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Understanding barriers for working with a management system in the construction industry

Master's thesis in the Master degree program, Quality and Operations Management

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Abstract

A company's performance may depend on the effectiveness of its management system. Without a management system, a company does not have a common way of working and may not strive towards the same objectives and policies. Information sharing within the organisation may also be more difficult without a system. One problem at the case company is the usefulness of the management system, which will be examined in this thesis. The purpose is to understand the barriers in working with a management system within the construction industry. Suggestions for a better, suitable way for the case company to adjust their management system will be proposed. This master thesis will further look at how a company can encourage information sharing. It will also provide suggestions on how the company can incorporate lean thinking into their business processes in order to include continuous improvements in the work. This study consists of a literature review, interviews, survey and observations, which results in problems identified and several proposals of improvement actions. The problems were analysed and relevant suggestions based on theory were proposed for a better way for the company to manage their management system, making it more efficient for the users.

Keywords: Management system, Knowledge reuse, Information systems, Lean management, Lean construction

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1
Introduction

This chapter describes the background to the problem and the purpose of this master thesis. The chapter will also state the research questions that will be answered in this report, as well as the delimitation and outline of the report.

1.1 Problem background

With todays rapidly change of demand, companies need to manage their operation so they can handle variation and adapt to changes (Chang, 2006). How to organize the operation varies, but a common way is process-based management. To look at the specific processes and evaluate, find improvements, and readjust them to processes easier to manage is vital for companies to compete on the market. All the processes in an operation work hand in hand and result in an outcome that should provide value for the customers (Margherita, 2014). How to handle the processes in an operation should be stated in the management system. A management system is a foundation for a company that should state the different activities, how to handle them and for example how to include continuous improvements and other routines in the daily work. How to make decisions that are in line with the company's objectives and strategy should also be stated in the management system (Margherita, 2014). Without a management system a company does not have a common way of working and may not strive towards the same objectives and policies. It is a way for the company to integrate a shared view in the organisation and implement routines and guidelines for the workers. In the management system, it is a good idea to include how to work with quality aspects. The activities in an organisation should result in high customer value with good quality (Chang, 2006).

It becomes more common that companies in the construction industry get more involved in quality issues (Bröchner et al., 2002). This is something that is necessary and can help to reduce waste in the operation. It can be hard to identify all processes and find possible improvements since the construction operation consists of many processes, and the activities are often done by different construction partners. The inability to fully implement the quality aspect with the overall management system will inhibit a company from reaching their full potential and achieving all benefits.

Efficiency is important in today's organisations, it is vital in order to deliver at the right time when the market demands. How to arrange the organisation to enhance the efficiency as well as the processes for maintaining the efficiency depends on the organisation's structure and the kind of result they strive for (Pawlowski et al., 2009). The organizational efficiency can be affected by personnel, processes, products and programs for example, and can improve the competitive advantage for

an organisation. The personnel's skills can be an advantage for a company and therefore, training is something that can enhance the competition. Programs need to be quick and precise so that delivery can be made in time and the processes should have a clear structure for the work (Pawlowski et al., 2009). Effectiveness can be described as how well the goals are reached, this may include when the company uses the resources in the most efficient way and also provides the personnel with the proper tools to complete their tasks.

A management system should include the common view of the company and describe the different processes that need to be executed in order to work towards the company's objectives (Margherita, 2014). The system should be a ground for decision-making and provide workers with standards and routines.
The case company's currently stated problem is the inefficient use of the management system. There is a need for the workers to use the system to form a common way of working within the company. The system faces some problems since the workers do not tend to use it as intended. The consequences have been that employees spend a lot of non-value adding time when working with the system. Working with Lean is a good way of eliminating all kind of non-value adding tasks in order to improve productivity (Dileep & Chemmannur, 2014). Time efficiency is especially important in the construction industry where a low productivity rate is common (Fayek & Mohammed, 2013).

1.2 Purpose

The aim of this thesis is to understand the barriers in working with a management system within the context of the construction industry, and identify actionable suggestions for improving its value for the organisation. The expected outcomes of the thesis will be classifications of barriers in working with the case company's management system and prioritize actionable suggestions for increasing the value of the existing management system. The case company wants to include the lean concept into their operations. Therefore, the lean concept will be described and be used to support the analysis of barriers identified and be a basis for given suggestions. However, the main focus will not be on lean management.

1.3 Research questions

- What are the barriers for working with the management system at the case company?

- What are feasible suggestions that can support improvements at the case company?

1.4 Delimitation

The master thesis will be limited to understand barriers of the management system in one company in the construction industry and propose solutions suitable for Tommy Byggare. Since Tommy Byggare is using the Povel management system, the focus will be on trying to propose improvements of the already existing management system for an easier and more applicable system to the everyday organisation. The recommendations will be adjusted to fit Tommy Byggare, but in the end the suggestions may be suitable to be applied in the construction industry.

1.5 Disposition

The outline of the thesis will be described in Figure 1, after the Introduction part a description of the methods used in the research will be described. That will be followed by the theoretical framework that will be a foundation for the thesis and help answering the research questions. In the theoretical framework management system, knowledge reuse, information management and lean construction will be included. The section after will consist of the empirical findings gathered through the different methods. This will be followed by an analysis and discussion of the theoretical framework and the empirical framework. In the conclusion, the research questions will be answered and suitable suggestions will be given. Future research and limitations will also be stated in the conclusion.

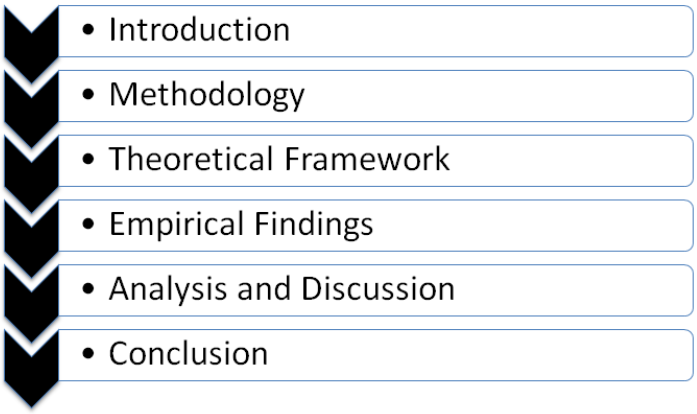

Figure 1: The outline of the thesis

2
Methodology

The following section will explain the methods used in order to conduct the research. It will also provide information about the validity and reliability of the research, as well as how ethical issues will be handled.

2.1 Structure

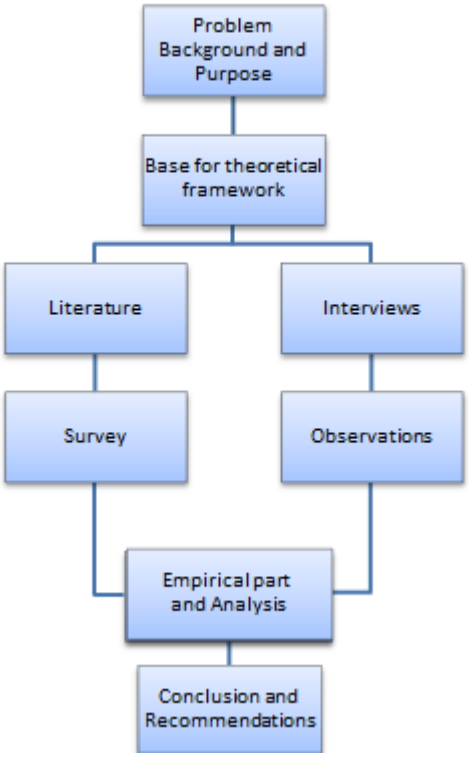

Figure 2: The structure of the different steps made for this research.

The method for this research includes; literature review, interviews, survey and observations. The data collected from the different methods were analysed and used for the foundation of the report. The literature review, interviews and the survey will be the methods mostly used in the report. This report will be formed as a qualitative research since the focus will be on conducting different research methods at the case company. This will be done in order to understand the problem the company is facing and build the report based on that. The study will be based on an inductive approach and conclusions will be drawn from the empirical and

theoretical data. The following picture illustrates the different methods conducted during the master thesis process.

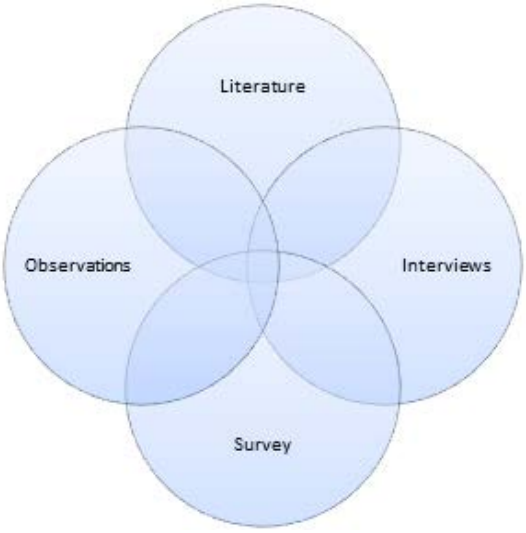

Figure 3:Overview of the methods used for data collection.

2.2 Literature review

The literature review was made with relevant scientific articles that would support the different aspects of this report in order to answer the research questions in the best possible way. The literature used for this master thesis was critically analysed in order to determine if it was suitable for this research. Well-known authors in the field were used and articles with the most citations were prioritized. The researchers included articles published more recently as well, to get perspective of how the development has progressed. Furthermore, the validity and reliability of the literature is of utter importance when accomplishing the research. The search engines used to obtain the articles for this report was Google scholar as well as the library database to find relevant articles. Furthermore, Web of science, Elsevier and Emerald insight were used as well. Finally 35 articles were chosen and identified as suitable for the research. Course literature was also used as a complement to the scientific articles and helped the researchers to get a broader understanding of the topic and set the base for the rest of the report.

Documents and internal information given by the company were also utilized in order to get a perspective of their current way of working, and to find the root-cause of the problem at the company.

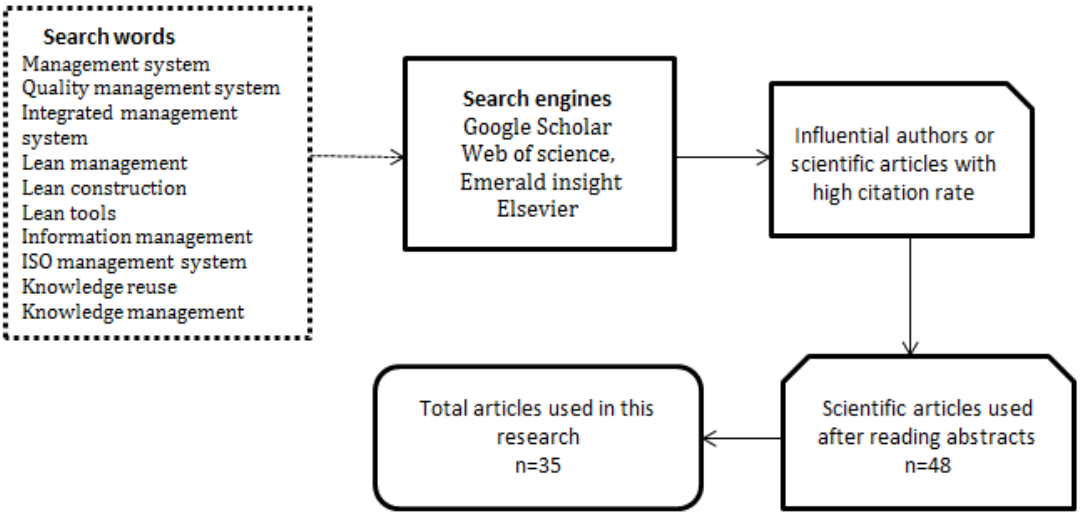

Figure 4: Process of the literature study.

The search words are: Management system, Quality management system, Integrated management system, Lean management, Lean construction, Lean tools, Information management, ISO management system, Knowledge reuse, Knowledge management.

2.3 Interviews

Interviews were conducted throughout the research process on different occasions, the interviews were done at Tommy Byggare's locations. People with different positions and experience were interviewed in order to get a broader sample size. Before starting the interview, the researchers provided a short description of the purpose of the master thesis to the interviewee to give the interviewees an understanding of the research. They were also given information about how the data would be used in the report and that the interviews would be anonymous, this to make the interviewees more relaxed and able to answer in an open way. The interviews were conducted in Swedish to be able to explain for the interviewees in a better way and the answers were later translated into English. After given permission from the interviewee, the interviews were also recorded to achieve a higher level of accuracy of the answers.

Semi-structured interviews were conducted since they create more of a dialogue with the interviewee and where follow-up questions can be made throughout the interview (Bryman & Bell, 2011). This improves the quality of the outcome since misunderstandings can be clarified immediately. A questionnaire was used during the interview, however explanation of the questions and follow-up questions were made during the process in order to get accurate data for the report. The interviews helped to set the foundation of the work and allowed the researchers to get an understanding of their current way of working and thinking.

The use of face-to-face interviews was the primary source of data from the company, it allows for an open discussion between the interviewer and interviewee (Bryman & Bell, 2011). However, phone interviews and questions sent by e-mail were also used during the process of the master thesis in order to get feedback on uncertainties. As well as reach people that did not have the possibility to meet. Phone interviews can facilitate communication accessibility for both parties and be more efficient.

After each interview, the researchers went through the recordings and detailed answers were written. This was a good way to secure that the data used in the report was correct and making sure not to forget any important details. The answers were then analysed according to their work position, experience of management systems, how long time they had worked for the company and common links were categorized into different sections.

2.4 Survey

A survey was conducted in order to get a more in-depth understanding of the problem the company faces and knowledge about what the workers found difficult with the current management system. The survey was also used to have the data from the interviews validated. This was a good way to get more information in finding the root-cause of the problem and work towards finding a better solution.

A survey was made in order to reach a bigger demographic which would enhance the reliability of the conclusions. The survey was made as a self-completion questionnaire and was sent by e-mail to people currently working with the management system and that use it in their work. This was workers with different positions and experience in the company, which was a good way to later categorize the answers accordingly. The questionnaire had open questions as well as more in-depth questions, but was made in a way that was easy to understand and follow. This is important since there is nobody asking the questions and to clarify misunderstandings (Bryman & Bell, 2011). The survey took approximately 15 minutes for the worker to fill in and consisted of questions that were answered by rating different statements. It was sent out twice to get more responses and to remind users to answer, in total 45 answers was received.

Before sending out the survey, it was tested by two persons outside the company and reviewed by the supervisor at Chalmers and one employee at Tommy Byggare. This was done to check the understanding, spelling and explanations so the questions were easy to understand and answer.

2.5 Observations

Observations were done when the researchers visited the company's offices and construction sites. They were often made simultaneously as the interview occasions on the construction sites, the head office located in Alingsås and the office in Gothenburg. This gave the opportunity to meet other employees working at the different locations of Tommy Byggare and also gave the researchers a more in depth understanding of how the work was conducted. Observations made at construction sites resulted in realizing the use of the different documents and also the routines when using the management system. Since the construction sites were on-going projects at different levels of accomplishment, it gave the researchers insight in how frequently and how the workers used the management system.

2.6 Validity and reliability

It is important to have reliable sources for this report, by having the data collection done with people with knowledge and experience in the company. Furthermore, when conducting the literature review it was important to use scientific articles and that they were critically analysed before using the data. As mentioned previously, the use of semi-structured interviews allowed the researchers to ask follow-up questions to clarify any misunderstandings (Bryman & Bell, 2011).
The supervisor at the company assisted with information about the company and their processes, which helped the researchers' to secure and control that the right data are used in the research. Access to the company's internal documents and systems enabled the collection of accurate data.

The reliability of this research will be strengthened by the ability of replication to other areas (Bryman & Bell, 2011). This master thesis will be examining one company in the construction industry, however the suggestions given in the report may be useful for other companies within the same industry and settings. The authors will also collect data at multiple occasions and with workers from different areas within the company, making sure that variation is minimized in the answers. This was done to achieve a more in-depth analysis and be able to examine the variation of the answers. The selection of people participating in the data collection will be carefully analysed and chosen in order to assure higher validity of the outcome (Bryman & Bell, 2011). In order to achieve a higher level of trustworthiness, notes were made during and after each occasion of data collection or field visit. The interviews were also recorded to secure that the correct data was used.

2.7 Ethical issues

Ethical issues are of great importance when cooperating with a company in writing a research report. According to Bryman & Bell (2011), there are four issues regarding ethical principles which are: harm to participants, lack of informed consent, invasion of privacy and deception. During the process of the master thesis, the researchers made sure that these ethical issues stated by Bryman and Bell (2011) were considered. The researchers also made sure that the documents given by the company were used in confidentiality and only in the intended way. The participants during this process were informed about the purpose of the data collection and were only used if consent was given by the participant. If the interviewees asked to be anonymous, it was respected and only data approved by the company was used in the report. The company is informed about the publishing of the thesis and approve the information used in the report. The company name will be used but names of interviewees will not appear in the text, only titles of those interviewed. This will be done to protect the individuals from harm, invasion of privacy and deception.

3
Theoretical framework

This chapter includes the theoretical framework for the study. It will further be the ground for analysis and suggestions throughout the report.

3.1 Management system

A well-designed management system is crucial for a company since it sets the base for how the company will perform (Tiller, 2012). The management system is a good tool to reduce the boundaries within the organization and help the information flow (Moljevic et al. 2013). In the management system, actions for strategic planning of practices, policies, tasks and processes within the organization can be found. The system gives a ground for the organization to make decisions according to the business strategy.

Tiller (2012), states that network-based systems are proven to be the most effective since it allows employees to access information in a more efficient manner. It is important that information in the management system is shared amongst the users. In order to create a sustainable management system, it is important to link the organizational strategies to the system. Furthermore, the author states the importance of having the data currently updated and trustworthy (Tiller, 2012).

Boiral (2012) found that the management system helped with internal communication within the organization and easier documentation management. By integrating information and knowledge in the management system, the amount of double work can be reduced since similar data can be detected (Moljevic et al. 2013). Moljevic et al. (2013) further mention that having documented procedures and structure helps newly employees to quickly understand and follow the requested work tasks. Important to remember is that implementing too many aspects into the management system can lead to increased bureaucracy, which may force to trade-offs which can further decrease the efficiency (Roy et al., 2013).

3.1.1 Implementation of a Management system

Resistance from the organization is a challenge that comes with most change processes. People tend to be afraid of change and not able to see how a new system will improve their everyday work (Nadler & Tushman, 2004). The way the system is managed and internalized will determine how successful the implementation will be and the potential benefits to gain (Boiral, 2011). Lack of employee involvement will create resistance further on, if not handled from the beginning. Proper understanding, guidance and involvement are crucial to avoid in-house resistance (Boiral, 2011). In order to maintain the effectiveness of the management system, it is important to assign appropriate roles and responsibilities to people that should work continuously with improvements in the system (Tiller, 2012). Here, leadership commitment is crucial in order to sustain a working management system.
Too strict standardization of routines may increase the resistance to change (Naveh & Marcus, 2005). They concluded that it is how the system is implemented that determines the degree of competitive advantage it achieves.

A company's management system should prevent problems from occurring (Moatazed-Keivani et al., 1999). Since there normally are many users of the management system, cooperation can be difficult. In order to overcome this, Moatazed-Keivani et al. (1999) state communication and feedback as crucial to create mutual trust and understanding. Cooperation between all departments is essential to make a management system work, so it is important to strive for. This will also facilitate the process of using the system according to the conditions which will enhance quality (Moatazed-Keivani et al., 1999). Since there are a lot of people involved in a construction project, there is a tendency of having difficulties in learning everyone about the routines and procedures involved (Landin, 2010). The earlier in the process the system is used, the more effective and useful it gets.

Bellotti and Smith (2000) mention that even with systems based on new technology, people still tend to use paper and folders when handling information. People dislike having to spend a big amount of time to master how to use a system; therefore the tools should not be complex or difficult to learn. In their study, they created a personal information management system that enabled the user to filter the search by specifying their needs. They mentioned that a way of facilitating the search of a specific document could be to have the user checking off boxes in the system.
An important factor in the proposed system is the menu which allows the users to choose how much content that should be displayed. The list of results then consists of information that is relevant for that user. Another example is the possibility to save previously made searches or search for documents that were used most recently (Bellotti & Smith, 2000).

Companies invest a lot of resources in implementing a management system, however if not used properly it becomes a failed investment (Markus & Keil, 1994). They mention that the lack of use is usually due to poor design of the system. If the people using the system do not see it as a tool that improves the productivity, they will not use it (Markus & Keil, 1994). They also state that many companies focus on improving one part of the system which leads to sub-optimization. It is important to look at the system as a whole and finding the root-cause to why people do not use the system. Interpreting the underlying reason from the users can however be difficult to understand. Users know what they find difficult with the part of the system they use the most, however they tend not to look at the bigger picture. It is further important to review the system on a continuous basis and get input from the users (Markus & Keil, 1994).

3.2 Knowledge reuse

Knowledge is an important resource in today's organizations. Alavi and Leidner (1999) mention in their article the importance of knowledge in the organisation for competitive advantage and as something that brings value to the operation. How to gain knowledge and how to remember and document it depends on situations as well as both human and technical resources. How to reuse information in an organization is important for the organizational effectiveness according to Markus (2001). The processes of knowledge can be either creation of knowledge for example product development or the reuse of knowledge and shared exercises to solve problems.

Resources can be seen as property-based and knowledge-based, however knowledge is not as easy to copy since it can be hard for others outside the organisation to understand (Miller & Shamsie (1996) in Alavi & Leidner (1999)). The knowledge can exist of an individual's knowledge or included in policies, routines and documents for the organisation to use. Knowledge can be explained as two different states, explicit and tacit. Explicit is the knowledge that is documented, has a clear structure and can be used by anyone (Markus, 2001). Tacit knowledge is the information that is captured in the head of a person; it may not be documented and shared with others. In knowledge management the flow of information can be discussed as well as information technology and the distribution of knowledge between people who have the information and the ones who do not. Only explicit knowledge can be a part of information technology (Markus, 2001).

How the organization distribute knowledge is of importance for efficient use and competitive advantage. The documents need to be stored in a suitable way and information technology is usually applicable in the form of Internet and intranets (Alavi & Leidner, 1999). Information technology can give easier access to the knowledge, this to manage the knowledge so the employees can take advantage of it, both for development of an individual's own knowledge base and to be able to use it for the organisational matter.

Markus (2001) identifies four types of knowledge re-users;
-Shared work producers work in a group and produce knowledge that they can reuse, this setting observe and give attention to things that needs to be improved and develop the teamwork for a better performance next time.
-Shared work practitioners consist of people that work by themselves but perform similar work, create knowledge for others to use and help each other. They can gain new knowledge from co-workers and can advise people.
-Expertise-seeking novices are people that need expert help, do not have the knowledge themselves since they need it rarely.
-Secondary knowledge miners are people who want to find and develop new knowledge.

The type "*shared work producers*" documents the knowledge for repeated use and therefore faces fewer challenges than the other re-user types. The shared work producers have easier to identify the information needed from the documents and use it in an efficient way. In this case they can understand the tacit knowledge of other colleagues within the team, which can lead to a better understanding of the documented explicit knowledge. The re-user can identify incorrect information and replace it since they can understand the tacit knowledge of a colleague. One problem with the other type, "*shared work practitioners*" is that even if they work similarly, the documented knowledge may not be appropriate in different work settings (Markus, 2001). As well as that the document can be out of date and not updated and therefore the knowledge is not appropriate anymore. The documentation also needs to be recorded in a way the users understand, it is important with proper information and data to contribute with accurate knowledge (Markus, 2001).

In Alavi and Leidner (1999) they discuss that knowledge can be seen in different ways; data and information, state of mind, object, process, access to information or capability, see Figure 5. To get a better understanding of what knowledge in knowledge management is and what their systems stands for they have made a description: "*The adopted definition, based on the work of Nonaka (1994) and Huber (1991), is: knowledge is a justified belief that increases an entity's capacity for taking effective action*" (Alavi & Leidner, 1999, pp 14). They further discuss that knowledge needs to be transferred and described so that users can understand it and use it to be valuable for the organisation. Also the importance for development and learning in an organisation, since a lot of information will not give value if it is not received in a good way by the users. Only to implement an information system and make information available will not spread knowledge within an organisation (Alavi & Leidner, 1999).

Definition of Knowledge		Implications for Knowledge Management (KM)	Implications for Knowledge Management Systems (KMS)
Knowledge vis a vis Data and Information	Data is facts, raw numbers Information is processed/interpreted data Knowledge is personalized information	KM focuses on exposing individuals to potentially useful information and facilitating assimilation of information	KMS will not appear radically different from existing IS, but will be extended toward helping in user assimilation of information
State of Mind	Knowledge is the state of knowing and understanding	KM focuses on exposing individuals to potentially useful information and facilitating assimilation of information	Impossible to mechanize state of knowing. Role of IT to provide sources of knowledge rather than knowledge itself.
Object	Knowledge are objects to be stored and manipulated	Key KM issue is building and managing knowledge stocks	Role of IT involves gathering, codifying, and storing knowledge
Process	Knowledge is a process of applying expertise	KM focus is on knowledge flows and the process of creation, sharing, and distributing knowledge	Role of IT to provide link among sources of knowledge to create wider breadth and depth of knowledge flows
Access to Information	Knowledge is a condition of access to information	KM focus is organized access to and retrieval of knowledge content	Role of IT to provide effective search and retrieval mechanisms for locating relevant information
Capability	Knowledge is the potential to influence action	KM is about building core competencies and understanding strategic know-how	Role of IT is to enhance intellectual capital by supporting development of individual and organizational competencies

Figure 5: Different definitions of knowledge (Alavi & Leidner, 1999).

3.3 Extracting information

Time is a scarce resource, especially in the construction industry where companies work according to a tight schedule. Panibratov and Larinov (2015) mention that time is the resource that affects the effectiveness of the company the most. Information management is necessary in an organisation and should guarantee that valuable information is maintained and used throughout the business processes. Lean encompasses waste elimination, identifying value and creation of a flow in the organisation, which fits well together with information management (Hicks, 2007).

In order for the management system to be helpful and used properly, it is important that it is easy to find the right document amongst a large amount of data. If the system is not working as a tool to find the right information, it becomes a hurdle instead of a way of extracting the right document easily (Ramakrishan & Gehrke, 2010). If the system works properly, the system can add a lot of value and save time and money. According to Ramakrishan and Gehrke (2010), a good way of improving the system is to centralize the data, taking into consideration how different people use it and managing it accordingly. They also mention that it is important to reduce redundancy, such as documents containing the same information without adding any extra value. According to Wise (2013), a company's management system becomes more effective if it is data-based. A management system that is data-based allows the company to store important guidelines and regulations that the company should work according to as well as internal documents.

The whole idea of storing data in a system is to be able to retrieve it in a simple way when needed. When sorting all kinds of data, categorization is important in order to find the right data when required (Lansdale, 1988). However, this is not as easy as it sounds, since there tends to be a problem of how to categorize a document. A study carried out by Malone (1983)

showcased the difficulties in classifying different information. A solution to this problem could be to classify files depending on when they were last used and/or the frequency of use. Since most workers use the same documents regularly, this would be a good way to get easy access to the most commonly used files. According to Malone (1983) an effective information management system would allow the user to search for multiple words. The system should recognize the keywords typed by the user and retrieve that exact file.

According to Lansdale (1988), one solution can be having a system that provides a number of options to the user which in turn leads to more specific options in order to find the right document. The problem with this solution is that people tend to select the wrong category, which then results in a lot of time spent on trying to find the first right option. This procedure makes the system counter-effective since a lot of time is spent on non-value adding activities. According to Lansdale (1988), the problem is that it is difficult to determine under which folder that type of information should go under. The word used when searching for a document may not be the same used when storing the file. Another problem stated is the fact that information usually overlaps more than one category, which makes it difficult to know where to place it. There are a lot of different words that can be used to name that specific document that incorporates the content of the document. The choice of how to name it should be clear and well-defined so that it is easy for all the users to understand. When trying to remember the name of a file, people tend to search for a word that they believe compromises the context of that file. However most of the times, this results in either a lot of irrelevant data or not finding any relevant documents. Lansdale (1988), mention that it is crucial that the information management system is adapted to the people actually using it, and how they believe is the best suitable way.

In the article by Teevan et al. (2004) they discuss the difficulties of searching for documents. Interviews were conducted for their study and one interviewee mentioned; *"I knew what directory I thought it would be in. I had this mental idea of which directory it was. It is just that I didn't know necessarily how to type that path name from memory and so I used the path completion to get the directory. [...] I didn't know that path down the whole tree. I didn't know how many levels down it was, even though I knew what the name was at the lowest level of that sub-directory*" (Teevan et al. 2004 p 418). Many of the people interviewed in the study carried out by Teevan et al. (2004) knew what document they needed, however, they did not know the path of extracting that specific document. A search engine that give examples of more than one path in order to help the user to navigate through the system and finding the wanted document is suggested (Teevan et al. 2004).

3.4 Lean construction

Lean management is about removing unnecessary waste from the production processes to create a better flow (Parkes, 2015). But most importantly, it is a cultural aspect, which has to be embraced by having everyone in the organization work towards continuous improvements, and strive for perfection. Lean is described by Womack and Jones (1990) in Hicks (2007) with five principles. First the value should be specified from the customer's perspective. Identify value streams for each product or product group. Focus on waste elimination and value flow should be created. The customer should control the production and the company should provide what the customer wants. At last, strive for perfection with continuous improvements and elimination of activities that create waste.

Lean construction is an approach of the lean management system, which applies for the construction industry. There are a lot of benefits that a company in the construction industry can achieve by implementing lean principles (Boiral, 2011). Lean manufacturing encourages standardised and repetitive processes, as well as improved processes that can decrease the lead time (Jørgensen & Emmitt, 2008). These are some aspects of lean that does not fit so well in the construction industry, since lean was first developed for manufacturing processes with high volume. A construction site consists of one project and does not stand for high volume. Repetitive processes can be made of some types of buildings but most often a construction project consists of new processes and every construction site is different (Jørgensen & Emmitt, 2008). According to Eriksson (2010), it can be a challenge to adapt lean in this type of industry. Since the construction industry does not operate according to a manufacturing line, the approach has to be adapted to this environment (Sacks et al., 2010). Therefore, the lean principles have to be customized in order to fit each context.

As mentioned above, critics of lean manufacturing believe that lean is a method for production with high volume, and that the tools do not fit manufacturers that do not live up to this condition. It is important to remember that publications about lean in the construction industry do not yet have a strong foundation and thus more research is needed (Jørgensen & Emmitt, 2008).

The customer focus is a big part of lean, all operations should bring value for the customer. This can be a barrier when implementing lean into construction since there is seldom only one end customer within a construction project, which leads to many different needs to take into consideration. A construction project delivers value over a long time period, one project may span over a year. Providing goods or services when the customer needs it is impossible for a construction project, since the customer has to wait to get what he ordered. (Jørgensen & Emmitt, 2008)

Eriksson (2010) mention that one important factor in lean construction is about creating a flow between the processes in order to make waste visible and finding the proper way of eliminating it. The outcome of the processes should represent the value that the company offer the customer. The activities are dependent on other activities in the operation and cannot work alone, so all processes needs to work together to create value (Chang, 2006). To determine the business processes the operation can be coordinated and resources can be distributed in the best way (Margherita, 2014). Continuously evaluating the processes and search for improvements makes the organisation more ready for changes in the market and can adapt efficiently to those (Chang, 2006). Identification of the processes and seeing the whole operation as linked processes leads to an easier way to map the different activities and see needed improvements, which can enable better efficiency (Margherita, 2014). A key aspect in lean philosophy is continuous improvement which is done by working with problem solving and finding the root-cause of problems (Eriksson, 2010).

Pheng et al. (2016) states that the productivity is low in the construction industry compared to other industries; this can be due to the unnecessary waste that can be seen throughout the whole supply chain. According to Pheng et al. (2016), there is a lot of waste that can be detected throughout the processes in a construction project. Waste from unnecessary use of resources such as material and time delay is seen as major factors contributing to waste. According to the lean principles, there are however ways to minimize waste in the operation. These activities are important in order to achieve transparency within the operation such as; training, coordination of activities, appropriate planning and scheduling (Pheng et al. 2016).

3.4.1 Waste

In lean, there is a focus on eliminating activities that do not bring value to the work. Within lean there are seven main types of waste that do not contribute with value for the operation. The seven types of waste are listed below (Hicks, 2007);

1. Overproduction is when the operation continues to produce when there is no longer a need; this causes increased inventory levels and high volume of products.
2. Waiting means phases when the activity is low, one process is waiting for another process to finish, and this does not add value.
3. Transports include movements that are unnecessary; work in progress is moved from one process to the next for example. This should be minimized since it will add more time to the process.
4. Extra processing refers to rework, handling of defects and overproduction.
5. Inventory means extra inventory that do not respond to the customer demands, then it is a cost for the operation.
6. Motion is when the employees take unnecessary steps or walks to get equipment for example. It will take time and is not value adding.
7. Defects, when the finished products do not meet the expectations.

Waste in the construction industry is typically more difficult to discover since they usually work with parallel activities simultaneously. Common waste in the construction industry is; time delays, reworking, unnecessary movements, excessive use of resources, large inventories and overproduction (Sacks et al., 2010). Another problem is the lack of communication between managers and contractors which makes it difficult to uncover processes that generate waste. Trade of information in real-time should be implemented in order to facilitate communication between all parties. Field workers tend to sub-optimize and focus on the local performance instead of focusing on the project as a continuous flow. According to Sacks et al. (2010), it should be the team leader who is in charge of making sure that the tasks are being performed and should communicate to the rest of the team. In order to achieve this efficiently, an agile information system is needed in order to reach out to everyone involved. An agile system is an approach that can quickly adapt to the circumstances. Feedback on the status of the current situation is important in order to let people working on the field be updated on what is happening (Sacks et al., 2010). Waste in the processes can also arise from failures in information flow, if information is not provided when needed or if the information is inaccurate or old (Hicks, 2007). Lean can enable a better flow if such waste is eliminated and the organisation strives for improvements of the information management.

3.4.2 Implementing lean in construction setting

To get an effective implementation of the lean concept, top management commitment and involvement is crucial. According to Fayek and Mohammed (2013), training and education about the lean philosophy should be done before starting to implement different lean tools. It is important that the lean concept is understood by everyone involved in order to have them work according to this new philosophy and incorporating it in their daily work (Fayek & Mohammed, 2013).

It is important to have goals that are both process- and result-oriented. However, companies should focus on being more process-oriented since this will enhance process improvements (Fayek & Mohammed, 2013). Most companies in the construction industry tend to be result-oriented, which means that they focus on the results such as cost and time. Workers view the project as different activities instead of looking at it as a continuous flow. Being too focused on results may lead to only looking at the problems at the surface, instead of finding the root-cause of the problems. This becomes a source of waste, since companies put a lot of resources to ”fight fires” instead of preventing them from occurring in the first place. An important part of the lean philosophy is to stop the process when there is a problem and finding corrective measures immediately (Sacks et al., 2010). This is called Andon, which in the manufacturing industry is about stopping the line when there is a problem and fixing it right away. By handling quality issues and other problems as soon as they are detected will prevent the problems from occurring later on when the problem becomes much greater (Sacks et al., 2010).

The construction industry has a relatively low input of workers in problem solving activities, which will inhibit learning in the company (Eriksson, 2010). Therefore, cooperation between everyone is important, as well as acknowledging people's input, making them feel that their suggestions matter. Working with quality circles is a good way of enhancing knowledge sharing which is an important step towards working with continuous improvement (Eriksson, 2010). Quality circles consist of a group of people working together to improve processes and contribute to learning (Salem et al., 2006). Another central aspect of lean construction is working closely with other actors in the supply chain and creating good, long-term relationships. Here, joint communication systems are important in order to facilitate cooperation between parties (Eriksson, 2010).

Fayek & Mohammed (2013) propose having daily ”huddle meetings” where the team at the field gets together and discuss reached milestones and problems that have occurred during their work. This is a good way for everyone to get an overview of how the project is progressing. It will give a sense of involvement when having the possibility to share own ideas and contributing to improvements of their daily work. Visualization is another good tool to use in order to let people get an insight on the progress of a project. This is also useful to facilitate communication between people within different functions, for example managers and field workers. Cross-organizational cooperation should be adopted by companies in order to prevent problems between organisational boundaries (Fayek & Mohammed, 2013).

When implementing a new philosophy into the culture of the company, there will be very different reactions from people affected by these changes. Fayek and Mohammed (2013) mention the need to segment them into different sub-groups of people. The champions are those who find changes fun and intriguing, and are willing to contribute to improve their daily work. Then there is another group that neither are positive nor negative to change nor are willing to test it out as long as it does not require too much effort from their side. The last group are people who are not willing to change and find changes unnecessary and a waste of time. It is therefore important to find ways of dealing with each group individually since they require different needs. Participation and showing short-term wins are an effective way of getting people excited about the change (Fayek & Mohammed, 2013).

4
Empirical data

This chapter contains a short description of the case company as well as data collection gathered through interviews and a survey.

4.1 Company description

The construction company Tommy Byggare started their business in 1970. The company developed to a real-estate group that today consist of three business groups which involves; properties, residences and construction services with main focus on commercial properties for business, industry and offices (Tommy Byggare, 2016). Since the start the company has grown and today Tommy Byggare engage 220 employees[1].

4.2 Povel Management System

Sveriges Byggindustrier is an industry association and employee organisation for the construction business in Sweden. The purpose of the organisation is to encourage the companies that are members in *Sveriges Byggindustrier* and foster the common interests of employees and employers. Also regulate wage systems and rules in the industry to have a fair structure. (Sveriges Byggindustrier, 2017)

Povel management system is a tool developed by *Sveriges Byggindustrier*. The system is directed to construction-, and facility companies and also specialized companies, this to enable an easier way to meet the requirements from customers and other stakeholders. Povel enables companies to create a management system, and give directions and tools to better establish a system that include the company's objectives with all the requirements that is placed on the construction companies today. To create a management system, the work needs to be structured and Povel gives the company guidance in the process of establishing a management system. The requirements of ISO 9001, 14001 and OHSAS 18001 are followed in Povel and the requests are taken into consideration. When implementing Povel, there are revisions made in connection with the final diploma. (Sveriges Byggindustrier, 2017)

Boiral (2011) states that companies who already have a working management system and incorporate the ISO system have been the most successful in the implementation process. It is however important to note that the ISO system will only be implemented successfully if managers and employees truly believe in its

[1] Environment manager, Tommy Byggare, Fabriksgatan, 2017-03-31

efficiency and the benefits it can bring (Boiral, 2011).

4.3 Description of the Management system at Tommy Byggare

Tommy Byggare is using the management system Povel, created by Sveriges Byggindustrier[2]. The system is developed in Microsoft Office and is based on a file structure. The Povel management system should contribute to creation of orderliness and integration of the company's systems. As well as meeting requirements from stakeholders, customers and society, increase preparations and planning for work and encourage continuous improvements (Sveriges Byggindustrier, 2017). If using Povel right it should help the company to be more profitable and effective in their processes[3].

In Povel there are four key parts included; management, resources, implementation and measurement/analysis/improvement. The management part addresses the responsibilities of the management and related missions they need to consider in the operation. Resources include the need of assets that are essential for the operation to work. The implementation part defines the operation process from start to end and measurement/analysis/improvement deals with all three mentioned parts and focus on continuous improvements in the operation. (Sveriges Byggindustrier, 2017)

[2] Environment manager, Tommy Byggare, Fabriksgatan, 2017-01-25

[3] Coordinator of Povel, Sveriges Byggindustrier, 2017-04-26

When implementing Povel 25 folders are recommended, a company using Povel can organize and add folders as they like, however the certification of Povel only involves the 25 recommended folders. Tommy Byggare added six folders to the 25 recommended folders; General documents (0), Operational development (00), Equipment rental (17), Damp proofing (21,1), Building service (25) and Temporary folder (30). Tommy Byggare therefore has 31 folders in their management system, as seen in Figure 6. Tommy Byggare is using an older version of Povel which does not have the latest updates.

0 General documents
00 Operational development
1 Business concept and vision
2 Policy and objectives
3 Organizational areas of responsibilities
4 Document management
5 Laws and requirements
6 Communication
7 Competence development Education
8 Risk analysis Emergency preparedness Crisis
9 Management review
10 Co-worker
11 Suppliers
12 Facilities and IT
13 Economic administrations
14 Work environment
15 Quality
16 Environment
17 Equipment rental
18 Market Customers
19 Tendering
20 Projection
21 Production preparation
21.1 Damp proofing
22 Purchase
23 Production
24 Completion
25 Building Service
26 Measurement analysis
27 Continuous improvement work Development
30 Temporary folder

Figure 6: The folder structure of Tommy Byggare's management system.

The implementation of Povel consists of several workshops with a supervisor working with Povel, the workshops can be done with other companies or internally with only the company. Not the whole company participate in the workshops; a selected group of people from a company are chosen to be a part of the Povel implementation and involved in the workshops. It is later their mission to inform the rest of the organisation and create an understanding in the whole company. During the workshops, presentations of the system and the structure is done and the company will go through the four sections in Povel; management, resources, implementation and measurement/analysis/improvement. The folders are divided into the different sections: folders 1-9 are management, 10-16 resources, 17-23 implementation and 24-25 measurement/analysis/improvement[3].

However, at Tommy Byggare they have taken away the structure of the four principal sections and have all the folders lined up, as seen in Figure 6. The Povel system offers a table of content in order for users to get an overview of the folders in the system, links to the documents are provided in the table for quick access[3]. As observed, Tommy Byggare does not have this table of content in their management system and the folders are placed in a list. This may have resulted in a structure that the workers feel is complex and hard to navigate in.

Each folder contains of material such as templates, documents and routines that is used in that context. For example in folder (15) Quality, the workers can find related subjects like quality policy, the quality goals and developing plan regarding quality etc. A sub-folder for comments (99) exists in each folder where workers can give their point of view and suggestions regarding the documents and templates. As can be seen in Figure 7, there are a lot of steps that needs to be taken in order to reach one specific document or template.

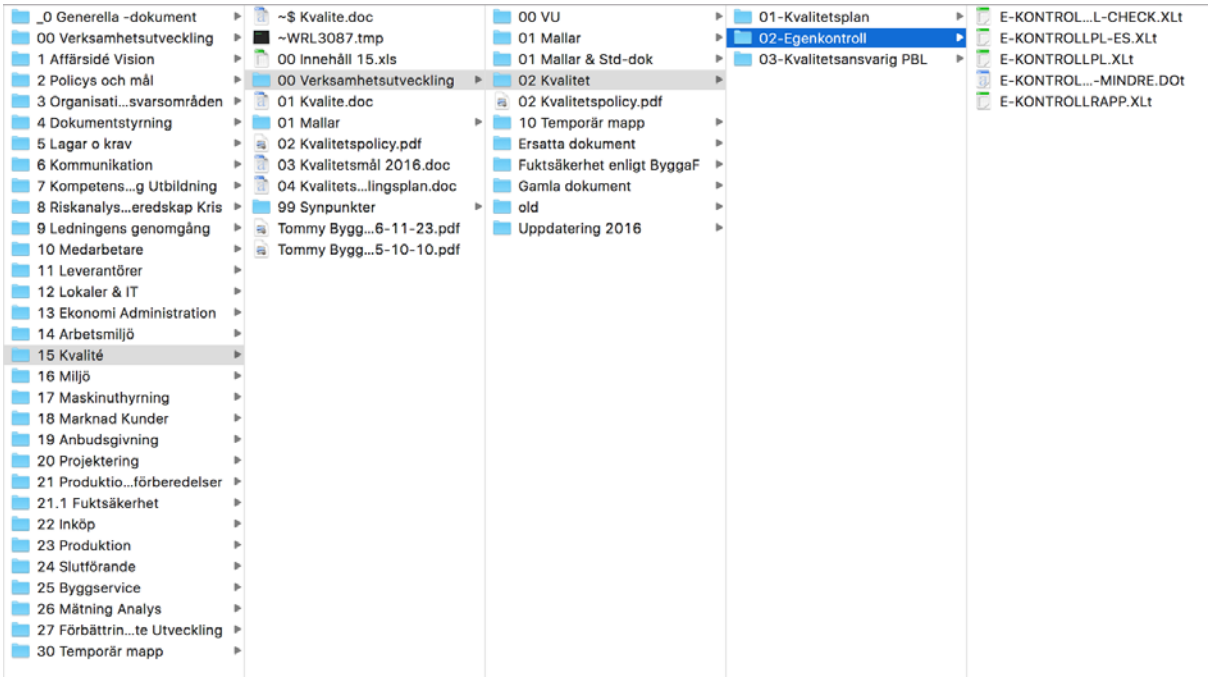

Figure 7: The structure when breaking down one folder (15 Quality).

The owner of the management system is the CEO. However, he states that he does not work with the formation and development of the management system[4]. He delegates the responsibility to the support functions that are supposed to work with improving the system and makes sure that they have enough resources for that purpose.[4]

[4] CEO, Tommy Byggare, Alingsås, 2017-04-10

4.4 Data collection from interviews

This section is based on empirical data received from interviews performed during visits at the company's various construction sites and offices. The interview answers differ due to different background of the workers, time of employment at Tommy Byggare and previous experience. The use of the management system also differs between the work positions.

4.4.1 Implementation

The current management system at Tommy Byggare is structured through Povel management system which they started developing in 2011. The company is also certified according to ISO since 2016[2]. The process of becoming ISO-certified can be easier when Povel management system already is implemented since the structure of Povel complies with the quality, environment and work environment requirements specified in ISO (Tommy Byggare, 2016).

When Tommy Byggare implemented Povel in 2011, one person was chosen to be responsible for the whole implementation process[5]. The 25 different main folders in the structure of Povel were divided between several persons who received the ownership of one or several sections[6]. They had the responsibility to update each folder with suitable documents needed in the work and documenting how the work was supposed to be performed. The responsible person for each section had the ability to choose other workers to be a part of the development of the folders as well. The person responsible for the whole process does no longer work at Tommy Byggare and the responsibility have been passed on to others.

One difficult part with the implementation of Povel was to allocate and divide all the documents into suitable folders[6]. A document can be used at several different occasions and it is therefore difficult to place them in one folder. This can be confusing for the users since they can associate one document with another folder than the one it is placed in[7]. This leads to unnecessary time consumed when searching for documents in the wrong folder. The process of establishing the system and later spread it in the whole organisation, to encourage employees to use the system in the right way have been a difficult part for Tommy Byggare[6].

[5] HR-Staff manager, Tommy Byggare, Alingsås, 2017-04-10

[6] Purchasing manager/Quality manager, Tommy Byggare, Fabriksgatan, 2017-03-23

[7] Project engineer, Tommy Byggare, Sisjön, 2017-03-13

4.4.2 Users of the Management system

Not all employees at Tommy Byggare have access to the management system[8]. There are about 100 people within the organization that have access to the system of the total 220 employees. However, only 70-80 people use the management system in their work and these are only white collar workers[9]. White collar workers consist of for example the construction managers, project engineers, field managers, middle management and foremen. The construction workers, also called blue collars, do not have access to the system since they do not have computers accessible. The blue collar workers report to the project managers if they need to update some parts in the system and get instructions from white collar workers.

The current organizational chart is structured in a hierarchical way where decisions mostly follow a top-down approach. Figure 8 is a simplified picture of the company's organizational chart since the company in reality consist of several employees within every occupational category. The field manager for example, normally has more than one middle manager that is responsible for the foreman and field workers.

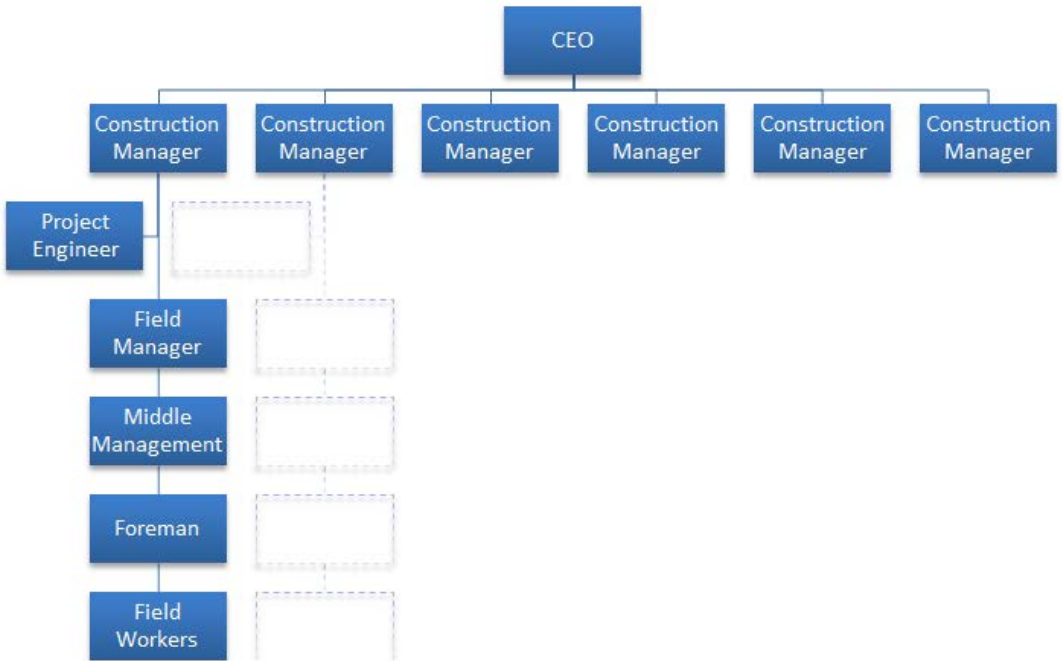

Figure 8: A simplified structure of the organizational chart at Tommy Byggare.

[8] Environment manager, Tommy Byggare, Alingsås, 2017-02-08

[9] Environment manager, Tommy Byggare, Fabriksgatan, 2017-02-09

4.4.3 Introduction of the Management system

The people interviewed at Tommy Byggare had different introductions of the management system depending on when the employment started at the company[10] [11]. People that have been working a longer time at Tommy Byggare experienced a lighter introduction of the management system[12]. An introduction was held where the overall system was explained at one occasion. The employees were then responsible to get to know the different folders and documents in the management system by themselves, and in the case of any uncertainties call and ask a colleague. However, the perception of whom to call differed since there was not a specific contact person responsible for handling this issue. The introduction of the management system was very quick and explained the same day, which people found overwhelming[11]. One field manager mentions that the introductions should be *"held on different occasions, not the same day. Otherwise it becomes too much"*[11]. People employed more recently at the company have a more thorough introduction, with explanation of the most commonly used folders in the management system[13] [14]. One middle manager points out: *"Cannot work with it in practice during the introduction",* concerning the introduction of the system[14].

Most employees consider it difficult to find the right document when they need it, which may be due to the fact that they did not have a thorough introduction of the management system[5]. Most workers do not have knowledge about what the system contains overall[12] [15]. From the interviews, it emerged that the employees that have been working since before they implemented Povel 2011 at Tommy Byggare, tend to not use the management system in the same extent as newly employed[12] [14] [15]. The workers with an employment earlier than 2011 that also had a chance to influence the implementation of the management system are more experienced in the system than workers who were not included in the development of the system. The common link of the users interviewed is that they find it hard to navigate in the system and that they call someone that has more knowledge about the management system when they have difficulties finding the right document[10]. One worker said during the interview *"My toughest challenge is to get as much as possible done within eight hours, then I cannot sit and search on a computer for two hours, so I will call instead and find out in two minutes"* [12]. This can be seen as it ruins the idea of working with a management system if not everybody is committed to use the system in their work.

[10] Field manager, Tommy Byggare, Kungsbacka, 2017-03-13

[11] Field manager, Tommy Byggare, Sisjön, 2017-03-13

[12] Field manager, Tommy Byggare, Kvillebäcken, 2017-03-14

[13] Project engineer, Tommy Byggare, Fabriksgatan, 2017-03-23

[14] Foreman 1, Tommy Byggare, Kvillebäcken, 2017-03-14

[15] Foreman 2, Tommy Byggare, Kvillebäcken, 2017-03-12

4.4.4 Perceptions of the Management system

Since the interviewees had different backgrounds, the answers and the perceptions of the management system diverged. Also the experience of working with or been introduced to management systems before, influence the different perceptions of the workers. Several of the workers that have been employed a longer time at Tommy Byggare do not have any experience of management systems before and got introduced to it at the company. For the workers that recently started at Tommy Byggare, the experience of management system is more common, some have worked with it at earlier employments and some have heard about it in their studies.

Better performance and efficiency of the management system is needed and making the system more user-friendly for the users. When asked what would make the system more efficient one respondent said *"The structure, work through the current folders and update everything, so that everything is available. It will make it easier, so you do not have to fill in the documents yourself and rework"* [7]. When employers feel that the management system is confusing and complex it makes it difficult to incorporate the system into their daily work. Proper understanding of the system is crucial in order to be able to apply it into the organizational culture, which in turn will determine its effectiveness[7]. *"It has been a time where a lot of documents was just laying around and created a mess, the system has not been maintained"*, one interviewee responded[10].

The start-up process for every project is the same, there are documents that are required at every construction site regardless the size of the project[1]. Must-have documents are documents regarding quality assurance plan, environmental plan, work environment plan, checklists and inspection list, information of the workers at the site and contact info, also regulations required from different authorities[16]. These must-have documents should be found at each construction site at the board in the construction shed, see Figure 9. The must-have documents can be found in the management system and are placed in different folders according to the subject. The interviewees' opinion is that some of the documents are placed under the wrong folder and is therefore difficult to find, this result in time spent in the system looking for documents. Most interviewees have different perceptions of where a specific document should be located. One interviewee said: *"It may feel like the templates are in the wrong folder from the beginning"* [11]. The interviewees mention that how much they work in the management system differs. The documents mostly used in the production are *"Quality", "Environment" and "Working environment"* [7].

[16] Field manager, Tommy Byggare, Kungsbacka, 2017-03-13

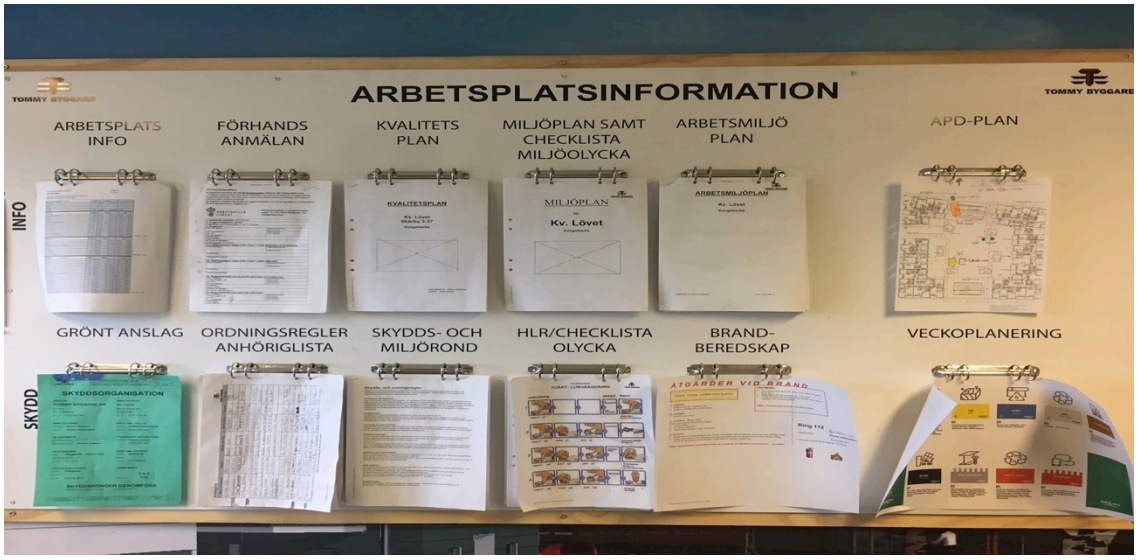

Figure 9: Workplace information board.

There is a need for a better structure and cleaning up, also to re-organize templates and documents to folders that are better related[10]. One of the workers interviewed said: *"You cannot find what you are looking for; there are so many folders and shortcuts you need to go through"* [10]. Another interviewee states the need to *"keep the amount of folders down"* [11]. When searching for the right document, there are a lot of steps that usually needs to be taken in order to find the right document. *"Even if you know what document you need, you will have to go through many clicks, many folder steps. Then you have to go back into another folder"* [13]. A proper search function is not available in the management system and therefore it is not possible to search for one specific document. When searching in the system today, the result is either a lot of irrelevant documents or no results at all[17].

The perception by the CEO is that workers are very committed in improving the management system. It is important that people feel that they can contribute with different ideas and opinions and feel engaged in the development work[4]. This statement the CEO concluded: *"The management system is a given but I do not think we have worked with it enough. We have a lot of work in front of us to get a better system. We need a lift"* [4].

[17] Calculation engineer, Tommy Byggare, Fabriksgatan, 2017-03-23

Most employees are convinced that a management system is something that can contribute positively to their everyday work if it is structured in a suitable way. It gives support in the daily work, answers any uncertainties and gives a common working ground. Every project is formed in the same way and the same structure should be found in each project. It makes it easier if a person change location to another construction site to enter the work and maintain and collect needed information[10]. At the same time the interviewees sees the management system at Tommy Byggare as something that do not always bring value to their work. When the documents are not good enough, people tend to lose confidence in the system and choose to work according to their own ways. *"Our management system has had shortcomings for a long time but there has not been anyone who has really worked with the system, it has not received any care. It has contributed to that you have taken some parts from the management system and then modified it to its own standard and that has been a lot of opinions about. Should we use the system or not?"* [18].
Many workers store the documents they often use on their own desktop, if they think it is in need of improvements they change their own document. One interviewee states: *"You have old templates saved on the computer that you use instead of using those in the system"* [6]. This becomes a problem since the users miss when documents get updated and also the need of updates will not be expressed[18].

Many of the interviewees see potential of improvements and think it is necessary to look through and review the system further. The workers mention that the management system have not been reviewed during the last years since focus have been on the ISO certification that was finalized in 2016. The folder 99 Comments should be used more according to one worker that states; *"There are structures in the folders where you work with the return of knowledge and further development, but they are not used very much. As for example, the folder Comments should be addressed"* [17]. This is a good way of getting new ideas of improvements and suggestions on further actions needed to be taken to maintain the system. The responsible team for the management system used to have meetings every three months regarding issues concerning the system. During these meetings, the 99 Comments folder should have been reviewed but according to the interviewees these meetings no longer exist[5 6 18].

[18] Construction manager, Tommy Byggare, Fabriksgatan, 2017-03-31

4.5 Data collection from survey

This section contains data collected through a survey that was sent out by email to employees with access to the management system. A second reminder was sent out to remind people to answer the survey. In total, 45 answers were received.

4.5.1 Profile of the survey respondents

There are between 70-80 employees at Tommy Byggare that uses the management system in their work. The survey was sent out to these users twice and 45 answers were received. The users that did not respond to the survey may not use the system as much or check their e-mails as often. Then the information may not have reached the intended respondents. However, the different work titles are represented in the survey (Figure 10) and it was a wide range in the age of the respondents (Appendix 4). This shows that different positions are represented in the survey answers and enable the authors to draw assumptions regarding the use of the management system.

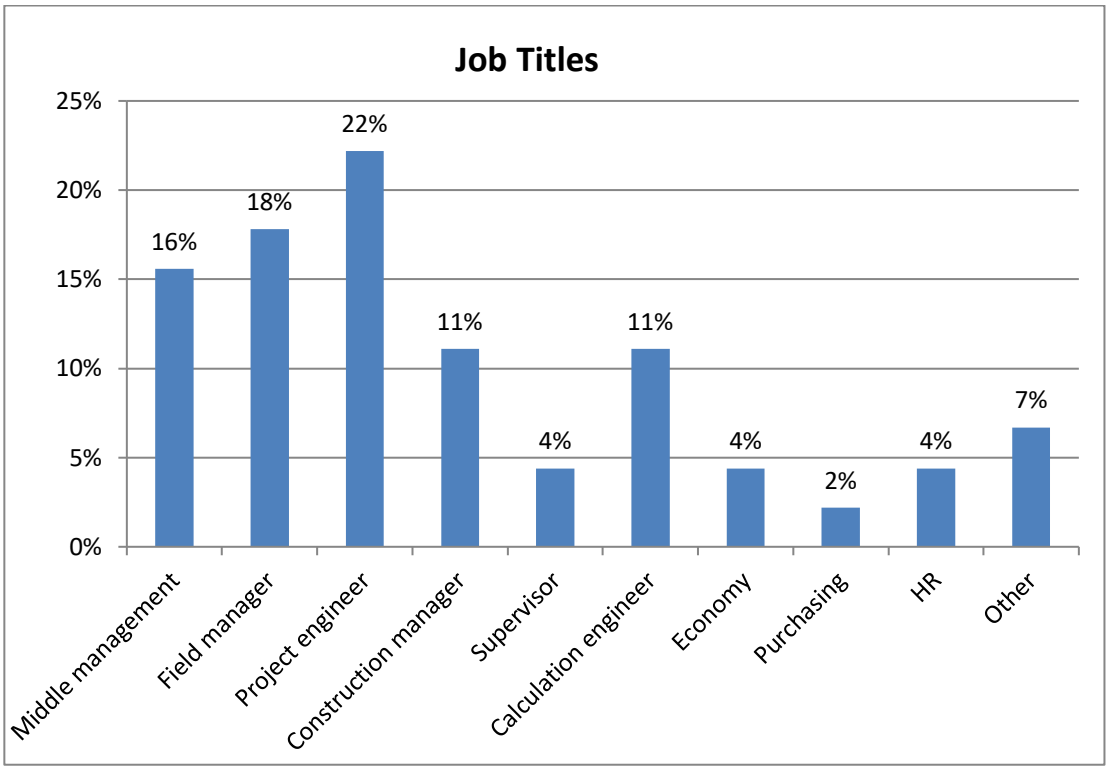

Figure 10: Job titles of the survey respondents.

4.5.2 Usefulness

The management system is used by the major part of the respondents one to several times per week, the remaining part uses the system every other week or more seldom, see Appendix 4. The main reason for using the management system is to retrieve templates, documents and routines for various work purposes. Many of the users do not fully agree regarding the usefulness of the management system for their everyday work, and not convinced that the system is as useful as it could be, see Figure 11. However, the employees do not think it is unnecessary to work with the system, if it works properly. The vast majority of the participants chose three and four on the scale of one to five regarding the usefulness of the system. No respondent totally disagreed to the usefulness.

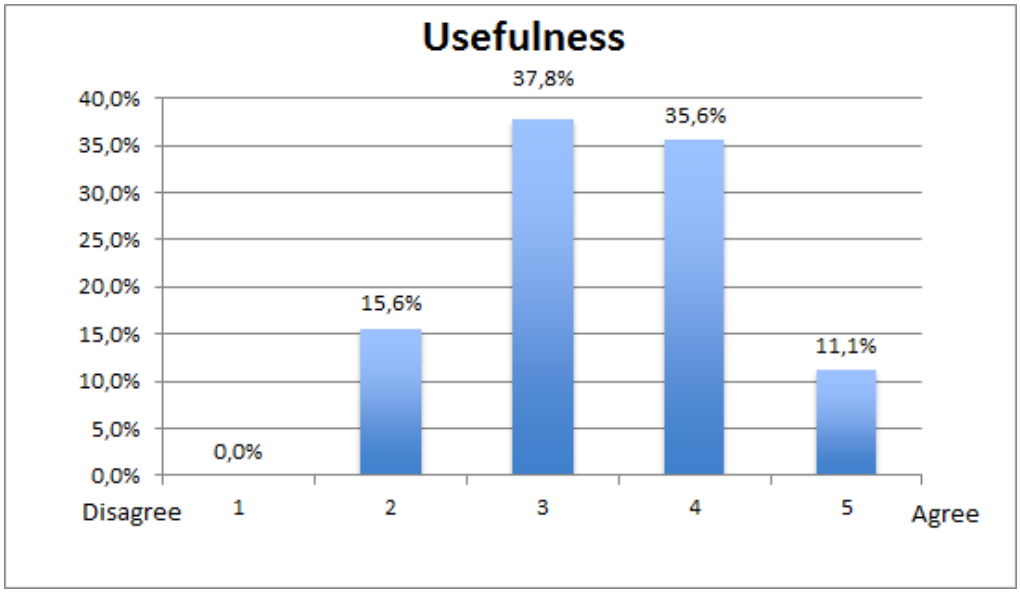

Figure 11: Illustrates the opinion of the usefulness of the management system. 1 on the scale represents "not at all useful" and 5 represent "very useful".

4.5.3 Effectiveness

One problem identified during the interviews is the time it takes to locate the right document in the management system. According to the survey, the main part of the respondents experience that it takes a long time locating in the system. As many as 87% of the respondents represent the part that have chosen the upper scale (bar three, four and five) on whether the statement is correct or not, see Figure 12.

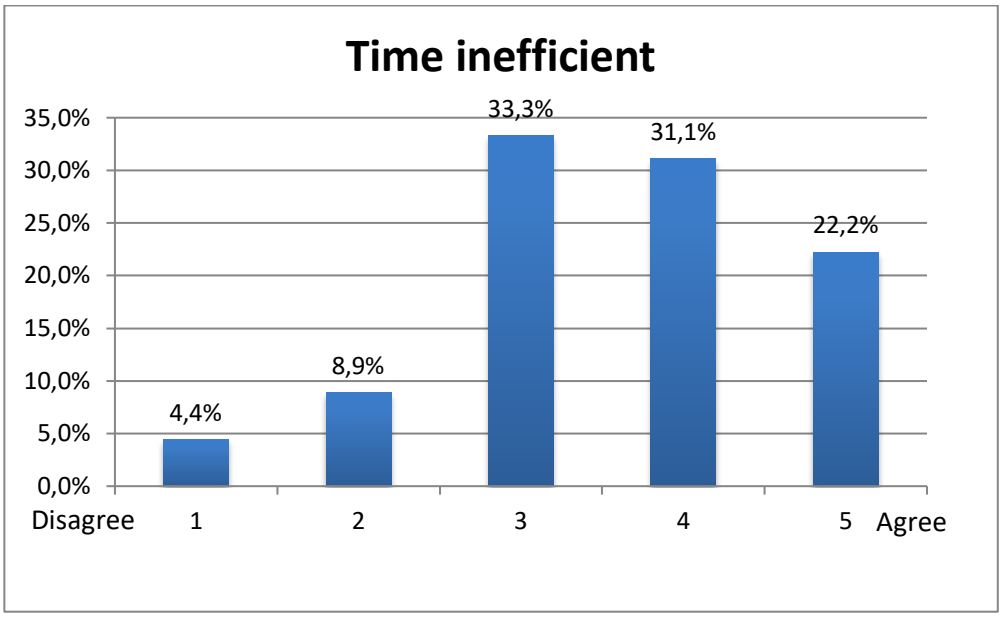

Figure 12: Time inefficiency. Shows how well respondents believe the following statement to be true: "It takes long time to find the right document in the system".

When investigating the effectiveness of the system five parameters were used; Easy to use, quick to use, easy to understand, easy to find in the system and adds value to the work. The judgement of the effectiveness of Tommy Byggare's management system were mostly negative as can be seen in Figure 13, the highest response on every parameter, is on scale two and three. The respondents' perceptions are that the system is not easy to use, 47% answered that they do not agree to the fact that the system is easy to use and 40% responded in the middle of the scale. When asked how easy the system is to understand, 48, 9% of the answers ended up in the middle of the scale, which represent that they neither agree nor disagree. Answers regarding if the system is quick to use and if it is easy to locate documents and templates had a high response on the lower scale. As many as 56% believe that the use of the system goes slowly. In total, 93% answered on scale one, two and three regarding if it is easy to find a document in the system, and 60% fully agreed to the fact that it is not easy to find documents. Despite the prior answers regarding the effectiveness, 80% of the respondents responded three, four and five on the scale and consider the management system to bring value to the daily work. Still, 20% consider the system not to be value-adding.

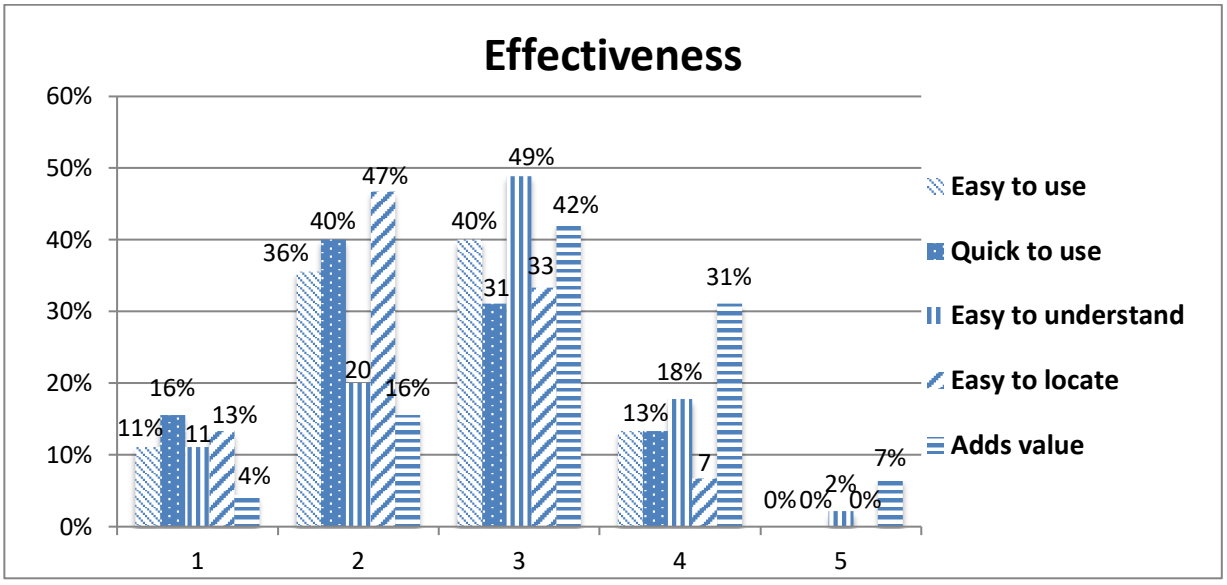

Figure 13: Shows the effectiveness in regards to different parameters.

Figure 14 shows the mean value of the responses on each parameter. The mean value do not differ a lot between the different parameters, the mean value on all the parameters is 2,7 on a scale between one to five and represents the value for the effectiveness based on the parameters. The respondents believe the management system not to be very effective but do not think it is unnecessary to use. The y-axis shows the standard deviation of the answers, as can be seen in Figure 14, Q4: Easy to locate differs from the other parameters. The standard deviation is 0,8 so the users do not agree to the same extent as in Q3: Easy to understand and Q5: Adds value, were the standard deviation is 0,94. Q1: Easy to use appear between Q4 and the rest of the parameters with a standard deviation on 0,87.

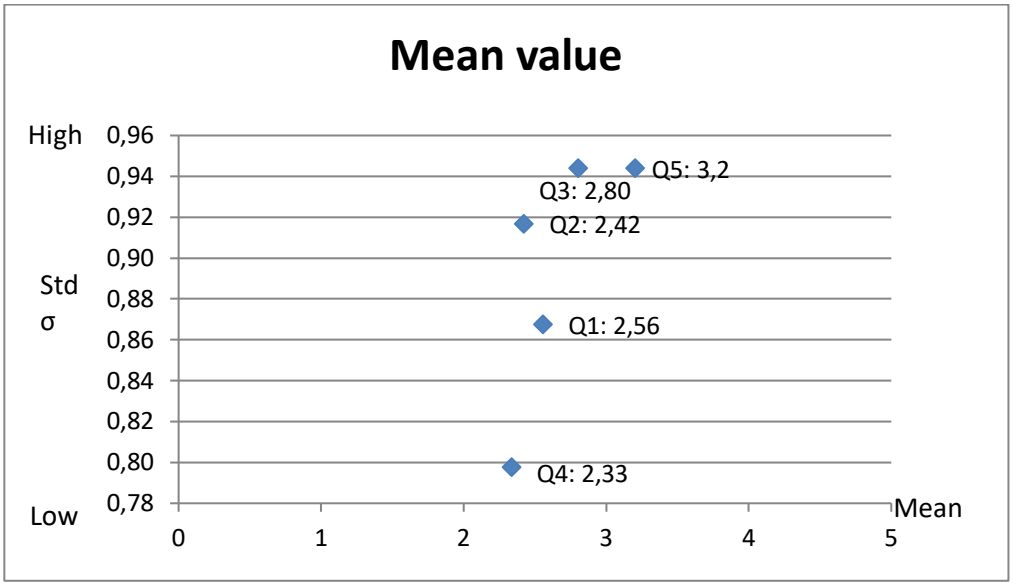

Figure 14: Shows the mean value and the variation of the answers from the survey regarding the statements: Q1: Easy to use, Q2: Quick to use, Q3: Easy to understand, Q4: Easy to locate, Q5: Adds value.

4.5.4 Perceptions of the users

When asked which statement best reflects the company's management system, the majority, 64,4% answered that it is difficult to locate the needed document in the system, see Figure 15. The perception of the management system being messy and complex had a high response rate. Only 6,7% thinks that the system is easy to use. On the other hand, several of the employees think the management system can be useful and bring effectiveness to the daily work.

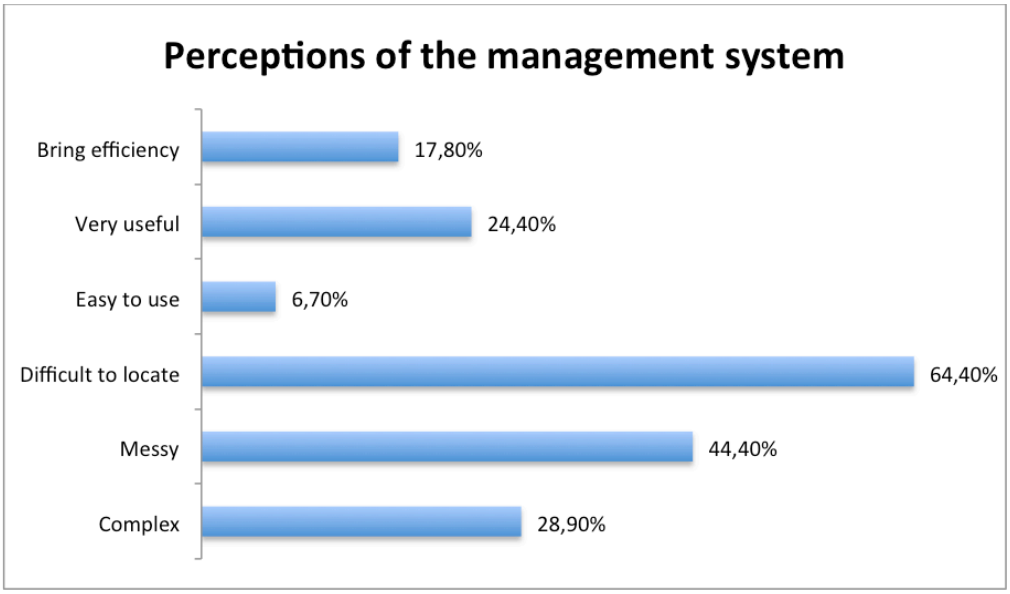

Figure 15: The perception of the management system.

Several of the respondents have a positive attitude towards a management system and think it can add value to the organisation and the daily work, however there are still some employees having the opinion that the system does not add any value. The major part of the participants are however positive towards the idea of improving the management system and making it more user-friendly and easy to use. Furthermore as can be seen in Figure 16, 67% believes that the management system is necessary for an efficient work. The fact that as many as 27% of the respondents claim that they do not know if the management system is important for an efficient work is obscure. This states that they are not convinced that the system will enhance the effectiveness.

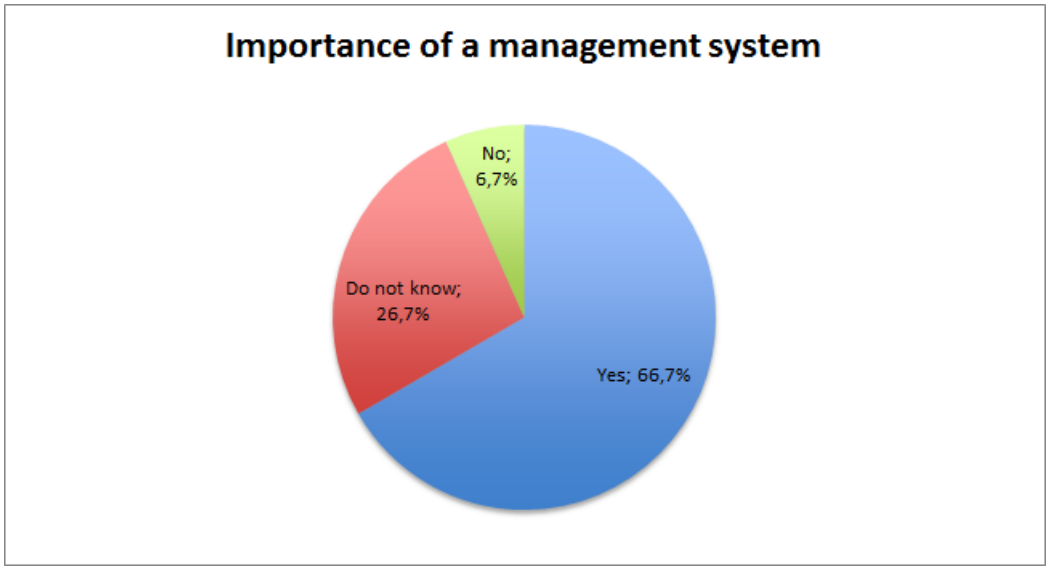

Figure 16: The importance of the management system.

4.5.5 Commitment

The process of informing the users about updates in the system is mostly done by mail, according to the respondents. However, as many as 42,2% answered that they do not get updates of changes made in the system, see Appendix 4.

When asked to what extent the users feel they have the opportunity to influence changes in the management system the answers varies a lot. Some answering that they had the opportunity to influence (29%) and some felt that they had not (18%). Most people however, (53%) answered neither nor regarding that statement.

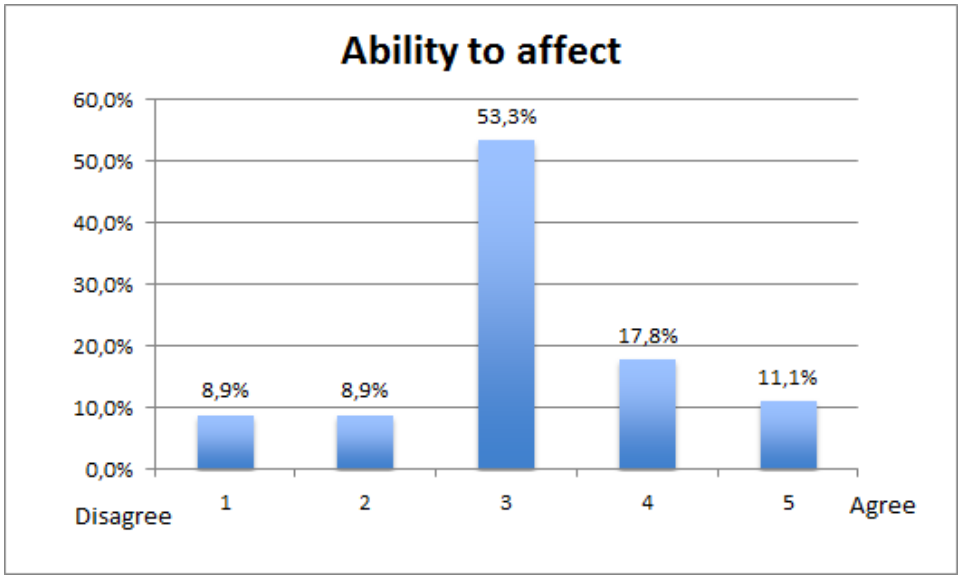

Figure 17: Shows to what extent the respondents believe they can affect the management system. 1 represent "Small extent" and 5 represent "Large extent".

When asked how the employees would be more engaged to be a part of the management system and develop the system further the respondents answered differently. If the employees had the opportunity to influence more, if they got a better explanation of how the system is supposed to be used and how it could be used more effectively are some opinions that would increase the commitment according to the respondents. An easier structure of the system, making it easier to navigate and that more time was given to the users to get to know the system will also engage the employees to be more involved in developing the system. To be included in the work can as well increase the dedication towards the system. How committed the employees are in the development of the system can be seen in Figure 18.

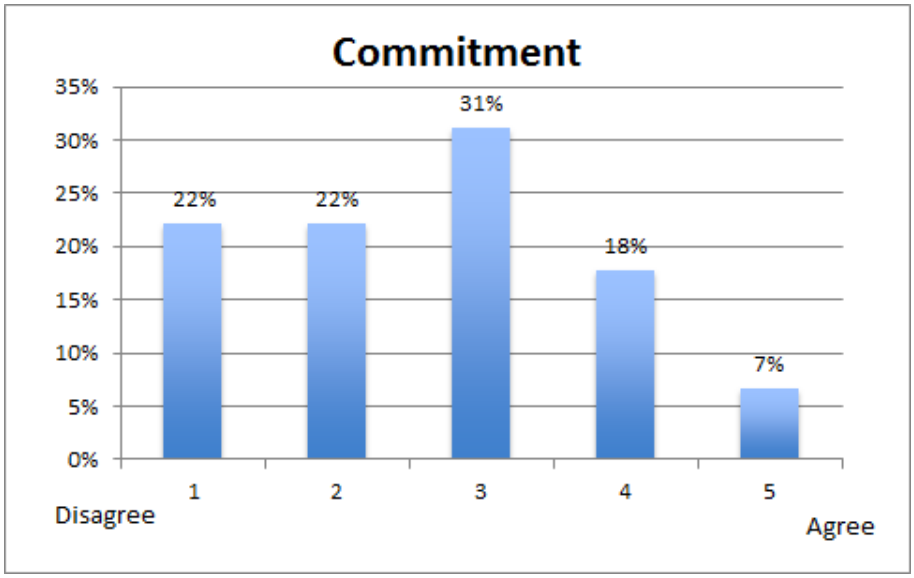

Figure 18: Shows the answers on the statement; "How would you rate your commitment towards the management system". 1 represent "Not at all" and 5 represent "Very committed".

4.5.6 The usage of the folders

To get an perception of how frequent the folders and documents are used in the management system, the survey respondents were asked which main folders they use the most in their daily work. The folders of work environment were most commonly used by the respondents. Other commonly used folders were also purchasing, environment, quality, production, projecting and tendering. By studying Figure 19, it is evident that some folders are used to a larger extent than other.

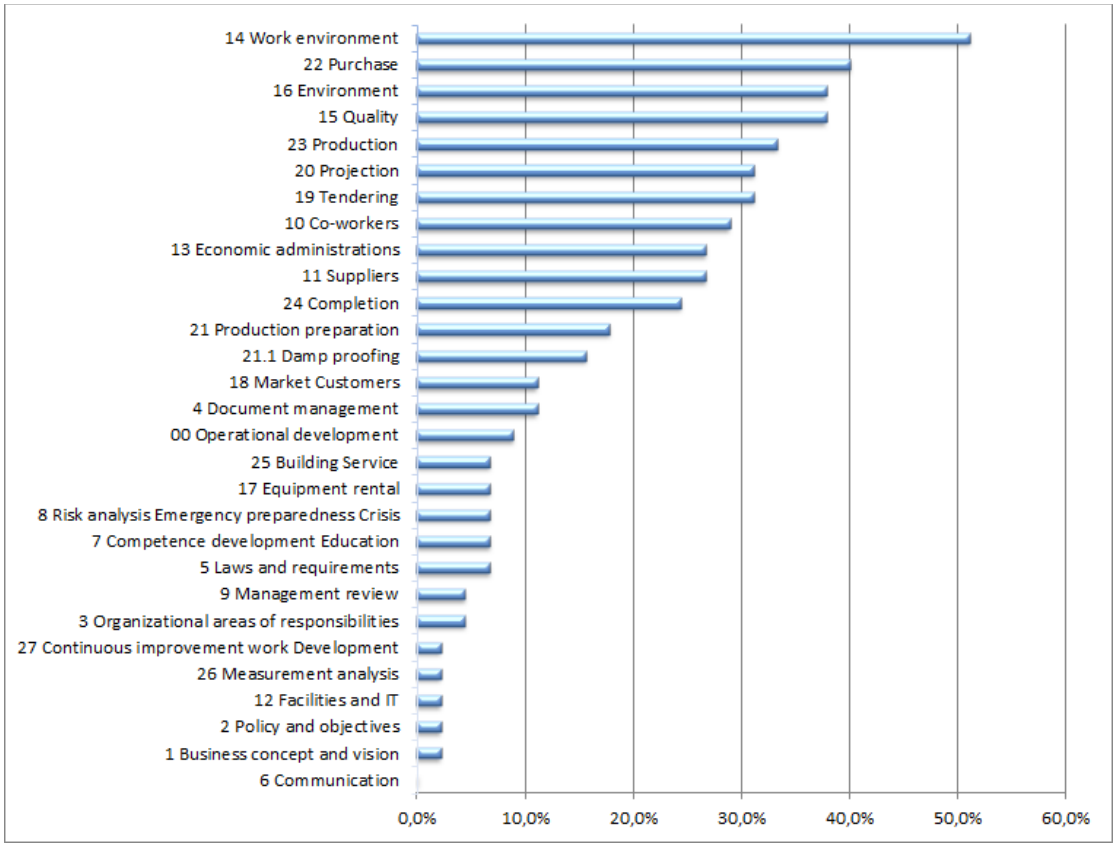

Figure 19: The most commonly used folders.

The survey also included a question regarding which folders they most commonly use in the start-up of a project. The answers revealed that the documents in this procedure are Work environment, Quality, Environment, Purchasing, Projection, Production preparation and Tendering. As seen in Figure 18, there are many folders that none of the workers use in the start-up of a project.

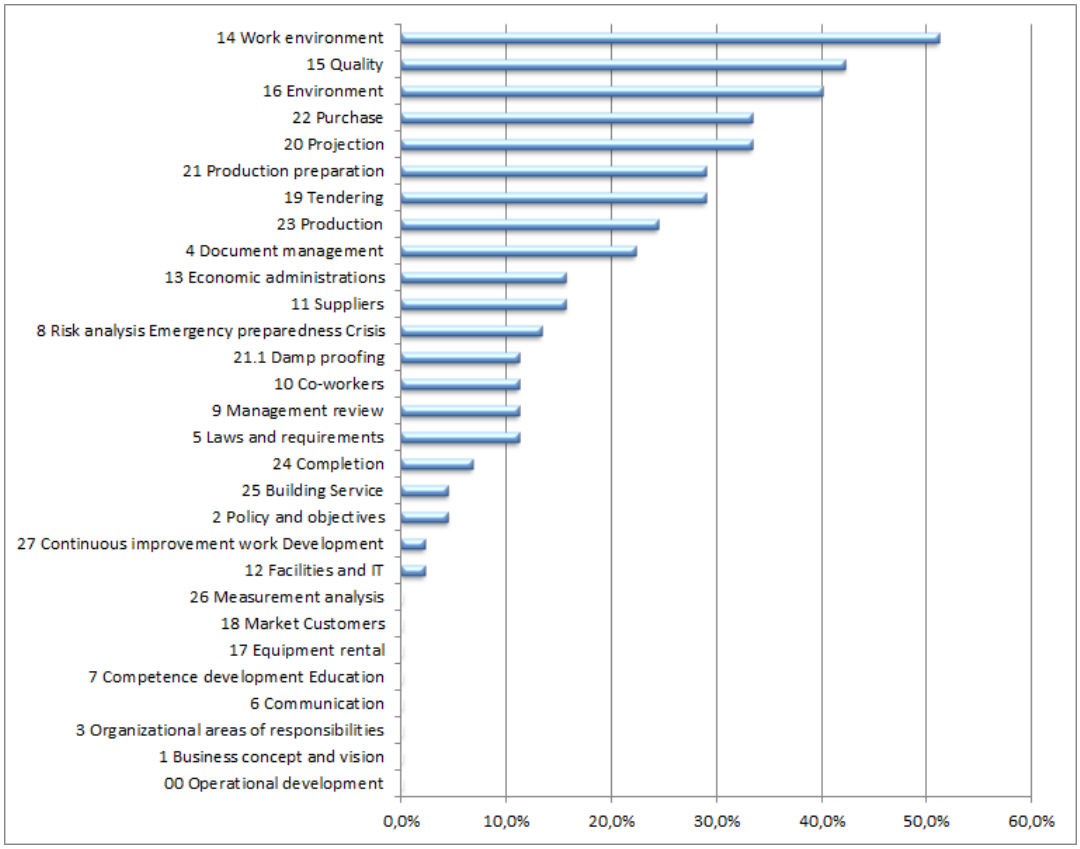

Figure 20: The folders most commonly used in the start-up of a project.

5
Analysis & Discussion

In this chapter, the empirical data will be examined in connection with the theoretical framework. An analysis and discussion of the theory will be conducted in accordance with suggestions on how the case company could improve the work with the management system.

5.1 Implementation process

The person responsible for the implementation of Povel at Tommy Byggare has left the company and the responsibility was not transferred in a good way. This may have harmed the knowledge transfer. It is crucial that the information and knowledge is passed on in an efficient way in order to facilitate for the worker that takes over. If not, it will be a loss of knowledge and resources which could have been used to the company's advantage. Since knowledge can be seen as competitive advantage it is important to work with knowledge reuse, document the explicit knowledge and try to capture the tacit knowledge of the ones leaving the company (Alavi & Leidner, 1999). If the system is not incorporated properly in the organization, it will become an unsuccessful investment which causes the efforts to be in vain (Markus & Keil, 1994). According to Boiral (2011), the success of the implementation is determined by how the system is implemented in the company. As mentioned regarding the lean concept, the unnecessary use of resources is one of the seven sources of waste. It is therefore important to find ways to use the resources in an efficient way in order to bring value to the organisation. At Tommy Byggare, placing resources on trying to solve problems at the surface and "fighting fires" is not an efficient way to use the resources. According to Pheng et al. (2016), proper planning is crucial to utilize the resources in order to not become a source of waste. This will help Tommy Byggare to allocate the resources where they are needed and use them in an efficient way.

A management system should contribute to a better performance for the company and should be linked to the organisation's different functions (Tiller, 2012). The system should also give the company a solid ground to make decisions, in accordance with the strategy (Moljevic et al. 2013). For an efficient management system there is a need to allocate responsibilities so that continuous improvements can be performed. Top management commitment is an area within the lean philosophy (Fayek & Mohammed, 2013), the commitment may affect how people further down the organizational structure will act. According to Tiller (2012), leadership is essential and need to be dedicated to the development and working with

improvements of the management system. At Tommy Byggare, the CEO has delegated responsibility to some workers that are responsible for different parts of the management system. They used to meet every three months in order to discuss improvement areas concerning the system. During these meetings suggestions and opinions from the users were reviewed and suggestions could be analysed and managed. However, with time the motivation towards these meetings has decreased and today the gatherings do not occur anymore. It is important to have clear directions so that routines are followed, otherwise the system will fall behind and not be as useful.

5.2 Management system introduction

People working at Tommy Byggare experienced different introductions of the management system. When analysing the results from the data collection, one contributing factor was the time of employment. According to Roy et al. (2013), a way to facilitate the procedure for newly employees would be to have a documented structure that is followed. Today, Tommy Byggare has an introduction sheet that should be followed according to the introduction process of new employees. It is important that new employees know the routines and procedures involved in their work. Landin (2010) states that the system should be used from the beginning in order to make it more valuable. The people employed before the implementation of Povel, did not receive the same introduction routine as people employed more recently. There is a need for all employees to be updated on information given in the introduction process, especially the ones who did not receive this thorough introduction routine at the company. It is important that the purpose of the management system is spread in the whole organisation, in order for employees at Tommy Byggare to use it in their work. As well as time to work with the system to get familiar with it and practice on where documents and templates are located, since it may be hard to find time for that later in the employment. The lack of introduction for the workers employed before the implementation may have caused a resistance and lack of motivation towards working with the management system. From the interviews it emerged that the ones employed before the implementation tend to be more negative towards working with the management system to the same extent. In a change process, a challenge for the company is the resistance to change (Nadler & Tushman, 2004). Many people can experience fear and cannot see that the change will contribute positively to their work. Therefore it is important to get everyone involved in the change process and get the employees to feel included to get them more motivated. If the employees do not feel a sense of involvement it will create resistance further on as well, it is essential to educate and motivate the users (Boiral, 2011). Tommy Byggare should spend time encouraging the workers to use the system. To clarify, from the survey it showed that age did not affect how often the users use the system, only the time of employment.

5.3 The structure of the system

When implementing Povel, the system comes with a pre-defined structure that companies can use as the core of their management system. The structure of Povel can contribute to creating orderliness of the company's processes if used properly (Sveriges Byggindustrier, 2017). In order to facilitate the accessibility of the system, the system comes with a table of content which contributes to easier access the right folder. The Povel structure contains 25 main folders regarding the most important areas to successfully guide the company's business processes. These 25 main folders

are divided into four head folders depending on the content of the document. Tommy Byggare has chosen to change the structure of the system, making it more adapted to their company. The table of content and the four head folders were removed, having all their folders lined up. Tommy Byggare added six folders to the recommended 25 and therefore has 31 folders in total. Ramakrishan and Gehrke (2010), mention that it is important to structure the data in the management system according to the users. After all, it is the users that need the system to be effective in order for them to execute their work. At Tommy Byggare there is a perception from the users that the system contains a lot of folders and that the structure makes it hard to navigate. Designing a better structure for the users can therefore be seen as an area of improvement for the company. A well-functioning management system also affect the company's performance, it contains the business policies, routines and processes and sets the base for the operation (Tiller, 2012). If the management system does not include the structure of work and connect the functions, the system will not perform efficiently.

Most of the survey respondents (53% do agree and 33% answered three on the scale), mention that it takes too much time to find the right document in the system. From the interviews, it was also evident that this was a major problem regarding the management system. This leads to a lot of non-value adding time that users spend on searching for one specific document, which inhibits their productivity. From a lean perspective, this would be considered a source of waste. According to Bellotti and Smith (2000), people prefer a system that is easy to master and that do not require the user to spend a lot of time to learn. Furthermore, it is important that the system is simple and easy to understand. Markus and Keil (1994) stated that the lack of use from the users could be associated with poor design of the system. It is also important not to include too many aspects in the management system since it can lead to increased bureaucracy and make the system more complex (Roy et al., 2013). If the users feel that the system is too complex and that it does not increase their productivity, they will not use it. This can be linked to the large amount of folders in Tommy Byggare's management system. It may be easier to use the system if the design of the system included fewer folders and a more structured way to find documents.

From the data collection, it was evident that people thought it was difficult finding the document they needed, searching through all the folders. Workers mentioned the fact that a lot of steps need to be taken in order to find the right document (see Figure 7), which also contributes to a lot of non-value adding time and can be seen as a waste (Hicks, 2007). In order for the management system to be used as an effective tool for the users, it is important that the users find what they are looking for quickly. It is crucial for the system to function in a more structured way to create a better flow and efficiency. If the system works as it should, it can contribute to adding value for the company and the time spent in the system will be minimized. According to the lean philosophy, the company should focus on what brings value to the customer, this is why unnecessary waste should be eliminated to achieve better performance for the customers and the organisation (Jørgensen & Emmitt, 2008).

Another identified problem with the management system at Tommy Byggare was the different perceptions of where the documents were located. One specific document is used by several different functions at the company and they may associate the document with another folder than the one it is placed in. This creates uncertainty among the users where a document can be found. Lansdale (1988) mentions the

problem with information in one document that may overlap into other areas which makes it difficult to know where to place it. The idea of a management system is that it should facilitate for the workers and it should be a simple way of extracting information. The categorization of documents and information is important in order for the user to be able to locate the right data (Lansdale, 1988). If this does not work, the users may loose confidence in using the system. The system should be a tool to help find information in a good way, otherwise it becomes a hurdle for the users (Ramakrishan & Gehrke, 2010). However, it can be difficult to know where to draw the line of what data should belong to which part. There is a need to find a location for documents that are more suitable for the users. The perception of that documents are placed under the wrong folders can be linked to the time spent tracking a document in the system.

The system is used by the major part of the survey respondents several times per week, others use the system every other week or more seldom, see appendix 4. If the system is used seldom it becomes difficult to remember in which folder a specific document is placed. It would be easier if the user could understand where to find the document using common sense instead of having to memorize where it is placed. One way of improving a management system is to centralize the data (Ramakrishan & Gehrke, 2010) by analysing how the users treat the data and how they manage it. This could ease the categorization of documents and routines. Also to clean up and remove similar data that includes the same information, since this does not add any value and can make it more confusing if the same data is stored at two different places. This is also a problem at Tommy Byggare, the system contains replicas of the documents but stored at several locations, therefore removal of replicas can enhance the effectiveness of the system. To classify information can be difficult (Malone, 1983), since it is important that the documents are classified in a way that most of the users understand. According to Malone (1983), the data can be classified according to how often it is used or when the data was used most recently. Then, the documents most commonly used can be identified and categorized according to that.

Must-have documents are documents required for every project, these documents can be found in the management system and are placed in folders according to subject. However, opinions from the interviewees referred to that some of the documents are placed under the wrong folder, this affects the time it takes to search through the system. The time spent looking for a document, does not contribute to better efficiency of the organisational flow. Creating a more efficient management system at Tommy Byggare is crucial since many of the users are unhappy with it today. If the system could provide options for the users to choose among, that would lead to more specific options, and that a document can be found easier will enhance the efficiency of the system (Lansdale, 1988). The problem with this is still under which folder to place the document, as well as the name the file is saved under. When searching for a document, the user may associate the name of the document with the purpose of use. It is therefore important to name a document according to the content and in a way that the users understand. People tend to use search words that have a connection to the content (Lansdale, 1988). Many users of the system at Tommy Byggare said that they know what document they need, however they do not know the path to find it. Teevan et al., (2004) also discussed this, even though the users know what document they are looking for, they tend to not know how to find it in the system. An effective search function can be a good idea that enables the user to find a document and the path to go (Teevan et al., 2004). This is also something many of the respondents mentioned, that they miss a proper search function to be able to

easily locate documents.

Another way to facilitate the search could be to have different options that the user can check off in order to reduce the vast amount of information in the system. This would enable the system to only search for documents related to the users specifications, which would increase the possibility of finding the right document in shorter time (Bellotti & Smith, 2000). For Tommy Byggare, this could be a solution to facilitate the search for the users, making it more time efficient.

5.4 Knowledge sharing

An efficient management system will enhance the knowledge sharing. To share information is crucial in a company, otherwise knowledge cannot be spread in the organisation. To share knowledge can be done by both human and technical resources (Alavi & Leidner, 1999), and it is important for the company to be able to reuse information for an efficient operation (Markus, 2001). Knowledge can be stored in documents and routines or in an individual's head, this is the difference between explicit and tacit knowledge. The explicit knowledge is easier to spread within the organisation, for example in the form of documents in the management system. Tacit knowledge that is captured in a person's individual mind is hard to transfer (Markus, 2001). When Povel was implemented, the responsible persons for the different folders were the ones who established the documents, templates and routines, as well as placed the documents and routines into different folders. The way they categorized the different documents may have created the feeling of a messy system by the users today. It is important to distinguish tacit and explicit knowledge in this matter. The responsible implementers may have documented the explicit knowledge but still possess much tacit knowledge which is hard to explain or transfer into a routine. This may have caused difficulties in understanding routines and documents, and also the perception that documents are placed under the wrong folder. Knowledge can be described differently by people; it can be seen as data, a state of mind or a capability for example. It can be good for an organisation if the employees have the same perception of what knowledge should comprise (Alavi & Leidner, 1999).

Information management can facilitate knowledge sharing, the use of Internet or intranets can be used when establishing an information system (Alavi & Leidner, 1999). Tiller (2012) also mentions that having a system being network-based will enhance the effectiveness of the system. Tommy Byggare may consider making their management system Internet-based in order to make their system more effective. A data-based management system can help with the storing of internal documents in a useful way (Wise, 2013). The management system gives the employees easier access to knowledge, both for their own development and for the organisation. It is of importance that the information and knowledge is understood by the users so it can be used efficiently. Only having a management system with templates, routines and information will not spread knowledge, there is a need of understanding it as well (Alavi & Leidner, 1999).

Markus (2001) discuss different knowledge reusers and at Tommy Byggare "*Shared work producers*" would be suitable, see section 3.3. This reuser type works in a group and produce knowledge they can use again. For Tommy Byggare to work with team members from different functions and areas, documents and routines can be established that will fit in several settings and be placed in accordance with a suitable

folder. This can create a common understanding within the company and better cooperation. The type "*Shared work producers*" has easier to understand the tacit knowledge of a person within the team and have easier to comprehend the documented routine that contains explicit knowledge. The type "*Shared work practitioners*" (See section 3.3) works by themselves but do similar work, the knowledge they create can be used by others as well. One problem with this type is that the documented knowledge can be out-of-date, or the knowledge may not be appropriate in a different setting (Markus, 2001). At Tommy Byggare the workers try to create better documents by themselves, however improvements done in one setting may not be suitable in another context. However, the knowledge needs to be documented in a way the users can understand, otherwise it cannot be used in a correct way. At Tommy Byggare, workers that do not have enough knowledge about the system and where to find a document, usually calls a colleague for help. The people they call are workers with more experience and knowledge about the system. This can be seen as the type "*Expertise-seeking novices*" (Markus, 2001), these are people seeking expert help instead of solving the problem by themselves (see section 3.3). It can be more efficient in some situations but in the case of Tommy Byggare, it may be more appropriate if every worker used the management system and were familiar with it. The fact that the users call a colleague for help when not finding a document will as well cause interruptions of someone else's work. The idea of the management system is for the company to work equivalent and it is therefore important to get the employees involved and work towards the same goals.

5.5 Document management

At Tommy Byggare, only the white collar workers have access to the system. The information flow follows a top-down approach where the white collar workers report needed information to the blue collar workers. It becomes challenging for the blue collar workers to see the organization in whole since they tend to focus on their local tasks and performance (Sacks et al. 2010). Workers tend to be result-oriented, only focusing on achieving good performance for their project. However, it is important for companies to be process-oriented, and focus on improving their work processes as well (Fayek & Mohammed, 2013). According to lean construction, the projects should be seen as a flow of continuous processes that are linked to one another (Eriksson, 2010). Here, top-down communication is crucial in order to overcome sub-optimization. Furthermore, some of the workers that do use the system tend to not use it in the most efficient way. Many users store documents on their desktops and work from there since they believe the system not to be efficient, which makes them loose confidence in using it. This leads to interruptions in communication amongst the users since they miss updates of documents and routines it can harm the common work structure. From the interview it showed that updates in the system should be sent by e-mail, but this seem not to be a standardised task. As many as 42,2% of the survey respondents mentioned that they do not get updates made in the system. Missing important updates may lead to having to rework or handle defects later on in the process which could have been prevented from the beginning (Hicks, 2007). Additionally, 26,7% of the users do not know if the management system is important to perform their work tasks and some workers (6,7%) even believe that their work would be more efficient if they did not use the system. This can be seen as a big problem for the company, since there are a lot of users not trusting the system, which may lead to resistance of use. The management system needs to be well-functioning so the users feel it contributes

positively to their work. On the other hand, 66,7% believes that the system is of importance to achieve an efficient work. Most of the respondents have a positive attitude towards a management system, however not the one the company have implemented today. Tommy Byggare should therefore take advantage of this positive attitude in order to improve their current system. The company should try to motivate the rest of the users feeling more negative towards the system, that it is of importance and give them more attention and a sense of participation. To create a system that the employees experience brings value and help them in their daily work, may contribute to a well-functioning management system that the employees trust.

Moljevic et al. (2013) states that the management system should help with the information flow and reduce the organizational boundaries. The management system should further work as a tool to connect different departments which is why it is important to have input from all departments regarding how to make the system more effective (Moatazed-Keivani et al., 1999). In order to work, it becomes important to have the information shared with all the users (Tiller 2012). Having the workers store documents on their own desktops will therefore inhibit this process which is why it is important to end this pattern and having workers using the system as it should be used. Having a system that the workers find useful and value-adding is a necessity, the structure of the system at Tommy Byggare needs to be re-organized.

5.6 Commitment

In total, 44% of the users responded that they are not committed to use the system. However, they further mentioned that if they got a more thorough explanation of how the system should be used or if they had the opportunity to influence the system would make them more dedicated in using and improving the system. According to Boiral (2011), people that do not feel involved in the implementation of the management system may create resistance towards the change. One way of giving the users the opportunity to influence could be to have huddle meetings where a team gathers to discuss problems and suggestions to improve the work (Fayek & Mohammed, 2013). It gives them the opportunity to influence and become a part of the improvement work, which will enhance the commitment to use the system. Visualization is another method that helps people to get an overview of how a project is progressing and provides the opportunity for an open discussion between people from different areas. The information board Tommy Byggare has at each construction site may contribute to a sense of participation for the workers. They can get information from the board and see how the construction plans progress. It is important to create transparency in the company, this to reduce the organizational boundaries (Fayek & Mohammed, 2013). The transparency will facilitate cooperation between different departments, and for people to be a part of the company's performance. Share of real-time information is needed to involve everyone in the processes and to create good communication within the organisation. The team leader should ensure that information is provided and communicated to the field workers (Sacks et al., 2010). One idea is to create an agile information system to be able to reach out to as many people as possible and provide up-to-date information.

Commitment is important for the company's management system, the system can help the information flow in the company as well as internal communication (Moljevic et al. 2013) (Boiral, 2012). The company needs to take communication and feedback seriously, these are factors that can create mutual trust and understanding in the organisation (Moatazed-Keivani et al., 1999). Cooperation between different

functions in the company is necessary for the management system to work, as well as to foster an operation for continuous improvements. Tommy Byggare needs to re-start a process for improvements of the system, if it is not updated and improved continuously it will not be a useful tool after a while.

Knowledge is an important resource which tends be neglected, especially since companies in the construction industry tend to prioritize other resources such as time and money (Fayek & Mohammed, 2013). Tommy Byggare has included folders for comments and suggestions (99 comments), this is a good tool to achieve return of knowledge and get suggestions on improvements from the ones using the system. However, the meetings where the comments were analysed is non-existing today, which may have created resistance and decreased the motivation to influence. For example, 18% of the workers mentioned in the survey that they did not believe they have the ability to affect the management system in a great extent. Tommy Byggare should maintain the process of going through the suggestions since it gives the users a chance to influence the system as well as share knowledge. Knowledge reuse brings value for a company (Alavi & Leidner, 1999), however according to Eriksson (2010), companies in the construction industry tend to not work with knowledge reuse from workers. Within the construction industry, knowledge usually follows a top-down approach where knowledge is transferred from white collar workers to blue collar workers. People working down the organizational structure tend to not have much influence on the processes. It is important that the workers feel listened to and that their opinions matter, otherwise it will inhibit learning. One lean tool that can be used to encourage knowledge reuse is quality circles, which implies that a team gathers and discuss problems and gives suggestions of how to improve that area (Salem et al. 2006). This contributes to workers feeling a sense of involvement and enables knowledge sharing.

According to Tiller (2012), leadership is crucial for the development of a management system. At Tommy Byggare, the CEO has allocated the needed resources in order to continue this work with continuous improvement. However, this has not been translated down the hierarchical structure.

5.7 Improvements

Ever since Tommy Byggare became ISO certified in 2016, they state that they have focused on the requirements of the ISO standard and how to incorporate it into their management system. Since Tommy Byggare already had a working management system, it may have been easier to incorporate the ISO standard into their management system according to Boiral (2011). He states that a working management system is one of the factors contributing to a successful implementation of ISO. However, this led to putting less effort and focus on the Povel management system which is in need of constantly being reviewed. According to Markus and Keil (1994) it is important that the system is continuously updated. The maintenance of the management system at Tommy Byggare needs to be prioritised, making sure that it is updated regularly. Ramakrishan and Gehrke (2010) mention the importance of minimizing redundancy issues in order for the system to only contain relevant information. This is an identified problem at Tommy Byggare as well, since the management system contains a lot of documents and routines that are not used. To clear these from the system can contribute to a better system containing only essential data.

If the workers do not use the system, it is important to find the root-cause of the problem. Many users tend to express the need of improving the part of the system they use the most, however this may lead to sub-optimization and a system that is only partially improved (Markus & Keil, 1994). It is important to take all parts of the system into consideration when improving it. Having a system containing out-dated information or having users not finding what they need when they need it, is a source of waste according to Hicks (2007). Out dated information may lead to workers having to rework the document and updating it so it contains current information. He also mentioned that waste in the processes also could be due to problems with the information flow, if the system contains information that is old or not updated.

The lean concept will help a company to evaluate their processes, finding improvement areas and eliminating waste from their processes (Eriksson, 2010). However, incorporating the lean concept into an organization does not only involve applying one part of the concept. Lean is a philosophy that should be incorporated into the culture of the organization and having employees in the organization working according to it (Parkes 2015). In order for people to know how they should incorporate lean thinking into their everyday work, knowledge about the concept is of great importance (Fayek & Mohammed, 2013). Since this is a new concept for Tommy Byggare, it is important that they are aware of what it entails and taking the necessary steps before implementing it, such as training and education of workers about the lean concept.

When implementing a change into the culture of the company, Fayek and Mohammed (2013) suggest segmenting workers into different sub-groups in order to facilitate the transition. People tend to be afraid of change and not able to see how a new system will improve their everyday work (Nadler & Tushman, 2004). Tommy Byggare should divide their workers into suitable groups according to how they feel towards change processes. Employees may have difficulties to see what a change could contribute to and be resistant towards the new way of working (Nadler & Tushman, 2004). There are people at the company that like to be a part of improving the system, which can be called the champions. The champions could help the transition of other people less willing to adapt to new work conditions. This would help with the resistance towards the change. It is important to manage each group differently, adapted to their needs. Nadler and Tushman (2004) state that showing short-term wins is a good way of getting people excited about the changes, making them more willing to contribute.

A part of lean consists of handling problems as soon as possible, putting the necessary resources to prevent them from happening again. This way of working is much more productive than handling problems when the consequences are much greater (Sacks et al., 2010). Lean construction is a way for companies in the construction industry to apply the approach to their organization. Companies can achieve many benefits by applying lean to their organization and in that way remove waste, then better efficiency of resources can be achieved (Hicks, 2007). However, it is important to note that lean was first adapted to the manufacturing industry with high volume production. Since the construction industry usually consists of one project that is different to another, and the customer can consist of more than one person, the approach has to be tailored to suit this industry.

6
Conclusion

This section will include a final summary of the findings to answer the research questions and suggestions for the case company will be provided. Future research and limitations are described as well.

The aim of this thesis was to understand the barriers in working with a management system within the context of the construction industry, and to identify actionable suggestions for improving its value for the organisation. The expected outcomes of the thesis are classifications of barriers in working with the case company's management system and prioritize actionable suggestions for increasing the value of the existing management system.

6.1 RQ1: What are the barriers for working with the management system at the case company?

Maintenance

The maintenance of the management system at Tommy Byggare has not been prioritized. Since the company implemented ISO, the development of the management system has fallen aside. One identified problem from the interviews was that the responsibility of the management system has not been passed on in a good way. The employee responsible for the development when starting the implementation has quitted the company and no one has taken responsibility of the system until now. The system needs to be currently updated so accurate data exists. One perception is that the system has had shortcomings for a while and no one has taken the responsibility to maintain the management system.

The structure

The structure of Povel consists of 25 folders, Tommy Byggare added six folders to their system. Perceptions of the users are that the current system at Tommy Byggare consists of too many folders. It harms the visualisation and makes the structure more difficult. Another comment from the users interviewed, was that it requires many steps before a document can be reached, see Figure 7. It takes too long time to locate a document in the system it also emerged from the interviews. This may be linked to the large amount of folders and all the steps that needs to be done to locate a document. These factors can be seen as barriers for the use of the system. The management system is clearly in need of a better structure and to become more user-friendly for the employees. When asked about what best reflects the management

system at Tommy Byggare, 64% agreed to the fact that it is difficult to find documents in the system. Other high responses were that the system is messy and complex and only 6,7% thinks the system is easy to use, it showed from the survey.

Other identified problems showed from the data collection, is that the users think the document seems to be placed under the wrong folder. One problem here is the categorisation of a document and to what part it belongs. The perception of where to find a document is not the same for every user, the one responsible to divide the different documents among the folders may not share the same view as another employee. This cause problems since the users have a harder time locating a document if they cannot see where it naturally belongs.

In the start-up of a project the must-have documents needs to be located. From the interviews it emerged that these documents can be difficult to find in a quick way. To take into consideration is that a construction project often spans over a long period of time so the users may not do the procedure of finding the must-have documents very often. It can be harder to remember where all the documents are placed if it is not something the users do frequently. These must-have documents may be placed more accessible for the users so the process becomes more efficient. If the system is complex the users can loose confident in using it since it is not value adding. The documents in the system can be old and not updated and the folder can exist of documents no longer used, it is a need to clean up the system. One problem identified during interviews was that the users tend to save documents they often use on their desktop for an easier access. If the document is not updated or correct the users can modify their own document for use. This problem leads to that the management system is not used as it is intended and the users will miss updates made in the system. The updates made in the system should be sent out via email to the users, from the survey it emerged that 42% do not get any notification about updates, see Appendix 4.

From the survey it showed that some folders are used to a larger extent than others. There are several folders that can be removed from the system or relocated. This can enhance the structure of the system as well as decrease the perception that the system contains too many folders and are hard to navigate in.

Introduction

The introduction of the management system differs between the users employed before and after the implementation. Nowadays, a routine for newly employees exist for them to go through the system. Further education about the system does not exist at the company, it is a good idea if every user received education in the management system so the system is used to the same extent and uncertainties are clarified. Some respondents mention that they call a colleague if they do not find a document, this cause interruption of someone else's work. It is crucial that the employees use the system as it is intended to, otherwise it becomes inefficient.

Perceptions

From the survey it emerged that several of the users think the system is useful and can bring efficiency to the work, see Figure 15. The respondents seem positive towards a management system and think it can be valuable to the work. However, the management system the company have today needs to be reorganised and more

user-friendly. The major part of the respondents is positive towards the idea of improving the system and 67% believes that the system is necessary for an efficient work. On the other hand, 27% do not know if the system is of importance and it can be seen as a problem, see Figure 16. These users need to be convinced that the management system is a useful tool, otherwise it can create resistance towards using it.

Some of the users do not feel they have the opportunity to influence the system. This is important for Tommy Byggare to change, if the users feel that they can be a part of the development and be able to influence the improvements it may give a better sense of participation and a more positive attitude to use the system. From the survey it emerged that if the user have a better opportunity to influence, and if they received better explanation of the system to be able to use it more efficient, it would increase the commitment towards the management system.

6.2 RQ2: What are feasible suggestions that can support improvements at the case company?

It is important that the management system is linked to the company's strategies. Information and knowledge should be merged in order to detect documents containing the same information. The system should be sustained and only include data that is updated and useful. Since re-work is considered a type of waste in lean, removing redundancy and out-dated information is important. Management commitment is a necessity in order to maintain the effectiveness of the system. One way could be to assign some people that should work with improving the system. Having the system network-based will facilitate the access of information for the users (Tiller, 2012). In order for workers to use the system, they need to have knowledge about it and understanding the purpose of using it. A clear structure with standardized procedures will help new employees to incorporate the system quickly into their work (Moljevic et al. 2013). However, if the worker feels constricted to a standardized work and routines, it may affect the willingness to use the system. Therefore, in order to avoid this, it is important to offer guidance and support from the beginning (Boiral, 2011).

Cooperation is important in order to support communication between different departments. How to distribute knowledge is of great importance, therefore the case company should support knowledge reuse by having people work in teams and produce knowledge for later reuse, see section 3.3, *Shared work producers*. Since this knowledge type is based on people with similar knowledge, it is easier to cooperate in documenting knowledge in a way for other users to understand (Markus, 2001). People have different perceptions on what knowledge is, it is important to create a mutual understanding of what the work entails, since this will affect the perception on where to store a document. The users should be able to find a document amongst a large amount of data, if not, the use of the system will be harmed (Ramakrishan & Gehrke, 2010). The data needs to be categorized and placed in suitable folders so the users can extract the data easily. It may be classified according to how the data is used or in which situation it is used, another idea is to categorize it depending on when it was used lately or the frequency of use (Malone, 1983). One way could be to observe how different people use the data and managing according to the users. It is

important to document the explicit knowledge in a way the users understand, therefore policies, documents and templates need to be designed and formulated in an easy way. The tacit knowledge is captured in an individual's mind and is difficult to document, if the person leaves the company the knowledge disappear as well (Markus, 2001). Therefore the company should try to capture the tacit knowledge as good as possible.

The system needs to be easy for the users, this can be done by providing the user with different options that will help the user define their needs and delimitate the outcome. A menu or the option to check off boxes, would allow the user to only search for specific data. Another example can be to offer the user the opportunity to search for documents that were used most recently or to save researches made in the past (Bellotti & Smith, 2000). Since most of the workers at the case company stated that they normally use the same type of document in their work, this would help to extract the right document. Since the must-have documents in the start of a construction project usually are the same, this would be useful for the users working in the projects. Another solution could be to group these documents into one folder in order to provide easier access. How to name a document becomes very important since people have different perceptions on what that document entails. Therefore, a clear and well-defined name should be used in order to create easier access. There is a need to find out what the users associate the information with and save it according to that, it should be adapted to the ones using the system. It is further important to create involvement and commitment of the users, understanding, guidance and sense of participation should be prioritized to avoid in-house resistance (Boiral, 2011).

Suggestion 1 - Education about the system

Education about the system can be a good idea for Tommy Byggare since some of the workers did not have a thorough introduction when they started working with the management system. The routine for introduction of newly employed should be evaluated and standardized, then the routine should be provided to every worker using the management system. This to gain a better understanding about the system within the company so that the users feel more committed in using the system.

Suggestion 2 – Improve the structure in the Management system

The structure of Tommy Byggare's management system contains a lot of folders and documents. This have caused the perception of that the system is complex, making it hard to navigate and difficult to find the document needed. The system contains replicas and old documents that are no longer used. Tommy Byggare should go through the system and remove out-dated documents and clean up in the folders so it only contains essential documentation. The amount of folders could be reduced, sorting them according to the recommended Povel structure with the four head folders; management, resources, implementation and measurement/ analysis/ improvement. Tommy Byggare should use the structure to make it easier for the users since not as many folders will be shown, and use the table of content provided by Povel. It will improve the visualization of the system and it may be easier for the users to navigate in the system. It is important to form the management system according to the users needs.

As the survey showed, some of the folders are rarely used. It may be a good idea to delete or move those not frequently used to a separate place to provide a better overview, see Figure 19. For example, Work environment, Purchase, Environment, Quality, Production and other commonly used folders can be located more accessible.

For an easier start-up process, the required documents for every project can be placed in one common folder. Then the workers do not need to go through a lot of folders to obtain a document, the access of the must-have document can become more time efficient in this manner.

Suggestion 3 – Provide the users with a search function

Provide the users with a menu were the folders and document can be found easily, this can help to narrow down the list of folders when searching for a document. One suggestion for Tommy Byggare would be to incorporate an effective search function to the system that provides the user with different options that can be checked off. This would facilitate the search process since it would reduce the list of results, making it easier to find the document needed. The data should be centralized by analysing how the users use the data. Today, Tommy Byggare's management system is based on a document structure, it may be more efficient if they made it Internet-based. This can enhance the search function as well as making the storage of data easier. An agile information system would help Tommy Byggare to adapt quickly to the environment, enabling to reach out to the users with updated information.

Suggestion 4 – Take advantage of the users input

Tommy Byggare should take advantage of the users input of the system regarding where to place a document and how they think the system should be designed to enable better ease of use. Furthermore, to change the structure of the documents according to how they should be used. Communication and feedback from the users is an important source of knowledge, it is also a good way to create mutual trust. Therefore going through suggestion folder (99) is essential. It is important that the meetings they used to have regarding system improvements should be sustained. These meetings are a good opportunity to go through improvement areas and taking into account the opinions of the users mentioned in the suggestions folders (99).

Suggestion 5 – Centralize the data according to the users

The company should continuously analyse the use of the system to be able to find solutions for a better system. The different perceptions could be identified and based on that knowledge, categorize the documents and folders to enable better understanding of where to find documents and routines. Since the users have unique associations it is important to take different aspects into account and form a common view for the users.

6.2.1 Constraints of the suggestions

Providing education about the management system for the users is a cost that the company should take into consideration. However, in the long run, the benefits may be greater than the cost since it will lead to workers using the system in a proper way, reducing the amount of time spent on searching in the system.

Improving the structure of the system does not require a lot of investments from the company, however the amount of time spent on structuring the system in a better way will be significant. For the company to implement a search function to the management system may be expensive. The benefits can however exceed the cost aspect since it will facilitate the work for the users. In addition, it may increase the productivity of the workers since they can spend the time on performing other work tasks.

A constraint for the company may be to get the users to share comments and suggestions of improvements, this activity needs to be incorporated. Furthermore, continuously motivating individuals of the importance of working with the management system can be a challenge. Having users not trusting the system is an implication that needs to be handled. Convincing employees that the system contributes to a more efficient work may be difficult to overcome if they have lost confidence in the system. Getting people to use the system as it should, and breaking old habits is crucial in order to improve. The users perception of where to place a document may vary, which will be a constraint for the people responsible for updating the system. Classification of information can be a difficulty since people have different perceptions of where that information best fits and this may become a challenge for the company. There is a lot of information that overlaps into different areas, which makes it a problem knowing where to draw the line regarding which folder the data belongs to. Another problem with categorization is that different people associate one document with different words. It makes it difficult to facilitate the search for all the users and how to name a file becomes a challenge. Furthermore, everyone have different perceptions of knowledge, which makes it difficult to document knowledge in a way that is understood by everyone.

6.3 Future research

It would be interesting to compare Tommy Byggare to other companies within the construction industry, analysing similarities and differences in the use of management systems. Investigating how Povel management system can be developed further to an even more efficient tool for a company is worth pursuing. Another interesting aspect would be to test how people would perform when asked to find a specific document as well as looking further into how the users associate the documents and folders.

Publications about lean in the construction industry are limited and there is a need of more research regarding this topic in order to draw stronger conclusions. Furthermore, future research could be to implement lean into the construction industry, analysing success factors and difficulties.

6.4 Limitations

This research was done at one company within the construction industry, therefore recommendations and suggestions may not be suitable for all companies within this industry. Since Povel management system is directed to construction- and facility companies, improvement suggestions regarding the management system may not be applicable to other industries or companies not using Povel. Important to note is that the sample size for the data collection is limited, which in turn affects the ability to draw conclusions regarding the whole organisation.

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CEO, Tommy Byggare, Alingsås, 2017-04-10
Coordinator of Povel, Sveriges Byggindustrier, 2017-04-26

A
Appendix 1

Intro survey

We are two students from Chalmers who are taking our Master in Quality and Operations Management. We are writing our thesis at Tommy Byggare and the purpose of this survey is to find out your views about your management system in order to identify potential areas of improvement.
The survey is anonymous and takes no more than 15 minutes to complete.

If you have any questions regarding the survey or if there is anything you do not understand then just contact us at one of the following e-mail:
Magdalenalemosribeiro@gmail.com
Lisajohansson0@gmail.com

Thank you in advance for your participation!
Magdalena and Lisa

Survey questions

- How old are you? (20-25, 26-30, 31-40, 41-50, 51-60, 61 and older)
- What is your position at Tommy Builders?
- How often do you use the management system?
- What do you use the management system for?
- How well do you agree with the following statement: it takes a lot of time to find the right document in the management system.
- How user-friendly is the system do you think? (On a scale of 1-5, where 5 is very user-friendly and 1 not at all)
- How would you assess the effectiveness of Tommy Byggares management system?
- Which statement do you think reflects Tommy Byggares management system the best? (easy to use, easy to find in, Complex, messy, difficult to navigate,, very useful, effective for our work)
- Do you think that the management system can be done simpler, easier to navigate? (Yes, No, Do not know)
- Which folders do you use? (List all folders in the management system)
- What documents do you use most often at the start of a project?(List all folders)
- Do you think your work would be more efficient if you "would not need to use" the management system (Yes, No, Do not know)
- Do you get informed of the changes made to the management system? If yes, how?

- To what extent do you feel that you have the opportunity to influence the management system?
- Do you have any recommendations on improvements concerning the management system? (Open question)
- How would you rate your involvement in the management system? (Scale 1-5)
- What would make you more committed to work with the management system?

A
Appendix 2

Interview questions to workers

- What is your position at Tommy Byggare?
- How long have you worked for Tommy Byggare?
- What is your experience of working with management systems? Have you worked with management systems earlier or do you have knowledge from studies?
- If yes to the above question: can you use the knowledge from previous experience when working with Tommy Byggares management system?
- How do you perceive the management system at Tommy Byggare?
- What part of the management system do you use the most?
- Is the management system useful on all types of projects? If not, how can it be changed to make it useful?
- How did you get knowledge about Tommy Byggares management system?
- How did you get introduced to the management system? Someone who taught you?
- What do you think has been lacking in the introduction of the management system? What could have been done better / differently? How?
- What advice and support did you get in the implementation / work?
- What is perceived as difficult / messy in the system? Why is it perceived as difficult?
- What can be done more efficiently?
- What do you think are value-adding / non-value adding activities?
- What difficulties have you encountered from the organization and which have been factors that contributed to success?
- What recommendations to you propose for a more efficient implementation?
- How does the management system work to increase the value of the organization do you think?

Interview questions to the CEO

- How long have you worked for Tommy Byggare?
- What is your experience of working with management systems? Have you worked with management systems earlier or do you have knowledge from studies?
- How involved are you in the work with the management system?
- Are you / will you be involved in the development work regarding Tommy Byggares management system?
- How do you work to get workers engaged to work with the management system?
- How do you expect the employees to work with the system? What is the goal?
- Were you involved in the implementation of Povel? Did you encounter any difficulties when implementing it?
- How is the introduction of the management system to newly employees? Is it something that can be done differently?
- What part of the system do you think is used the most by all of the employees?
- What part do you work mostly with?
- Do you think you're familiar with all parts of the system?
- What is your view / opinion on Tommy Byggares management system?
- Do you see any difficulties with the system? What and why?
- What do you think is the biggest problem employees experience with it?
- What would you recommend to change in the system to make it more effective? In what way does the management system contribute to increased value for the organization?
- If you would implement Povel today, what would you focus on?
- How do you work today to maintain and improve the system?

Interview questions for Office staff (management)

- What is your position at Tommy Byggare?
- How long have you worked for Tommy Byggare?
- What is your experience of working with management systems? Have you worked with management systems earlier or do you have knowledge from studies?
- If yes to the above question: can you use the knowledge from previous experience when working with Tommy Byggares management system?
- How do you work with ISO in your daily work?
- How did you start the implementation with Povel / ISO? Did you encounter any difficulties in the implementation process?
- How is the introduction of the management system to newly employees? Is it something that can be done differently?
- Is there anyone to contact if you have questions about the system?
- What part of the system do you think is used the most by all of the employees?
- What part do you use most?
- Do you think you're familiar with all parts of the system?
- What is your opinion on Tommy Byggares management system?

- Do you see any difficulties with the system? What and why?
- What do you think is the biggest problem employees experience with the management system?
- Is there any part of the system that you find unnecessary?
- What would you recommend to change in the system to make it more effective?
- How does the management system increase the value within the organization, do you think?
- If you were to make the implementation today, is there anything you would do differently?
- How do you work today to maintain and improve the system?
- How do you inform workers with updates / changes made in the system?
- How do you treat comments of improvement suggestions (99) in the system?

Additional questions to responsible persons of the management system

- In your VLS, you have a chapter called 99 views for each folder, how many write something there, how do you treat it?
- How do you get informed about updates made in the system? What is the process like?
- What is the biggest problem right now with your management system according to you?
- How many employees are there in total?
- Is someone in charge for each folder?
- What can be more effective in your opinion? Which folders are used the most?
- Is it possible to track the number of clicks?

A
Appendix 3

Quotations in Swedish

Field Manager, Sisjön

”Lägg upp det på flera tillfällen, inte samtidigt. Blir för mycket”

Middle manager, Kvillebäcken

”Får inte arbeta i det praktiskt i introduktionen.”

Field manager, Kvillebäcken

”Min tuffaste utmaning är att hinna med så mycket som möjligt på 8h och då hinner jag inte sitta och leta på en dator i 2h så då ringer jag istället och får reda på det på 2 minuter.”

Project engineer, Sisjön

”Strukturen, genomarbeta det som finns. Uppdatera allt, så att allt finns. Det gör det enklare, så man slipper fylla i själv och göra om.”

Field manager, Kungsbacka

”En tid då det varit mycket dokument som legat och skräpat. Inte underhållits.”

Field manager, Sisjön

”Kan kännas som mallarna ligger i fel mapp från början.”

Field manager, Kungsbacka

“Inte hittar det man söker, varit så mycket mappar och genvägar man får leta sig igenom.”

Field manager, Sisjön

“Hålla ner kapitelantalet.”

Project engineer, Fabriksgatan

”Även om man vet vilket dokument man behöver så går man igenom många klick, många mappsteg. Sedan måste man backa och in i ett annat projekt.”

CEO, Tommy byggare

”Ledningssystem är en självklarhet men tycker inte att vi har arbetat tillräckligt med det. Vi har mycket jobb framför oss för att få ett bättre system. Vi behöver ett lyft.”

Construction manager

”VLS har haft brister under lång tid men det har inte varit någon som på riktigt har jobbat med systemet, inte fått någon kärlek. Det har bidragit till att man tagit några godbitar ur VLS och sen modifierat det till en egen standard och det är väl det som varit mycket åsikter om. Ska vi använda VLS eller ej?”

Purchasing manager, Fabriksgatan

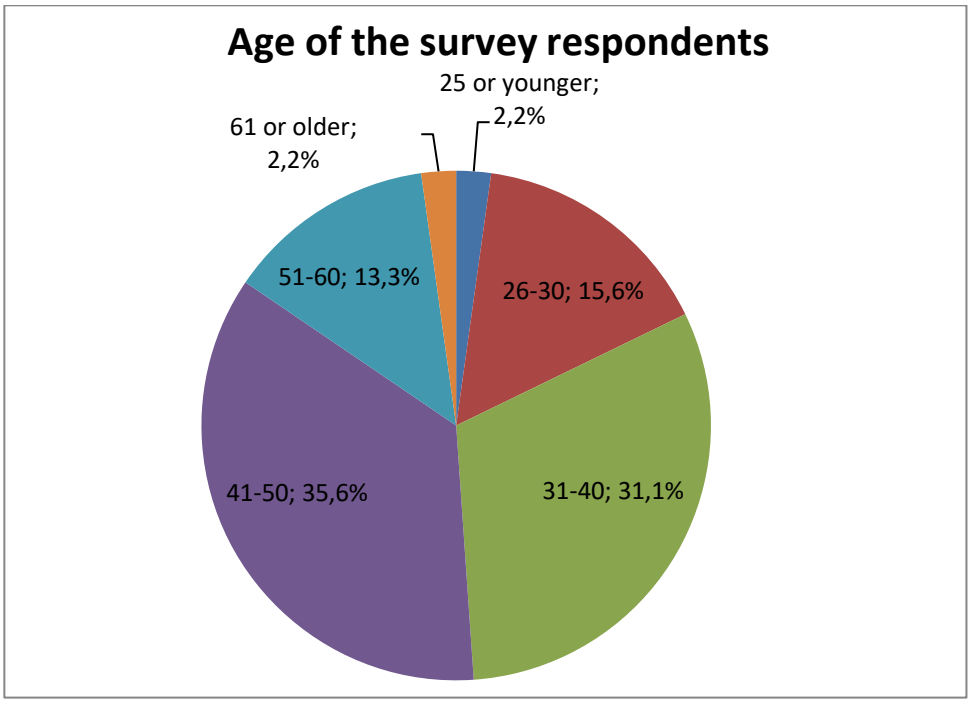
“Man har gamla mallar nedsparade på datorn som man använder istället för att använda de som finns i VLS.”

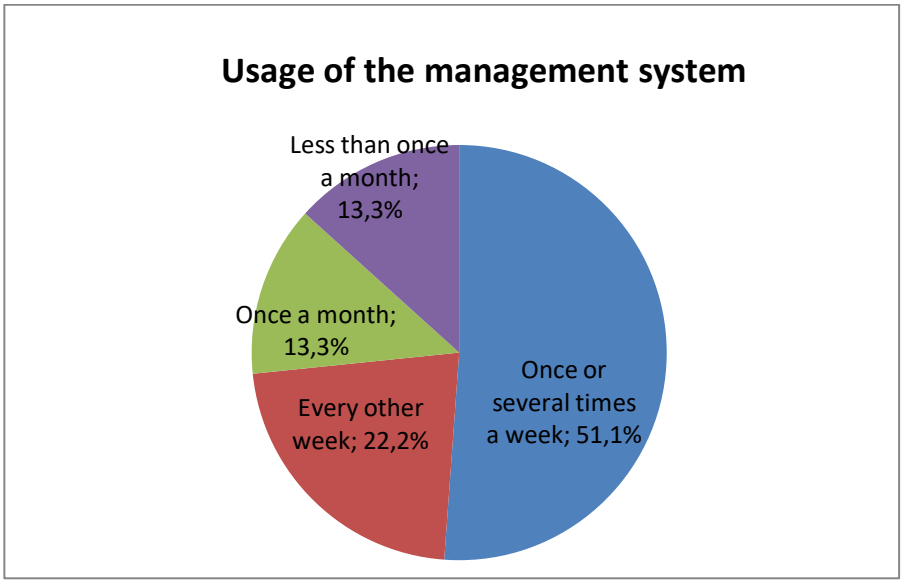
Calculation engineer, Fabriksgatan

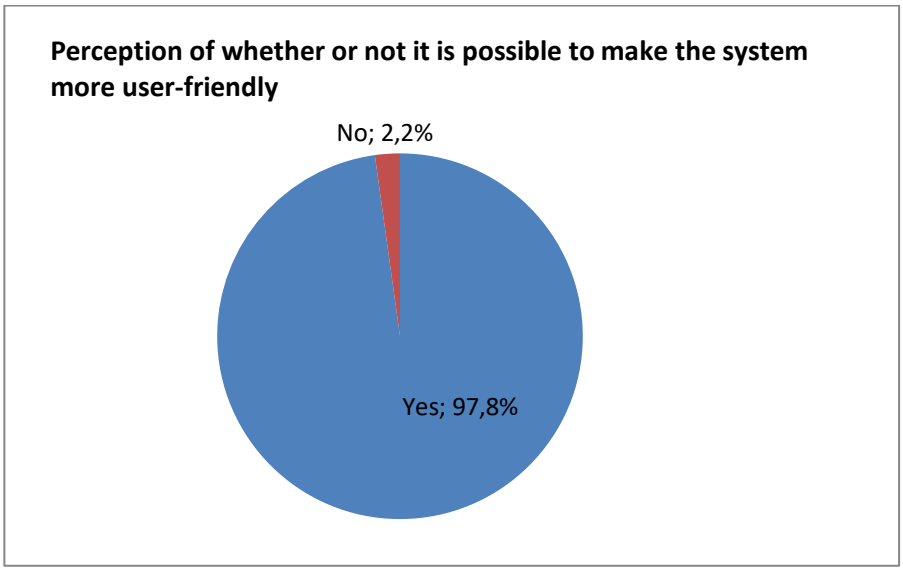
“Finns strukturer i mapparna där man jobbar med återföring av kunskap och vidareutveckling. Men de används inte så mycket. Som till exempel synpunkter borde tas tag i.”

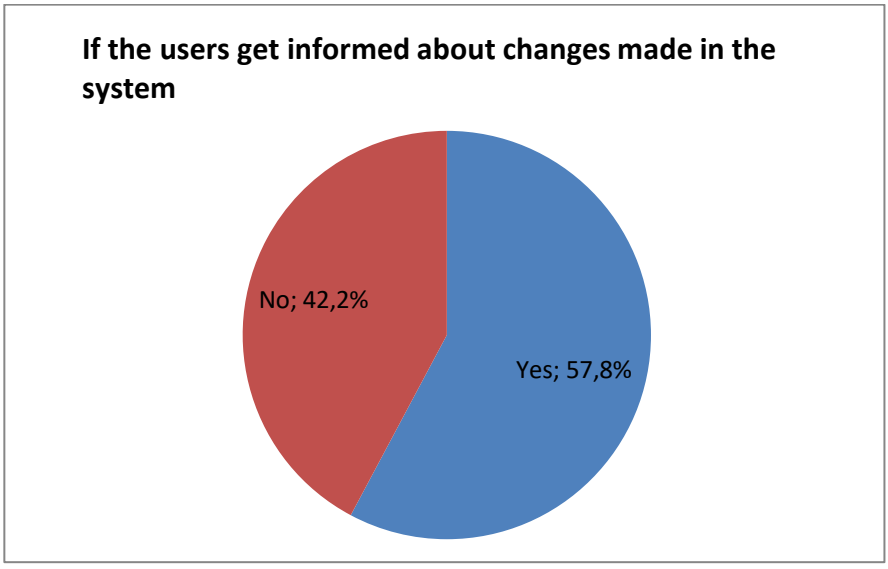
A
Appendix 4

Figures from the survey




Usage of the management system
Less than once a month; 13,3%
Once a month; 13,3%
Every other week; 22,2%
Once or several times a week; 51,1%


Perception of whether or not it is possible to make the system more user-friendly
No; 2,2%
Yes; 97,8%


If the users get informed about changes made in the system
No; 42,2%
Yes; 57,8%