

Preface

*“If the 6 of us in the directorate would come up with 10 improvements each we’d have 60 improvements. If all 500 employees of the plant would come up with **one** improvement each we’d have 500 improvements.”*

/Anders Wibäck, Quality Manager, Cargotec MAU Lidhult

Our master’s thesis was conducted from the 1st of November 2010 to the end of February 2011. It represents the final part our Master of engineering degree at Faculty of engineering, Lund University. The thesis consists of a case study in Kalmar Industries MAU Lidhult. Our task was to develop and implement a system with focus on continuous improvements for the whole organization.

It has been a challenging, intense but also very stimulating journey for us and we would like to thank all of you who gave us this terrific opportunity and for your support.

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Abstract

- Title:** Implementing Lean Manufacturing philosophy at Kalmar Industries with focus on continuous improvements.
- Authors:** Ardit Cejku and Ulrik Ottoson
- Background:** To stay strong and competitive in the business high productivity and low manufacturing cost are crucial. Kalmar Industries know that they have potential to accomplish better results if they engage all employees to cooperate. Due to the financial crisis other things have been prioritised and not enough Lean thinking exercised in the organisation. Through better understanding and clearer vision they will achieve to work together and strive towards same goals.
- Problem description:** Financial crisis has forced Cargotec to deprioritise their improvement work which currently is highly unstructured. Only limited a number of employees are involved.
- Through structured way of working employees would be convinced. Thus, favour all parts within the organisation.
- Purpose:** To develop a system where all ideas and suggestions could be gathered and visible for the whole organisation.
- Objectives:** Analyse, improve and present a better solution for Cargotec.
- Deliverables:**
1. Analysis which contains certain information and takes following aspects into consideration:
 - Definition of current way of working with continuous improvement
 - What obstacles could occur with a new system
 - How can the organisation engage all operators and deliver correct message throughout the organisation.

2. IT based system which supports and displays the improvements and their progress.

Method:

This master's thesis was approached with a qualitative method to capture the entirety of the problem. Data analysis was collected from literature study, several interviews at Cargotec MAU Lidhult and benchmarking against Electrolux, Haldex Traction and Höganäsbolaget . This thesis was performed iteratively, particular in the stages of empiricism and analysis.

Conclusion:

The developed system provides visibility and helps departments to work cross functionally. Through simplicity more employees would be engaged in the organisation and new improvements would be generated. Cargotec needs improvement teams consisting of operators as well as representatives from several support functions. These teams will have fortnightly reconciliation meetings to achieve a higher level of cross functionality. When introducing it is important to deliver the right message to the operators, which is "Never-ending improvements benefit both employees and enterprise". In the long run, Cargotec MAU Lidhult will stay as a strong competitor in the business.

Keywords:

Continuous improvements, Lean Manufacturing, Visibility, Cargotec, Kalmar Industries.

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Shorts and acronyms

C.I. – Continuous Improvements is an ongoing attempt to improve services, products and processes. Those processes which are customer valued are evaluated and improved based on their efficiency and flexibility.

Directorate – Top management at MAU Lidhult consisting of plant manager, quality manager, controller, production service manager, head of logistics and head of HR.

ERP System – Enterprise Resource Planning, an IT system which handles the flow of information throughout the entire organisation.

MAU - Multiple Assembly Unit. Definition within Cargotec of a certain type of plant which can assemble any Cargotec product

MAU Lidhult – The plant where the thesis was conducted.

OEE – Overall Equipment Effectiveness is metrics for measuring the of utilisation manufacturing processes. It indicates the efficiency of the actual performance.

Reach Stackers – Large counterweight trucks which are used in ports for moving and piling containers.

RoRo - Roll on/Roll off, a concept for moving wheeled cargo from ship to shore and vice versa.

Ship-to-Shore Cranes – Large dockside cranes that are used for loading and unloading intermodal containers from container ships.

SOP - Standard Operating Procedures. An instructive document which describes how a task is meant to be executed.

1 Introduction

To accomplish good results within an organisation and achieve set targets it is vital to make everybody engaged in the company and together work in the same direction. Markets today are very competitive and it is more than necessary to have systems that clarify how companies should work with continuous improvements. Customers' expectations are rising and it forces firms to do right from the very beginning since mistakes are often not affordable. The Japanese have over years developed different strategies which make products more qualitative. By putting more effort focusing on quality cost savings can be achieved. Japanese have increased quality and productivity in their organisations meanwhile the range of products has been wider.

Cargotec MAU Lidhult has been engaged with continuous improvements since last year, yet they have not good software to collect all information and simplify the process containing how to follow different improvements and their status. This Master thesis is performed in Cargotec MAU Lidhult and it is the final moment in the authors' academic degree, Master of mechanical engineering at Faculty of Engineering, Lund University.

1.1 Company introduction Cargotec, Kalmar industries, MAU Lidhult

Hiab, Kalmar and MacGregor are three different daughter brands of Cargotec. They are all successful in the field of efficient cargo flows whether it is on land or at sea. Cargotec has a global network and they focus on high consumer service by being located close to customers around the world. The technology that is used is cooperated with consumers and different environmental aspects have been considered. Almost 10 000 people are today working at different Cargotec sites and the annual sale is approximately 2.6 billion dollars.

The strategy being used within the company is well developed and the aim is to be global market leader in cargo handling. To be able to achieve this Cargotec has to grow faster than the industry itself.

Focus is set on:

- ✓ Enhanced customer focus
- ✓ Be in the frontline by developing and strengthening customer support
- ✓ Winning market share
- ✓ Clarify internal vision
- ✓ Cargotec has some goals within the financial sector that need to be achieved to stay competitive in the market.
- ✓ 10 percent annual sales growth
- ✓ 10 percent raise of the profit margin
- ✓ Gearing below 50 percent

1.1.1 Kalmar Industries

Kalmar Industries is a renowned company within container handling solutions in ports and terminals. They are global market leader within this business, every forth container at a terminal around the world is handled by a product from Kalmar Industries. Containers are handled by ship-to-shore cranes, shuttle and reach stackers. Their main customers are very differentiated and spread out. Kalmar forklifts trucks are used by heavy industry, Kalmar terminal tractors are used by logistics centres and finally Kalmar reach stackers are used by the paper and wood industry.

The organisation Kalmar Industries is also involved in port automation and remote maintenance products which are developed in cooperation with customers and partners. Their range of products is wide and all products need value added services such as maintenance contracts.

1.1.2 Hiab

Hiab is working with on-road handling solutions. It is an organisation which has its focus on customer relations and is globally established. To be successful in moving goods on road it is difficult since the competition is intense. Therefore, well developed solutions are needed. Examples of areas where Hiab is involved in are forests, waste handling and recycling.

Load cranes, Loglift and Jonsered forestry are all products from Hiab. They also manufacture demountable systems as Hiab Multilift. Since their products are advanced the load of maintenance is relatively high.

1.1.3 McGregor

McGregor is a big international company that puts its focus on maritime transportation and offshore industries. It is essential to have safe products that are reliable within this business. The range of products is wide and includes hatch covers, cranes, RoRo etc. In addition, McGregor equipment is also available for vessels.

1.2 Problem description

Today, the staff of Cargotec MAU Lidhult works with improvements in an unstructured way which varies between the different departments. In some departments a factory worker may bring up suggestions for improvements with a team leader. The team leader then evaluates whether or not to implement the suggested improvement and with help from production engineers he or she executes the implementations. This means that the factory workers' participation in the work with continuous improvement is very limited and this situation may cause decreasing engagement and involvement in the production process development.

The unstructured way of working with continuous improvements that MAU Lidhult is currently executing has implied that there is very limited documentation of passed improvement actions and their results. There is a concern that without access to the history ideas of new improvements will not surface as much as desired.

Limited history of implemented improvements has also meant that there are currently no visible signs of finished or ongoing actions. The directorate is confident that visualisation of the actions and suggestions is of absolute necessity in order to succeed.

The different departments at MAU Lidhult do not communicate improvement work with one another. Therefore the potential exchange of knowledge and experience that could occur cross functionally is not utilised.

1.3 Concerns

The main concerns raised by MAU Lidhult directorate for this thesis are:

How do you make improvement work continuous and not a project with a start and a finish?

Historically there have been cases of companies engaging consultants or own employees to start up structured improvement work. Initially this works very well. Many suggestions may surface and many of those may be implemented. As soon as the project has ended activities go down and over time it fades out into nothing.

How do you make all employees engaged in working with continuous improvements?

The idea of working with continuous improvements is that everybody does it at all times. Naturally there will be some who quickly become engaged and others will be reluctant to actively work with it. However, this does not mean that only limited number of people have ideas for improvements. If not most employees take part, there is an obvious risk of failure.

Is a reward system needed to encourage employees to share their ideas?

To stimulate the flow of new ideas coming in, a reward system might be of help. It is a quite common view that compensating individuals for particularly good suggestions can cause people to keep ideas for themselves. Also, it becomes very important who came up with the suggestion. As an alternative to this, one can use a system that rewards the respective teams for good improvement efforts.

In what way of manner do you achieve simplicity throughout the organisation?

A system for collecting and follow-up of improvement suggestions should not be too complicated to manage. If an employee feels that it is too much of an effort to record an idea there is a risk of decrease in engagement over time.

1.4 Purpose

MAU Lidhult needs a structured way of working with continuous improvements. That includes how to put together improvement teams and how ideas of new improvements ought to be collected and executed.

In this process there is also a need of a system to document implemented improvements and their results as well as documenting the status of ongoing

actions. Such a system needs to be easily displayed to enable workers to view the improvement work at any time. It needs to answer the four following questions:

What improvement actions have been carried out?

What are the results of these actions? (Time savings, cost savings, environmental improvement etc.)

What improvement actions are currently on the table?

This visibility is one of the key elements to the system. An employee finding out how current improvement work is progressing should never entail any major efforts.

1.5 Delimitations

The operation methods and the software system are mainly meant to be customised for MAU Lidhult. However, there is a wish that this could be implemented on all the Cargotec sites globally. The focus lies on production but the authors are also meant to investigate whether or not the support functions ought to have a system of their own for continuous improvements.

1.6 Objectives

The project's objective is to produce a system for continuous improvements which the authors will have to develop and deliver. This system will collect information and make all different improvements traceable for Cargotec Lidhult. It should also be applicable in different Cargotec sites around the world.

1.7 Deliverables

1. Analysis which contains certain information and takes following aspects into consideration:

- Definition of current way of working with continuous improvements

- What obstacles could occur with a new system

-How can the organisation engage all operators and deliver correct message throughout the organisation.

2. IT based system which supports and displays the improvements and their progress.

1.8 Disposition

This thesis follows a certain structure. Every new chapter is introduced by a short summary and then explained more in detail. Here below is the content listed.

- Chapter 1 *Introduction*
This chapter gives the reader an insight of goals and purposes, objectives, deliverables and disposition.
- Chapter 2 *Methodology*, the part where different potential methodologies for our case are described and discussed.
- Chapter 3 *Theoretical backgrounds*, describe the theory behind Lean and what tools the authors have used in the report. The history behind ideas and concepts within Lean Manufacturing are discussed.
- Chapter 4 *Empiricism*
Here are all the results presented from interviews, company visits and literature study. All data that the authors gathered are presented in this phase.
- Chapter 5 *Analyses*
In this chapter all collected data is analysed and discussed. Questions as these below are needed to be answered:

How is the current situation?
What will the consequences be of potential changes?
What further actions should be taken into account?
Which parts should be more emphasised?
- Chapter 6 *Conclusions recommendations and further actions*, describes the conclusions of the case study. An insight of what this thesis has contri-

buted to Cargotec MAU Lidhult but also to science. This chapter closes the whole report.

2 Methodology

The purpose of this chapter is to explain what methods will be used while producing this thesis.

2.1 Main purpose

When discussing methodology, a task's purpose is often categorised into one or more of the following alternatives (Höst et al., 2006):

- Descriptive
- Exploratory
- Explanatory
- Problem solving

The studies executed in a *descriptive* thesis are meant to investigate and describe how something is done or how it works. This also applies to the studies of an *exploratory* thesis but in that case they are way deeper and more thorough (Höst et al., 2006). When there is limited knowledge about the research subject, the purpose is often exploratory (Björklund and Paulsson, 2003). *Explanatory* studies seek explanations and connections to how something works. A *problem solving* (or *normative*) thesis tries to find a solution pre-defined problem (Höst et al., 2006). The purpose of the studies is usually problem solving when there is plenty of knowledge about the subject and the goal is to provide guidelines and suggest future actions (Björklund and Paulsson, 2003).

The overall purpose of this thesis will be a mixture between first descriptive and later on problem solving. In order to be able to solve the problem at hand one needs to thoroughly investigate the situation and the prerequisites for the research object. Thus, the authors need to start the first phase of this project by mapping the current continuous improvement work at MAU Lidhult for the time being which means the purpose of the first part is descriptive.

After investigating the situation at MAU Lidhult another descriptive part will be needed: obtaining a view from other companies with experiences from working with continuous improvements.

The main purpose of the thesis is problem solving. MAU Lidhult management presented their need to have a more structured approach to the plant's continuous improvements and the authors' task will be to present a system which supports such structure.

2.2 Research strategy

Within applied sciences the five most common scientific approaches are:

- Survey
- Case study
- Experiment
- Action research
- Clinical research

Surveys are used when the research is descriptive. Data is gathered at a certain point in time and is used to describe conditions or identify standards to which existing conditions can be compared. The advantage of using surveys is that they always scan a wide field of e.g. populations. Because of this one can claim, with some statistical ground, that certain characteristics occur regularly. Thus surveys enable the researchers to generalise (Cohen et al., 2000).

The level of complexity between surveys can differ from very simple to very complex which is why they can function as support for other research strategies (Höst et al., 2006).

The purpose of a *case study* is to deeply describe a phenomenon or an object (Höst et al., 2006). It may be of use when analysing a situation where things not can be measured or computed numerically. Clear boundaries around the case subject are of necessity and it is also important to let the situations speak for themselves without further interpretation by the researcher (Cohen et al., 2000).

The strength of a case study is that it observes effects in real contexts and because of that the researcher can find the answers to what it is like to be in a certain situation (Cohen et. al 2000). Commons methods of collecting data are interviews, observations and archive analysis (Höst et al., 2006).

Experiments strive to explain what causes a particular phenomenon. Through experiments the researcher may compare different technical solutions or investigate how a change in a parameter affects an object. The planning needs to be very thorough since one cannot change an experiment's set up half-way through the process (Höst et al., 2006).

Action research is not completely standalone but needs support from other research methods. Usually one starts by observing the object through a case study or a survey. After that, a potential solution to the problem at hand is produced and

presented. Then the solution is evaluated, redesigned and improved. Action research is an iterative method so the redesigned solution goes through this cycle once again (Höst et al., 2006). This way of working is very similar to a so called PDCA (Plan-Do-Check-Act) analysis.

The difficult part of the action research method is the evaluation of the solution. It is sometimes hard to criticise what you have created yourself. To avoid complications like this and to ensure some level of objectivity one can start by deciding how the solution shall be evaluated (Höst et al., 2006).

Clinical research is very similar to action research when it comes to methods and structure. The significant difference is that in an action research, the researcher defines the problem which should be solved through the study. In clinical research, a company, an organisation or a person has a problem or a subject that needs investigating and the researcher executes the study. It is argued that the chance of success is higher if the initiative comes from someone who wants help rather than someone deciding what to study (Reason and Bradbury, 2001).

The research strategy of this thesis will be clinical research since Cargotec MAU Lidhult directorate has a clear view of current problems and what they are aiming for. The authors will start by observing and mapping the prerequisites of the plant to use for a draft of an IT based system. This system may be evaluated by Cargotec staff and it can then be redesigned to better suit the operators. Potentially this cycle will be repeated numerous times and this iterative method applies directly to the strategy of clinical research.

2.3 Research approach

2.3.1 Quantitative and qualitative studies

A *quantitative* study is when the gathered data and information can be measured and valued numerically. Not everything can be measured quantitatively which limits the possibilities of generating new knowledge. When collecting data in a quantitative study, surveys and mathematical models are suitable (Björklund & Paulsson, 2003).

The information and data from a *qualitative* study may consist of words, descriptions and interpretations (Höst et al., 2006). A qualitative study is used when wanting to reach a deeper understanding for a specific subject or situation.

One of its disadvantages is that one can hardly consider the drawn conclusions to be general. That is because there is usually no statistical confidence behind them due to the limited range of studied objects (Björklund & Paulsson, 2003). Qualitative studies will be exercised throughout this thesis.

2.4 Data collection

Here follows an outline of the different methods of data collection in scope for this thesis.

2.4.1 Primary and secondary data

Data obtained in a thesis may be primary or secondary. The latter is acquired from sources where the information is produced in another purpose than the actual study such as books, leaflets and journals. On the contrary primary is data gathered with the purpose of being used in the actual study. Examples of methods to obtain such data are interviews, questionnaires and observations (Björklund and Paulsson, 2003).

2.4.2 Methods of primary data collection

Here follows short explanations of three common methods of data collection all of which generates primary data:

- Interviews (structured, unstructured and semi-structured)
- Questionnaire
- Observations

Interviews are common when it comes to gathering information from people. “Any person-to-person interaction between two or more individuals with a specific purpose in mind is called an interview” (Kumar, 1999, p. 109). With this wide definition in mind, it is clear that interviews might take all kinds of shapes and with great variety. It is up to the researcher to decide the degree of flexibility i.e. if the interview is to be structured, unstructured or semi-structured.

In a *structured* interview the investigator uses a pre-decided schedule which states the exact phrasing of the questions as well as their order. It is important to follow the schedule firmly in order to make the data from several interviews comparable.

This comparability is the greatest advantage of using structured interviews (Kumar, 1999).

Unstructured interview means that the researcher produces a framework which serves as a guide. Then he or she formulates the questions spontaneously during the conversation. This makes unstructured interviews particularly useful when there is little knowledge about the area which is to be investigated. As the researcher learns more and more about the subject, the interviews can change radically throughout the project. This implies on one hand that later interviews may generate deeper understanding and on the other that the information from different interviews become incomparable (Kumar, 1999).

A *semi-structured* interview is when the researcher uses a number of pre-defined questions as support to the conversation but lets the interviewees speak freely about the subject (Höst et al., 2006).

“A *questionnaire* is a written list of questions, the answers to which are recorded by respondents” (Kumar, 1999, p. 109). It is suitable to use when wanting to obtain data from a large group of people. One needs to have a clear view of the purpose and the desirable data in order to compose an accurate questionnaire. It is rather time-consuming to develop but on the other hand the data is usually quite straight-forward to analyse (Cohen et al., 2000).

Observations mean that the researcher studies a situation or an object live rather than getting second hand information. In that way one can notice details that a person would not speak freely about in e.g. an interview. Also, the data is not influenced by the participants’ opinions (Cohen et al., 2000).

The data needed as foundation for designing the continuous improvement work at MAU Lidhult consists partly of the demands and expectations from the plant’s staff. In order to acquire this data, semi-structured interviews with numerous key persons at the plant, will be held. However, this split into two segments. First the authors will interview several individuals from management and later on some operators as well. As *very* vague guidelines for these interviews approximately 10-15 pre-written questions will be used. These questions are presented in the empiric chapter.

There was also other data which is considered to be of great importance, namely experiences from people who have worked with continuous improvements for a period of time. Thus, benchmarking against other none-competing companies will also be part of the data collection. The benchmarking consists of study visits (observations) and semi-structured interviews.

2.4.3 Literature study, secondary data collection

To get a grip of former research within continuous improvements, other related areas and research methodology, a literature study is being exercised as part of the data collection. It will be more intense in the beginning of the project but also runs parallelly with other actions throughout the thesis. The data gathered in the literature study will be secondary. To find suitable books and articles the authors use two search engines:

- Lovisa, a search engine for Lund's university libraries.
Address: <http://lovisa.lub.lu.se/cgi-bin/webgw/chameleon>
- Google scholar, a google search engine which is specialised for scientific literature.
Address: <http://scholar.google.com/>

The terms used to search within these engines are:

- Continuous improvement
- Lean Manufacturing
- Lean Production
- Lean wastes
- Kaizen
- Methodology
- Clinical research methodology
- Research methods
- Metod
- Forskningsmetodik

By using these terms in the search engines stated above the authors find the literature needed to build a solid theoretical frame of reference. The books and articles used as references are between 4 and 17 years old.

2.5 Induction, deduction and abduction

When working with a thesis it is common that one wonders between levels of abstraction where theory and empiricism are considered to be the extremities. *Induction* means that reality is being studied and the researcher tries to detect patterns which can be summarised in models and theories (Björklund and Paulsson, 2003). There is no definite need for reading and studying earlier research, but the theories are stated on the basis of observations in a real situation (Kovács and Spens, 2005).

Deduction starts with a study of existing theories about the subject in scope before starting empiric research (Björklund and Paulsson, 2003). According to Kovács and Spens (2005, p. 132) “a deductive research follows a conscious direction from a general law to a specific case”.

After studying existing theories the researcher then draws conclusions about the object which will be studied. These conclusions will be either verified or proven wrong during the research of the actual object (Björklund and Paulsson, 2003). Thus, having a solid theoretical base about the subject and clear hypotheses before starting the actual research is of absolute necessity when using a deductive approach (Kovács and Spens, 2005).

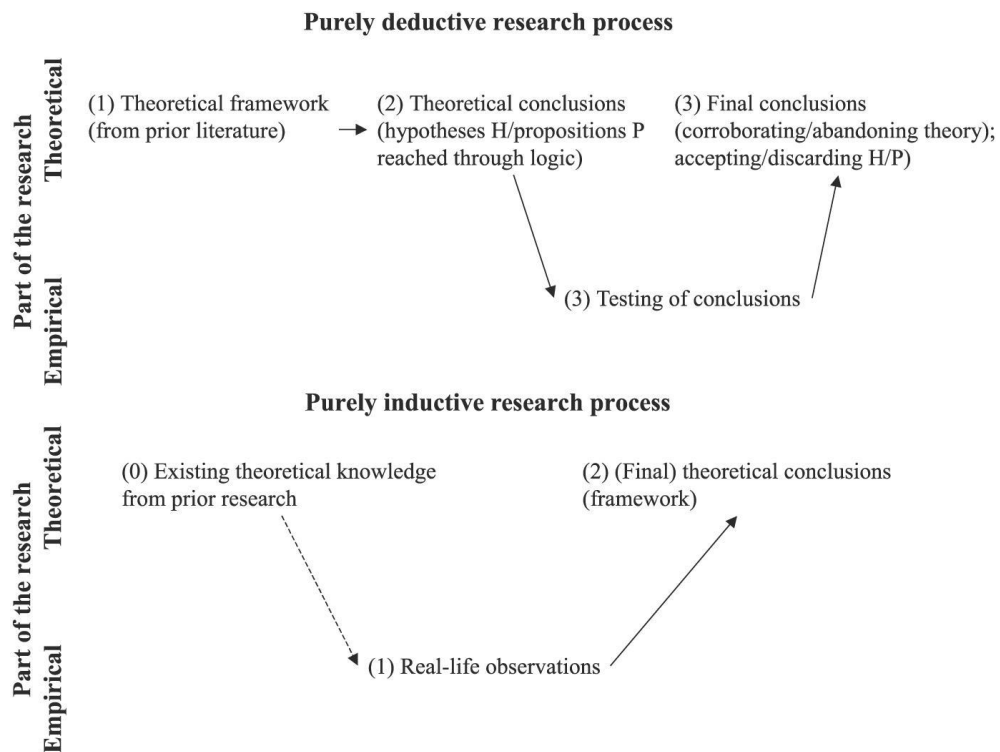


Figure 2.1: The deductive and the inductive research process (Kovács and Spens, 2005, p. 137)

A mixture between induction and deduction is called *abduction* (Björklund and Paulsson, 2003). Many scientific breakthroughs were achieved through studies that did not follow a strictly inductive or deductive methodology. That makes an abductive approach appealing to many researchers (Kovács and Spens, 2005).

Much like induction, an abductive research starts with limited theoretical knowledge and a study of real-life situation. These observations are checked and possibly matched with existing theories as further studies of the real situation is executed. This is an iterative process which ends in final conclusions and proposals which can be implemented later on (Kovács and Spens, 2005).

When unexpected observations occur, conclusions may not be drawn using established theories. In those cases the situation often calls for some creativity and intuition from the researcher, which is highly significant for an abductive research approach. This usage of intuition makes abduction deviate from other scientific methods of explanation (Kovács and Spens, 2005).

It is common that case studies and action researches use an abductive approach. This is because the data collection runs parallelly with the stating of hypotheses and the testing of theories (Kovács and Spens, 2005). Figure# shows a schematic view of the abductive research process.

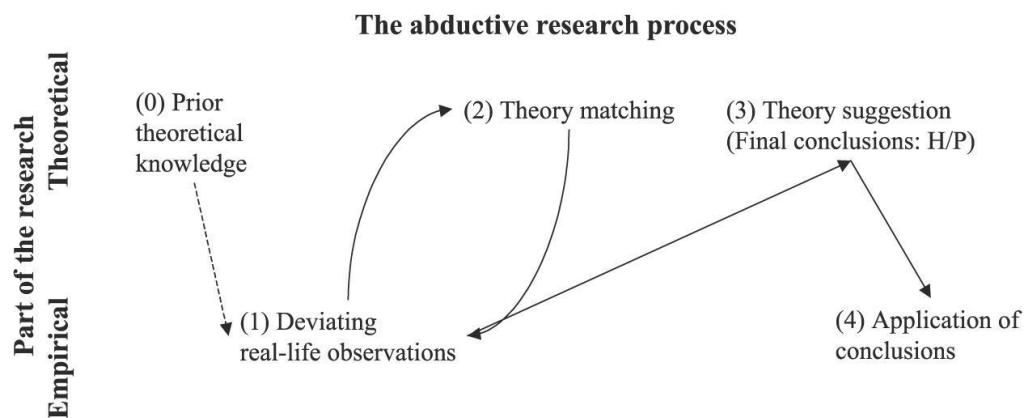


Figure 2.2: *The abductive research process* (Kovács and Spens, 2005, p. 139)

In this thesis the approach will be abductive. With some theoretical knowledge about Lean Production, continuous improvement and teamwork in production, the authors start by studying the current improvement work at MAU Lidhult. Combined with the data from the benchmarking against other companies, theories on how the Lidhult staff ought to work will take form. Then a system will be drafted, evaluated and improved.

2.6 Validity and Reliability

The most common concepts in measurement are reliability and validity. Every measurement device should contain some special features according to several experts. It does not matter if the assessment is traditional or not, it has to be developed in a way that contributes accurate information (Mehrens et al., 1987).

2.6.1 Validity

Validity is vital for effective research, invalid researches are worthless. The authors mentioned qualitative and quantitative research earlier, even here validity is a requirement. Depending on what kind of data there is validity varies. For instance, in qualitative data validity is often addressed through the strength and sincerity of the data accomplished. In quantitative data validity might be improved by proper statistical management of data. Validity is recognized in many forms (Cohen et al., 2000):

2.6.2 Content validity

This type of validity is concerned with sample population representativeness, i.e. computer literacy contains skills in word processing, database, internet etc. Hence, it is almost impossible to cover all parts of computing. For that reason the amount of tasks are determined and sampled. Content validity is established by more than one person, often a panel. The disadvantage with this approach is that the content experts in the panel forget that it is written to other people and take their knowledge into consideration. It is common that these tests are very difficult since those experts take their knowledge for granted and do not care about others. Content experts believe that memorising historical facts are important for students, a step to understand philosophy better (Cronbach, 1971).

To ensure items' representativeness it is vital to sample carefully. For instance, a researcher did a spelling test for French students. He wished to see how well they spelled 1,000 words but he restricted the test to fifty words. Later on the test would make sure that it represented the range of spellings in the 1,000 words. This is ensured by including all the spelling rules in the test in the proportions in which they took place in the thousands words (Cohen et al., 2000).

2.6.3 Internal Validity

There are external and internal validity depending on sort of threats. Any factor that has impact on the result of the experiment is defined as a threat. Internal validity refers to how the treatment results in the dependent variable. This type of validity is only relevant in studies regarding attempts to establish a casual relationship, there is no relevance in descriptive studies. There are eight different confounding variables that interfere with internal validity in the purpose of isolate casual relationships.

The most noteworthy threats to internal validity are history, testing, instrumentation, selection, maturation, regression and experimental mortality.

Controlling for potentially mixing variables minimizes the potential for an alternative explanation of the treat (Abrahams, 1997).

2.6.4 External Validity

External validity refers to the extent to which results can be generalized to the wider population (Cohen et al., 2000).

In practice it is not appropriate to measure the whole population, therefore measurements are taken from well performed samples. The result of the sample may not be applicable to another comparable group if the subjects of those samples are not randomly selected from the population. The main purpose of research is people behaviour and it is vital to the degree that generalization of information can be done to the wider population. The more the environment of the subjects in a research is controlled the more the subjects in the experimental groups differ from those in the general population (Abrahams, 1997).

Here below are threats to external validity in naturalistic research listed:

- Selection effects (constructs only relevant to a specific group)
- Setting effects (the result is heavily dependent on their context)
- Construct effects (constructs in fact are specific to a certain group)
- History effects (situation are not comparable due to their occurrences at unique circumstances) (Cohen et al., 2000).

2.6.5 Reliability

The definition of reliability is how consistent your instruments are, the extent to which an instrument measures the same subject on same conditions each time. In other words, it is the repeatability of your measurement. It is important to have in mind that reliability is estimated and not measured, if a person scores same result twice the test is considered as reliable. Reliability can be estimated in two different ways:

2.6.5.1 Test/Rest

The idea of this method is to perform a test once, then do it again and accomplish same result. This way of estimating reliability is the more conservative one. Three actions that need to be taken into consideration to fulfil this method are:

1. Separate time for each subject when implementing measurements
2. Execute the connection between these two measurements
3. Both testes are done under same circumstances (Colosi, 1997).

2.6.5.2 Internal Consistency

Internal Consistency is another method of estimating reliability. It encourages the correlation between groups of questions. A questionnaire is done by grouping various questions that measures the same concept, i.e. three sets of four questions. Then the answers are analyzed and a correlation runs between those groups of questions to determine if there is reliability in the instruments measuring that concept.

The more significant difference between these two methods is that test/retest involves two instruments treating administration of measurement in comparison to internal consistency method which only refers to one administration of that instrument (Colosi, 1997).

2.7 Methodology summary

Main purpose: Problem solving and descriptive

Research strategy: Clinical research

Research approach: Abductive

Type of study: Qualitative

Data collection methods: Semi-structured interviews, observations and literature study. (Figure# shows the chronology of the data collection.)

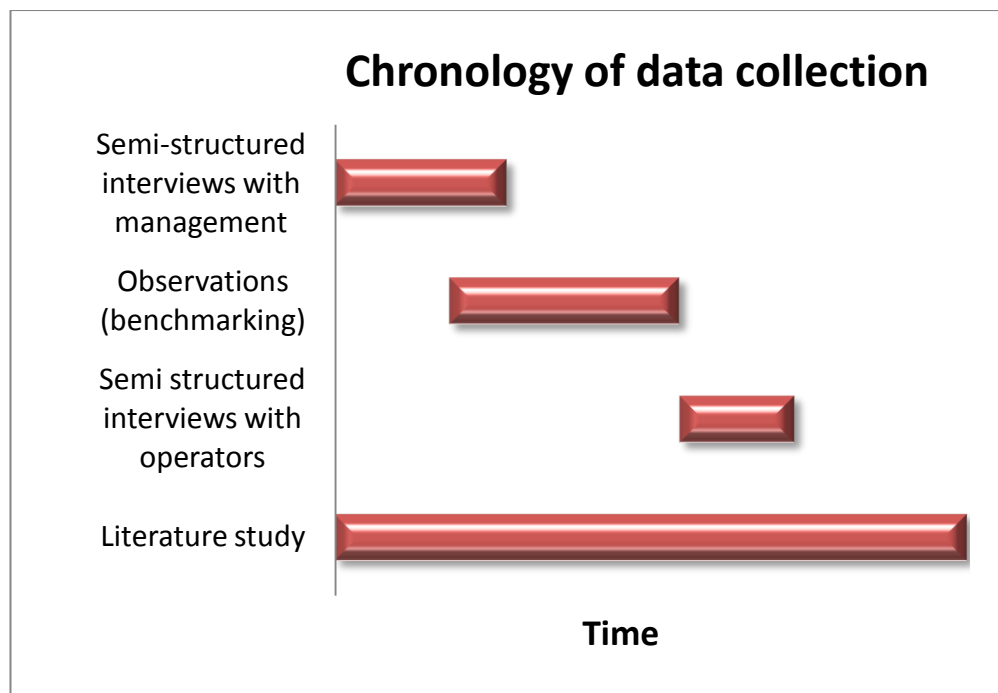


Figure 2.3: Chronology of data collection

2.8 Methodology discussion

Since MAU Lidhult management presented the core problem and what the staff needed to begin their structured improvement work, the main purpose of the thesis is obviously problem solving. The descriptive part of the project is merely necessary in order to start solving the problem.

Clinical research is a natural strategy because the authors will start by observing the situation at MAU Lidhult and other companies and then produce a proposed way of working. Furthermore the iterative process of gradually refining the solution that is significant to clinical research will be exercised throughout this thesis.

The reason why qualitative studies will be used in this project is first and foremost that when it comes to continuous improvements, there are no standard methods.

Each company needs to find its own way of implementing and working with it. Thus, there would be of no practical use in this case to conduct a survey with a large number of companies. Even if such a survey ought to give some statistical indications on how others have organised their improvement work, one could not know if that information would help MAU Lidhult. The idea is rather to get much input from a limited number of persons and use that as a foundation when proposing ways to work.

Interviews were decided the best way of getting a collected view of the needs and expectations from the MAU Lidhult staff. It will also be used in the benchmarking process. The main purpose of using semi-structured interviews and not structured ones is to avoid leading people into talking about what the authors would like to know. Having them speak freely will enable the authors to reach their “top of minds” i.e. finding out what is important to them.

Observations will be a natural part of the benchmarking. Visiting other plants and watching how the employees work with continuous improvements in the daily processes will hopefully prove to be a good way of seeing examples that might or might not work in MAU Lidhult.

The literature study is necessary in order to get a solid base of knowledge in Lean Manufacturing, Kaizen and its history, modern approaches to continuous improvements etc. as well as research methodology.

3 Theoretical backgrounds

3.1 LEAN

Lean Production can often be seen as a complex system. The heart of this system is Just In Time delivery and low inventories. By having low inventories, issues such as demand fluctuations and supplier demands are eliminated. Focus is put on improving the quality of inputs and reducing lead time. Through these efforts the result is continuous improvements in quality, responsiveness and productivity. Lean Production entails cooperation between design for manufacture problems and suppliers on quality. It ensures that the main focus should be held on the design stage since the ease of manufacture, quality and service are built into the product (Levy, 1997)

3.1.1 The Five Core Principles of Lean

Lean make firms more profitable through using less human effort, less storage space, less time and less capital tied items. There are five core principles of Lean:

1. Define Value from the Customer's Perspective

Value must be defined from a customer's point of view so value-added activities can be sorted. This is difficult since it requires much knowledge of how each specific item meets the customer needs. Price and time have a vital role and when value is defined a good platform is made for further work (Womack and Jones, 2006).

2. Describe the Value Stream for Each Product or Service

To deliver a finished and desire product to the customer the organisation has to perform a bunch of activities to succeed that. This set of activities is called the value stream and it is seen as a core principle of Lean Manufacturing. Companies can easily see which activities bring value to the product which implies on reduction of non value adding activities (Womack and Jones, 2006).

3. Create Flow in Each Value Stream

The basic idea of flow is to make the activities cooperate so the items will easily be processed through the machines. A good flow has to present in the value stream and this should be considered carefully from the firm. Easy flow means less stock and more storage space. This is the only Lean principle that can directly challenge the batch and queue system of manufacturing, where items are produced in large batches. Lean is aiming to reducing the size of production batches by improving the flow of the value stream. Thus, firms will achieve lower manufacturing costs and higher flexibility in processes (Womack and Jones, 2006).

4. Produce at the Pace (Pull) of Actual Customer Demand

Pull of actual customer demand is the fourth essential principle of Lean. Lead times were radically reduced when firms were moving from traditional batch-and queue manufacturing to continuous flow production. These implied on better and faster respond to demand and storage space were increased (Womack and Jones, 2006).

5. Strive to Continuously Improve All Business Operations

Kaizen is the Japanese term for continuous improvement and it is the fifth core principle of Lean. Companies that conduct Kaizen thinking always stand in the front and surely ahead their competitors. Even though Toyota is known as one of the most or probably the most “Lean” business enterprises in the world they are still aiming to improve their activities (Womack and Jones, 2006).

3.1.2 JIT

In Japan it is common that companies require vendors to do more than one delivery a day. These deliveries are scheduled to arrive within every second hour. This is impossible to achieve if some components are transported by slower modes, as ship for example. Due to inclement weather it is very difficult to appreciate when the components are arriving. To avoid delays to customers many companies today are implementing JIT deliveries for components from warehouses located in the area. These differ from ordinary JIT when the

components are delivered straight from the factory. To accomplish this low inventory is crucial for the company (Levy, 1997).

3.1.3 Flexible Manufacturing

The ability to customize a product is vital since our customer needs are bigger today. By having low inventory in stock and flexible manufacturing organizations respond more rapidly to fluctuations in demand. To accomplish flexible manufacturing all components from suppliers have to be delivered fast and delays are not affordable. The ability of manufacture a wide range of products in smaller volumes affect the economy of scale which implies on reducing the encouragement for global production (Levy, 1997).

3.1.4 Close Relationships with Suppliers and Customers

Good relationship and close connection between suppliers and customers is crucial for Lean Production. Many organizations in US copied the Japanese and reduced the number of suppliers, they focused on fewer instead and thus enhanced the relationships between them (Levy, 1997).

“Lean” is a common word today and very abstract due to different definitions from vary authors. It is important to have a consequent definition but the work from the authors can be challenged since Lean has changed over years. To achieve a better overview we take a closer look of how these authors saw Lean Production from their point of view.

3.2 Types of waste

Elimination of Waste Is the Soul of Lean

The Japanese term for non valuable activity is called Muda and it is a key concept in Lean control. There are seven different wastes that are important to have in consideration, since waste reduction is an effective way to gain profits for organizations (Carpenter et al., 2009).

Defects

By decreasing the numbers of defect products firms achieve more pleasant

customers. Firms will become more profitable by introducing waste management processes in order to reduce the level of scrap products (Carpenter et al., 2009).

Overproduction: Overproduction happens when more products than required are produced. This is the most dangerous kind of waste since it hides the production issues. All those overproduced products must be stored and necessary storage will be occupied (Carpenter et al., 2009).

Transportation is a none value-added activity. Ever since an item is moved there are risks that it can be damaged or delayed (Carpenter et al., 2009).

Waiting: This waste is important and very common. All time for resources to arrive or products to be delivered are an important factor for the company. It is expensive when a product can not be further manufactured due to delayed components. Waiting is a waste that is common and important and should be reduced as much as possible (Carpenter et al., 2009).

Inventory can be seen in different forms, as raw material, work-in-progress or finished goods. Items in these forms mentioned above and not being processed to add value are considered as waste (Carpenter et al., 2009).

Motion is the process being performed by an employee or a machine. Motion should be taken into consideration since it has the ability to damage items if not executed properly (Carpenter et al., 2009).

Overprocessing refers to actions when more equipment than required is used. Products are being advanced manufactured and are more difficult to maintain. Customers may need to perform tasks that they are not qualified for to maintain their competency. The training cost that occurs can be used to equalize the waste related to overprocessing (Carpenter et al., 2009).

3.3 Continuous improvements

There have always been needs for improvements within the production of goods and services. However, the degree of structure and the aim of the work regarding this matter have varied. Traditionally the improvement work has been conducted by management and executed exclusively by specialists (Nilsson, 1999).

“Continuous improvements” is a more modern term for improvement work. Significant for continuous improvements are that they are always small changes in a process which differentiates them from radical and large scale changes e.g. new machinery (Nilsson, 1999). Another important part of the more modern approach

is that people working in production is highly involved in designing the improvement work. Then the same people have mandate to actively execute the improvement activities as long as one always keeps up-to-date with the customer's needs (Ljungberg and Larsson, 2001). Involvement of the workers in the improvement work is supposed to boost learning and engagement of the staff. The degree to which team leaders and specialists are involved differs between companies (Nilsson, 1999).

The most important thing about working with continuous improvements is to never stop (hence the word *continuous*). A process always needs to adapt when needs and demands change. However, this is often neglected since the staff considers its time far too limited to focus on continuous improvements. There is an obvious danger in only trying to solve today's small problems and forgetting to look forward on what might be demanded in the future (Ljungberg and Larsson, 2001).

When introducing continuous improvements, many companies in western countries tried to mimic the Japanese model *Kaizen*. Gradually Swedish companies have developed their own ways of working with continuous improvements since parts of the Kaizen method have proved unsuitable in Sweden (Nilsson, 1999).

To boost performance of a process one can choose between using continuous improvements and completely redesigning the process. If performance goals are not met when the redesign is done, continuous improvements are often used as complement to try and reach the goals (Laguna and Marklund, 2005).

3.3.1 Kaizen

Kaizen is a Japanese concept fundamentally based on working gradually and never-ending with continuous improvements. The translations of the word differ radically depending on source but one is that "kai" means "change" and "zen" means "make better" (Gembutsu Consulting, 2007). Combining those two ought to roughly mean "change to the better". That may be interpreted as an *improvement* which Huda and Preston (1992) argue is a satisfactory translation.

The Kaizen concept was introduced in the 1960's in Japan. At that time the country suffered from tremendous shortage of labour and enterprises tried to attract workers by offering lifetime employments. In return the workers who signed such contracts committed themselves to contribute to the company's long term development. Thus the birth of Kaizen was a fact and the concept is still today considered to be an essential element of the Japanese manufacturing

success (Brunet, 2000). Naturally this appeals to European and US based companies too and Wittenberg (1994, p. 12) claims that “the Kaizen concept is the key to understand the differences between Japanese and Western approaches to management”.

The philosophy of Kaizen is people-centred rather than system-centred. It shall involve all company personnel at all times. Initially standards to which all operations are meant to be performed are set (Huda and Preston, 1992). Then follows two key items of the Kaizen discipline: maintaining those standards and improving them (Wittenberg, 1994). This both depends on and enables the workers reflecting on their tasks and assuming responsibility for development (Huda and Preston, 1992). Employees are expected to participate more and more in the evolution process of the business the longer they work. The same idea applies to the quality thinking. The knowledge of quality is supposed to be transmitted throughout the entire staff in order to empower people to solve their work problems on their own (Wittenberg, 1994).

Traditionally Kaizen in Japan starts with making every employee part of a self managing group which then negotiates its performance targets with management. Also teams of 4-10 people (often the same as a self managing group) have weekly meetings to discuss Kaizen activities (Brunet, 2000).

The incitement of performing a typical Kaizen action is to reach the targets of the group. It is often both formulated and carried out before reported since it usually is a very small action, thus limiting administrative burdens. Every team is supposed to each year conduct a few large-scale Kaizen projects which follow a strict analytical and reporting process. The focus of these projects is not the achieved results but rather to train the teams in certain methods and analytical thinking (Brunet, 2000).

Sometimes the philosophy is figuratively described as an umbrella covering the very wide range of activities involved (Huda and Preston, 1992). Figure# shows an example if this.



Figure 3.1: The Kaizen umbrella (Huda and Preston, 1992, p. 11)

One activity that is not covered by the umbrella is innovation. The reason is that it is considered to be the antithesis to the Kaizen process. An innovation is known as a drastic improvement that often needs investments whereas a Kaizen action is meant to be small and in no need of additional funding (Wittenberg, 1994).

The success of Kaizen highly depends on engagement from management. One of their big challenges is to display improvement actions which have implied significant results. This is to avoid a decrease in motivation from the workers (Brunet, 2000). At times when continuous improvements appear to be fruitless it is up to management to show engagement a visible commitment to Kaizen activities (Huda and Preston, 1992). There is also a great administrative task to review all the suggestions to actions (Brunet, 2000).

Just as any other core principle of Lean Production, the Kaizen way-of-working calls for elimination of waste e.g. inventory. By reducing stock levels one does not only free capital that used to be bound in goods but also exposes problems in production. The aim is then to remove those problems one by one much like in process-oriented thinking which Kaizen promotes. The theory is that a process must be improved to achieve improved results (Wittenberg, 1994).

In Japan *quality circles* have been quite common among companies working with Lean Manufacturing. They are groups consisting of production and quality engineers and factory workers who meet outside of working hours to discuss issues related to quality and how to improve it. The work in quality circles is not mandatory and un-paid (Nilsson, 1999).

3.3.2 Kaizen Blitz

A Kaizen Blitz event is when a number of people gather for some days to drastically improve process. The German word “blitz” meaning “lightning” emphasizes speed to which this is supposed to be done. It follows a top-down structure starting with concerned managers brainstorming over the process’ development potential and waste elimination. Ways to rapidly implement the improvement suggestions are then decided. The implementations are carried out by managers and workers together (Business Knowledge Source, 2010)

3.3.3 Reasons for working with continuous improvements

Changes will always occur in all organisations. One of the key elements to structured continuous improvement work is to involve everyone who is concerned with the change. Naturally that becomes the main reason to work with it. If people are left out of the change process they are more likely become reluctant to the changes. If they feel involved instead the level of responsibility rises. When administrative tasks regarding changes and improvements are put on the employees and they are able to both plan and execute the actions, they get more inspired at work (Jakobsdóttir, 1999). Some argue that in order to stay competitive, a business cannot afford not to work with continuous improvements.

In Jakobsdóttir (1999) a study of three companies with between 49 and 420 employees was performed. She gathered the employees’ impressions and experiences from implemented quality systems. All of those systems used continuous improvements, PDCA cycles and other Kaizen elements. The conclusion was that employees feel that those elements build a good forum to discuss improvement actions and this caused them to become more engaged in the general problems of the company. The decentralised decision making enabled them to have more influence over their own work and implied that all problems surfaced and were dealt with.

3.4 PDCA cycle

During the 50s Edward Deming proposed a model that considered business processes. The processes were analyzed and measured to identify causes to why products vary from customer requirements. Demings claimed that business processes in a continuous feedback loop. Thus, managers can identify and change

particular parts that are in need for improvements during process running. The diagram he created illustrates this continuous process, also referred as the PDCA (Arveson, 1998):

Plan-Do-Check-Act involve four phases:

Plan: Identifying and analyzing the problem

Do: Implementing the solution and measure its performance

Check: Analyzing whether it could be improved in any way

Act: Implementing the improved solution fully

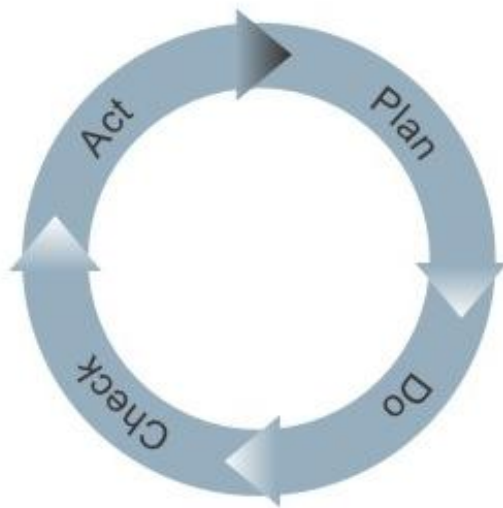


Figure 3.2: The PDCA-cycle (Mind Tools, 2011).

This tool encourages companies to be methodical in their approach to solve problems. Here follows the steps for how using the tool (Mind Tools, 2011):

Step 1 Plan

Sketch a solution and draw as much information as possible. Afterwards it is appropriate to map the process (Mind Tools, 2011).

Step 2 Do

This phase contains several activities:

- Generate possible solutions

- Consider all solutions and choose the most appropriate one
- Implement a pilot project in a specific area.

It is important to clarify what “Do” means. In the PDCA cycle “Do” means “Try” or “Test” and the full implementation happens in the step “Act” (Mind Tools, 2011).

Step 3 Check

In this phase you control and measure how effective the pilot solution has been. Possible improvements are also taken into consideration. You may go back and repeat the two first phases until you are completely satisfied with the solution. But it has to be profitable to go back and repeat the “Do” and “Check” phases, the costs should outweigh the benefits of repeating these steps (Mind Tools, 2011).

Step 4 Act

The full implementation happens in this phase. But cycle does not stop here, it continuous and loops back to the Plan Phase and seek for further possible improvements (Mind Tools, 2011).

Edward Deming sought of improvements in the level of production. His focus was put on industrial production processes. These kinds of improvements are still needed but the core drivers occur on the level of business strategy. Another process is strategic deployment. (Arveson, 1998).

3.5 Suggestion Scheme

Kaizen requires good engagement from the management in an organisation. It is important that there is knowledge in the company about the function of quality. Suggestion scheme is a need to implement continuous improvement. Why should firms be engaged with suggestion schemes?

In the beginning of the 19th century a lot of German organisations introduced this type of operation mode. An incitement to suggestion scheme is cost savings through more efficient working methods. The employees participate and strive together towards the vision. This kind of framework creates democracy through the whole organisation and motivates employees to get more engaged with issues

within the company. Award is often promised and motivates them more (Ekvall, 1995).

It is important to encourage staff members to come up with ideas and suggestion for different types of improvements. This procedure is called suggestion scheme and considers any aspect of work from better customer relationships to cost savings when manufacturing. If their idea is implemented they should be rewarded for their initiative. The benefits with a suggestion scheme is that it hopefully bring cost savings and greater efficiency, encourage staff member involvement and enable employees at “floor” who often have the best ideas since they are closer to the problem. The drawback with suggestion schemes is that it vital to maintain, constant management is crucial to achieve high effectiveness (Chartered Management Institute, 2006).

The market today is very competitive and customers’ expectations are higher. New ideas, more innovative products and better processes are vital to succeed. Firms must engage all employees to work together. It is important to have a steady flow of ideas from all type of employees, those who are closest to customers to those from the “floor”. A well developed culture must be present in those organisations so it facilitates the maintenance (Kaufman, 1999). The suggestion scheme focuses on to increase quality and production. For example, a committee is build to decide which improvements are about to be implemented. This committee usually consists of team leaders and production managers. Later the improvement is performed by the specialists or employees with much knowledge in that area (Nilsson, 1999).

Suggestion scheme is known for a long time in Japan and has had a crucial role in the work with Kaizen. Toyota introduced this way of thinking very early and has been successful. One of the key parts to Toyotas’ success is that they appreciate suggestions and does follow ups. In this manner employees felt participation and motivation were gained. The management group reviews all suggestions and reward people behind some valuable ideas (Bergman & Klevsjö, 2001).

There are six different actions that are important to consider achieving an efficient suggestion scheme:

- Respond to the staff should be written within a week. Actions are taken depending on what answer is given. For example, if the answer is “maybe” try to explain the issue more in detail. Credibility is build through making and keeping new promises.

- Respond to all members in the management group. When a staff member writes he or she writes often what it on the mind of many. Don't forget to thank writers for their contribution.
- An award should be given right away to the staff members contributing a valuable suggestion. Many suggestion schemes use a process for evaluation of an award. First, the boxes are emptied monthly. Second, the suggestions are sorted by a Committee and an analysis is done considering costs, viability etc. Third, the reward is decided from the management group to the appropriate staff members. Finally, the reward is conducted.
- Establish categories for regular awards which help staff to bring new ideas. Here below are examples for different categories that can easily the work:
 - Suggestions for getting closer to customer
 - Suggestions for implementing immediately
 - Suggestions and ideas for future directions
- Recognition should be given to the winning suggestions and the people behind them. Challenge everyone within the company to double up the amount of ideas in the following year.
- Act upon what your staff suggest and implement (Kaufman, 1999).

3.6 Visualisation as an improvement tool

Some argue that it is easier to visualise a workplace and how it functions if you can see it in pictures rather than if the information is communicated orally or written. Also when discussing work-related issues, it is easier to engage people in conversation and the risk of misunderstandings and conflicts decreases when using figures and pictures instead of written documents and the spoken word (Nilsson, 1999).

In the last chapter of Nilsson (1999) a number of case studies about visualisation as an improvement tool are summarised. The following conclusions are drawn:

- The rapid technological evolution makes the industrial society depending on knowledge, information and services. This demands that employers and employees have similar notions about how the company works.

- Visualisation can make people have the same impression of concrete stuff such as plant layout, material flows, transport routes and production (work) flows.
- There is a need of visualisation when it comes to abstract stuff such as responsibilities and authority, power and influence, knowledge and competence, conflicts and tension.
- To meet tomorrow's challenges it is crucial for companies engaged in improvement work, to be able to visualise abstract organisational and administrative circumstances as well as concrete stuff connected to e.g. production.
- Visualisation can imply that a discussion within a project group gets more intense and engaging because comments become shorter and greater in numbers.
- Visualisation can help the employees participate in a discussion and express the opinions since pictures may be used as a common tongue.
- Pictures can help people develop the same impression of how the company works.
- Visualisation can be used as an improvement tool in order to achieve productive savings and increase of efficiency.

4 Empiricism

In this chapter the data acquired during the interviews with MAU Lidbult staff and the benchmarking will be presented.

4.1 Interviews

This section shows the questions used as framework for the interviews and the data acquired during the interviews.

The authors have been interviewing 11 people from management (white collar). Each person discussed topics concerning continuous improvements, implementation and how an IT based support system ought to be designed. To get a deeper understanding of the needs and expectations of the people who will actually work with continuous improvements in the future, 7 operators (blue collar) were interviewed as well. The discussions referred to subjects such as how management should engage employees with continuous improvements, how they should be stimulated by working with Lean Manufacturing and how the organisation should overcome barriers between departments and work cross functionally. The duration of the interviews varied from 30 minutes up to an hour.

4.1.1 Results from the interviews with management

This section shows a compilation of the authors' impressions of the views and opinions from the people interviewed. These are not the opinions of the authors.

One thing that many emphasise is simplicity. To accomplish success problems have to be broken down to smaller pieces. In that manner it is easier to follow up and maintain the processes. Ideas from operators are best collected if the system refers to simplicity. Heavy administrative burden avoids good ideas from reaching the management group. It is important not to measure the amount of actions, because it can put focus on wrong things. Instead, the company should measure how much effort and time that is saved by implementing particular improvements. Also, encouraging employees to estimate the potential savings when coming up with a proposal would have a purpose. This is not to try and get exact figures but it rather makes people reflect upon effects of changes and it sends the message that improvements are meant to benefit the organisation as a whole.

Some of the interviewees argue that improvement actions ought to originate from problems. That is the base of inspiration for change. By first identifying the issues which need resolving one builds a foundation from where ideas can take form.

There are organisations today that just focus on future and easily forget history. By measuring improvements and looking back at history employees can see how much the company has succeeded and this motivates them more. It may show what the teams have accomplished and hopefully people feel that the workplace becomes better and better the more improvement actions that are taken. The results will be even greater if the organisation engage all employees to work together and strive towards same goals.

To motivate and stimulate employees working with continuous improvements the organisation need to instate a compensation system. One needs to be careful when starting a compensation system: one needs forums for discussing and process the question. It is easy that employees might keep their ideas to themselves if the rewards are individual and it would disfavour the firm. Operators will not work together and goals and targets will not be achieved. Therefore, it is important to prioritise the team and not the individual when introducing a compensation system.

At Kalmar Industries today management inspects/ revises/ audits production. To reach great goals and be ahead of their competitors they need the ideas to come from the “floor”. It ought to be the workers who inspect both their own and other departments. Cross functionality through departments auditing each other. It is crucial for a company to cooperate between departments. Issues from some departments can be solved from other departments who perhaps have experience from that or have a completely different perspective on the issue at hand. One should be able to leave improvement suggestions to other departments. *However*, the problem is that you let the responsibility of execution to someone else. By doing that there is a risk that the sense of ownership for the solution decreases. That was also considered one of the biggest disadvantages of a traditional suggestion scheme among the interviewees. It is really difficult to get the operators truly involved if there only task is to hand in a proposal and not be responsible for carrying it out.

MAU Lidhult constantly work with setting standards: if something has proven to work in one department the manager of another area ought to try and implement it among his or her workforce as well. The purpose of this figure is to show within what areas MAU Lidhult Management agree and where the opinions diverge.

	Plant Manager	Production Manager	Head of Logistics	Head of Human Resources	Quality Manager	Quality Engineer
Simplicity	X	X	X	X	X	X
Cross functionality	X				X	
Individual compensation system						
Group compensation system	X	X	X	X	X	X
History			X		X	
Measuring continuous improvements			X		X	

Figure 4.1: An outline of what subjects the interviewees chose to emphasise.

4.1.2 Results from the interviews with operators

This section shows a compilation of the authors' impressions of the views and opinions from the people interviewed. These are not the opinions of the authors.

Some of the interviewed operators could recall the suggestion scheme that MAU Lidhult exercised many years ago. Anyone who handed in a suggestion that was implemented received a percentage of the financial benefit generated to the company. The operators argued that taking that away was a profound mistake.

“Den stora förloraren om du tar bort något sådant, det är företaget.” (Interviewed operator, 2011-02-09)

This quote means “The great loser if you take such a thing away, is the company” which suggests that even if MAU Lidhult would reject many proposals they would still have a lot to gain from the feasible ones.

There have been prior initiatives with continuous improvements at MAU Lidhult but according to the interviewees all have failed mostly because the time span from ideas to implementations have always been far too long. The people

responsible for taking it forward have not been enthusiastic enough. The employees want both rapid feedback on suggestions as well as encouragement in order to come up with more ideas.

A few operators argued that there are bigger more important things to attend to at MAU Lidhult before focusing on continuous improvements. They mean that it can be a waste of effort if one concentrates on that instead of dealing with greater problems first. As alternative solution the factory could have one employee who works only with problem solving and improvements. That person would be at the operators' service and attend to whatever issue that occurs.

Cross functional work is generally considered a good thing. When there are changes made in one department that effect others the flow of information would get better if some operators would get to see the improvements in other areas of the factory. The interviewees also point out that informing each other about new standards and alterations is something that MAU Lidhult staff needs to get better at.

Most of the interviewed operators' find that the improvement teams ought to have some sort of reconciliation meetings. However, it is important that these meetings do not consume too much time which is why they should not occur more often than biweekly. The opinions differ regarding what support functions should attend those appointments. Some think that almost all functions ought to be represented whereas others seem to think that production service is enough.

“Det räcker med en person från produktionsteknik. Skulle de behöva så kan de delegera vidare. Vi ska inte lägga någon energi på vem som tar hand om det.” (Interviewed operator, 2011-02-09)

Roughly this means “It is enough with one person from production service. They can delegate further if they need to. We should not put any effort into who takes care of it.” So the concern is that the meetings might become inefficient if there are too many people. There is also a risk that if e.g. purchasing comes to five meetings in a row where no purchasing related topics are discussed the motivation will decrease. The focus ought to be on the operators discussing the ideas which are on the table, deciding which ones are worthwhile and determining who is responsible for executing what actions.

4.2 Benchmarking

The reason for benchmarking against other companies is to see examples of their improvement work, how it was introduced and how it is part of the daily operations. Some of the wonderings the authors had about those companies were:

- How do they work with continuous improvements?
- How are ideas and suggestions recorded and collected?
- How do they measure continuous improvements?
- What difficulties have they run into so far?
- How did they implement improvement work?
- What efforts and investments have the improvement work called for?

4.2.1 Company presentations

The three companies that were part of the benchmarking are Electrolux Laundry Systems Sweden AB located in Ljungby, Haldex Traction Systems Division in Landskrona and Höganäs Sweden AB in the city of Höganäs.

4.2.1.1 Electrolux Laundry Systems

Electrolux Laundry Systems is a company with 1100 employees. The head office is in Ljungby, Sweden and additional manufacturing sites are located in France and Thailand. The company produces large laundry systems for tenement houses, hotels, geriatric care centres and workplaces (Electrolux Laundry Systems, 2010)

In 2005, Electrolux introduced their global production system: Electrolux Manufacturing System (EMS). The EMS promotes improvements in safety, quality, cost and delivery aspects of manufacturing with stability, process improvement and culture change as the three fundamental elements (Electrolux Manufacturing System, 2009).

4.2.1.2 Haldex Traction Systems Division

Haldex Traction Systems is a tier two supplier in the automotive industry established in 1998. The company manufactures four wheel drive systems for global passenger car manufacturers such as Ford, General Motors and Volkswagen (About Haldex/Traction System, 2008). The factory in Landskrona, Sweden is characterised by a highly automated line production.

Haldex have been involved with Lean since the early 21st century. Hence, they are successful and one of the top companies in Sweden concerning continuous improvements. This stair below is well known within Haldex. Different steps are defined:

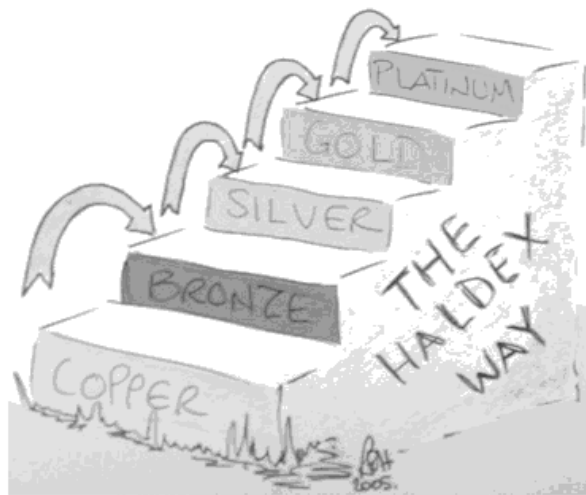


Figure 4.2: The stairs of The Haldex Way.

4.2.1.2.1 Haldex Way

Main issues for Haldex are to increase cost efficiency and productivity. The framework Haldex Way has been used to improve these key issues. Haldex Way has its roots in the Lean Production philosophy. Customer satisfaction and elimination of waste are highly prioritised. They are aiming to achieve a better flow between customers, production and R&D. Basically, Haldex Way consists of three core values:

- Customer first
- Respect for the individual
- Elimination of waste

4.2.1.3 Höganäs Sweden AB

Höganäs AB's history lies within coal mining, bricks and pottery. Today the company only produces metal powders which are used in sintered components, high temperature brazings and soft magnetic composites for example (Höganäs AB, 2011).

The manufacturing site in Höganäs consists of 5 factories, R&D office and the corporate headquarters. A total number of 650 people are employed at the site. Major part of the machinery consists of large industrial ovens. The company has numerous plants with both similar and different types of machines in Great Britain, Belgium, India, China, Japan, the US and Brazil.

4.2.2 Results from benchmarking

Here the reader is meant to be given a view of the authors' impressions from the benchmarking visits.

4.2.2.1 Continuous improvements at Electrolux Laundry Systems

The 6th of December 2010 the authors went to Electrolux in Ljungby for a study visit containing a tour through production and a conversation with the quality manager. Examples were shown on how improvement work were executed and visualised in the daily processes. Electrolux has a clear focus on efficient, fast and structured problem solving. Any operator who finds a problem can immediately report it orally to the production line's team leader, who is an operator that besides assembly has some administrative tasks e.g. updating production boards and SOP's. Then the team leader puts together a group where all functions which are needed to solve the problem, are represented. If needed, the problem is broken down into parts which were delegated to the responsible functions. E.g. if the root cause of a problem consists of a logistics and a maintenance section it is up to those functions to attend to their respective feature (see Figure#).

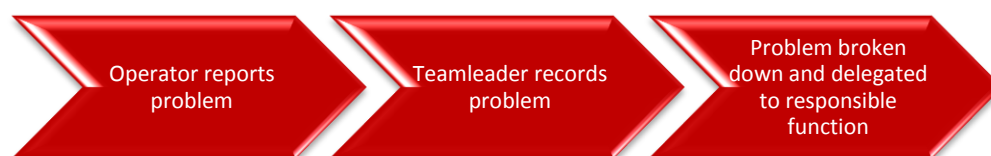


Figure 4.3: Electrolux's process of taking idea to action.

Parallely with this, all the managers at the plant meet twice a week on the factory shop floor to discuss and delegate problem solving actions.

To visualise the ongoing problem solving work Electrolux uses a white board where problems are shown, broken down into parts and the respective department shows the status of their part. Figure# displays an example of this.

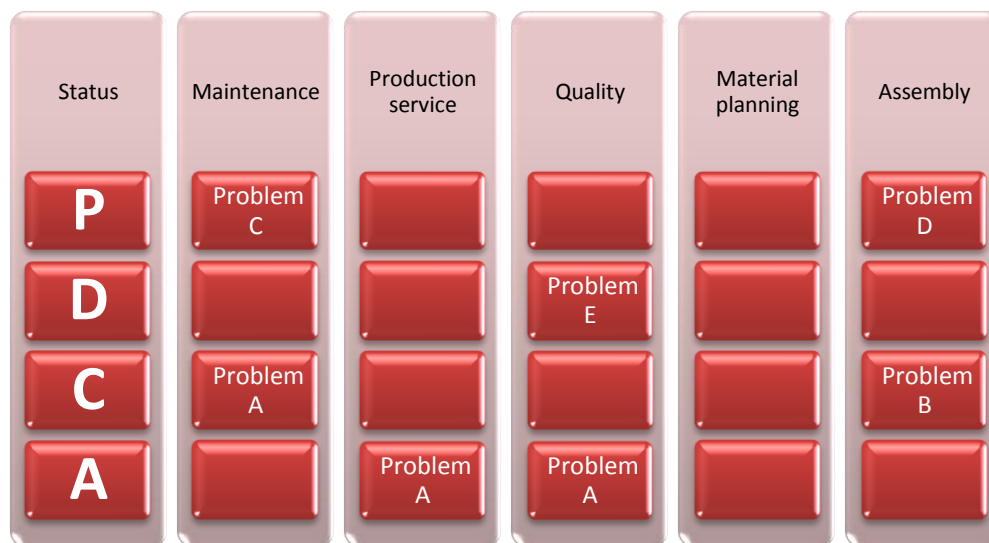


Figure 4.4: A schematic figure of Electrolux's way of displaying their problem solving work.

A problem with status "P" is in its initial phase and one with status "A" is almost finished. Notice how one problem may appear under several departments which means that it is broken down into segments with different responsible departments.

To support the structured problem solving, Electrolux intend to implement improvement teams in the near future. The idea is that every assembly line has a team consisting of the team leader and a representative for each support function. These teams will have weekly meetings to coordinate the ongoing actions and delegate new ones. See Figure# for an example of such a team.

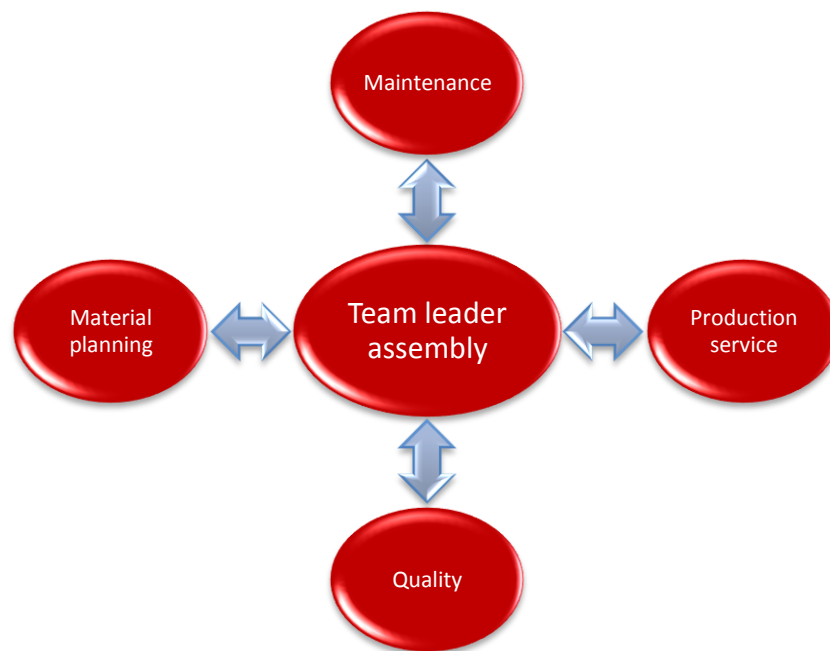


Figure 4.5: An improvement team in assembly at Electrolux

As a complement to the improvement teams each support function is meant to have a team of their own where every member reports the problem solving work to the manager. This is also a forum where one may seek assistance if one is struggling with a task in the assembly improvement teams. Figure# shows maintenance's improvement teams.

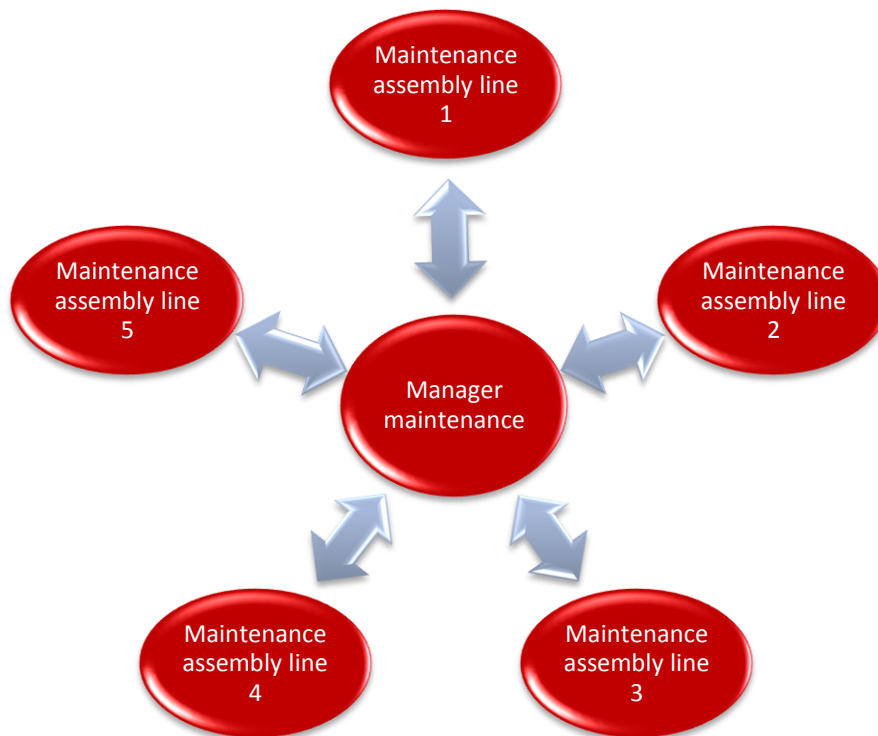


Figure 4.6: A support function improvement team at Electrolux

4.2.2.2 Continuous improvement at Haldex Traction

On the 12th of January the authors visited Haldex Traction in Landskrona. During the stay there the authors saw how they worked with continuous improvements and discussed future actions.

Today, Haldex Traction consider themselves at the step Gold. To achieve this lots of improvements have been done and focus has been set on cooperation. Every Friday all production is cut off for a couple of hours just for focusing on follow-ups for issues from previous week. In this manner, they maintain the plant better and small changes make the difference.

Haldex Traction measure many processes with OEE. When improvements are implemented and various activities are accomplished the company can look at the OEE to compare different processes. Availability, performance and quality are all core parts in OEE. These parts are multiplied and the result will be between zero and one hundred percent (REACH, OEE, 2009).

Definition:

$OEE(\%) =$

$Availability(\%) =$ _____

$Productivity(\%) =$ _____

$Quality(\%) =$ _____

Working with OEE involves understanding the 8 types of waste, where the last one is called “creativity of employees” and it differs from organisation to organisation. Some chose to take it into account, others do not.

Another measurement that Haldex Traction frequently use is First Time Pass.

Definition:

$First\ Time\ Pass =$ _____

The result will not exceed 100 % and explains the quality of products produced. Both those two measurement explain more or less the same thing. OEE takes more details into consideration. Thus, it is more descriptive.

4.2.2.3 Continuous improvements at Höganäs Sweden AB

The authors visited the headquarters of Höganäs Sweden AB, for an interview with and a company presentation by the human resources manager, on the 13th of January 2011.

Höganäs practices a traditional suggestion scheme with focus on technical improvement proposals. Any operator with an idea can share that with his or her

shift leader who gives some first responses on how to improve and present the proposal. The suggestion will then be reworked and presented to the related managers who may evaluate if it is worthwhile. Then the implementation process can start.

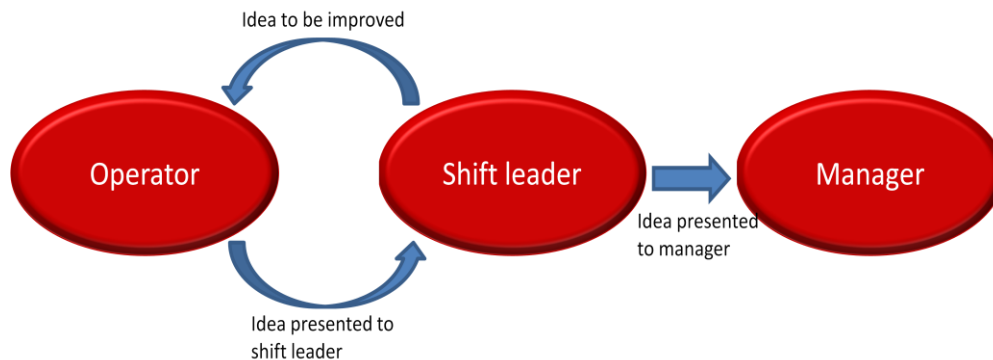


Figure 4.7: Höganäs AB's process of an idea from an operator to the responsible manager who may then implement the suggestion.

When an improvement is executed the operator who came up with the idea is rewarded financially with a percentage of the cost-savings it generates to the company.

Standardisation is an absolutely essential feature of the improvement work at Höganäs. When an alteration of machine technology is carried out and proven successful the engineer responsible for the machine type has an important task. The alteration needs to be thoroughly documented to enable an implementation of the improvement on similar machines in other Höganäs sites. Periodically all machines go through audits and the outcome of that is an action list of what needs to be corrected. On the same time as a machine is being adjusted and corrected the old documented improvements are implemented as well.

To enable the operator coming up with the improvement suggestion to monitor the ongoing work, Höganäs uses an IT based system. When it is decided that a proposal will be carried out the operator gets an action number with which he or she can follow the implementation process.

The authors got the impression that Höganäs find that their suggestion scheme has worked adequately but not enough improvements have been implemented through the years. They plan an internal revision of the entire system during 2011. That would enable the company to redesign the improvement routines in the future.

5 Analyses

In this chapter a collaborated picture from the interviews and the benchmarking is drawn. The intent is to give the reader a notion of MAU Lidhult's prerequisites for implementation of continuous improvements.

5.1 Procedure



Figure 5.1: This figure displays the flow of information throughout the organisation.

The authors acquired data from interviews and company visits processed it among themselves. Finally, the authors applied it on the plant Cargotec MAU Lidhult. Information was brought from several interviews at Cargotec in Lidhult. Those people were both individuals from management and machine operators. Further information was collected from visits at different companies. The authors used all information and applied on Cargotec MAU Lidhult. Through frequent visits the authors achieved a good dialog with the organisation.

5.2 Interviews with MAU Lidhult management

It is quite clear that the general view of MAU Lidhult management is that an absolute vital prerequisite for a system assisting their improvement work is

simplicity. The authors agree with this undoubtedly. If it is too complicated to share ideas and implement them the process of improving will never take-off. The intention of the directorate is that by leading the operators and supporting them to the fullest in the initial stages of the Kaizen work a certain mind-set will develop. In time it will start living its own life and the operators will constantly reflect upon and think about areas to improve and how to do it. That is when one uses the power of the entire workforce which is far more effective than having just a few people responsible for reforms.

One of the greatest challenges with this project and for the future work of MAU Lidhult is to make the improvement work continuous and lasting and not being a project which ends at a certain point in time. The whole Kaizen concept is founded on the idea that one can always become better, costs can be cut and performance can increase. A common mistake when introducing is that management sends the signal that it is time to improve everything fast. Once the novelty wears off the employees' motivation decreases and the Kaizen process slowly fades. The authors would like to avoid this from happening at MAU Lidhult. Management's true test will be to lead and motivate the operators without doing the work for them. Just provide the platform and support needed and encourage the operators to take as much responsibility as possible. Only then will the staff be truly motivated and stimulated to improve their processes independently rather than feeling it is something they need to do because the boss demands it.

MAU Lidhult has a history of using traditional suggestion scheme with individual financial compensation to the person generating the proposal of change. Both the directorate and the authors are very critical to two aspects of such a system. One is that by only rewarding the person coming up with the idea one may create an environment where people tend to closed up and keep their ideas to themselves. The other is that in a suggestion scheme the idea creator is not part of the execution of the action. The sense of ownership will be significantly greater if one is at least partially responsible for implementing what one has suggested.

In the start-up of Cargotec's continuous improvement work it will be very tricky to make the operators adapt to the situation and accept the concept. The solution to this is probably for management to create a need for continuous improvements. That is obviously not so easily done. For the operators it is quite comfortable to maintain the approach that "things are working adequately and we do not need to change or improve anything". Probably the directorate need to identify a few operators who may be extra keen on taking a more prominent role, perhaps with some administrative tasks, related to continuous improvements.

Hence, these operators can function as ambassadors and initially help the Kaizen process to take-off.

5.3 Interviews with MAU Lidhult operators

When implementing Lean Manufacturing throughout the entire organisation it is vital to make sure that correct message reaches to operators. By prioritising continuous improvements their load of work would be reduced. Hence, it favours the employees in the long run. Another crucial point that should also be reached to the operators is that Lean Manufacturing contributes significantly. This implies on the importance of team ships, working together and striving towards same goals instead of working individually.

It concerns the authors that some of the operators feel that working with continuous improvements means having a misguided focus and that others seem to think that the workplace of MAU Lidhult needs no changes. The difficulty lies in making people realise that gradually enhancing in small steps does not rule out solving the large problems as well. It is rather a complement. One also needs to understand that even if the companies' processes function at a satisfying level today, one can always get better and actually needs to get better to meet the rising demands of the future. Overcoming these two obstacles when introducing Kaizen will undoubtedly be management's biggest challenge.

Having one employee whose sole occupation is problem solving and improvement work might be a good initiative at many enterprises. However, the directorate have made it clear that in MAU Lidhult's reality there is no financial capacity of hiring an extra person for that and the current labour force is needed for the daily production.

Determining what support functions ought to attend the meetings of the improvement teams is apparently difficult. The authors believe that one representative from each department is ultimate. Thinking cross functionally is vital to grow as an organisation and become successful. It is crucial to cooperate and believe in the same vision. There can be occasions when some of representatives are less active since those specific improvements do not include their departments. They feel present but not like they are participating. But in the long run it is better to have all representatives in those meetings even if it does not include all in every meaning. In a cross functional point of view it is vital.

The authors definitely think that the improvement work needs to be cross functional to a certain extent. Especially since some of the interviewed operators

announced that MAU Lidhult often needs to be better at informing about changes and new standards. Hearing this made the authors anticipate that there is great potential in exchanging experiences among the departments. Probably there are already solutions somewhere within the plant to problems that occur at anywhere in the company. One way to benefit from this is that someone from each improvement team occasionally attends the meetings of others.

5.4 Benchmarking

5.4.1 Electrolux Laundry Systems

At Electrolux the authors had the opportunity to see both how the improvement work and the problem solving is conducted and performed today as well as what further processes will be introduced in the near future.

Each and everyone had clear roles when it came to problem solving. The operators were obviously empowered to announce problems in production. Next step was the team leader calling a group together and the actual solving of the problem could start. The authors found this concept very appealing because of its simplicity and the utilisation of very large parts of the staff. Encouraging people to report problems rather than to keep living with them benefits the business and operators alike.

The break-down of every problem meant finding all the root causes and reflect on what department needed to do what in order to do solve it. That structure combines making individuals partially accountable and encouraging teamwork at the same time. Ideally this can gain the sense of ownership of the process for the involved employees and the realisation that it often takes the effort of a whole team to achieve improvements.

Visualising the ongoing problem solving actions the way Electrolux did (see Figure# in section#) serves many good purposes. Both managers and operators can without further inquiries see what is happening and how far the work has come. There is no need to ask the persons responsible. It also shows that actions are taken to constantly better the production processes and that improvements are prioritised.

The authors got the review of Electrolux as a well developed and organised company. Through good technology the production could be measured. Hence,

management knew how much hours they were ahead or behind in manufacturing. One minor issue within the firm from the authors' point of view is that they wait for problems to do improvements. They do not have any suggestion scheme and collect spontaneous ideas. First, an issue occurs then actions are taken to solve the problem. By not waiting for the problem many issues could be prevented and the efficiency within the company would increase.

5.4.2 Haldex Traction Systems Division

On the 12th of January the authors visited Haldex Traction in Landskrona. They and Eric Narfeldt, Haldex Way Site Coordinator, discussed about Haldex Way and future actions. The authors were impressed and convinced over the company which had most experience from Lean Manufacturing in comparison to the other two companies, Electrolux and Högånsbolaget.

They were very organised and had clear directive of working with continuous improvements. Every Friday the production lines stopped for a couple of hours in purpose to engage all employees. A well implemented Lean thinking was established throughout the organisation. Haldex Traction had been involved with Lean since the beginning of 21st century and it was significant that they had put a lot of effort. By keeping the system very simple they have been successful. Simplicity, there is no need to be advanced. The suggestion scheme, all routines, everything were done manually. In that way, ideas reached to the management and didn't disappear during the road.

One disadvantage with Haldex Traction was that they did not take history into account. They focused on future and how to do it better. It is worthwhile to look back and see where the firm was ten years ago and where it stands today to see the difference. Thus, employees see how they have progressed and influenced the company. Hence, their motivation and stimulation will gain.

Overall, Haldex Traction is a well organised company which has accomplished much in Lean Manufacturing. In the Haldex Way stair they are in gold and aiming to stand in the platinum phase in the future. By putting lot of effort in Lean it helps them in the race against their competitors. They are always a step ahead. Haldex Way is inspired from Scania's Lean thinking and it is considered as one of the best in Sweden. Simplicity, short decisions and future focus are all core parts for successful Lean Manufacturing, so far Haldex Traction have done it well and have a solid ground for further work.

5.4.3 Höganäs Sweden AB

The authors' got the impressions of Höganäs Sweden AB that improvement work was not an obvious part of the day-to-day work for the operators. Even though suggestions were encouraged with potential financial compensation, employees were not expected to come up with ideas. Also, the focus of the suggestion scheme was only on technical improvements related to machinery and not e.g. environmental or work flow improvements.

Höganäsbolaget used traditional suggestion scheme where the single individual is prioritised. The authors did not get the impression of an innovative and modern company. By prioritizing on the individual person it inhibits the firm from striving together towards same goal. People might keep their ideas to themselves. Thus, they become very competitive and work against each other instead of cooperating.

5.4.4 Differences and similarities between the three companies

Electrolux	<ul style="list-style-type: none">• +Well organised, short decisions• -Waiting for problem instead of preventing
Haldex	<ul style="list-style-type: none">• +Simplicity, structured way of working• - No history
Höganäsbolaget	<ul style="list-style-type: none">• + Standardised• -Compensation for the seperate individe

Figure 5.2 Pros and cons for each visited company

All these three companies have benefits and drawbacks. They are similar in a way that they all are aiming to improve their Lean business and lots of focus is put on that. Simplicity is significant for Haldex Traction in Landskrona and that is one of the core reasons to why they have been successful within Lean in comparison to other Swedish companies. They vary in some aspects, but have more or less same

vision. To become successful today and be ahead of your competitors it is important to have an innovative thinking throughout the whole organisation.

If an employee provides a good idea Höganäsbolaget reward him or her, they have a compensation system for the individual. In this manner they are not prioritizing the team, only the separate individual. The authors believe that this disfavour the company as a unit and not good in the long run.

6 Conclusions, recommendations and further actions

All weeks of action research in Cargotec MAU Lidbult has given the authors insight of the problem, prerequisites and objectives to introduce continuous improvements at the plant. Here is a compilation of the thoughts and conclusions of this thesis.

6.1 Proposal

The authors have developed an excel based system. This excel file is supposed to be used among employees throughout the company. It is based on MUDA i.e. the following 8 different types of waste:

- Over production
- Waiting
- Transportation
- Over processing
- Stock
- Unnecessary motion
- Bad quality
- Not using the creativity of the staff

These are the 8 wastes that Cargotec have defined and use in internal terminology and every suggestion should derive from these wastes. By using a complementary paper pen method where ideas can be recorded on paper or whiteboard, plenty of operators can be engaged. There are people who do not prefer the usage of computers and in this manner these barriers would be overcome and more employees will be involved.

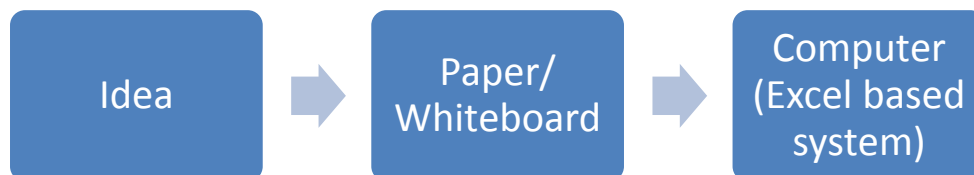


Figure 6.1: An overview of the process of going from idea to action.

Apart from type of waste the person handing in the suggestion needs to state the following information as well:

- Name of the person handing in the suggestion and department that she/he represents
- Description of current situation (problem)

- Potential improvement (proposal)

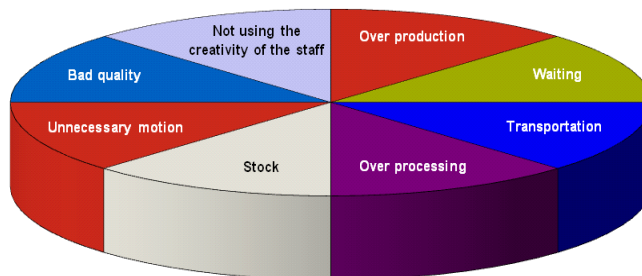
Transcribing a written suggestion into the computer demands an administrator that frequently updates the excel system. With the decisions from the improvement teams' meetings as base the administrator adds the following information to each suggestion:

- Department responsible for execution
- Deadline (week number)
- Status (ongoing/finished)

Before every meeting the administrator checks what ongoing improvements have been concluded and changes the status from “ongoing” to “finished”. Then she/he does the last completion of facts:

- Savings
- Unit of saving (SEK, Hours/week or Work environment)

Figure# shows a sample from the excel based system with some fictitious improvements.



Type of waste	Person handing in suggestion	Department handing in	Current situation (problem)	Improvement (proposal)	Responsible department	Status	Deadline week	Saving	Unit of saving
Stock	Bob Smith	Logistics	Screw #123 i purchased in too large quantities.	Purchase smaller batches.	Purchasing	Ongoing	23		
Unnecessary motion	Patrick McNeil	Heavy assembly	Fork lift drivers drive too long routes.	Optimize fork lift drivers' routes.	Logistics	Finished	19	3	Hours/week
Bad quality	Sarah Howe	Final assembly	Too many faulty parts delivered to final assembly.	Extra inspection before material leaves Medium assembly	Medium assembly	Ongoing	22		
Over processing	Ken Jones	Preassembly	Many purchased parts needs re-painting.	Raise quality requirements on incoming goods	Quality	Finished	18	12	Hours/week
Bad quality	Ken Jones	Preassembly	Workplaces in preassembly not cleaned properly after shift.	Update 5S check-list and make sure it is being utilised.	Quality	Finished	19	1	Work environment

Figure 6.2: A preview of the excel based system which is meant to support the future improvement work at MAU Lidhult.

By having appointments fortnightly team leaders from different departments can check status of ongoing improvements and work cross functionally with other departments. Appointments that are too frequent are not appropriate since operators should not see working with continuous improvements as a burden.

When operators are comfortable with the paper pen method a completely computer based system might be interesting to implement. However, the transition needs to be smooth in order to work, but in the long run it could significantly reduce the administrative burden connected to continuous improvements. The operator with the idea types it into the system and during the next meeting someone completes the suggestion with responsible individuals, deadlines and status.

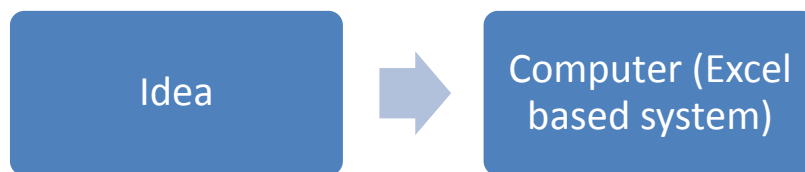


Figure 6.3: A simplified process of going from idea to action. This may be appropriate to implement in time when operators are comfortable with the paper pen method.

Simplicity is crucial to give the organisation boost and engage as many employees as possible. By keeping it simple the firm achieves a good initial flow. A method is to put whiteboards on every department where the individual can anytime write down his or her thoughts. Hence, all potential and ongoing improvements are visual for everyone. Within all improvements there may be those which really make a difference.

“Among all grains of sand corns there might be grains of gold.” (Anders Wibäck, Quality Manager, Cargotec MAU Lidbult)

The advantages with visibility are that the operators can see the status of every improvement and see that they are taken seriously. The whiteboard shows who is responsible for each specific improvement. Thus, it is easier for operators to see in which stage their idea is.

The disadvantages with a system like above are that every issue and possible improvement cannot be explained in detail. A whiteboard have limitations and every idea can only be explained briefly. Thus, a complementary oral description by the idea maker to the other meeting attendees is necessary.

6.2 Further Actions

After implementing this system including continuous improvements on Cargotec MAU Lidhult there are actions that need to be taken. It is crucial to follow up all suggestions. Thus, the concept stays alive. Cargotec wants to implement this concept throughout the whole organisation globally at once. Therefore, it is important to convince all operators that this time is significantly different in comparison to all previous attempts which have failed. Management have to emphasise that in the very beginning to win trust from their employees. When all operators are engaged and lots of improvements are generated more or less this whole concept is self going. In conclusion, further actions are vital to keep such concepts alive.

6.3 Course of Action

To achieve success it is crucial to have a well structured way of working. Clear guidelines and directions are vital to engage all operators to strive towards same goals and targets. By introducing a map with clear guidelines the organisation's way of conducting improvement work will ease lots of labour.

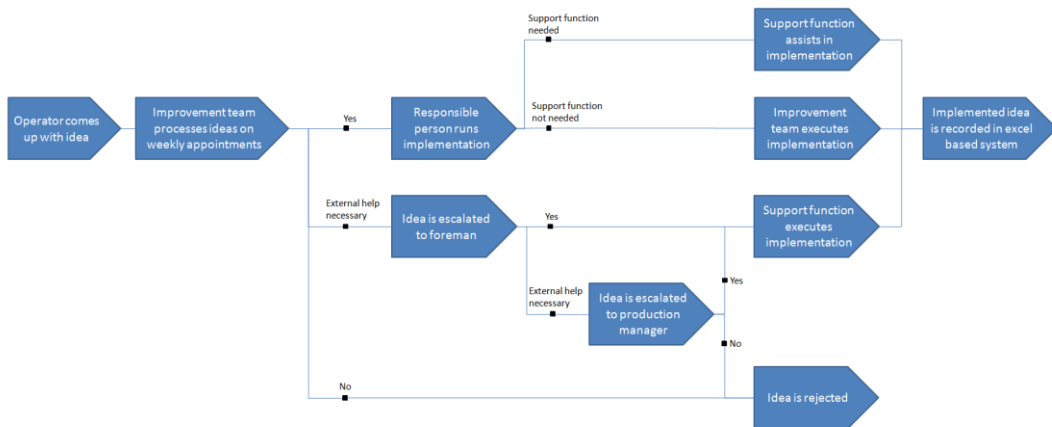


Figure 6.4 Process map clarifies different activities throughout the whole process. An enlarged map may be found in attachment 4.

6.4 The Authors' Contribution to Science

From the literature study the authors early learned that the general opinion about implementation of structured continuous improvements is that there are no universal set up to use. Every company needs a tailor made solution for themselves in order to be successful. It has to fit into the corporate culture; a strictly hierarchic business would not implement continuous improvements in the same way as a flatter organisation would, because empowering the employee is such a fundamental element. One also needs to consider whether the company sells services or goods and how they are being produced. Many factories have a high speed line production where an operator easily can grasp that by cutting 3 seconds in assembly time from every piece produced, there are many hours and lots of money to be saved. Cargotec MAU Lidhult on the other hand is characterised by a slower more manual type of assembly. During the interviews it became apparent that some operators do not believe that there is any point in standardising a new way of assembly which only saves 10 seconds to every cycle. Thus, in such a business management has a bigger challenge in convincing the employees of the effects of many small improvements.

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Attachments

Attachment 1: Interview questions, MAU Lidhult management

As mentioned in the methodology chapter the interviews with MAU Lidhult staff were semi-structured. Here are the questions the authors used as framework for the inquiries:

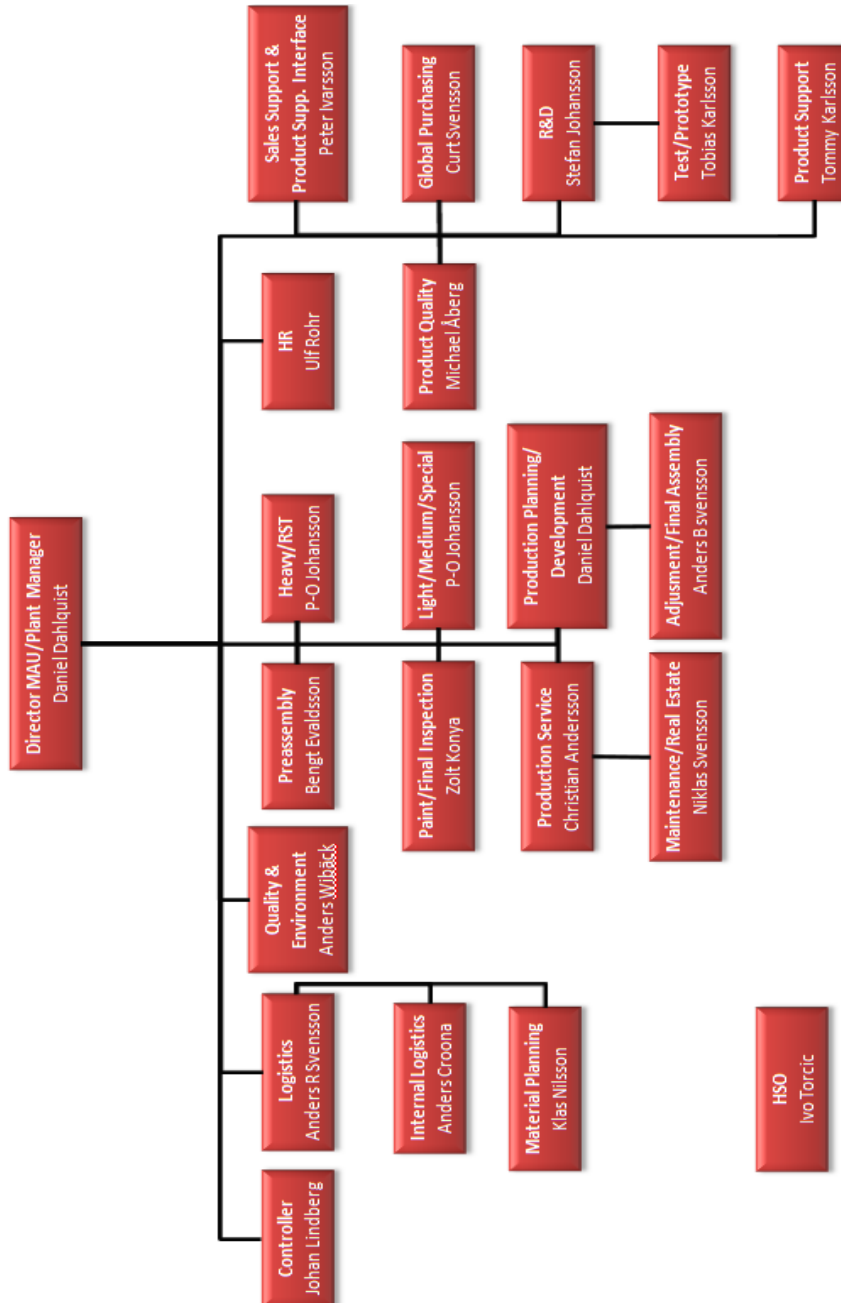
- How would you prefer that MAU Lidhult worked with continuous improvements?
- How do you think routines for collecting, executing and follow up ought to be designed?
- Would all employees have the ability to hand in a suggestion?
- Would employees have the ability to hand in improvement suggestions to departments at which they do not work?
- Should improvement suggestions only be handed in during certain times (such as weekly meetings) or could they be handed in whenever?
- Would everyone to be able to see all the suggestions that are handed in?
- Ought the sheer number of suggestions to be limited? If so, why and how?
- Are there risks in limiting the number of suggestions?
- What are your expectations on an IT based system to support the continuous improvement work?
- What specific demands does your department have on such a system?
- Do you have any ideas for the layout of such a system?
- Would everyone be able to follow the status of ongoing improvements?
- When compiling an IT based system, would you prefer that we use software that already is used at MAU Lidhult (e.g. an excel based system or incorporating it in the current ERP system)?

Attachment 2: Interview questions, MAU Lidhult operators

As mentioned in the methodology chapter the interviews with MAU Lidhult staff were semi-structured. Here are the questions the authors used as framework for the inquiries:

- How ought MAU Lidhult to work with continuous improvements?
- When you get an idea for an improvement, how would you like to pass it on? (Write a note, on a whiteboard, orally etc.)
- Would you like to work cross functionally with continuous improvements?
- What would an improvement team look like?
- What supporting functions would be represented? (Production service, quality, logistics, finance etc.)
- How would meetings be organised? (Who supervises? Frequency?)

Attachment 3: Organisation Chart of Cargotec MAU Lidhul



Attachment 4: Process Map

