Introduction of continuous and structured improvement methodology in sawmill industry: a case study

Introduktion av kontinuerlig och strukturerad förbättringsmetodik inom sågverksindustrin: en fallstudie

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**ABSTRACT**

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**Abstract (in English)**
The goal of this thesis is to create a methodology that helps companies in the sawmill industry to improve their efficiency. The purpose the case study is to create a more efficient production process by improving the structure of the work through improvements in leadership, commitment and motivation. The methodology is tested in the case company and together with the selected empirical data I generates a situation analysis in order to facilitate detection and observation of factors that are essential to study to improve the production. The results of the methodology used in the case company led to several factors considered important for improved efficiency. The most relevant success factors are better quality in communication and leadership processes. Recommendations for the case company to succeed with the implementation of the relevant factors, is to induce motivation and highlight the purpose of the change, and introduce more openness between managers and workers. This will lead to an improved structure that will benefit the critical improvement factors.

**Keywords**
Production process, Situation analysis, Methodology, Structural changes, Productivity, Case study, Quality, Change Management, TQM 7 Wastes, Sågverksindustri, Process industry

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DEFINITIONS

Process, “Sequence of interdependent and linked procedures which, at every stage, consume one or more resources (employee time, energy, machines, money) to convert inputs (data, material, parts, etc.) into outputs. These outputs then serve as inputs for the next stage until a known goal or end result is reached”, Businessdictionary (2015).

Production, “The processes and methods used to transform tangible inputs (raw materials, semi-finished goods, subassemblies) and intangible inputs (ideas, information, knowledge) into goods or services. Resources are used in this process to create an output that is suitable for use or has exchange value”, Businessdictionary (2015).

Productivity, “A measure of the efficiency of a person, machine, factory, system, etc., in converting inputs into useful outputs”, Businessdictionary (2015). Productivity is computed by dividing average output per period by the total costs incurred or resources (capital, energy, material, personnel) consumed in that period. Productivity is a critical determinant of cost efficiency”, Businessdictionary (2015).

Continuous improvement, “Programmed, and an almost unbroken, flow of improvements realized under a scheme such as Kaizen, lean production, or total quality management (TQM)”, Businessdictionary (2015).

Change management, “Minimizing resistance to organizational change through involvement of key players and stakeholders”, Businessdictionary (2015).

Method, “An established, habitual, logical, or prescribed practice or systematic process of achieving certain ends with accuracy and efficiency, usually in an ordered sequence of fixed steps”, Businessdictionary (2015).

Quality, “In manufacturing, a measure of excellence or a state of being free from defects, deficiencies and significant variations. It is brought about by strict and consistent commitment to certain standards that achieve uniformity of a product in order to satisfy specific customer or user requirements. ISO 8402-1986 standard defines quality as "the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs." If an automobile company finds a defect in one of their cars and makes a product recall, customer reliability and therefore production will decrease because trust will be lost in the car's quality”, Businessdictionary (2015).
ABBRVIATIONS

TQM    Total Quality Management
PDCA   Plan Do Check Act
CI     Continuous Improvement
MCDM   Multi criteria decision making
SWOT   Strengths, Weaknesses, Opportunities, Threats
DMAIC  Define Measure Analyze Improve Control
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1 INTRODUCTION

In this chapter the foundation of the thesis is explained and the factors of the problem are described.

1.1 BACKGROUND

In recent decades, organizations are facing harder competition (Passemard et al. 2000). Enlarged competition in technology and progressive demanding customers forces organizations to search for superior effectiveness in order to stay profitable (Myhal et al. 2008). Constant changes in environmental breakdown and bigger costs in energy and raw materials lead to lack of resources and therefore it is crucial to produce the most of the available assets (Lönnqvist, 2010). The sawmill industry is very intense with producers battling each other to produce at lower cost. Exporting nations such as Brazil, Chile, Argentina and Uruguay is competing against Canada, Sweden, Norway and Finland. Moreover, materials such as plastics, steel and concrete are also competition to the timber products (Donoso, 2007). The wood is a valuable material for human development (etc. furniture and buildings) as it is for national economic growth (Ogundari, 2010, Donoso, 2007).

If we look closer to the Swedish market the international competitiveness is restricted by national norms, taxes and technical trade barriers. On the other side is the national competitiveness dependent on laws and orders, such as abuse of dominant positions in the market or illegal price cooperation with companies (Ganslandt et al. 2002). According to (Lundahl, 2009, Eliasson et al. 2014), year 2007 became a top year when Swedish sawmills produced 18.6 million $m^3$ (annual average 15 million $m^3$) of sawn wood products. Around 11 million $m^3$ (60 percent) was exported to other countries to a value of 27.5 billion SEK, with a trading surplus of 25.4 billion SEK, shows that the Swedish trading surplus the same year was close to 110 billion SEK. The same year sawmills bought 38.2 million $m^3$ of logs and more than 97 percent of the volume was harvested and purchased in Sweden. The growing forest is still higher than ever due to the results of a successful forest-planting program. However, the Swedish sawmill industry has experienced a rather dramatic reform over the last decades, where the total number of sawmills and employees has constantly decreased (Lundahl, 2009, Eliasson et al. 2014). Sawmills that produce over 100,000 $m^3$ have increased, but the number of sawmills with an annual production of less than 50,000 $m^3$ has decreased. The number of employees has been cut to almost a fifth during the last 40 years. Yet, during the recent years after the economic boom, sawmills have employed more people. The main income in sawmills is from sales of lumber and by products such as bark, chips and sawdust. The cost of raw material, followed by labor, capital, and operations costs are known to be the largest budget items for sawmills (Lundahl, 2009, Eliasson et al. 2014). To be able to compete successfully on international markets, countries, industries & individuals must have a constant increase in productivity (Arze & Svensson, 1997).

According to (Feruer & Chaharbaghi, 1994) competitiveness has different meanings. One way is to view competitiveness as the ability to convince possible customers to choose what they have to offer over other alternatives. And another view of competitiveness is as an ability to continuously improve process capabilities, core competence as well as capabilities that drive, these competences are considered to form the essence of competitiveness. Firms that does not adapt to the market-change are
forced to leave it. To avoid ineffectiveness, an organization has to be more adaptive (Ganslandt et al. 2002). The way a firm organizes and manages their activities (etc. manufacturing, selling, research & development) are linked to the competitive advantage. Each of these actions produces value to the customer or the organization. The final value is created by the price customers want to pay to get their service/product and the costs of producing it (Song et al. 2013, Lönnqvist et al. 2010). Companies that meet competition are known to stay more responsive to the change due to the human principle and the desire to stay updated with new working methods or/and products (Shurchuluu, 2002, Lönnqvist et al. 2010). The internal improvements are many, but some of them can be extended with employees' skills to be able know how to act in difficult situations, or to minimize the number of revisions, which would mean a reduction of failures in the production process, which in turn would save time. In the same way the employee skills can lead to external improvements as greater customer service (Hill, 2005, Prashar, 2014, Varca, 2004). Well-known methods that are associated to improvement of an organization are: total quality management (TQM), Six Sigma, Lean Manufacturing, 5S and Kaizen. These methods have different objectives but a similar goal; continuous improvement of a process (Trehan et al. 2011, Kumar et al. 2014, Rambabu et al. 2015, Jain, 2015, Lingham 2008). Introduction of improvement work in sawmill industry has not been fully investigated and therefor it is necessary to study how it is possible to introduce improvements in the sawmill industry, appendix 1 – scientific research table.

1.1 PROBLEM DISCUSSION

Continuous improvement in an organization needs a long-term strategic approach to be successful. The aim is to improve a situation or process with brainstorming, in order to discover if the execution generates the optimal output. The work behind the continuously improving should be seen as a standard working routine for managers and employees as the development in the market is a never-ending procedure (Berger, 1997, Bergman and Klefsjö, 2007). When making changes (improvements) in an organization it is important for managers to have knowledge about change management. The change management goal is to positively inspire and support employees to the change. If the employees do not trust the new change it will not be successful and lead to disappointments. Possible consequences need to be addressed when creating a change (Webster, 1999 and Weber, 2001). A constant demanding world with increased costs of wood is encouraging and forcing the sawmill industry to adapt in order to stay operate (Bartram, 2011). One way to adapt is to analyze and find explanations to continuously solve problems in the production process (Rambabu et al. 2015, Ho et al. 2005). A sawmill is known for its straight line production flow and can be compared to the process industry where raw material is mixed, separated or formed to a finished product (Rathore, 2015, Donoso 2007).

A production process can be improved by utilization of the efficient communication, working methods, and competence (Kumar, 2015). Internal communication plays an important role, and it needs to be handled in a proper and understandable way, from both the managers’ and the employees’ sides. There are different ways of communication, face-to-face communication is one and online-based communication is another. The face-to-face is maybe the best one since you actually can observe and show the problem/issue, but it can be time consuming. The online-based communication is done via phones or written communication (e-mail, social media), this one is less
time-consuming, but it can also be time consuming if proper and understandable language isn’t used. The effectiveness of a communication tool depends on how they fit the current working area and the business goals (Zerfass, 2011, Ruchi, 2013 and Welch 2012). Having right competence comes from education, training and experience. Education is needed to be seen as an investment that will improve knowledge and lead to better performance for a company. At the same time have the employees be curious and learn from experience. Knowledge is good when conducting work to understand possible outcomes and necessaries and when participating in a new improvement method (Hill, 2005). Implementing a new working method can be challenging, as people are not willing to change. They have to be motivated and see a better outcome of it to be successful. Different mentioned improving methods (i.e. 5S and Six Sigma) are aiming an operating process to be less time-consuming with less effort for the employees (Rambabu 2015, Trehan, 2011). These improvement potentials, as well as improvements for the individual employee, should effectively be communicated.

1.2 PROBLEM PRESENTATION

No production line is flawless, it can always be improved. Several different aspects within a company influence the function of a production process. One of them is working method and it is linked to procedures, structures and communication between the functions within a process. These perspectives can directly or indirectly influence the productivity. It is therefore critical to investigate, highlight, reduce and improve the working process to increase use of the resources available for the specific production process. A poorly structured organization in a manufacturing process effects the communication and improvement work. Therefore introduction to structured improvement work, based on known improvement methods is an essential part to consider in order to continuously improve a production process. Introduction of a methodology is important to do in order to build up more productive working process and involve employees to work together in order to handle present and future difficulties.

1.3 PROBLEM FORMULATION

A research question has been formulated by the given information:
How is it possible to introduce a continuous and structured improvement methodology in the sawmill industry?

1.4 PURPOSE

The purpose of this study is to develop a methodology for the introduction of continuous and structured improvement in a sawmill production process. The methodology will aim to improve productivity for the sawmill industry by making the work in the production more structured.
1.5 RELEVANCE

Lumber is in many cases seen as a raw material product by the world. The raw material has a focus on competition amongst the suppliers on availability and price. Consequently, the price of lumber is set by the world market and forcing the sawmill industry to improve internally. Additionally, the mentioned and continuously demanding global and international market, forest impact on the economic growth, increased customer demands, and large budget cost for the sawmill manufacturing process, an essential competitive strategy will focus at continuously lower production costs to adapt to these forces (Eliasson et al. 2014, Ogundari, 2010, Donoso, 2007, Ganslandt et al. 2002, Lundahl, 2009, Rambabu et al. 2015, Ho et al. 2005).

Lundahl (2009) addressed, his own study, the issue of how to lower the production cost in sawmill industries. This study concluded that the Swedish sawmill industry have potential to improve their productivity (and lower their production costs) by an implementation of a method such as TQM (a continuously improvement philosophy) (Eliasson et al. 2014). Furthermore different improvement methods/philosophies does highlight that continuous improvement of a process is important in order to be more profitable (Trehan et al 2011, Kumar et al. 2014, Rambabu et al. 2015, Jain 2015, Lingham 2008).

The conclusion of the article search supports further research, as no relevant studies were found in the specific area. Basic keywords from the problem formulation, such as, sawmill industry improvement, sawmill industry productivity, and sawmill industry structure are used in an article search to discover relevant studies. This resulted in no relevant study that’s been made with introduction and continuous structured improvement method in the sawmill industry, based on article searches. The search involved several databases such as: Emerald Insight, One search, Taylor & Francis, Forest Science and Science direct. The full scientific research can be found in appendix 1 – scientific research table.

The hits from the article search were sorted according to relevancy. If the search generated 50 or less hits, the reports were examined by reading the introduction and abstracts. The search was narrowed with additional search keywords if the search generated more than 50 articles. The limit number of 50 or less was there to make it possible for the authors to examine the articles. In addition, many hits should make it impossible to examine all articles due to the limited time.
1.6 LIMITATIONS

This investigation focuses on development of a method that will continuously benefit equivalent companies with similar problem. The method is based on one single case company and its production line, the sorting process. The developed method will focus on this case company’s and companies in general with the same problem/issue; focus on their current and desirable situation to conduct reasonable results by analyzing different perspectives (working method, competence and communication). The developed method will act as a starting point for the company to continuously improve. Possible results and effects of the implemented method will not be seen due to the limited timeframe. The authors have chosen four different improvement methods for improving this sorting process. The well-known methods; Lean Manufacturing, TQM, 5S, Six Sigma are chosen due to their focus on continuous improvement and theoretical accessibility (Trehan et al. 2011, Kumar et al. 2014, Rambabu et al. 2015, Jain, 2015). Cost of implementation of these methods such as education costs etc. will not be considered, as the costs are hard for authors to estimate and time consuming.

1.7 TIME FRAME

To secure the quality and utilization of time spent on the thesis, authors has planned this study in accordance with the GANTT-chart seen in fig. 1 below.

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Fig. 1, applied study-time frame
2 LITERATURE REVIEW

This chapter consists of research methods that will be applied when processing this project.

2.1 SCIENTIFIC APPROACH

To think scientifically is the key factor to make a proper study, according to (Ejvegård 2011). A scientific thought involves the mind to think critical, to examine the facts, judge various approaches and realize consequences with them. Science is characterized for planning with a careful performance to share the results and conclusions to the society. Thurén (2007) confirms that science is seeking for the truth and continuously improvements. Patel & Davidson (2011) writes further that science aims to develop new knowledge. Knowledge can be gathered through empirical science and theory. An empirical science is known as knowledge from reality observations in the operating environment. Theory on the other hand is logic data that explains existing information of a studied area. The theory and empirical support each other in the creation of knowledge. According to Thurén (2007), the empirical part tests the theory in order to draw conclusions. This way of combining theory and empirical findings is known as a hypothetical-deductive method.

Hypothetical-deductive method will be used in this study. Theoretical findings within the study area will be tested empirically with conclusions. The method is based on the research question, mentioned in the problem formulation, and what type of results it may achieve.

2.2 RESEARCH DESIGN

According to Bell (2007) many study methods are available to conduct a study, for example case studies, survey studies and experimental methods. Bell (2007) continues with stating that a case study has possibility to study a problem area under a limited time frame. Case studies can with help from company employees and authors identify a new working method on an institution or a change in the organization. Bell (2007) explains that it is important to know that a case study has its disadvantages and benefits. As the case study works with single events it will be a problem to generalize the findings. The benefit comes from the possibility to apply many different data sources to conclude a valuable result in the case study. Finally, as a case study is done in the reality it is easier to get total understanding of the studied process (Wallén 1996).

A single case study will be applied in this work. It will give the possibility to apply different sources to develop a valuable study and deep understanding of the problem area. The nature of the problem in this case study is also connected and best answered with qualitative and in depth studies.
2.3 DATA GATHERING

Two different types of approaches regarding information gathering are available; quantitative and qualitative (Patel & Davidson 2011). Holme & Solvang (1997) says that it is not necessary to separate them within a research project, thus rather combine them for more beneficial project. Quantitative data means that is can be counted, measured, shown or corresponded in figures. The information does not need to be numeric but is often that. This type of information is good for statistical presentations with tables or diagrams that show exact information (Ejvegård, 2009, Patel & Davidson, 2011). Qualitative data is the opposite of quantitative information (Patel & Davidson, 2011). According to Holme & Solvang (1997) qualitative data provides deeper and understanding knowledge of the researched problem that cannot be rewritten in numeric terms, i.e. not be calculated (Ejvegård 2009). The quantitative data is primarily gathered though interviews (Holme & Solvang 1997).

According to Tantawi et al (2013) data can be classified into primary and secondary data. The researcher himself with the purpose of answering his research problem gathers primary data. This type of information can be more reliable than secondary data, which may have been collected by someone else in another context with different purpose. Additionally is secondary data less time consuming due to that researcher doesn’t need to make an own research from the basis.

*During this research there will be a mix between quantitative/ qualitative information and primary/ secondary data to bring understanding of the context, to secure the reliability and to save time. Qualitative data will be collected through interviews, literature and observations. Quantitative data will be considered when analyzing the sorting process to see where the improvements can be necessary. Primary information will be gathered during the collection of empirical findings via interviews and observations in order to answer the problem area. Secondary data will be used from literature i.e. books and scientific researches to develop needed knowledge for the study.*

2.3.1 INTERVIEW

An interview is a way to gather information based on questions (Patel & Davidson, 2011, Bell, 2006, Ejvegård, 2011, Patel & Davidson, 2011). The question method for collecting information has to be considered of two main terms, the degree of structure and the degree of standardization. A high standardization means a less flexible interview where questions don’t change concerning content or order during the dialogue, and low standardization means the opposite (Patel & Davidson, 2011). Three types of structure can be involved in an interview; structured, unstructured and semi-structured. A structured interview means you do not deviate from the script at some point during the interview. You do not even ask follow-up questions based on what the candidate replies. Unstructured interview is the opposite for this. The third type is semi-structured interview and it is like the structured but here it is allowed to ask follow-up questions. To obtain a quality interview, the author must be a good listener and prepare correct and understanding questions for each interview. Taping the interview is a good method to collect all necessary information (Ejvegård, 2011).
In this study the author will aim on semi-structured interviews with less standardization when gathering the information needed to the case company's context. Semi-structured and less standardized questions are used to be able to have an open discussion and ask questions according to the interview. The authors did not have a clear picture of what the real cause of the problem was, and understood that the interviewees would have different views.

Data will be gathered via more standardized but still semi-structured interviews. Interviews will be directed to different employees at the case company in order to provide different opinions to the research problem. The authors will be calm and open-minded to avoid nervousness from the respondent. The interviews will be taped to secure the information, if possible.

2.3.2 Observation

Observations provide information about the individual or group by looking around on the environment and person behavior for answers (Holme & Solvang 1997). As the observer is studying his intended goal it is important to make notes in order to obtain the memory for later usage. According to Holme et al (1997), Patel et al (2011) and Bell (2006) observations can be structured or unstructured in different forms. Structured observation means that the observer has already prepared a schedule, where he in early stage knows what behaviors and objects to look for. Unstructured observation is usually used for investigation to collect as much information as possible for a specific problem area (Patel & Davidson, 2011). As the presence of the observer can affect the behavior of the person being studied, the researcher can decide to participate in the context or keep himself outside of it (Holme & Solvang, 1997).

In this study both structured and unstructured observations will be researched. The structured observations will be used to investigate a specific area closer, as the unstructured one will be used to gain general knowledge of the case company. Notes will be written in order to remember the observation. The personnel at the case company will be aware and informed why this observation is made by the authors to prevent negative behavior from the employees.

2.3.3 Literature

Literature defines every printed or Internet based material for instance books, booklets and scientific articles (Ejvegård, 2009). By help of a developed search strategy the author can find similar articles or books that can be useful to the problem area. Literature search usually takes a lot of unnecessary time for the writer. Thus a planned literature search can avoid spilling unnecessary time to developing the actual project (Bell, 2006).

During this research the literature will be gathered for theoretical framework from books (University library) and scientific articles using several different databases (etc. Emerald and One search). Organizational booklets will be used to get knowledge about the specific case company. Books and articles will be used during every chapter in this study besides for the empirical part. Relevant keywords will be used when searching the
2.4 RELIABILITY, VALIDITY AND GENERALIZATIONS

The chosen research methodology to gather data is always important to review before deciding if the information is reliable and valid (Bell, 2006). Reliability is defined as a measure based on the same circumstances of using a method or instrument to provide the same results over and over again. According to Patel & Davidson (2011) validity is dependent on what we say we should research and what we actually are researching. Thurén (2004) explains that a research is not relevant if the reliability is high in a study at the same time the validity is low. The quality of an investigation is dependent on the reliability and validity of the used data, writes (Patel & Davidson, 2011).

According to Bell (2006), to control the validity and reliability of a research it is necessary to consider if another researcher would use the same method or instrument reaching the same results. Knowledge before and through a study increases the validity since the ability improves for the researcher to ask the right questions for the specific research (Holme & Solvang, 1997). Enhancing validity can be made by a concept called triangulation. Triangulation aims at providing as correct picture of the specific situations as possible by the use of combined data gathering methods i.e. literature, observation and interviews (Patel & Davidson, 2011). Patel & Davidson (2011) further explains how recording the interviews can increase reliability and ensure understandable questions. The ability to control the information again from a recorded interview will improve the reliability by ensuring that the information is written correct. Understandable questions so that the author and respondent understand the survey in the same way will also improve the reliability level.

Generalizing means the ability to use the theory or model in further investigations (Patel & Davidson, 2011). In order to generalize a case study to another situation is depending on the similarities between the studies. A detailed description is necessary in order to provide the reader a possibility to evaluate if the research is applicable or not (Lincoln & Cuba, 1985).

Interviews during the data collection will be noted by both authors and recorded if possible. This will give the opportunity to effectively save all needed data and the ability of controlling it. The importance of making notes is high to sustain the reliability. A triangulation methodology may be used with interviews and observations to ensure the reliability and validity of data. The author will make the respondent of the interview understand all the questions by an introduction of the studying problem area and ability to ask if they do not clearly understand something. During the observations the authors will be prepared to take pictures and make understandable notes. Authors will further gain knowledge before and thought the study while developing the method to enhance the validity.

The study procedure will clearly describe the findings, and how/why different approaches are made to give reader (students and people from industries) the ability to use the specific data in further investigations.
2.5 SUMMARY OF THE METHODOLOGIES

This will be a case study with a hypothetic-deductive approach. Both qualitative and quantitative data will be collected through interviews, literature and observations. The diagram below shows how this project is planned to proceed.

Fig. 2, Summary of the methodologies- Presentation of authors working approach
3 THEORY

This chapter consists of the written theory that is needed for analyzing the empirical findings and describes different elements for a better understanding of the content.

3.1 PRODUCTION PROCESS

The very concept of processes comes from the Latin word “Processus” and “Procedere” which roughly can be translated as “progress” or “go ahead”. In broad terms, it can be stated that a process involves coordination between people, i.e. if an agreement between individuals who interact and whether these individuals has the right competes. Definition of a process is often described conveniently by what characterizes it. A process has a beginning and an end, a customer and a supplier; it consists of a network of constituent activities, it produces a value-result and it is repeated time after time (Bergman & Klefsjö, 2012).

A company can be described as a network of processes. There are different types of processes, and they can be separated in several ways. The most common way to separate them is to structure them by the task of the process. A distinction is often made between three different processes:

- The main process has the task to meet external customer needs and add value to the products offered in the organization. An example of this kind of processes: Product development process.
- Support processes, whose task to provide resources to the main processes, the support processes have internal customers. Example of this kind of processes: Maintenance process
- A management process, whose task is to decide the organization’s objectives and strategies, also has the task to support the improvement of the organization’s other processes. Example of this kind of processes: Processes of strategic planning.

Each process has the purpose of satisfying their customers with as little resource consumption as possible. In order for a process to be performed certain resources are required of various kinds, such as information, energy or working hours. It requires careful planning, and resources that are sufficient for a process to be able to run (Bergman & Klefsjö, 2012). According to Dzindolet, Beck & Pierce (2006), automation could be defined as “sensing, discovering, information processing, decision making or action that is controlled and carried out of people, but which in practice is carried out of a machine”. Although automation is often seen as a radical technological change, one can say that it is a natural extension of the mechanization that produced the industrial revolution. The sawmill process is seen as automated in this study (Rathore, 2015, Donoso, 2007).
3.2 PRODUCTION IMPROVEMENT & PRODUCTIVITY

Productivity can be defined in many different ways, but in the simplest terms, the productivity is the measurement of output relative to an input. Through the use of appropriate strategies, many manufacturing companies can improve their productivity to reduce the costs of production (Lin et al. 1994). Discussion of productivity by many commentators often leaves with the impression that the concept only relates to the ability of labor to produce. Yet productivity relates to all factors of production, not just labor, and can be defined as the average amount of net output (or value added, i.e. the value of gross output less any materials or services for use in current production) that is produced by one unit of input (Susan et al. 1992). Bergman & Klefsjö (2001) further writes that the productivity can be seen as a personal attitude where the person seeks continuous improvement of what already exists. The employee or all human beings should be confident that it is possible to do better today than yesterday, and tomorrow do better than today. This is called having the right attitude and seeking productiveness.

According to Swartling (2007), you get an increase in productivity if you successfully improve a production. For example, an upgrade of the existing equipment, or an investment in new equipment, which is seen as a production improvement. This results in increased productivity. Improving means in most cases to invest (Swartling, 2007). With the technological revolution and the rapid improvements that are constantly done, it is critical to have modern equipment. For instance, if the specialization increased and the production equipment is purchased from external suppliers, who sold the same equipment to competitors, that made the machine itself become a less competitive advantage. And because the same production equipment was available to all competitors, the focus was put on improving existing routines instead of investing in new ones. The focus was changed from quality (TQM), continuous improvement (Kaizen) to focus on waste (TPS) (Swartling, 2007).

3.3 QUALITY

Quality can be interpreted in many different ways, but the most common associated with quality of a company is that the quality is directed towards customers. Ex: “Quality is when the customers returns, not the product”, it can be ascertained with this quote is that the customers not only assess the product that has been offered by the company, but also an overall assessment of the experience with the company (Bergman & Klefsjö, 2012). According to Crosby (1988) a company management defines its quality like this: “what is good, no one knows what that is, except the one that says it”. Quality must be, according to Crosby, defined as a conformance to requirements. Garvin (1985, cited by Bergman & Klefsjö, 2012, p. 24-26) discuss five different perspectives in the concept of quality. The perspectives that are mentioned are:
The *transcendent* perspective is the most common in the art. This kind of quality cannot be specified but it can be identified when it is experienced. When it comes to the *product-based* approach it is reverse. Here the quality is measurable and precisely, it is determined by the dimensions of characteristics that the product has. The *user-based* approach says that the customer judges the quality of a product. *Production-based* is linked to the fulfillment of the tolerances and requirements in the production, here the quality is all a matter of technique. The *value-based* approach defines quality in relation to cost and price. A business or organization cannot just have a vision of quality concepts, different approaches are needed depending on different parts of the company or organization, Garvin (1985, cited by Bergman & Klefsjö, 2012, p. 24-26).

For the past three decades, a variety of quality management practices witnessed among other things, TQM, Six Sigma and lean manufacturing. Obviously there are differences in these quality management methods, but they also have a common set of principles: in particular, to minimize waste and reduce costs while improving quality as a means to increase customer satisfaction (Pokinska et al, 2010).

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### 3.3.1 THE PURPOSE OF LEAN MANUFACTURING

The approach of lean manufacturing to reduce waste and increase the performance has become increasingly important over the years. To implement lean production system is a process that includes an assessment of the current situation and designing a production system based on lean systems concepts and technologies for waste reduction. There are seven classic types of waste mentioned by Ruy et al. (2014); transportation, inventory, motion, waiting, overproduction, over processing and defects. The development from present to the future state is a continuous process, which requires many kaizen projects to eliminate or reduce all types of waste. The ability to determine which types of waste should be reduced first is a fundamental aspect in the planning and implementation of lean manufacturing. By using FMEA (Failure Mode and Effect Analysis), one can establish some priorities for reducing various types of waste (Ruy et al. 2014).
3.3.2 7 WASTES TO CONSIDER

The easiest way to define waste is as “Something that adds no Value.” Lean manufacturing has as main objective to systematically identify and eliminate waste and losses in the process. It usually starts from the seven traditional wastes.
- Transport
- Inventory cost
- Unnecessary motions
- Waiting
- Waste of overproduction
- Over processing
- Defects (Sörqvist, 2004).

Transport is the movement of materials from one place to another; this is a waste, as it adds zero value to the product. Inventory costs concerns tied up capital, every piece of product tied up in raw material, work in progress or finished goods has a cost and until a sell has been done that cost is on your company. Unnecessary motions are those activities of man or machine which are not as small or as easy to accomplish as possible, for instance bending down to retrieve heavy objects at floor level when they could be fed at waist level to reduce stress and time to retrieve. How often do you spend time waiting for an answer from another department in your organization, or waiting for a delivery from a supplier or an engineer to come and fix a machine? People tend to spend a massive amount of time waiting for things in our working lives (and personal lives too), this is an obvious waste. The most serious of all of the seven wastes; the waste of overproduction is when you make too much or too early. The waste of over processing is where we use inappropriate techniques, oversize equipment, working to tolerances that are too tight, performs processes that are not required by the customer and so on. All of these things cost us time and money.

The most obvious of the seven wastes, although not always the easiest to detect before they reach your customers. Quality errors that cause defects most likely cost you far more than you expect. Every defective item requires rework or replacement, it wastes resources and materials, it creates paperwork, and it can lead to losing your customers (Sörqvist, 2004).

3.3.3 QUALITY & PRODUCTIVITY

Previously a contradiction between productivity and quality was believed, i.e. that higher quality could only be achieved at the expense of productivity. Modern quality management avoid working in that way; now it is believed that improvements should be created already in the design and development of the product and the production itself. Productivity is seen primarily as a personal attitude, which leads to progress seeking continuous improvement of what exists. It must be convincing that everything can be done better today compared to yesterday and tomorrow can be better than today. To have the will to improve the current situation without taking into account how well it seems to be, and regardless of how good it really is. Permanent applications of new theories and methods are necessary and to believe in a man’s capacity to improve their conditions is also crucial (Bergman & Klefsjö, 2012).
3.3.4 **TOTAL QUALITY MANAGEMENT (TQM)**

According to Grimsdal & Gunnarsson (1993) Total Quality Management is a Japanese concept to organize and to lead a company to be able to achieve high quality on everything that’s they do, and thereby reach success. The main activities of the TQM concept is to identify, quantify and eliminate mismanagement of processes and products. Bergman & Klefsjö (2001), interpreters TQM "to constantly strive to meet, and even exceed, customer needs and expectations at the lowest cost through continuous improvement where everyone is engaged and has a focus on organizational processes (Bergman & Klefsjö, 2001). Total Quality Management (TQM) aims to achieve customer satisfaction; cost effectiveness and that their work is defect free. The customers will be satisfied only if the products have a very low defect rate (literary none or zero). The product also has to have a competitive price. By focusing on process improvement, customer and supplier improvement, teamwork, training and education TQM will achieve customer satisfaction; this is an important objective for any organization (Harrington & Voehl, 2012).

3.4 **IMPROVEMENT**

According to Sörqvist (2004) an improvement means a breakthrough, where you go from a current level of performance to a new and better level. Overall distinguishes between breakthroughs in technology and breakthroughs in attitude. The technical breakthrough may be such that they are working with a new approach, a new tool or a change to a machine – the purely technical solution to the problem. The attitude is about how individuals in the business embrace and accept the necessary changes. This can be complicated depending on how people take it, because everyone is different. It requires changes in people’s feelings, knowledge, habits, behavior and more. It may easily happen that there will be big problems if it’s not managed properly. According to Sörqvist (2004), the focus is more often on the technical solutions than the attitudinal; the attitudinal is in many cases overridden.

One can drive improvement by focusing on different approaches both within and outside the company. There are three areas to put the focus on; Customer focus/ process focus, operations focus/product focus and revenue focus/ costs focus (Sörqvist, 2004). To get the best results you should have a balanced focus in all areas. The purpose of the customer focus/ process focus is to eliminate the shortcomings and errors from the customer’s perspective, adding features that provide increased value for the customer or to exceed customer expectations. To streamline the process, the focus of improvement efforts should be to analyze and carefully evaluate a company process with respect to time, quality and cost parameters. The aim is to reduce the incidence of errors and disturbances that will streamline operations and / or introducing new working methods.

When applying a business focus/ product focus, improvements aim to create better conditions to perform the work, increase customer satisfaction, improve efficiency and create job satisfaction where the whole operation and all processes must be considered. A focus on the products (product focus) is to improve the goods or services produced, so that fewer errors and problems occur. An important basis is to have a good knowledge and good communication with customers. Finally, with the revenue focus/
cost focus improvement efforts can be focused on increasing operational revenues and reduce its costs. Increased income means systematically to identify and exploit opportunities for increased sales, greater market share, and reduced price sensitivity among customer. Some important factors may be, customer satisfaction, locality and goodwill. When costs are reduced it means that the processes and products are efficient.

3.4.1 PLAN-DO-ACT-CHECK (PDCA)

The PDCA-cycle is an integrated part of a process line; it is designed to be used as a dynamic model and the main purpose of the PDCA is to improve a process. The model consists of four phases; Plan, Do, Check, and Act as illustrated in Figure 3. The process improvement starts with careful planning, which in turn leads to corrective and preventive actions; this is supported by appropriate quality an assurance tool that leads to a real process improvement (Paliska, 2007).

Plan, when different problems show and gets discovered, the first thing is to determine the most important cause of the problem and then break down the problems so it can be manageable. This applies for using some of the seven different improvement tools which are: data collection, Pareto diagrams, division, control charts, histograms, Ishikawa diagrams and connection diagrams. For breaking down the problems, an important tool is the FMEA (failure modes and effect analysis) (Bergman & Klefsjö, 2011).

Do, when the most important cause of a problem is found then you should designate a working group that gets the responsibility for the proposed actions to be conducted. It’s important to get all the involved people to have full aware of the problem and the agreed action that needs to be done (Bergman & Klefsjö, 2011).

Check, when the actions have been made someone have to re-examine the material, and control if the implemented measures led to the intended improvement. Once again
several of the seven improvement tools could be applicable. When convinced that the actions have got effect and the level of quality has improved it is important to keep the new improved level. This can be achieved sometimes with the help of an improvement tool called control charts (Bergman & Klefsjö, 2011).

Act, it is about learning about improvement work for avoiding the same problem once again the next time. If the activities were successful the new improved level should become permanent and the improvements should spread. Otherwise we have to learn of the process and then run through the improvement cycle once more. It is also important to analyze how the work with the problem solving was managed in order to learn and improve the problem solving capabilities (Bergman & Klefsjö, 2011).

3.5 DMAIC A METHOD FOR INCREASED PERFORMANCE

The major focus of the DMAIC method is to increase performance reliability and solve problems of a process. This method is identified with several steps; Define, Measure, Analyze, Improve and Control. The first step Define involves defining the team’s role, project scope and limitations, customer expectations and requirements, and summarize of future goals (Kumar et al. 2014).

The second phase Measure, includes process mapping of the problem area, validate and select measurements systems in order to provide a structure to evaluate current performance. Analyze is the third step. The third phase are determining the root cause of problems to understand why defects occurred and comparing with prioritizing, opportunities for improvements. Phase four, Improve, focus on statistical and experimentation techniques for creation of possible improvements to reduce the amount of quality problems. Finally, the last step in the DMAIC method ensures that the improvements are continuous and documented (Kumar et al. 2014, Kuan 2012).

3.5.1 Five Whys – Finding Root Cause Technique

The “Five Whys” is a technique that was developed by Sakichi Toyoda to find the root cause of a production problem (Ohno, 1988). During the years, educators and social scientists have adapted it to facilitate root cause analyses. This technique involves transforming a problem into a “why” question. Participants brainstorm (based on experience and knowledge) the answer on the intended problem with “why”. The most conceivable answer to the question “why” is selected and turned into another “why”. This process repeats five times.

Participants involved in the root cause analysis are encouraged, in connection with life experience, to systematically work with the cause of problems in a way that avoids assumptions. Therefore, the “Five Whys” method requires skilled employees in the specific problem with critical questioning and reflection knowledge. This technique can result in several different conceivable answers, which can turn an organization into new ideas and thoughts. It can also be difficult to carry out when there are limited number or answers, especially for social problem. For example, an answer to a problem can sound like: “they are born lazy”, and therefore it can be hard to move on to another “why”
The technique is illustrated below using an example with a failed vehicle.

The vehicle will not start. (The problem)

1. **Why?** - The battery is dead. (First why)
2. **Why?** - The alternator is not functioning. (Second why)
3. **Why?** - The alternator belt has broken. (Third why)
4. **Why?** - The alternator belt was not replaced in time. (Fourth why)
5. **Why?** - The vehicle was not maintained according to the recommended service schedule. (Fifth why, a root cause)

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**3.5.2 Multi Criteria Decision Making**

Decisions are made when there are selections between different alternatives. In organizations people are forced to take decisions, which can influence; customers, employees, suppliers and other cooperative partners. Multi Criteria Decision Making (MCDM) helps to rate, weight and provide a score to a solution (Jacobsen & Thorsvik, 2008, Lozano et al. 2013). An example of this is can be seen in *Figure 5* below.

![Decision Matrix](source: Prismdecision, Image by Unknown)

Lozano et al. (2013) explains the idea of the *Decision Matrix* (or MCDM matrix). It starts with a problem. Then relevant solutions to the problem are identified together with company criteria’s. Company’s criteria’s are rated and the solutions are weighted. Weights are made up to tell the importance of the solution and the rate are showing how good relation the solutions and criteria’s have. Later, the weight and rates of a solutions are multiplied with each other to a total sum. The sum identifies the solution(s) that are considered to be those most important one that will benefit the company.
3.5.3 SWOT

The SWOT-analysis is used as a tool of strategic planning (Syazwan, Abu Bakar & Hamid, 2014). Proctor (1992) stated that the SWOT-analysis is suitable for countries, industries or organizations to follow, as the SWOT-analysis identifies the environmental relationship between internal and external environment. By using the SWOT-analysis the user of it will facilitate to have a better understanding on how to use it, more precisely how to turn the weaknesses into strengths and how the threats can become opportunities by using the strengths (Syazwan, Abu Bakar & Hamid, 2014). This technique is a very simple one, it is easy to understand by the users of it and it provides a device of good structuring for sorting out the ideas about the company’s future. The SWOT-analysis is known all over the world because of its inherent attractions, such as: the technique is very simple in concept to immediately and readily access it to the managers. No computer or management scientist is needed (Piercy & Giles, 1989). It provides a device to structure the awkward mixture of quantitative and qualitative information of both familiar and unfamiliar facts. It is an analysis of strengths and weaknesses presented internally in the company, while the opportunities and threats are what the company faces externally.

![Fig. 6, SWOT-analysis (source: Enjoytemplates, Image by Unknown)](image)

3.5.4 ISHIKAWA DIAGRAM – ANALYZE CAUSE OF PROBLEM

According to Vekemans (1991), when making improvements to upgrade quality of manufacturing, several processes are needed to be controlled. For visualization of a manufacturing process a diagram called Ishikawa diagram is applied to better understand the connected structures, (Ishikawa, 1982). The Ishikawa diagram is mainly used for illustrating the cause-effect and relations to the intended problem in a simple and understandable way. Breaking down the problem into a manageable problem increases the understanding and the relation between the problem(s) investigated (Vekemans, 1991). Different factors can be connected with the problem/defect. Each of
these factors can be divided into sub-factors that are describing the factor. One way to work with the Ishikawa diagram can be made according to the 7M diagram. 7M-diagram works exactly as the well-known Ishikawa diagram, the only difference between a “normal” Ishikawa diagram and 7M diagram is that the 7M diagram has the 7Ms; Management, Manpower, Method, Measurement, Mechanical, Materials and Mother nature. You don’t have to use all of the 7Ms, you can use as many as you find relevant to your problem. Sometimes you need help getting started with improvements in all different areas of a business. In most cases, it is assumed that the causes of a quality problem can be attributed to any of these 7 Ms (Bergman & Klefsjö, 2001).

- **Management**, does the management provide for instance, sufficient support and sufficient resources for activities such as quality activities?
- **Manpower**, for example, does the operator have appropriate training, motivation, experience? Does the user understand how to use the product?
- **Method**, are there proper tools and drawings? Is the process parameters well specified and is the steering ability sufficient?
- **Measurement**, are the measuring devices calibrated properly? Are disturbing environmental factors?
- **Machine**, performed an appropriate preventive maintenance? Is the machine such that the variations between the manufacturing units are small enough?
- **Materials**, what about the quality of the material used in the process. Is a supplier quality activity adequate?

This 7M diagram is illustrated in figure 7. This figure is based on six cause areas. The management area is missing.

![Fig. 7, 7M Ishikawa diagram (source: Creately. Image by Unknown)](image-url)

When developing a 7M diagram you first start to write down the problem/defect to find the cause factor(s). Identified areas that are connected to the problem are documented and under each area, the causes of the problem within that area are noted (Slobodan, 2014).
3.6 PROCESS MAPPING

A process consists of flows and activities, an activity “takes one input, add value to it and give output to internal and external customers (Klotz et al. 2008). The input and output represents the flows between activities, the most common consists of information. The output from an activity in one process is an input for the next one (Klotz et al. 2008). Process maps are today used as a visual aid to demonstrate how a working process works. Typical of process mapping is that they show what should be done, who will do it, when and where it will happen (Berente, Vandenbosh & Aubert, 2009). What is process mapping? As Anjard (1998) indicates it is to identify, document, analyze and develop an improved process. Working in teams and with continuous discussion is an important aspect when developing and using process maps (Anjard, 1998). There are some benefits with process mapping that often are focused on improvements as a result of a review of the process that are based on the future process maps. It is the original process being mapped, and the resulting map is the one used to identify opportunities to improve. The results obtained are represented by a future-state map, which then is applied in order to modify and hopefully improve the original process (Berente, Vandenbosh & Aubert, 2009).

3.7 PROJECT MANAGEMENT & CHANGE MANAGEMENT

To plan, control and manage large complex “concrete” projects, requires project management capabilities, as this has developed in the recent years. Based on these, the so-called “hard” concepts emerged; various project success criteria that are important such as control, handling out schedules, costs and scope. Project management can also be seen as to be able handle change. In most organizations, it is the manager who is responsible for the successful delivery out a complete project (Bourne & Walker, 2004). The project manager must manage the processes for developing plans, schedules, reports, experiences and forecasts that will serve as communication devices to all involved and interested. It is important to seek out, manage the needs of customers and suppliers, which requires a mix of management and leadership. It is important to have leadership skills to be able to motivate the personnel and ensure that all team members have their needs and wants met (Bourne & Walker, 2004). In order to do prepare for a project time schedule it’s important to have clear objectives and that the available recourses are known before the start of the project, and this is also a requirement for preparing the budget. There are several different types of recourses; the most common type is the project personnel, which in hand can be divided into different professional categories; Computers, Financing, Facilities, Materials, Services, Equipment (Antivik & Sjöholm, 2007).

There are several different ways for a manager to schedule the project work that has to be done and the Gantt chart is a crucial way to do it. The Gantt chart was first used as a production-planning tool to be able to manage and plan the batch production. Today, the Gantt chart is seen as a simple, intuitive, practical and useful tool to connect project activities and durations. And as (Geraldi & Lechter, 2012) states the Gantt chart is one of the if not the most used tool in planning and controlling tools in different projects nowadays. The chart is not only for connecting different project activities and durations,
the Gantt chart can also be a useful tool if it’s used as a tool to communicate the project schedule and to make sure that everyone involved understands the progress of the tasks that are in the chart. A project manager can for instance use the Gantt chart to point out and show the potential delays and make sure that the focus of the project team is on the critical tasks (Geraldi & Lechter, 2012).

Change Management

It is not an easy task to motivate employees in a changing or/and unstable environment. A leader in an organization is faced with several of challenges to keep productivity high. The leader himself needs constantly strive for change thought creative thinking (Benson, 2008). To be able to create a motivational environment and trigger employees to continuously change, some methods are stated, such as:

- Form a strong improvement plan with goals, activities and expected result
- Have a clear and positive vision of the outcome the change shall create
- Act as a strong and secure role model
- Believe in the new and ongoing system and structure
- Be positive and understanding
- Set short-range goals and checkpoints
- Encourage experimentations, risk taking and brainstorming
- Pay attention to employee knowledge and experience
- Continuous reward the employees for good work

What a leader should not do is escaping the truth, saying that nothing will change, hiding from the group and delay to deliver bad news. This will not positively generate motivation and a future change (Cameron and Green, 2009).

Further, Cameron and Green (2009) describe the Noer’s model in four steps of how a leader can manage change in an organization:

- Level one aims to make the management effective and efficient. This is made with an honest open communication with the participants. It is better to over-communicate than under-communicate.
- Level two is about allowing handling of personal feelings. Managers can simplify this process with one-to-one meeting or group meetings.
- Level three are focusing on surviving the future. Here is participation of the employees made to together form a stronger future in the organization. This can encourage engagement, commitment and most important, a higher degree of success.
- The last level in the Noer’s model talks about to standardize the changes. All changes made must be given the fundamentals and time necessary for the employees to deal to the new working routines.

Motivation, change management and productivity are intertwined and linked. All these three should be a major consideration for today’s transformational leader (Benson, 2008).
3.8 Motivation & Communication

Motivation can be defined as the art of helping people to focus their minds and their energy to do their work as efficiently as possible (Crumpton, 2013). The human motivation is intimately tied to emotions. Employee motivation affects one’s social skills, and is correlated to emotional intelligence. The most fundamental and motivational techniques used to coach others require that managers and supervisors are active. It will provide:

- An active coaching to motivate employees
- Give positive feedback and reward good behavior
- To publicly recognize the efforts
- To lead by example
- Set a good example and show willingness to be part of the team
- Ask questions and show interest and empathy in the details.

These are typical basic motivational techniques used by managers and supervisors, and that has been used for years in normal environments, but to keep people motivated during the years of adversity requires leadership. Motivation is an important part when it comes to work in the changes, it is important to understand how people are motivated and what you can do to increase people’s motivation. It is important to try to increase people’s motivation since it’s very important for an individual’s ability and willingness to perform (Söqvist, 2004).

Communication is crucial to how modern organizations operate, and are therefore the key to cooperation for the realization of organization’s goals. In some studies that are done on communicating face-to-face it shows that only 7 % of the information that the recipient perceives is conveyed through words, 38 % through the sentences and words expressed and 55 % through body language. This means that face-to-face communication may experience some problems that would not arise in written communication (Jacobsen & Thorsvik, 2008). Perhaps the biggest drawback of written information is that it provides relatively little scope for mediation of “rich information “, i.e. there is limits to how much information can be transmitted in a message. In recent decades there has been a revolutionary development of electronic means, for efficiency in several areas. IT (Information and communication technology) refers to electronic means of data collection, storage and presentation of information, transmission, processing and for connecting people, functions and different units both within and between organizations. The IT contribute much, among other things, it contributes to that organizations develop new communication networks that otherwise probably would not have arisen. It can also help to increase both the frequency and volume of communication in all direction within the organization and thus facilitate coordination (Jacobsen & Thorsvik, 2008).

Communication problems within organizations are not something that is rare; it usually involves too poor communication between management and employees, where the management does not listen to the staff’s view or does not inform what is happening. But it is not just between management and employees communication problems arise, Often the communication of employees among themselves is poor and employees might know very little about each other’s work.
4 DEVELOPMENT OF THE METHODOLOGY

In this chapter the development of the methodology applied in this case study will be presented and explained in details. The description of each phase in the methodology is connected to the theory part and the theoretical connection is motivated and explained in details. The methodology chapter is mainly inspired by the PDCA-cycle with other inputs of improvement theories and methods.

4.1 METHODOLOGY INTRODUCTION

The methodology is based on several forces to improve the sawmill industry internally, such as continuously demanding global and international market, forest impact on the economic growth, increased customer demands, and large budget cost for the sawmill manufacturing process (Eliasson et al. 2014, Ogundari, 2010, Donoso, 2007, Ganslandt et al. 2002, Lundahl, 2009, Rambabu et al. 2015, Ho et al. 2005). Additionally a study by Lundahl (2009) concluded that the Swedish sawmill industry have potential to improve internally in order to increase the productivity by using a continuous improvement philosophy (Eliasson et al. 2014). The methodology is specifically adapted to the sawmill industry’s needs, characteristics and conditions. The need is not only improving the productivity but also to introduce and continuous approach to this, which justify the use of the PDCA-cycle. TQM is the foundation and inspiration of the whole methodology, as it covers all the different areas such as improvement, project management, motivation, change management and improvement methods.

The sawmill industry is characterized as a production line where each individual process affects the next. It can be easier to implement improvements in a linear process. Example, if there is an error in the middle of the entire process line. This means automatically that one or some of the previous steps lead to that error. Thus, it becomes easier to know where and how to improve. The preconditions for change and improvement in the industry are to have good communication and be involved as an individual. It is up to each leader/manager of the company to ensure and motivate their workers to communicate and be involved in the improvement efforts. While each individual must assume its own responsibilities for improvement, it is the manager's task to motivate and make sure it gets done. The aim is that the methodology should be easy to use and to implement. The methodology was made to make it possible for everyone who uses it can take advantage of it. It is simple as possible because not everyone have the same skills in a company. Also, in an improvement work, it is important to ensure that everyone involved understands and can convey their views.

In this case the methodology will lead to a more structured working environment. This methodology does not only help the company to improve but also to introduce an improvement methodology by following the various improvement methods and the mindset of the model. It is critical to investigate, highlight, reduce and improve the working process to increase use of the resources available for the specific production process. Each phase in the methodology should be easy to learn and fast to conduct which affects the choice of tools and methods. Time is for many companies an important factor to effectively learn the process in order to use it. The faster one learn, the faster the company can be completed with the implementation, but also have more time for other important things within the implementation.
4.2 METHODOLOGY DESIGN

The methodology is described on a conceptual level in Figure 8, and in more details in Figure 9. The trigger point to the problem/opportunity identification is based on production improvement, productivity and waste. Every company wants to minimize their waste and increase their productivity, to do so an improvement of current production processes is necessary. This is important because a company have to increase their profit and stay competitive on the market. With a stable economy, a company gets more opportunities regarding production improvement which in hand could lead to finding possible financers if needed. The steps are mentioned in the picture below. Detailed description of the steps are described in the following sections below.

Fig. 8. Introducing and supporting model

4.2.1 PHASE 1. INVOLVING THE PERSONNEL

Upon improvement work, it is important that everyone involved respect and follows the agreed rules, standards and decisions. As a project leader it is important to be prepared for the goals and the work ahead that needs to be done. It is important to believe, understand and stay positive during the work, by motiving and encouraging the
involved and yourself, to set up short range goals and be a strong person that others can rely on. Further, these important factors are pointed up:

- Form a strong improvement plan with goals, activities and expected result
- Have a clear and positive vision of the outcome the change shall create
- Act as a strong and secure role model
- Believe in the new ideas
- Be positive and understanding
- Set short-range goals and checkpoints
- Encourage experimentations, risk taking and brainstorming
- Pay attention to employee knowledge and experience
- Continuous reward the employees for good work (Cameron and Green, 2009).

Read further in the in chapter 3.7 to see how a leader of an organization can manage change.

The first phase is more like a preparatory step before starting the current situation analysis. It’s based on the theory from the project management and Motivation & Change Management part.

4.2.2 Phase 2. Current situation analysis

The purpose of making a situation analysis is to jointly conduct a positional and risk analysis through discussion regarding order and systematic work. For supporting a situation analysis, it is helpful to prepare relevant discussion questions. It is important for the project manager to have a critical view in order to produce the most relevant answers to the questions, which then can be used out to obtain information on how the current situation is at the company as well as the improvement possibilities. The best and perhaps the most effective way to conduct a situation analysis is to brainstorm issues related to the production and management. Is also important that project manager go out to the company to obtain an overall picture of how the company looks, and observe the workplace and the environment. It is also important to ask the right question to the right person, i.e. people with knowledge about the problem area.

Next step is to conduct a SWOT-analysis, based on the responses received from the questions and observations. The SWOT sets out strengths, weaknesses, opportunities and threats of the organization. Strengths and weaknesses are internal within the company while opportunities and threats are external, strengths and weaknesses are also in the moment while opportunities and threats are often in the future. A SWOT-analysis is made to gain a wider/better picture of what the problem / problems are within the company.

The content of the second phase can be connected to the theory, mainly from SWOT-analysis and from the Plan phase in PDCA, where data has been collected to make a current situation analysis in form of a SWOT analysis for better understanding of the problem/problems. SWOT-analysis is proposed because its simple to use and requires no greater knowledge or experience, and is easy for all involved to understand. It provides a simple but effective basis for strategy and vision work and it is easy for anyone involved to contribute to the discussion. Moreover, it can be done both
individually and in groups. It is important that all the people involved are motivated to improve, which may be linked to the theory of motivation.

4.2.3 Phase 3. Identify the Root Cause of the Problem

To be able to find the root causes of the problem a critical identifying technique could be used. One such is 5 Whys which is used in order to break down the main problem to the core. The 5 Whys involve transforming a problem into a “why” question. It is very important to make a check list at the beginning to be able to check later on if everything is done or if something has been forgotten. A Gantt-chart can also be done in order to know when to start and end the activity. This check list can be changed during the process; something can be added or removed. The participant’s starts to determine the root cause(s) of the trigger point in order to know what areas to concentrate on from the SWOT-analysis. The answer to the question why should be based on the participants knowledge and experience to avoid assumptions. The most probable answer is chosen and turned into another “why”, this cycle repeats five times. It is also important that the participants are experienced in the specific area that’s being analyzed.

If a company would like to develop an improvement idea instead of a problem, the firm can use a reverse 5Why method the same way that is done with basic 5Whys tool, but here the beginning is from the other side, not from the top to the bottom, but from the bottom and up.

The third phase of the model is based on the theory of 5 Why’s and the Plan phase of the PDCA is included here too, as in the previous phase but the difference here is that you use the data to identify and break down the problem. 5 why’s is first and foremost very easy to use, while responding to the problem of a critical approach that can result in different responses that can lead to new ideas and thoughts, and is therefore good to be used within the sawmill industry to critical investigate and highlight the area that needs to focused. The authors recommend the 5 Why method in order to identify the root causes of the problem. This method fits any kind of organization/ company, it is easy to implement and easy to understand. Therefore this could be done by anyone at any level in any organization/ company.

4.2.4 Phase 4. Analyze the Root Cause

After the identification of the core problem it has to be analyzed in detail. Different aspects can be connected to the core problem; therefore it has to be analyzed carefully to be able to identify all of these aspects. Brainstorming is a good way to examine possible causes such as, lack of correct tools, poor machinery, poor staffing, bad working environment etc. Keep in mind that there could be more than one possible cause and solution to the intended core problem. A helping tool to analyze the core problem could be the 7M Ishikawa diagram; this diagram identifies potential factors that affect the root cause. In total seven root areas are included in 7M Ishikawa, but the participants in the project have to choose the most critical areas that will be investigated in this step. If an area is not relevant and not affecting the problem/idea it should be
disregarded to minimize unnecessary confusions. If a factor appears in more than one area it can be recognized as an important factor to improve.

The fourth phase of the model is based on the theory of the 7M diagram and from PDCA-cycle and TQM. TQM contains of the seven basic tools of quality, where Ishikawa is one of the seven tools of TQM. When it’s mentioned in the TQM the context is called Cause-And-Effect-Diagram. Benefits of using the Ishikawa diagram are that it provides a visual picture of the problem and potential categories of causes it is encouraging creativity through the brainstorming process. The 7M diagram is chosen because it is simpler to both use and understand than for instance the FMEA. This makes the 7M Ishikawa diagram more effective in this case since people that never used it will learn it relatively fast. Also, this type of Ishikawa diagram is used due to its suitable nature for this project.

4.2.5 Phase 5. Setting Goals and Solving the Root Cause

After a careful analysis of the root cause, it is important to set goals that are related to the root cause. The targets will be based on preferred situation after the change. It is important to involve all the staff that is relevant for this. After you set appropriate goals, you should try to solve the problem based on the goals set up. Depending on what the problem is, different solutions to the root cause are developed. When the various solutions have been identified it is important to discuss and weigh them up in advantages and disadvantages so that later on you can rank them in order of importance. This can be done by utilizing the MCDM matrix. Based on the MCDM matrix the solution with the highest rank, which means that it’s most critical, is chosen. If two or more solutions end up with similar total scores you would have to take into account all these in the further.

The fifth phase is based on the PDCA cycle do-phase as well as the DMAIC’s improvement phase where one use the brainstorming and involvement of relevant personnel. This phase can also be connected to the Project Management theory, since the manager(s) develop plans to solve different issues that come up, also to make sure that all the persons involved communicate with each other. The MCDM is selected to be used in the sawmill industry as it is weights criteria and ranks the solutions to the criteria’s to make the analysis more accurate/reliable. Also, the matrix shows a structured picture of improvement methods and criteria’s that are analyzed. For better understanding of usage of the MCDM method see fig. 5 Decision matrix in Chapter 3 - 3.6.3.

4.2.6 Phase 6. Implementation

Based on the findings from the previous phase- Goal set up and root-cause solution, the most relevant solution or solutions will be implemented. Depending on how the problem and solution looks like, different things has to be considered and done. Therefore it is important to know what to consider and what to do first. To do so a checklist of all activities to be included could be a good way. Following the checklist is crucial to not forget any step or to repeat the same thing. Phase six is not based on any particular improvement method, but here you have to make sure all involved know what
they should do and that everyone has had their voice heard, and then simply implement what you have come to as a conclusion.

*This phase has connection to the Do-part in PDCA, the Improve part in DMAIC and also Change Management Theory. This theory is used because the characteristics. It is only certain characteristics used by each method mentioned. Phase six is based on the project management theory. Especially focused on tools for time planning and recourse planning.*

### 4.2.7 FOLLOW UP

When the actions have been done, the implemented changes must be evaluated. This can be made by observations and a follow up on the checklist that was done in the previous phase. The whole improvement process is about learning and avoiding the same problem once again. If this is successful, the improvement shall be permanent. Otherwise we have to learn from this and then go through the improvement process once again. It is also important to analyze the problem solving to next time be more effective and productive next time. The last level in the Noer´s model is regarding standardizing the changes. All changes made must be given the fundamentals and time necessary for the employees to deal with the new working routines, Cameron and Green (2009).

*Phase seven is based on PDCA´s check and act, Motivation and Change Management theory. To be able to perform this phase the checklists and goals that have been set up in phase 6 has to be followed up in order to see what’s been done an how it’s going, to later on see if it has to be redone or not. Motivation and Change Management theory is chosen due to continuous motivation. PDCA-cycle is chosen because it highlights learning from the improvement work.*
### 4.3 Summary of the Methodology Phases

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Method</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Involve the personnel</td>
<td>• <strong>Description:</strong> Involving and inspiring the personnel to the project.</td>
<td>• <strong>Method:</strong> List of possible motivation and resistant to change factors.</td>
<td>• <strong>Output:</strong> Organisation prepared for the started project, project organisation defined (ska ni nåma detta måste det finnas med i teorin med).</td>
</tr>
<tr>
<td>2. Current situation analysis</td>
<td>• <strong>Description:</strong> Discover firm strengths, weaknesses, opportunities, threats.</td>
<td>• <strong>Tool:</strong> SWOT-analysis</td>
<td>• <strong>Output:</strong> Discovered where company stand today in the market.</td>
</tr>
<tr>
<td>3. Identify the root causes</td>
<td>• <strong>Description:</strong> Finding root-cause of the trigger point</td>
<td>• <strong>Tool:</strong> 5 Whys</td>
<td>• <strong>Output:</strong> Company know what areas to improve from the SWOT-analysis</td>
</tr>
<tr>
<td>4. Analyze the root cause</td>
<td>• <strong>Description:</strong> Analyze the root cause; how the process works today</td>
<td>• <strong>Tool &amp; method:</strong> Ishikawa diagram and brainstorming</td>
<td>• <strong>Output:</strong> Cause-effect relationships to the root cause is found.</td>
</tr>
<tr>
<td>5. Setting goals and solving the root</td>
<td>• <strong>Description:</strong> Rate solutions and weight criteria’s against each other</td>
<td>• <strong>Tool:</strong> MCDM matrix</td>
<td>• <strong>Output:</strong> A vision of how the root-problem should be eliminated and how important the alternatives are</td>
</tr>
<tr>
<td>6. Implementation</td>
<td>• <strong>Description:</strong> Implementation/initialization of the chosen solution(s).</td>
<td>• <strong>Method:</strong> Implementation of MCDM result</td>
<td>• <strong>Output:</strong> The most relevant solution(s) are implemented in the firm</td>
</tr>
<tr>
<td>7. Follow up</td>
<td>• <strong>Description:</strong> Check how the solution(s) are implemented in the daily work and based on the set up goals.</td>
<td>• <strong>Method:</strong> Check list follow up</td>
<td>• <strong>Output:</strong> The results of the implementation and if possible changes/customizations/is needed.</td>
</tr>
</tbody>
</table>

*Fig. 9. Summary of methodology development steps*
5 EMPIRICAL DATA
In this chapter the empirical data will be presented gathered from interviews and observations.

5.1 ABOUT THE CASE COMPANY

Hanåsa Sågverk is a family owned company in the third generation. Started up in the early 1900s, the saw was then agile and the timber was sawn with a steam engine. Hanåsa Sågverk was in 1951 built up permanently. The company only works with redwood and has an annual production of 20 000 m³. The raw materials are sourced normally within a radius of 50 km from Hanåsa Sågverk, according to the data obtained by the manager at the case company. The sawmill will take advantage of forest resources in a gentle way by use of efficient logistics, since they minimize their transport and they are self-sufficient in fuel for wood drying and the entire production facility. The wood used is of the finer qualities and is excellent for the woodworking furniture and fittings in strip industry. Hanåsa is selling their wood in Sweden and abroad. The export share varies between 40-60 %, according to the manager at Hanåsa Sågverk. The countries that they export to are basically all the Nordic countries, Poland, Germany, Belgium, parts of Southern Europe, Northern Africa, Asia and the Middle East. Since the company is a smaller player on the market they focus on to supply customers with special requests regarding dimensions, grades and volumes. The setup of the sawing and drying depends on what the customer wants. They believe that this adds value for the customers, for themselves and above all for the forest owner they bought the timber from which they see as the most important aspect in their cycle. Hanåsa sawmill has the ambition to always take advantage of the fine raw materials in the best way possible; to have access to an efficient production line, a knowledgeable and aware staff and that they should have good and healthy business relationships with customers.

The company is a little bit unique in the sense of that they both have dry and raw timber going through the same sorting process (today it’s more usual to have two different sorting machines, one for dry timber and one for raw timber). The production process at Hanåsa Sågverk starts when the timber enters the process through the treadmills in form of logs. The person that is sawing the material is sitting in a “monitor room” where he/she has different monitors, joysticks and buttons to be able to saw the material in the way that the customer wants it. After the sawing of the material the person in the “monitor room” has to send the material to either the drying department and then to the sorting process (depending on what the customer wants) or directly to the sorting process. If a customer decides that they want to dry the wood it usually takes a little bit longer time for the customer to receive it, since it has to be dried for a certain time. And once the wood has been completely dried it’s sorted very carefully (depending on which quality and dimensions the customer wants) and after the careful sorting the material goes to the packing, after that the material is taken to the stock by a forklift. And then it’s ready to be shipped, but there is also one more process that can be included depending on the request of the customer, that process is treatment of the products. Some customers want their products to be surface treated and in that case the company send the products to a local surface treatment company. After the surface treatment the products will be shipped to the customer. If a customer want their products to be raw then it’s kind of the same process but, there is no drying of the material. The rest of the processes are exactly
the same as for dried material. Large parts of the production are quite old. The machines at the sorting are also relatively old and have today some downtime, “stop and go”, frequently and that of course influence the production. The employees maintains the machines once every month, otherwise maintenance is made only if something is broken or if the production stands still, and the most common maintenance activity that is usually done is cleaning around the machine. Hanåsa Sågverk currently has no plans to purchase new equipment, primarily because the company is rather small, and do not have the financial capacity for those types of machines would need upgrading. They have replaced some parts on some machines, and they have also had plans to expand the grading mill so dry timber and raw could be sorted separately. The current situation with the machines at the company does not affect the quality of the products.

The communication at Hanåsa Sågverk is important, because basically everything produced in the company is unique in its own way, depending on what the customer wants.

Fig. 10. Production flow

Today people in the company communicate with com-radios among themselves. In addition they communicate in form of informal meetings where all involved can speak freely in the break room or around their boardroom table. It is also where the most important discussions are handled. The usage of the com-radio is very effective because passing the information that you want is speedy. Com-radio is used on regular basis when any kind of help is in needed, with anything (if you want to know something special, or if it has become a stop etc.) The working environment at the company is good, and it is a very familiar environment. But it is a bit disorganized and unplanned on many levels. Work instructions and descriptions of everything from safety to some small things that are good to keep in mind do exist, but they are inadequate. They do not have proper safety or, working templates, i.e. what can be useful to bring before entering a working area like right clothes and tools, or what to do after a safety issue occur. Also, the case company highlight and have cleaning routines but have no table of in-
formation where everyone can see when, where and who has to do it. At the grading mill the machines are equipped with some instructions, such as which buttons to press depending on the quality of the planks. The company has tried to implement improvement methods, more specifically 5s, but it was no successful implementation. There was no one who was in charge for the implementation and it was never followed up properly.

5.2 THE SORTING PROCESS

Hanåsa Sågverk aims to sort between 25-30 pieces per minute. They used to sort 25-30 pieces per minute previously but after 2009 when the workforce was completely renewed the sorting process has not come up to the same level of performance, Nowadays they sort 15-17 pieces per minute, according to the manager at the case company. The goals set up for the sorting process is to continuously improve the process and everything around it, to sort as much as possible in as short time as possible, and to minimize overtaking’s. The case company will not begin to buy, sort or pack their timber before the payment from their customers have arrived. At Hanåsa there are two options for the sorting process depending on the customer requirements. Option 1 is that a customer buys raw timber. In such a case the timber gets to the sorting directly from the sawing with help of a forklift. Then the sawing pattern has to be programmed into a computer according to the customer requirements. The requirements such as dimensions, length and packing instructions etc. are also noted on a piece of paper. After the sawing the boards/planks “drop” down in to the fallout and+ further on to a track and through a buffer where the wood is buffered up by two elevators to the actual sorting. The boards come up at regular intervals, where the sorter manually assesses the quality while the machine sorts the length/ width etc. The worker who choose the quality of the boards are pressing one of eight different quality level buttons that is most suitable for the boards. Knowledge about how to choose the right quality level can be learned with help of a literature book and a lot of experience. The material is sorted into compartments where there is a track with hooks that picks up the boards and then sorts the different compartments along the path. Then it is packed and sent either directly to the end customer or it is sent for treatment.
Option 2 is the same principle as option 1, however, the wood is dry and retrieved from the warehouse instead of coming directly from the sawing and put on a track directly outside the grading mill. The dry timber is going directly to the end customer, so it is especially important to program correctly from the beginning so that overtaking can be avoided. When dry wood is sorted it is very important to consider the different qualities available.
6 Analysis

This chapter describes how the methodology is applied at the case company. It will only consist of the preface and Phase 1 to Phase 5, since there is no time to go further with the methodology.

6.1 Methodology Usage on Case Company

The idea to improve within the case company came from the strivings to be more competitive and financially stronger. To do so the case company needs to change and improve practices for the better. The authors got the mission to map the current sorting process to see why this process was ineffective. The aim was to improve internally to be more effective, competitive and financially stronger. In order to not fall back into same type of problem(s), the methodology is built up to continuously improve the company.

6.1.1 Phase 1. Involving the Personnel

As a manager it is important to be able to both motivate and to deal with personal emotions, to always be honest about things around the production and to always be positive and understanding during changes in a production. One of the most important thing for the manager is to pay attention to what his employees has to say, because they might have previous experience from something. It is also important to pay attention to the personnel’s knowledge since they are the one’s working at a specific production process, and if they are working there every day they will probably know the process better than anyone else at the company so their knowledge about the machines and what needs to improve is very important for the manager in a changing working environment like this methodology improvement. It is also important for all employees (both managers and working personnel at the case company) to not hide from the truth, because that only hurts the company. It is important to always be honest about everything that is going on at the company in order to get the best results.

At Hanåsa Sågverk there are some problems with involving, motivating and communicating all the persons that are working at the company. In the current situation at the case company both the managers and the employees are not involving each other when decisions are made regarding production processes and general information about what is going on in the production. It is important for the manager at the case company to involve all people that has to be involved, communicate with them so that there are no misunderstandings, and all the time motivate the personnel to always improve both themselves and the process where they work on. This in order to minimize the waste and to increase the quality of the products that is sent out to customers. There is a very good atmosphere on breaks but when it comes to the production there are some problems related to communication. For instance, once the operators wanted to replace some tools because they wanted the tools as close as possible to the machines, but they did not tell the manager about their needs and just placed the tools to in their mind a better fitting place. The manager did not like the placing of tools, because it was on a place that sometimes can disrupt the sorting process in the company. The manager in turn did not say anything because it could lead to unnecessary discussions.
In this case study, the authors of the thesis were in charge of data gathering and analysis. In an ordinary improvement project, a project leader at the case company would normally be assigned as the manager and the man in charge of this process. In the beginning of the case study, the authors involved personnel on all levels and let them know the reason for them to be at the company, in order to prepare for the coming process. The personnel included in the interviews case company had different titles/roles and represented in total three different levels. Two managers, the head of department for the sorting process and three of his workers were interviewed. These persons have different roles at the case company; the managers are taking care of the economy, sales and they both also work in the production. The head of department at the sorting process is helping out with that specific process, but his main employment is to feed the sorting process with material directly from the sawing process or the inventory. The three workers work within the same process but have different roles; one of them is sorting the material with the sorting machine, the other two is helping out with the sorting and also packing the sorted material.

The authors observed the whole sawmill area but concentrated themselves to the sorting process as this was the area that was not going so well. The interviews started with an introduction of what the authors did at the company and who they were. After that the interview continued with questions and discussions relevant to the project, i.e. how they work today and how they would like to work. How they are solving problems today and common defects/problems affecting the process. Since the authors did not know what the problem was, people connected to different fields were also considered in the interview, i.e. maintenance, machinery, method, working environment and man power. The authors believed in their improvement project, acted secure against the employees and managers, were positive, understanding and encouraging the employees to come with their own ideas and thoughts in order to have a more positive environment.

6.1.2 Phase 2. Current situation analysis

Firstly it is important to create a picture of how the production looks like at the company. A good way is to observe the production on site in order to know whom to involve in the more formal interview. The authors went to Hanåsa Sågverk with questions that have been brainstormed around the problem given, questions about, the working environment, the production processes, and communication and so on (see appendix for whole questionnaire). The questions given to the working personnel and the managers differed slightly depending on the role and knowledge they possessed, but since the manager at Hanåsa Sågverk also work in the production, the questions were quite alike. In this study theory was used to discover potential threats and what positive/negative factors that were needed to be taken in consideration. The questions were based on the different perspectives of production with help of theory, i.e. what strengths/weaknesses/opportunities they see in their company, how they do things today and how they should fulfill their vision. When the interviews have been finished and you know how the current situation is, the results are summarized in an SWOT-analysis, see fig 12.
### Internal factors

<table>
<thead>
<tr>
<th>Positive factors</th>
<th>Negative factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td><strong>Weaknesses</strong></td>
</tr>
<tr>
<td>• A process that handles both raw timber and dry timber</td>
<td>• A process that handles both raw timber and dry timber</td>
</tr>
<tr>
<td>• Been in business a long time</td>
<td>• Bad communication</td>
</tr>
<tr>
<td>• Adapt its products to customer requirements</td>
<td>• Not productive</td>
</tr>
<tr>
<td></td>
<td>• Not organized</td>
</tr>
<tr>
<td></td>
<td>• Bad working environment</td>
</tr>
<tr>
<td></td>
<td>• Not enough employees</td>
</tr>
<tr>
<td></td>
<td>• Not experienced personnel</td>
</tr>
<tr>
<td></td>
<td>• Bad machinery in sorting process</td>
</tr>
</tbody>
</table>

### External factors

<table>
<thead>
<tr>
<th>Positive factors</th>
<th>Negative factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunities</strong></td>
<td><strong>Threats</strong></td>
</tr>
<tr>
<td>• Technological achievements</td>
<td>• More bigger and developed companies</td>
</tr>
<tr>
<td>• Education of employees</td>
<td>• Trade barriers</td>
</tr>
<tr>
<td>• Reliable customers</td>
<td></td>
</tr>
</tbody>
</table>

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**Fig. 12, SWOT-analysis**

**Strengths**

A process that handles both raw timber and dry timber:
- This is a strength due to the fact that only one machine can produce the raw and dry timber. No extra employees, space or investing in new machines is needed.

Been in business a long time
- Managers have been in the business since 1951 and are familiar with the whole industry. During the years they have established potential contacts with buyers and sellers.

Adapt its products to customer requirements
- Customers can choose several different types of quality they want, due to that the case company production line are able to produce wood in 9 different qualities.
Weaknesses

*A process that handles both raw timber and dry timber*
- This is also a weakness, because their production line is limited in capacity of produced wood per minutes. Moreover, because they do not have enough people working with the process, therefore the people working there right now have to run back and forth when a stop occur, which it does pretty much.

*Poor communication*
- They communicate with com-radios, which are good because everyone has one and everybody can hear what the others say, which could be educating. But the communication is not as good as it could be, for instance they do not talk to each other when important decisions have to be made. They could for example say something and thereafter do a complete other thing. Or they do not just act without telling anyone. Economy, orders, improvement work and production efficiency etc. are well documented by their IT-system, but poorly followed up.

*Not productive*
- Hanåsa Sågverk is not productive enough as it is today. The goals that are set up are to produce 25-30 planks a minute. Today they produce 15-17 pieces in a minute. As it is today with all the resources (equipment and personnel) available the maximum capacity is 15-17 pieces.

*Not organized*
- There are a lot of things that could be better organized at Hanåsa, for example to keep all the tools needed close. If the tools are needed they should be near so that it does not take time to go and get them. Also to keep the working space clean all the time; today it varies at Hanåsa. Some working areas are clean while others are not. But they have tried to introduce that every Friday the last 20-30 min of the working day they clean their working area. Unfortunately, the cleaning only takes place if they have time for it. If something for example has to be finished before the weekend they skip the cleaning.

*Not enough employees*
- Simply they do not have the number of employees at Hanåsa today as would be required. It was easy to see that they lack of personnel, since the managers must work at all the different processes, and since persons working at a process needs to stop that process in order to make sure that the preceding process is running well.

*Not experienced personnel*
- The most employees at the sorting process are new and still fresh. Some of them have worked 4 months to around two years. Around 50 percent (three of six that the authors interviewed) had no previous education in the sawmill industry.

*Outdated machinery*
• Some of the processes have machines that are very old and worn, while others are newer and better. The old machinery would need replacement of vital parts or the full system.

**Opportunities**

*Technological achievements*
• An opportunity to improve the machinery can be current if the case company increases their profit. The main machines in the sorting process have not been updated in more than 20 years and might need an update.

*Education of employees*
• Managers have not managed to increase the knowledge and skills of the employees in the sorting process to sort as effective as they would like, and they have not managed to pass their knowledge regarding the sorting process. It might then be an opportunity to start educating the employees.

*Reliable customers*
• Find more potential customers and retain current customers.

**Threats**

*More bigger and developed companies*
• Companies in the same branch that can produce more units and has been longer in the business, with better financials and technology are a competition to Hanåsa Sågverk. More effective companies can lower their costs and in that way attract more customers. Thus, customers have several alternatives from whom they will buy.

*Trade barriers*
• Trade barriers can be a threat due to changes in how the wood has to be packed, campaigns, which encourage people to shop locally, duties and taxes. This has been indirectly discussed with the company.

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### 6.1.3 Phase 3. Identifying the root causes of the problem

This step is breaking down the trigger point i.e., the case company is not financially stable, in order to find out what weakness points to concentrate on in the SWOT-analysis. It can be linked with poor communication, not organized and poor working environment, also not experienced personnel and that the organization is not productive can indirectly be affected by a structured working environment. The only step of phase 3 is to do the 5 why’s method/technique.

The manager of Hanåsa sågverk said that the company isn’t financially stable, therefore the first question to ask is “Why isn’t Hanåsa sågverk financially stable”? Because they aren’t productive enough. So, “Why are Hanåsa sågverk not productive enough”? 
Because the sorting process is not as effective as it can be. So, “Why is the sorting process ineffective”? Because their working environed is not organized. “Why isn’t Hanåsa sågverk organized? Because the company isn’t structured. “Why isn’t there any structure at Hanåsa sågverk”? The last why, is also the root cause of the problem.

- Why isn’t Hanåsa sågverk financially stable?
- They aren’t productive enough
- Why are Hanåsa sågverk not productive?
- The sorting process is not effective enough unlike it can be
- Why is the sorting process ineffective?
- Their working environed isn’t organized
- Why isn’t Hanåsa sågverk organized?
- The company isn’t structured
- Why isn’t there any structure at Hanåsa sågverk?

The question of why there is not any structure at Hanåsa sågverk is going to be further analyzed in the next phase.

6.1.4 Phase 4. Analyze the Root Cause.

Based on previous phase, phase 3, the root cause to the trigger point (no structure) can be used as a starting point in the Ishikawa diagram and connected with causes. The cause areas and factors connected to this problem are based on the interviews, observation and discussions made at the company. A factor can be involved in different cause areas.

The cause to the problem (no structure at Hanåsa sågverk) can be seen in five different perspectives; man power, environment, machines, method and management. The other two areas of the 7M Ishikawa technique material and measurement are excluded because it is not relevant to this case. The perspectives are based on the internal processes due to it is something the authors can affect. That the case company have too less employees etc. and what the rivals are doing are not considered. The problem is illustrated with a 7M Ishikawa diagram, see fig 13.

Fig. 13, Case Company 7M diagram

A more structured work at Hanåsa sågverk would help them to be more efficient and productive. An analysis of these five aspects is further done. The communication aspect
is seen in two areas, method and manpower, and the authors conclude that this can be one of the main factors that are necessary to improve as it affects more than one cause area.

**Management**

*Incorrect leadership processes*

Incorrect leadership processes comes from the non-ideal methods to develop trust in each other. It is important that leader(s) influence their employees. The same applies to the employees, it is important that they also have an influence on their leader(s). Moreover, it is important to have an environment where they can trust each other, and can divide the work evenly between each other, so that a leader does not need to take too much responsibility. In addition, it is also important that a worker dare to take the responsibility, if the worker feel that he / she is unable to take the responsibility that is required; they have to be honest enough and able to speak up.

*To wide control*

The leaders at the company try to have too much control in their work, as they want to manage the sorting process as well as the economy, purchasing and sawing. This does not work in the long run and can lead to poor quality when conducting working tasks, due to lot of things on their mind. This also affects the structure in the same way as they cannot redirect orders and responsibilities in an appropriate manner.

**Machines**

*Old machines*

Old machines can lead to bad structure at the case company. Today the machines at Hanåsa are old but they are still running at its potential capacity. Example of this can be; if there is a stop between the sawing process and the sorting process where the “drop down” is (which is usual), there can be some difficulties to maintain proper working structure and flow because the person working at the sorting processes has to get down to that drop and sort the planks, which means that the machine on the sorting process has to be shut down. This interrupts the working structure for the employees, as they are disturbed by unnecessary issues.

**Manpower**

*Communication*

The employees at Hanåsa sågverk do not use clear communication about what and how to do different kind of work. Today it leads to unnecessary re-work that takes unnecessary time. The time wasted here leads to stress which in hand leads to worse decisions. Everyone at the company has basic knowledge/experience about almost every working area, but sometimes they do not have enough knowledge/experience to work without the communicational help when something unexpected happen. Communication is there for important to know who will fix the unexpected issue. Communication is important in this case because if something happens, the workers need to help each other.

*Lack of knowledge and competence*

Lack of competence and experience is affecting Hanåsa sågverk negatively. Everyone except the managers at the company has been there for 4 months up to 2 years, and that person who’s been there for 2 years has worked there on and off until this year. The other persons have been there for a maximum of 1.5 years. The managers have both been there since the start of the company, so those two are the only ones with
experience and knowledge about how the sawmill could work more effective. The managers has not been able to share their knowledge with the employees so far, since they constantly have to be involved and ensure that nothing goes wrong at any process. One other reason possible is that the managers might not have the experience and skills to learn out, and they maybe have not trained been in it.

**Working environment**

**Disorganized**

Today Hanåsa sågverk has a very disorganized and unplanned working environment on many levels at the company. There are things that are started up but they are not fulfilled, they have created various instructions and descriptions of how to do at certain processes, what tools you should use out etc. These instructions and descriptions are relatively old and cannot be used today since some things are missing and others are outdated. Furthermore, the company is not cleaned. There are tools and stuff that are not used but just lying everywhere, which makes it difficult to find what you might need. Hanåsa sågverk has tried to introduce a time for cleaning on Fridays when there is nothing else to do; so then they clean for 20-30 minutes. But as it is today they would need cleaning every day, to keep it as clean as possible at all times.

**Method**

**Maintenance**

Maintenance is a possible cause to poor structure as no scheduled maintenance exists at the company today. They are doing maintenance sometimes when they have time, i.e. when stoppages occur or if they do not have something else to do. Today they have a list of what has to be maintained, etc. oil the machine and clean their working stations, but this is not fully followed. At Hanåsa insufficient maintenance results in a dirty working environment and can worn out the machines in time. Can also lead to confusions between the employees due to that they change working places. The tools/parts that are easy to access in the machinery is usually more often maintained.

**Communication**

The communication between the employees is mainly handled with the com-radios and this technology is very important for them, mainly because it is very effective and because everyone can hear what’s said and learn from the information given from the com-radios. But there are also downsides. An example of the problem with communication can be; an employee changes something into what he think is better and easier for him and for the company, but he doesn’t say anything to the managers which could lead to misunderstandings that can lead to same thing done twice by different people. The communication method face to face is used as a last solution if it is hard to understand how to fix a problem etc. This method is also used when a more serious problem arises that cannot be solved by com-radio. As documentations is an issue there is no specific documentation made in an IT-system or logbook for changes or improvement.
6.1.5 Phase 5. Goals Set Up and Solving the Root Cause.

In this phase goals are set up which is affecting the root cause of the problem. It is important to setup goals and solutions based on the findings from phase 4, the 7M diagram that is analyzing the problem. So firstly the solutions that will be used in MCDM is discussed and identified and thereafter evaluated by the use of MCDM.

**Area: Man power**

Solution to *Lack of knowledge and experience*: **Educate employees**

The experience of employees would have been higher if they had been working there for a longer time, but that is nothing the authors can influence. Instead, education could be a solution. Hanåsa Sågverk could educate their employees through internal training or by sending them on relevant courses. It is important here that the leaders motivate and encourage their employees to learn new things. Managers can take their responsibility and take courses in management/leadership to be able to motivate and manage their employees in the most efficient way.

Solution to *Communication*: **Better quality in communication**

The solution to this problem is to be more open, ask if you do not understand something, do not take anything for granted but always inform if you see any kind of possible problems or solutions in the daily work. If you cannot take it through the com-radios you should take it face-to-face, which is a better way to talk with anybody, since you can talk and hear better than if you talk with the com-radios. It is better to learn right from the beginning if there is something you want explained or if you want to explain something. To document activities in an IT-system, logbooks or write it down on whiteboards can be a solution to simplify the communication as everyone involved can take part of what is being said.

**Area: Machines**

Solution to *Old machines*: **Invest more in machinery**

The solution to this problem is to invest more in machines, either to purchase or to fix new ones or replace parts of the machines. This is something that the authors have not been looking deeper into, but this could be a possible solution. During the years new machine(s) have been introduced to the market, but as it seems today the company is not financially stable to invest in totally new machine(s). Replacing parts of the machine(s) is therefore a better solution. One machines that can sort raw and dry timber at the same time is a crucial investment for the company to be more efficient in their work.

**Area: Management**

Solution to *wide control*: **Divide working tasks**

The solution to this problem is to divide the work and reduce the need for management control. The work has to be distributed to the staff with the right skills, alternatively to learn new task. One way could be to introduce job descriptions so you know what to do.

Solution to *incorrect leadership processes*: **Improved quality in leadership processes**

Taking initiative and showing the way for the employees can improve the quality in the leadership process. It is also important to find the balance between managing and leading, where the manager’s role reflects directives and are strictly enforced. The
leaders provide motivation and are more involved with their workers. A leader can solve this by testing different management techniques. Employees can also take initiative to make a change, but the leader has to be aware of the change made and never “loose” the control over it. This can be solved with communicating and documenting activities. It is important that the leader is open for suggestions and willing to test. Usually, those who work on a process have or get ideas about what can be improved, since the process is in their daily work. To increase the employee’s motivation the leaders could allow their employees to be involved and participate when important decisions are made (eg. setting goals), the employees should be able to discuss how they want to achieve their goals or goals set up by the company. Another way is to let the employees see the big picture and explain why some parts look like they do and others do not. As a leader you should try to understand how your employees think and try to see things from their perspective (the same applies to the employees but in opposite). One example for this can be to have quality meetings, daily planning of the production, education seminars and suggestion boxes (these boxes should be put up in the employee dressing room to make sure that the notes are anonymous).

**Area: Method**

Solution to *Maintenance* actions: Improved maintenance actions
To solve this problem one should introduce both regular maintenance work for working places and the machines. This can most easily be solved by making a list of how and what should be done each day / week / month to prevent this from being forgotten. It also applies to plan when to do this, for example, oil the machine after each working day. The list can be set up where everyone walks past and where it is the most visual. Each workspace can have its own list after the labor process conditions.

Solution to *Communication* actions: Better quality in communication
*see area man power in current phase.

**Area: Working environment**

Solution to *Disorganized working environment*: More organized working environment
Development and implementation of instructions and descriptions of working processes, it is important that the leader(s) of the company takes a big part and drive the procedure with their employees in order to create good instructions and descriptions of the working processes that are located at the company. This also includes cleaning of the working areas. It is important to know when to clean and who is supposed to clean, and that this is actually followed and not forgotten. Lists on working areas, in coffee rooms and lockers rooms to always be reminded of it, are one solution. And after a while this will become a habit. Another solution could be to leave 15 min for cleaning the working areas every before they end their day. The 5s method fits well here; this method creates order in the working areas.

Following list summarizes the suggested solutions:

- Educate employees
- Better quality in communication
- Improved maintenance actions
- Invest more in machinery
- Divide working tasks
- Improve quality in leadership processes
- More organized working environment
These will be evaluated using the MCDM approach, see fig 14. The criteria are based on the 7Wastes described in the theory chapter that is aiming to improve the trigger point, financial stability. Five of the seven waste are considered in this case as the other two are not relevant for the specific problem area.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weights</th>
<th>Educate employees</th>
<th>Better quality in communication</th>
<th>Improved maintenance action</th>
<th>Invest more in machinery</th>
<th>Divide working tasks</th>
<th>Improve quality in leadership processes</th>
<th>More organized working environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unnecessary motions</td>
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<td>3</td>
<td>4</td>
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<td>4</td>
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<td>5</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>3</td>
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</tr>
<tr>
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<td><strong>45</strong></td>
<td><strong>24</strong></td>
<td><strong>21</strong></td>
<td><strong>26</strong></td>
<td><strong>44</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>

Fig. 14. MCDM-diagram Hanåsa Sågverk

The points and the weighting were done by one of the managers and one employee. They started with weighting the criteria and they had only ten points in total to divide between the criteria. Thereafter, they related the improvement methods to the criteria, where they had to give a score of 0-5 in rating points depending on how well an improvement method fit the criterion. If 5 points were given, the ratio was excellent and if 0 was given there was no relationship at all between them. For example, better quality in communication has an excellent relationship with the waste of production. Multiplying and adding the weight points with the rate calculated the total score. An example of this calculation for the solution to educate employees would be: \( (1 \times 4) + (2 \times 2) + (3 \times 2) + (2 \times 4) + (2 \times 5) = 32 \).

Based on the total score of the MCDM matrix, the most critical solutions were: better quality in communication (45 points) and improved quality in leadership processes (44 points). Also the solution more organized working area scored relatively high (39). The authors choose to consider these three areas when recommending improvements to implement.

Just as the Ishikawa diagram shows it is all about the structure, where the case company must structure the major part of the undertaking in relation to how it looks like today. The authors believe that a structuring within the company at all levels would benefit them. The study shows that quality in communication and quality in leadership processes should be improved at first hand.
The authors would first and foremost like to recommend that everyone in the company become more open and dare to say what they think and feel to each other, for instance if you see something or if you want to improve something, you should suggest that to the managers and not just do it without saying anything. It is better to discuss to see what kind of views they have on it, in order to avoid unnecessary conflicts. By discussion between each other about this to get an overview and different viewpoints on the whole, which is very good while everyone would feel more involved in the work which would eventually lead to overall more feeling of involvement in the actual work. The same applies to the managers and leaders at the company, obviously it is those who take the most important and final decisions, but as a leader you should still be able to discuss with their employees to see what they think. This can be made with help of a follow up of the suggestion notes on a whiteboard.

It is also important that the leaders take greater responsibility than they currently do, showing that they want change by motivating and engaging their employees for change. It is important for the managers to show that they are the leaders by being humble and not going overboard with it, to take important decisions and lead the way for the employees while always staying humble and positive. The managers at the company could also become mentors to those workers who are in the company until that they feel safe at the work they carry out. The managers are so experienced, and have been through so much within the company that they now know how everything works better than anyone. By being a mentor to the workers they would also save money, because then they would not have to send them on courses or pay others to come and learn them.

The authors would recommend the company to have daily meetings including managers, area managers and one person from each working area, where you go through what have happened during the day at work, what has gone well/ not so well, how many products have been produced, have there been some unnecessary stops, how many / how long and so on. This should be carried out by the leaders, which the authors would recommend that they take 15-20 min each day to go through all this and hear what everyone has to say about their processes and then discuss it together and come up with improvements and solutions for possible problems. This would also improve their communication with their employees and vice versa, to be able to get a communication that has quality in several ways. The authors also think that this would develop the leaders, their leadership skills since they would have to motivate, engage and discuss with their employees. The managers at the company could also become mentors to those workers who are in the company until that they feel safe at the work they carry out. The managers are so experienced, and have been through so much within the company that they now know how everything works better than anyone. By being a mentor to the workers they would also save money, because then they would not have to send them on courses or pay others to come and learn them.

Firstly the manager can take part with the employee to educate and make sure that he/she is doing what is supposed to be done. This can continue until the manager feels that the employee can do it by themselves. After the “learning process” the employee can have regular meeting with the manager to discuss possible problems or ideas that can arise from the education. This can be made in groups or individually depending on the situation (i.e. time or severity of the learning process). In the future the employee can in his turn teach others the same thing as the manager.
Another recommendation for the company is to introduce 5s, they have already tried it once before but did not succeed with it. At that time they did not have the right personnel to execute it and implement it. Today there are people that wants to get involved and are motivated to change, but who needs a last push to accomplish it. But first and foremost the managers needs to get involved in what the 5s means, then they have to make sure that this comes out to the employees. By increasing the visual and informal messages about 5s gets the employees more aware of the approach. The management should ensure that they constantly strive to control and evaluate 5s implementations to be able to create a continuous approach to production. The monitoring will result in greater awareness among employees, which will further enhance the understanding of 5s. They should strive to improve through continuous monitoring and evaluation. All the results should be discussed with the employees. Depending on the situation, different project manager can be responsible for the discussion. Otherwise, if there is not project manager the manager of the company should be responsible.

Example of checklist

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible</th>
<th>Solution</th>
<th>End Date</th>
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<td>important solution</td>
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*Fig. 15. Checklist example*

Activity can be changed depending on how many activities there is at the company. The person responsible for the activity are divided when each activity is chosen and they are responsible to finish it in time and involve all right persons to the task. Solutions are defined at the beginning but can be changed during the process. The end date are filled in when an activity are finished.
Example of a Gantt-Chart

![Gantt Chart]

**Fig. 16. Gantt-Chart example**

This table present an example of a Gantt-Chart. It describes when the activities starts, duration of activities and end date. Together with the checklist it is possible to see for how long the activities shall be.
7 RESULTS

This chapter will present the results of the methodology in accordance to the trigger point.

From MCDM result, authors have established how to satisfy the trigger point. The two most critical solutions for the case company became better quality in communication and improvement quality in leadership processes. The least critical improvement method was maintenance actions, invest more in machinery and divide working tasks.

A closer look at the criteria shows that waste of production is the criterion that Hanåsa want to enhance the most (it got the highest weighting score). Shortly thereafter comes, the waiting, over processing and defects which had 2 points each, they are therefore equally important. That criterion is least important according to the company is to improve unnecessary motions. The two most critical solution methods both have high relationship with the most important criteria and it is this that distinguishes them.

The methodology was useful for the case company. They got a mapping of current situation with root cause of the problem and possible solutions and how to solve the different problems. The methodology was easy to use and everyone understood the purpose and goal of the methodology in order to solve all the problems. Everybody was involved with each other and got their voice heard which is good in order to get different perspectives. The data gathered during the process of the methodology was easy to collect and understand since it is a simple methodology. All data that the authors gathered was relevant.

The tools used in the methodology can of course be changed but the authors used simple tools in order to make it as simple as possible for the users and descriptions in order to make it even simpler and easier to understand. Therefore the authors suggest not to change any tools. No step should be avoided in order to get the best background information of the problem/idea to be able to fully implement the methodology and to solve the problem/idea.

Implementation and follow up phases was not included when testing the methodology, but the other five steps gave reasonable results and are therefore relevant to use.
8 CONCLUSIONS

This chapter will present the conclusions of this degree project.

The research problem investigated in this thesis was *How is it possible to introduce a continuous and structured improvement methodology in the sawmill industry?* The authors think that this can be solved with the help of the developed methodology with its simple systematic that tells what to do and how to it. When the authors developed the model, it was important to develop a continuous methodology that would benefit the users in the long run. The methodology is developed in a structured way, that is easy to follow, and the methods/tools used in the methodology are easy to use and learn. The methodology can be applied in other small- and middle sized companies with similar problems, in addition to the sawmill industry, since the tools/methods can be modified to suit the user. The selected problem area and the company resulted in a usage of simple tools and methods in the methodology. For other problem areas or situations, you can use other tools and methods. The steps with the results and the solutions can be safely used in sawmills and other businesses. As the methodology only has been tested on one sawmill there may arise some problems in the different stages not encountered in this case study. If you do not follow the objective of each phase of the methodology the work can lead to an inadequate result. It is important to know how to use the analysis results for identifying the root cause. According to the case study results better quality in communication and improvement of the quality in leadership processes are the two factors that shows up highest potential to achieve a better structure, be more profitable and to be able to tackle the external and internal threats there are. In addition to these two aspects, it is important that all involved show commitment and a willingness to learn in order to succeed with continuous change. The improvement methods can be related to each other. Soft values rather than technical improvements might in other words be the best solution. To be able to succeed in improving the structure of a company, it is important that you are motivated and contribute to a positive atmosphere. It is important to pass on knowledge and information to your employees in order to streamline the organization towards new goals, strategies and ways of thinking. Successful implementation of the two identified main factors will result in that the company will increase the quality of the work and become more competitive. The production will minimize unnecessary; movements, waiting times, produced goods, efforts and errors in the production. This virtue also reduces the production cost. By a reduction of the selling price the company can attract customers and distinguish the company in the market, both globally and internationally. This also benefits the environment and the forest; the result leads to less unnecessary emissions and less use of raw materials. When identifying problems, personal insults should be avoided in order to minimize that a person gets frustrated or sad. A good thing to do when an individual is a problem that is affecting the ide/problem is to talk with him in personal and describe so he/she understands why and how he/she is affecting it.

The decisive factor that makes the methodology successful will be completed when the two last stages that have not been tested at the company. Implementation and monitoring will require continued discipline, and knowledge of the areas that have been investigated. Problems that can occur with the methodology may be that a person is directly singled out as a problem to be solved and which can also lead to the need to kick people. The improving methods should be kept at a level where it is easy to perform it individually. It does not mean that it is the individual who creates problems but instead it is no appropriate method to carry out the individual work.
9 REFERENCES

In this chapter the references that were used in this project work will be presented below.

9.1 ARTICLES


INTRODUCTION OF CONTINUOUS AND STRUCTURED IMPROVEMENT METHOD IN SAWMILL INDUSTRY: A CASE STUDY


INTRODUCTION OF CONTINUOUS AND STRUCTURED IMPROVEMENT METHOD IN SAWMILL INDUSTRY: A CASE STUDY


9.2 INTERNET SOURCES

9.3 BOOKS


9.4 FIGURES

Figure 1: Timeframe (own picture)

Figure 2: Summary of methodologies (own picture)

Figure 3: Leanmaster, 2013. PDCA, Cycle. [Image online] Available at: <http://lean-master.com/1/post/2013/08/sdca-before-you-pdca.html> [Accessed 30th April, 15]

Figure 4: The five perspectives in the concept of quality (own picture)

Figure 5: Decision Matrix [Image online] Available at: <http://www.prismdecision.com/the-matrix> [Accessed 20th May, 15]

Figure 6: SWOT Matrix, 2013. SWOT Analysis [Image online] Available at: <http://www.enjoytemplates.com/swot-analysis-template/> [Accessed 10th June, 15]

Figure 7: 7M Ishikawa diagram. [Image online] Available at: <http://creately.com/blog/diagrams/fishbone-diagrams-tutorial/> [Accessed 17th June, 15]

Figure 8: NN-model (Own picture)

Figure 9: Summary of methodology development steps

Figure 10: Production flow (Own picture)

Figure 11: Sorting process/flow (Own picture)

Figure 12: SWOT-analysis (Own picture)

Figure 13: Case company 7M diagram (Own picture)

Figure 14: MCDM diagram Hanåsa Sågverk (Own picture)
# List of Appendices

## Appendix 1 – Scientific Research Table

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APPENDIX 2 – INTERVIEW TEMPLATE FOR MANAGERS

(Q=Question)

Q: Vad har du för position på företaget?

Q: Hur länge har du arbetat på företaget?

Q: Har du någon utbildning? Vilken i så fall?

Q: Har du någon tidigare erfarenhet från sågverksindustrin?

Q: Hur ser du på arbetsmiljön i företaget? Vad är bra/ mindre bra?

Q: Hur skulle ni beskriva arbetsklimatet på företaget?

Q: Kan du beskriva sorteringsprocessen, så detaljerat som det går?

Q: I dagsläget, vilka svårigheter/ komplikationer finns det med sorteringsprocessen? Vad är bra och vad är mindre bra? Vad tror du kan förbättras?

Q: (Vad ser du (Stefan) för skillnad på bra och mindre bra arbete på sorteringsprocessen? Vad gör den som gör arbetet mindre bra? Och vad skall den personen tänka på för att göra ett så bra arbete som möjligt?) Vilka är de vanligaste sakerna man glömmer inom arbetet på sorteringen? Vad tar mest tid?


Q: Vilka syften har kommunikationen? Och vad för sorts kommunikationsinnehåll?

Q: Har ni någon gång använt er utav förbättringsmetoder (5s, Six Sigma, TQM mm.)? I så fall vilken metod, och hur gick det?

Q: Tror du att era maskiner som finns på sorteringen påverkar själva sorteringsprocessen, bra eller dåligt? Är det mycket reparationer på nuvarande maskiner? Hur underhåller ni era maskiner, (dagligen, vecka, månad?) Skulle det gynna om ni köpte nya? Hur mycket skulle det kosta er?

Q: Tror du att ett strukturerat arbete skulle gynna er? På vilket sätt? Införande av check-/listor och utförliga beskrivningar skulle det vara något för er? Tror du att det skulle underlätta arbetet?

Q: Hur används arbetsinstruktioner idag?

Q: De instruktioner som finns idag, vem har gjort dem? Hur många personer var involverade i att göra dem?
Q: Vad har ni för mål när det kommer till sorteringsprocessen?

Q: Hur involverade är alla personer som arbetar kring sorteringsprocessen? Hur mycket har de som jobbar på sorteringen något att säga till om?

Q: Arbetar företaget något med att motivera personalen på företaget? Hur motiverar du arbetarna på företaget? Känner du dig motiverad till förändring på företaget?

Q: En utförlig beskrivning på hur sorteringsprocessen skall gå till?

APPENDIX 3 – INTERVIEW TEMPLATE FOR EMPLOYEES

(Q=Question)

Q: Vad har du för position på företaget?

Q: Hur länge har du arbetat på företaget?

Q: Har du någon utbildning? Vilken i så fall?

Q: Har du någon tidigare erfarenhet från sågverksindustrin?

Q: Hur ser du på arbetsmiljön i företaget? Vad är bra/ mindre bra?

Q: Hur skulle ni beskriva arbetsklimatet på företaget?

Q: Kan du beskriva sorteringsprocessen, så detaljerat som det går?

Q: I dagsläget, vilka svårigheter/ komplikationer finns det med sorteringsprocessen? Vad är bra och vad är mindre bra? Vad tror du kan förbättras?

Q: Vilka är de vanligaste sakerna man glömmer inom arbetet på sorteringen? Vad tar mest tid?


Q: Tror du att era maskiner som finns på sorteringen påverkar själva sorteringsprocessen, bra eller dåligt? Är det mycket reparationer på nuvarande maskiner? Hur underhåller ni era maskiner, (dagligen, vecka, månad?) Skulle det gynna om ni köpte nya? Hur mycket skulle det kosta er?

Q: Tror du att ett strukturerat arbete skulle gynna er? På vilket sätt? Införande av checklistor och utförliga beskrivningar skulle det vara något för er? Tror du att det skulle underlätta arbetet?

Q: Hur används arbetsinstruktioner idag?
Q: Hur involverade är alla personer som arbetar kring sorteringsprocessen? Hur mycket har de som jobbar på sorteringen något att säga till om?

Q: Känner du dig motiverad till förändring på företaget? Känner du att cheferna är bra på att motivera?

Q: Får ni någon feedback från chefer när ni arbetar?