each answer

The interviewees mentioned that there is not a particular method to ensure if the client shares all the information needed. They mentioned further on that the information constantly grows and is modified throughout the process. In other words, the client informs the project manager about their expectations and additional requirements constantly through the project phases in different circumstances. These circumstances are for instance when an obstacle occur through the process and the client need to make a decision and therefore the client reveals a particular wished outcome, or as the project precedes the client gain more knowledge and awareness and therefore inform additional requirements. The interviewees also stressed the importance of asking as many questions as possible to the client, hence that is their way of ensuring that they comprehend client's requirements and expectations. One interviewee stated that the more questions asked the clearer project brief and less changes in the future of the project process, which leads to preventing additional project cost. Two interviewees stated that they work with a visual planning software tool. With this tool they use a "decisionlogg" during meetings, which functions to examine the client requirements in detail by asking many questions. The "decisionlogg" has beneficial functions as showing what was asked for during meetings and showing the change history. Three interviewees stated that the protocol document functions as a tool to ensure the client shares all expectations since it is sent to the client after the brief meetings and afterwards checked and approved by the client. The client afterwards sends it back to the project manager and this works as a process of ensuring if both parties understand each other correctly.

Deep discussions happen with the client depending on the client's own experience and knowledge about the project process and about the project type they plan to build. If the project manager decides that the client do not own enough knowledge and experience about the project process then the project manager takes the initiative to have more and longer meetings with the client. One interviewee mentioned that if the client has enough knowledge and experience then the procedure is that the meetings happen on a regular basis of every week.

It is stated that the "wish-list" syndrome happens occasionally depending on the client they are working with. The interviewees further stated that the budget plan that they create for the requirements determines whether to keep the high expectations and the wished requirements or not. In other words, the cost that the client is ready to pay is the determining factor regarding the "wish-list" syndrome.

4.1.2.2 Discussion

The theoretical review claims that poor communication between the client and project team leads to project objectives that are non-clarified. Moreover the lack of common language often leads to information that are misunderstood or wrongly assumed of what is meant (Yu et al. 2007; Yu & Shen 2013; Kamara et al. 2000). The interview result shows that misunderstandings happens depending on the client's experience and knowledge, since if the client knows more about the project there is common language between those involved in the initial phase. In other words the common language ease the communication between the involved people and ensures they indicate the same things. The incidents of misunderstandings also depend on the initiatives taken by the project manager, such as asking many questions or reserving more time for deeper discussions.

The "wish list syndrome" is when client's demand very high requirements and state complex expectations with the expectation to be bargained down from them by the project managers (Yu et al. 2007). It is additionally stated that the wish-list syndrome is seen with inexperienced clients that do not know their real needs and therefore depends on designers to sketch their expectations (Kelly & Duerk 2002). The results show that this syndrome happens depending on the client type and moreover on the client's will to pay for the wishes.

4.1.3 Documentation Tools

The first question is "What tools do you use to document the requirements?" The aim with the first question is to find out what tools the project team members and project managers use to document the requirements and the upcoming changes through the project phases. The following question is "Do the functions of these tools help or hinder the process in a way?". This question asks if the tools selected hinder the process in a way or if it helps the process, if so with which aspects do they help. Finally the questions aims to identify if the challenges found in the theoretical review, such as inadequate selection of communication tools (see section 2.3.1.1) exists on the market that the interviewees work in.

4.1.3.1 Results

*What tools do you use to document the requirements? **Do the functions of these tools help or hinder the process in a way?



Figure 9: Number of respondents who mentioned each answer

The interviewees use the similar programs, such as Microsoft Word or Microsoft Excel. They stated that the downside with using Microsoft Word is the difficulty to find specific information, and the downside with using Microsoft Excel is that there is no traceability function. In other words it is hard to trace back changes of history and view who did the changes and when and why they were done. One interviewee uses One-Note on an IPAD during meetings and use the notes later on the personal IPAD for tracking changes and history of meetings.

Besides the protocol the interviewees use email as a tool to document additions and changes, this was commented as a quick way of responding to questions and an effective way of communicating. However emails were additionally mentioned as time consuming since the amount of emails gets bigger with time and it is difficult to find specific information and other colleagues don't have access to read the emails.

The interviewees mentioned the easiness of BIM tools such as 3D models and other programs that are especially designed to manage the process of a project. They mentioned it is much more easier to understand what are being talked about with BIM models since the mind have the different interpretations of the reality. BIM is a way of ensuring everyone being on the same track during the project.

4.1.3.2 Discussion

The results show that the tools have useful and also lacking functions. The useful function is that the documentation is digital. Moreover the lacking function is

traceability, which hinders the process by disabling reviewing of project history and therefore hindering for an outsider or for a project manager that has forgotten something to understand the decisions taken in the project (Yu & Shen 2013).

4.1.4 Achieving Requirements

The question is "What kind of difficulties do you face trying to achieve client's requirements?" This question is a general question in order to gain a broad overview of the difficulties faced achieving client requirements. The following question is "What do you do to overcome these difficulties?" It aims at clarifying the overcoming methods of the difficulties in practical experiences. Finally the questions aim to identify if the challenge found in the theoretical review, such as the challenge of handling manual and paper intensive documents (see section 2.3.1.2) exists on the market that the interviewees work in.

4.1.4.1 Results

*What kind of difficulties do you face trying to achieve client's requirements? **What do you do to overcome these difficulties?



Figure 10: Number of each respondent who mentioned each answer

The interviewees mention that the complex requirements come along with client requirements. The more complex the requirements are, the more it costs to fulfil the requirements. A well-formulated budget solves any problem, however it is a challenge to influence the client into simpler requirements because it is time consuming and it needs additional effort. The initiative taken by the interviewees is to have additional meetings and to explain to the clients why the complex requirements lead to higher costs.

Another challenge mentioned is clients that prefer to not be involved within the process lead to lack of understanding of the decisions and the proceedings. The project teams works and goes through the phases of the project and when the client is not aware of the process the team has to go back in order to keep the aim of the project in consistency with the client's expectations.

It was stated that the transaction of the information from the project team to the construction client is a challenge. This challenge depends on the contract form signed with the client and the construction client. Furthermore it is difficult for the construction client to grasp the whole process, amount of information and background of the project when the contract type requires a handover of the project to the construction client. Moreover the project team gathers all documents related to the project and sends them over to the construction client. Then the construction client prints these documents and stores them in files at their office. The interviewee states that these files needs to be thoroughly read and understood by the construction client however in reality this does not often happen since it is very time consuming and needs to be done by more than one person in the company. In order to overcome this difficulty all the stakeholders have an introductory meeting at the beginning of the handover, where they go through important points in a couple of hours.

4.1.4.2 Discussion

The results showed that the difficulty of transferring a large amount of knowledge and information to the construction client is an obstacle for a smooth construction process to happen. This is because the printed A4 documents are not thoroughly read and secondly because information might get lost or misinterpreted. The paper intensive and manually managed documents slows down the process, risking specific information to be "hidden" between other information or lost and is not environmentally friendly since it includes many printed papers (Jallow et al. 2014).

4.1.5 Changes and Updates

The question asked is "What process do you follow to handle changes in the project?" The purpose of this question is to map the structure of how changes are handled in the project process. The other questions asked are "Do you have a central storage that you store all the requirements?" "How is the brief updated and is it accessible for every stakeholder?" and "Do you ever lock the document of client requirements to not be modified? ". These questions aim to gain insight in the document process in detail. Moreover the questions aim to identify if the challenges found in the theoretical review, such as lack of a central storage mechanism (see section 2.3.1.2), the original brief not carried along throughout the process (see section 2.3.1.2) exists on the market that the interviewees work in.

2.1.5.1 Results

*What process do you follow to handle changes in the project? **Do you have a central storage that you store all the requirements? ***How is the brief updated and is it accessible for every stakeholder?



Figure 11: Number of respondents who mentioned each answer

The demand for changes is informed by texts in mail, by verbal communication through phone conversations and by face-to-face meetings. The interviewees stated that the method followed for changes depends on the change demanded and when it is demanded. For instance at the planning phase the changes are documented with the protocol or the "decisionlogg" the managers use, moreover the architects also redraw and make additions if it is required. If the change is required during the production phase the construction protocol is used. Another type of change is stakeholder changes. Examples of a stakeholder change is that one manager might have taken too much responsibility by leading more than one project or the construction client replaces the project leader position with someone from their own side. Either situation brings challenges since the new project leader does not own the experience of the project and there is a higher risk for specific information to get lost during the process.

There are central storage systems used in the company however the interviewees stated that the preference of the system depends on the project, on the project manager and on the client. For instance in one project Dropbox have been used as storage system and it has been accessible for everyone working on the project including the client. Sometimes the client chooses and sometimes the project manager chooses the central storage system where all the documents are uploaded. Moreover who choses the system depends on the mutual agreement between the client and the project manager.

The interviewees send out a reminder through email or phone to the project teams whenever the documents are updated. The accessibility for the stakeholders depends on the management system used by the project managers. For instance the "decisionlogg" is accessible however the emails are not. Furthermore the interviewees stated that the requirements could be changed and updated anytime, however the later the change the more costly it will be for the client.

4.1.5.2. Discussion

The results shows that there are central storage systems used in the projects however the results also show that there is no defined approach of which system to use in the projects. The theoretical literature emphasizes the importance of a central storage system where the requirements are stored by describing that it gives access to the latest version of the requirement to all stakeholders and that it utilises the management of the requirement changes throughout the project lifecycle. A lack of a central storage system furthermore leads to requirements held in different locations by different people (Jallow et al. 2014).

The result shows there was no direct statement about the changing brief document throughout the process. However there was a statement that the change of stakeholders could lead to loss of information and knowledge of the project, which result in a changed brief document that is not consistent with the initial brief. This causes difficulties since it is important to understand the change process and to see if errors occur during the change process (Yu & Shen 2013).

The results shows that the interviewees follow a sort of improvised process to manage changes, since it depends on their own former experiences within the field, the type of change and the phase of which the change are requested. Theoretical literature states a defined approach of how to manage the changes in particular circumstances is needed since change process requires dependency checking between requirements to double-check impact of changes, which leads to more ineffective and in efficient work that takes time (Jallow et al. 2014).

4.1.6 Focus

The first question that is "What do you put focus on the most when you collect the requirements?" intends to map the aspects that the project managers focus on while collecting client requirements. The following question that is "Do you put focus on the client's business strategic goals?" aim to see if any focus is put on the client's business goals, in other words if outcomes not directly related to the project are important to the project managers. Moreover the questions aim to identify if the challenge found in the theoretical review, such as inadequate identification of needs and requirements during development process (see section 2.3.1.2) exists on the market that the interviewees work in.

4.1.6.1 Results



*What do you put focus on the most when you collect the requirements? **Do you put focus on the client's business strategic goals?

Figure 12: Number of respondents who mentioned each answer

The interviewees focus on going through all the decisions in detail and ensuring that the client approves, the requirements about the appearance and the experience of the building, the function of the building that will be constructed and the residences that will live in it. They also stated that they focus on the clients overall objectives of the project, such as the business goals and long-term strategic goals.

4.1.6.2 Discussion

The result shows that there are different focus points in every project. The focus are on identifying client requirements or on other requirements and aspects of the project. The theoretical review emphasizes the importance to perform adequate identification of needs and requirements since it leads to efficient and effective progress, therefore it may be beneficial to have a structure for identifying needs and requirements (Yu & Shen 2013).

4.1.7 Requirements

The questions asked is "What requirements did the client ask for in the last project you worked on?", "What kind of requirement are usually asked for in housing projects?" and "How do you document non-measurable requirements?" The purpose of these questions is to gain an insight and have a general overview of what type of requirements are required in projects. Additionally the aim to have an overview of what requirements are usually asked for in housing projects and to overview the documenting of intangible requirements.

4.1.7.1 Results

*What requirements did the client ask for in the last project you worked on? **In housing projects, what kinds of requirement are usually asked for? **How do you document non-measurable requirements?



Figure 13: Number of respondents who mentioned each answer

There are different types of requirements requested, such as a number of square meters of the apartments that affect the price of the apartment. Other requirements are municipal requirements, the maintenance of the constructed building and experienced consultants.

The architects document non-measurable requirements by having a dialogue with the client. The project managers then review the drawings and models produced by the architects to see if they are in consistency with the economical, environmental, and municipal and other client requirements. It was stated that there is no systematically defined approach towards non-measurable requirements and that it would be good to have it.

4.2 Communication Management

This part introduces questions related to communication management.

4.2.1 Difficulties with Communication

The purpose of the question "Do you have difficulties with communication during the building life cycle?" is to map the general difficulties of the communication in the project process and to gain an insight of the causes of the difficulties. Moreover the questions aim to identify if the challenge found in the theoretical review, such as unstructured and non-clarified approaches for communication (see section 2.3.1.1) exists in the environment that the interviewees work in.

2.2.1.1 Results



Do you have difficulties with communication during the building life cycle?

Figure 14: Number of respondents who mentioned each answer

The interviewees stated that usually the project managers are not involved throughout the whole building life cycle. The project managers, depending on the contract form, are at the most involved until the maintenance phase. This lack of involvement in the maintenance phase creates the challenge of communicating all knowledge and information from one party to another party, which leads to the risk of vital information and knowledge remaining unknown. The information and knowledge is communicated through printed folders and these folders can be many depending on the project size. These folders tend to make it harder to understand the project and are not the most suitable communication tool. It was also stated that if there is anything that the maintenance responsible company wants to change or add in the building, they hire another client to perform and not the project team that have run the project. The new hired project team do not own the necessary information and knowledge about the building and therefore they often do not come with the smartest solutions.

It was stated that vague guidelines of how to perform the project tasks lead to difficulties during the project process. Furthermore if the project team members and the client are directed with clear guidelines of how to communicate and which structure to follow then the project process functions with maximum efficiency in terms of communication.

Emails create difficulties tracing previous conversations and they are not accessible for anyone else than the email owner. One solution mentioned is a program called Project Place. This is a virtual planning program, which serves as a common portal where everyone can post and answer questions, and it is accessible for every project team member. Except from being a live communicational platform another good side of this program is that the documented changes and additions can be traced, which is in contrast to the formal protocol that are signed and sealed after meetings and do not show changes and additions.

4.2.1.2 Discussion

The results show that clear guidelines are necessary for the stakeholders to integrate efficiently. The result additionally shows that visual planning software, Project Place, is used by one of the interviewees because the existing tools, such as emails, are not efficient enough for communication. Moreover emails are difficult to trace specific information and provide limited access to others. The theoretical literature supports the essence of communicative actions in the initial phase of the project. One study shows that the most important critical success factor of the initial phase is open and effective communication (Yu et al. 2007). Moreover, the documentation of the decisions taken at the meetings tends to be vague and they usually do not reveal explanations of why the decisions were taken (Kamara & Anumba 2001).

4.2.2 Stakeholders

The question "How much does the client representatives want to be involved in the process?" aim is to identify the approach to client's that choose to not be involved in the project process. The question "How do you approach the situation when stakeholders do not understand each other's language? " aim is to understand the approach towards circumstances where project team member, clients and other stakeholders do not comprehend each other or the information regarding the project. And finally the question "Do you focus on the end-users requirements?" aim is to identify the approach towards the end-users of the construction projects. Moreover the questions aim to identify if the challenge found in the theoretical review, such as need of end-users not included (see section 2.3.1.2) and lack of stakeholder involvement (see section 2.3.1.3) exists in the environment that the interviewees work in.

4.2.2.1 Results

*How much does the client representatives want to be involved in the process? **How do you approach the situation when stakeholders do not understand each other's language? ***Do you focus on the end-users requirements?



Figure 15: Number of respondents who mentioned each answer

Clients usually choose to be involved and to take part of the project process. The clients that are involved in the process constantly communicate with the project team members through phone, emails and meetings. Either the client or employees representing the client participate in the process to control the proceedings. The interviewees additionally stated that it is their wish to include the client as much as possible since there are less changes and additions when the clients are aware of the decisions taken and process of the project. However in cases where the client is not involved in the project process, then the interviewee's take the initiative to invite the client to meetings, and aims to involve and inform the client as much as possible.

The moment the interviewees notice that any of the stakeholders misinterpret information or do not follow the process, they have more meetings and try to increase the communication. In urgent situations phone calls are made for direct and instant communication. Additionally, it was stated that a 3D model makes the project easier to comprehend and it is an efficient tool to ensure whether the stakeholders speak the same language.

The end-users are included in the project development phase if it is one of the client's wishes. However it was also stated that the end-user needs usually are included, whether the client wishes it or not, since the sustainable aspect of the project is vital for the company, but also for the success of the project.

4.2.2.2 Discussion

The results show that there are different approaches towards including end-users in the project. The inclusion depends on whether the client's aim is to include the end-users or not. Moreover the project manager can also influence the client to include the end-users in the project. This shows that lack of inclusion of end-users needs happen sometimes in the market. The theoretical literature mentions that the projects that are completed without containing the end-users functional needs leads to additional cost and time since another design and construction team is recruited again (Yu & Shen 2013)

Lack of stakeholder involvement in the project development process happens depending on the client type. Moreover the result also show that the project managers prefer to include the client as much as possible in order to proceed the project in the most efficient and effective way. The results additionally show that the general and common approach towards misunderstandings between stakeholders is to have more meetings, which in other words are more hours of employment and therefore higher cost. It is therefore to the benefit of the client to be involved in the process as much as possible to keep a lower budget (Jallow et al. 2014).

4.2.3 Feedback & Review

The question asked is "Do you have a feedback procedure of the requirements or a review?" question aims to gain an overview of how feedback and reviews are structured in the company. Moreover the question aim to identify if the challenge found in the theoretical review, such as lack of review and feedback (see section 2.3.1.3) exists in the environment that the interviewees work in.

4.2.3.1 Results

Do you have a feedback procedure of the requirements or a review?



Figure 16: Number of respondents who mentioned each answer

There are review meetings where the project team representatives and the client sit together and go through the project in detail. Alternatively a similar method is a checklist that is studied through the end of the meetings with the clients. It was stated that there are no defined and structured method to collect feedback from the internal stakeholders in the company or from the external stakeholders. However the company culture norm is to ask a colleague for specific feedback regarding a project. Moreover, there is no time left for feedback procedures since the project managers directly go from one project to another and they work on more than one project simultaneously.

A well social relationship with the client leaves a positive impression with the client even if there were mistakes in the project process or unexpected outcomes of the project. Moreover the importance of having a well-established dialogue with the client was stressed to result in client satisfaction.

4.2.3.2 Discussion

The results show that there is a lack of a procedure for getting feedback internally or externally in the company. A review or a checklist is included in every project, sometimes at the end of every phase however the aim of the review is not feedback. Therefore the outcome does not involve learning from mistakes and considering

changing methods in the project process, which is stated in the theoretical literature to be essential for developing management in projects (Yu & Shen 2013).

CHAPTER 5

General Discussion

5.1 Factors on requirement, information & communication management

This study shows that there are various factors that affect the management of information, communication and requirements. This part discusses these factors together with the research question that this study asks, whether there can be a defined structure to follow in every project in order to optimise requirement, information and communication management of the initial phase of the project processes. However, the optimisation of the initial phase will be ensured if the whole life cycle is examined, therefore this discussion views the whole study regardless of the life cycle phase (Jallow et al. 2014). There are two most dominant factors found in the study, which are the client and the project manager. These are identified, analysed and discussed separately.



Figure 17 Total percentage of each factor that affect the information, communication and requirement management found in this study.

5.1.1 Client



Figure 18 Number of responses of the results that are dependent on the client

The results show that the framework for collecting and documenting the requirements is an improvised process depending on the client. For instance if the client is from an organization related to the government such as the municipality, they usually already have ready documents and structures to work with before coming to the company. Another example that the results show is when a client that lacks experience and knowledge demands a project, the followed process is decided by the project manager and therefore the project manager have more impact on the decisions regarding the requirement documents and process structure. This shows that applying the same framework for collecting requirements in every project is not practically done and it is not efficient, additionally it is dependent on the client type. However, the theoretical literature highlights another perspective on this matter by stating that there are different types of clients, such as user clients that represent the users needs of the project and paying clients that represent the organisational needs of the client's company. They influence the progress of the initial phase and require the project managers to understand the different perspectives represented by the client and to translate the client's business needs into construction terms (Kamara et al. 2000). Therefore, the complex nature of the client is the main reason there is a need for adequate requirement management (Jansson et al. 2013; Kamara et al. 2000). Moreover, all the information collected during the initial phase must be documented in a smart way, in other words with adequate requirement management, to establish effective communication between the project team members and to reduce the project development time and cost (Jallow et al. 2014).

The results show that transferring requirements from a project to be re-used in another

project optimises the initial phase of the project by saving time. However the results also show that re-using requirements are only practically efficient when the same client is involved, since it is more likely that the client will demand the same technical and design requirements again in their projects. Kivinemi (2005) argues that every project is unique and it is not possible to standardise different types of requirements, since even though there might common requirements there will also be many different additional specific requirements. The author proposed a framework, which is named the requirements specification model, that identifies a set of requirements which allows the additional specific requirements to adjust to a particular project (Baldauf et al. 2013). This shows that the same client may not have to be involved in order to re-use requirements and achieve time and cost efficiency.

The results show that the client directly affects which requirement types are dealt with during the project phases of the project, since the client choses the project type to be constructed and has economic, business and strategic goals that affect the requirements. However the theoretical literature claims that the client does not have to necessarily be the controlling factor in this case. It claims that is possible to optimize the initial phase by gaining a better understanding of the requirements (Kamara et al. 2000). The environmental, site and regulatory requirements go together with the client requirements, which eventually form the design requirements. As the progress continues the design requirements turns into construction requirements. A part from these requirements, there are other project requirements such as the business need of the client that should be satisfied with the constructed project. The business need of the client, that for instance could be a symbolic building at the entrance of the site, will affect the site, environmental and regulatory requirements. This shows that the other project requirement, either limit the client requirements or increase their satisfaction (as shown in figure 18). Therefore the authors claim that an adequate understanding and an effective processing structure of the client requirements is necessary since it will ease the process of adjusting the requirements with one another. Because the site, environmental and regulatory requirements are much more difficult and costly to change than the business need of the clients (Kamara et al. 2000).



Figure 19 Demonstration of the relationships between the requirement types (Kamara et al. 2000)

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The results show that the end-users needs of the facility is included it is one of client's objectives to include the end-users needs. The theoretical literature mentions that the projects that are completed without containing the end-users functional needs leads to additional cost and time since another design and construction team is recruited again (Yu & Shen 2013; Jallow et al. 2014). Therefore it can be said that even if the client does not incorporate end-users in their project plan it is always necessary for them to be incorporated for the project process to be optimised and to achieve overall client satisfaction. Yu & Shen (2013) introduces the method PEAS to be used in situations when there is a late or lack of involvement of end users in the project initial phase that will help ease the information and requirement process. According to Brauer (1992) the client have the knowledge to answer the four key aspects that are needed to include the end-users needs, such as people/personnel, equipment, activities and schedule (PEAS). These four keys form the basis of end-user requirements for a building or facility, which will lead to the success of the client's organisation.

5.1.2 Project Manager



Figure 20 Number of responses of the results that are dependent on the project manager

The result from this study shows that the project managers have developed own ways of collecting information from the client in order to make it as efficient as possible, such as having a check list, a decisionlogg and having as many meetings as possible. Moreover the practical experiences of the project managers show that the very demanding and different clients and the different building requirements results in the information management of the project to be improvised and varying. However the theoretical literature argues that there is a need for a well known and structured method to process

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information including the requirements (Jallow et al. 2014). Pena & Parshall (2001) supports this by claiming that information collected in the initial phase must be documented in order facilitate effective communication among team members. Edgar Schein introduces three project manager roles which are the doctor-patient role, purchase-of-expertise role and the process role (1978). Jallow et al. discusses that by being aware of these three roles and their relationships to the client, it is possible to have a management structure for collecting information that depends on these roles (2014). Furthermore this was also mentioned by the interviewees in this study as the depending on the clients, such as clients that consult the project manager with fixed and established documents and other inexperienced clients that let the project manager steer the documentations. Furthermore this is also discussed in the 4.1.1.2 Discussion part of the section 4.1.1 Framework for Requirements.

The result shows that the project managers follow their own way regarding how to manage change of requirements, which depends on the change demanded, and when it is demanded. For instance at the planning phase the changes are documented with the protocol or the "decisionlogg" the managers use, moreover the architects also redraw and make additions on paper printed drawings if it is required. If the change is required during the production phase the construction protocol is used. The international literature states that the due to the dynamic nature of the client requirements they mature along with the progress and involve numerous paperwork, which is consistent with the results found in this study (Jallow et al. 2014). However the authors further claim that manual and paper intensive work lack efficiency and effectiveness. Moreover the change process requires dependency checking between requirements to double-check the impact of changes to other requirements. This leads to more ineffective and in efficient work that takes time. For these reasons the process must be rationalised and the systems must be used for information processing (e.g. workflows) in order to strengthen coordination and control between project teams (Jallow et al. 2014)

5.2 Main challenges

The research question asked in this study is "What are the challenges of managing information, communication and requirements in the initial phase of the project?" This part addresses the main challenges found in this study and then discusses each challenge by presenting possible solutions. The main challenges are transferring information, traceability and lack of feedback procedure. This study shows that these challenges are mentioned the most. Therefore it is believed to have a worthy of note impact on the process if they were managed and improved, in terms of process efficiency.

5.2.1 Transferring information

The results show three occasions where transfer of information happens and is a challenge. The first occasion is in design-build projects where the construction client takes over the project manager's role shortly after the start of project life cycle and during this handover the construction client faces the challenge to understand the tacit and in tacit information of the project. The third occasion that the results additionally

show is when there is a change of a stakeholder or more stakeholders, such as project managers and construction clients, during one of the project phases. The third occasion is when the projects duration is until the maintenance phase of the project life cycle. The handover of information to the client or the stakeholder that are responsible for the maintenance phase is a challenge, since the volume of information is vast, it is mainly paper intensive and it includes personal experiences and observations gained from the project progress. Kiwinemi states that the impact of stakeholder change leads to serious loss of important requirements knowledge because generally requirement changes are stored in the mind of the project team as tacit and implicit knowledge (2005). Even if the knowledge related to requirements are documented it is hard to trace and it is difficult for the new person to know what to look for (Kiviniemi 2005). Additionally more time is needed to transfer all the information which leads to a higher cost (Yu & Shen 2013).

5.2.1.1 Proposal

A solution to this challenge could be found in focusing how to document and store information and tacit knowledge in a way that will facilitate effective management while information transfer happens. The theoretical literature discusses the benefits of changing from documenting traditionally with paper based tools to documenting with BIM models and tools (Jallow et al. 2014).

5.2.2 Lack of Traceability

The results from this study mention that it is difficult to trace documentation done with word and excel programs, conversations with email and project history with protocols. This challenge is also found in theoretical literature addressed as a main problem. The original requirements are generally not documented therefore they can not be traced back, therefore is no explanation of why a certain technical solution have been chosen and based on which criteria's (Yu & Shen 2013). The documents that can be examined after the building completion are usually the drawings and the requirement specification documents which do not contain enough explanations (Yu & Shen 2013).

5.2.2.1 Proposal

Brennan (2009) states that traceability is a useful tool to perform impact analysis of changes and relations between requirements and design, which is efficient for the management of project life cycle phases. The author additionally emphasizes the importance of traceability by describing it as a way to follow the life of a requirement both forward and backward. Therefore it is highly recommended to implement traceability functions to the existing tools and programs. Furthermore, the results mention the benefits of a "living" method of documenting requirements and changes. A living document means that it has functions such as tracing change of history, can be easily modified, has accessibility for every stakeholder and it is easy to read. This type of documenting could be a solution for the traceability hinder. An example of this type of programs is the visual planning software Project Place, which is used by one of the interviewees.

5.2.3 Lack of feedback procedure

The result from this study shows that there is no feedback procedure and that there is a review procedure, which functions as a method to check and control if the project's proceedings is accordingly to the project brief and the requirements. However the review procedure is formal and can be seen as a checklist rather than a procedure where learning takes place.

5.2.3.1 Proposal

Blyth & Worthington (2001) claim that feedback is important both to the managing party and the clients, since successes, failures, mistakes and past experiences of what does and does not work well would lead to optimised decision making in the initial phase especially when collecting requirements.

This study shows that project managers have found practical solutions for particular situations in terms of efficient communication, requirement and information management. An internal procedure of sincere feedback session where everyone shares their best-of-best solutions, for instance visual planning and the decision logg, may lead to increase in efficiency and optimisation.

CHAPTER 6

Conclusion & Recommendations

This study shows that it is possible to optimise the initial phase of the project process with the management of information, requirements and communication management. The study views and analyses all phases that the company's project manager's work with and presents the matter with a broad perspective. The study found that the structure for managing information, requirements and communication in the company mainly depends on two dominant factors, which are the client and the project manager. The study shows that the client type and the project manager affect the tools, document types, the requirement types and therefore they have a major impact on the process and the progress. However the study additionally shows that even though the many things depends on these two factors there are methods and ways to control the information and communication management, which are supported by the theoretical literature. The major hinders that the project manager's face in the project process in the company are lack of traceability, lack of feedback procedure and transferring information between stakeholders.

It is recommended to use this study as a basis for further studies to customise solutions and management structures to be developed for the company. This study shows that optimisation of the initial phase is possible. Therefore it is recommended to further focus on mapping the requirements management in detail in the company in order to develop a precise and clear requirement management structure. Moreover, studying the different project delivery systems in the company, such as design-build and design-bid-build, and the variations depending on the system may give beneficial findings. These findings can then be used for optimising the project process. It is additionally recommended to identify the low hanging fruits that can be found in the main challenges discussion. By identifying the low hanging fruits are firstly implementing a feedback procedure where managers of the company share their own experiences and efficient solutions they use in order to tackle the difficulties in the construction industry. Secondly, to use programs with traceability functions since this is found to be a major function that will ease the communication and information exchange between the project team members.

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Appendix A - Interview Questions Swedish

Information

- 1. Följer ni någon plan eller något ramverk för att samla in kundens krav och önskemål under mötena med kunden och under byggnadens livs cykel?
 - Används en förberedd lista av frågor som ställs till kunden eller improviserar ni?
 - Återanvänds kraven (t.ex. tekniska krav) som har samlats in i tidigare projekt?
- 2. Hur säkerställer ni att kunden delar med sig av all relevant information?
 - Planerar ni in djupdiskussioner?
 - I den internationella litteraturen finns något som heter "the wish list syndrome". Det är när kunden tendera till att förhöja sina krav med förväntan att förhandla ned från detta. Möter ni detta syndrom i era projekt?
- 3. Vilka verktyg används till att dokumentera kraven? (Papper, penna, dator/mobil/platta?)
 - Är funktionerna av dessa verktyg till hjälp eller upplever ni att de hindrar processen på något sätt?
- 4. Vilka svårigheter stöter ni på när ni försöker uppnå kraven?
 - Vad gör ni för att överkomma dessa svårigheter?
- 5. Vilken process följs för att hantera ändringar under projektet?
 - Finns det ett centralt lagringsutrymme där alla krav samlas?
 - Hur är kravspecifikations-dokumentet uppdaterat och är den tillgänglig för alla?
 - Är kravspecifikations -dokumentet med kraven från kunden någonsin bestämt så att det inte kan modifieras mer?
- 6. Vad lägger ni mest fokus på när kraven samlas in?
 - Fokuserar ni på kundens strategiska affärsstrategiska mål?
- 7. Vilka krav ställde kunden i det senaste projektet ni arbetade med?
 - Vilka krav är vanligt förekommande i bostadsprojekt?
- 8. Hur dokumenteras icke-kvantifierbara krav? T.ex. Arkitektoniska krav.

Kommunikation

- 9. Har ni svårigheter med kommunikationen under byggnadens livscykel?
- 10. Hur mycket vill kunden eller kundens representanter vara involverade i processen?
 - Hur förhåller ni er till situationen där aktörerna inte förstår varandra? T.ex. missuppfattningar av 2D ritningar, representationer eller termer.
 - Hur garanterar ni att kunden och ni förstår varandra?
 - Lägger ni fokus på brukarnas krav/önskemål? (T.ex. hyresgäster, läkare)
- 11. Har ni någon feedback-procedur eller en form av granskning av kraven?

Appendix B – Interview Questions English

Information

- 1. Do you follow any framework or a plan to collect the requirements during the meetings and throughout the building life cycle?
 - Do you have a pre-fixed list of questions to ask or do you improvise?
 - Do you re-use the requirements collected from project to project?
- 2. How do you ensure that the client informs all the relevant information needed?
 - Do you plan in-depth discussions?
 - In literature there is a term called "the wish list syndrome" (User groups tend to maximise their wish list in anticipation of being bargained down from this). Do you come across this syndrome?
- 3. What tools do you use to document the requirements? Paper, pen, computer, recording?
 - Do the functions of these tools help or hinder the process in a way?
- 4. What kinds of difficulties do you face trying to achieve client's requirements?
 - What do you do to overcome these difficulties?
- 5. What process do you follow to handle changes in the project?
 - Do you have a central storage that you store all the requirements?
 - How is the brief updated and is it accessible for every stakeholder?
 - Is the document of requirements from the client ever frozen?
- 6. What do you put focus on the most when you collect the requirements?
 - Do you put focus on the client's business strategic goals?
- 7. What requirements did the client ask for in the last project you worked on?
 - In housing projects, what kinds of requirement are usually asked for?
- 8. How do you document non-measurable requirements? For instance architectural aesthetics.

Communication

- 9. Do you have difficulties with communication during the building life cycle?
- 10. How much does the client representatives want to be involved in the process?
 - How do you approach the situation when stakeholders do not understand each other's language? Misinterpretation of 2D drawings for instance.
 - How do you ensure you and the client fully understand each other?
 - Do you focus on the end-users needs?
- 11. Do you have a feedback procedure of the requirements or a review?