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Improving an after-market service by implementing strategic guidelines and process improvements.

A case study of a Swedish defense and
security manufacturing company.

*Master's thesis in Management and Economics of Innovation Programme
Division of Service Management and Logistics*

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MASTER'S THESIS E 2017:079

Improving an after-market service by implementing strategic guidelines and process improvements.

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Abstract

After-market departments are business departments that manage services such as maintenance, spare parts and repair units. After-sale services are additional high-marginal sources of revenue that can increase customer satisfaction and customer loyalty. Hence, functioning after-sale services are important in order to increase a company's competitiveness and retain future sales.

In this research, a case study has been performed where an after-market department has been studied. The after-market department has undergone several organizational changes within recent years where processes and strategic objectives have become absent. Thus, a reenactment of the after-market department and establishing of processes has been incited. The research covers to identify the strategic approach of an after-market department, the current repair process and improvement suggestions within strategy and the repair process.

Throughout interviews, observations, study visits and workshops, several business departments and process participants have been identified to be involved in the repair process every day. To clearly map out the company's current repair process, a cross-functional process map were established and outlined. The repair process has been identified to consist of high variety, persistent repair units where technological and functional errors varies. Hence, efforts are required in order to manage such a wide and complex process.

By verifying and analyzing findings, measurable objectives, responsibilities and lack of process ownership have been discovered as factors that deteriorates the company's repair process. Hence, improvements within these fields has been suggested. The improvements includes to start using measurable metrics related to repairs and the repair process. Suggestion to appoint an operative process owner to maintain the repair process and to establish clear work instructions within the repair process to reduce responsibility uncertainties. The suggestions also included improvement of the repair transportation.

The company's endeavor to reenact a pure after-market business department forces to set and communicate strategic goals within the organization and the department. Clear strategic goals has been found non-existing at the after-market department. Hence, performance objectives and vision are suggested to be established in order to align the employees to strive towards the same goals.

Further areas of research have also been discussed with the case company. These areas includes processes and IT-management related to the repair process and the after-market department. The authors suggests that the offering process, merge of IT-systems and the customer demand should be further investigated as these areas were found to be deficient.

Keywords: Process Improvement, Process mapping, After-market strategy, After-sale services, Repair process

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Abbreviations

A repair: a unit that needs a modification, reparation or an update.

The repair process: The process where all the units, in need of repair, have to go through at the case company.

The service coordinators: The employees working at the after-market department and is handling the repairs from start and finish.

The system testers: The employees working at the manufacturing department where all the units are fault tested in a complete system. In the repair process, the units are passing this manufacturing unit twice. First for the verification of error and secondly, when the repair is repaired and needs to be verified as ok.

FF: Fault found. When a repair is tested and one or several faults are identified.

NFF: No fault found, when a repair is tested and **no** faults are identified.

ERP-system: The ERP-system used by the case company.

Following orders are created in the ERP-system:

CRO: Customer Repair Order: The order where everything is summarized

SO: Shop Order is the order which illustrates the required operations that are needed in the reparation, hence “the recipe”.

CO: A customer order is a demand driven order where all the demands for the repair are reported. (Materials, resources)

NCR: A Non-conformance report is a document where all operations performed is reported and explained.

Offer: The document stating who much the repair will cost and how many days it will take. This document is usually drawn and send to the customer after the first fault test. However, the offer can be revised due to complications that might occur during the reparation. When/if the customer wants to go through with the reparation they will return an order confirmation to the case company.

PM: Project manager.

TAT: Turn-around time.

BFPREP: A customer owned inventory where customers are subscribing for spare parts and desired products.

1

Introduction

This chapter starts with a description of the thesis context and the background of the case company where the thesis was performed. The chapter also contains the purpose, aim and delimitations. It is also clarifying the research questions that will be answered throughout the thesis.

1.1 Context

The industry of original equipment manufacturing is struggling with competition from emerging markets, the rapid evolution of technological innovations, increasing customer expectations, decreasing margins and higher cost (Legnani, et al., 2013). In the late 1980s, the term servitization was mentioned by Vandermerwe and Rada (1988) arguing that organizations can improve their competitiveness by offering services to their customers. Many companies have also realized that value added services can generate additional sources of revenue (Legnani, et al., 2013). Argued by Legnani, et al., (2013) services generally have higher margins compared to selling newly produced products. A study made by Dennis & Kambil (2003) revealed that after-sales services within the manufacturing contribute with approximately 25% of the total revenue, and between 40-50% of companies' profit. According to Mehdi Amini, et al., (2005), offering after-sales services is vital for the company's performance.

After-sales services in a manufacturing company are services offered to customers that involves repairs, spare parts and different types of modifications of products (Mehdi Amini, et al., 2005). After-sale services are complex to manage due to the necessity of allocating resources and supporting both new products and products sold in the past (Cohen, et al., 2006). Hence, it is crucial to maintain and improve after-sale services (Cohen, et al., 2006). It has been argued that there is sparse literature regarding how to strategically create, sustain and make decisions in manufacturing company and after-sales services (Subramoniam, et al., 2010). Hence this research will contribute with insights within the field of after-sale services.

1.2 Background

The thesis has been performed at a business area within a company, which provides world premier solutions for surveillance, avionics and systems to detect, locate and protect against threats. The business area consist of several divisions where, Sourcing & Production is the one of most concern in this master thesis. Sourcing & Production has 380 employees in total, where 200 of them are based in Gothenburg. The Gothenburg site is mostly developing and producing radar systems and laser products but also facilitating all products that need to be modified or

repaired. Throughout the research, the business area within the company where the research is performed, is referred as the case company.

The production, within surveillance, has a typical process structure and layout due to the customized products. Each complete radar system consists of a few number of standardized units and the rest is custom specific, dependent on different functionality and demands from the customer. The case company is offering after-sales services that allow its customers to get support with defected products. There are different types of after-sales services; repair the old unit, purchase a new one, purchase a functioning second-hand unit or replace an un-functioning repair unit by switching it to a unit at the customer owned inventory stock. Depending on the customer's contract, repairs are handled differently, both in time and cost.

However, independent of the customer agreement, the defective items, referred as repairs, are flowing through the same production departments as the newly produced products, called serial production. Therefore, each production department has a mix of spare parts, repairs and serial production, which results in a complex situation. Due to the highly customized products, there are difficulties when planning and repairing these parts. Some units are repaired at the case company and some at an independent sub-contractor. Regardless of the place of repair, the main issues are that there is a long turnaround time and difficulties to estimate the cost of repairs.

Besides the complexity of a mixed production, within the recent years, it has been extensive organizational- and IT-related changes, which has led to further uncertainties within the repair process. There are several new IT systems, which are supposed to increase the ease of administrating and control the repairs and repair process. In addition, organizational changes have been made, where professions in the process have been removed or moved to another department. Hence, it has been expressed and experienced that the repair process needs to be improved and structured in order to reduce the turnover time and meet customers demand.

Due to the complexity of the process and all changes that have been made, the case company has identified a need to improve the process of repairs. The focus was on mapping the current process and suggesting improvements that could streamline and ease the process.

1.3 Purpose and Aim

The aim of this master thesis is to suggest improvements within a repair process, as a part of an after-market department at the case company. The repair process is a process with many activities, people and departments involved which, generates a complexity that needs to be managed. It is of great value for the case company to be able to provide a good service to its customers in order to stay competitive and keep a loyal customer base.

The purpose of this master thesis is to map out the current repair process, identify critical activities and make suggestions in order to be able to improve the repair process and create an after-market strategy. The outcome of this master thesis project is to generate an analysis report and suggestions for future improvements of the repair process.

1.3.1 Research questions

The study will include mapping a repair service process and identify issues regarding the current strategic approach to the repair service. The research ambition is to identify factors that impact the repair service process at the case company and suggest improvements that need to be taken into considerations in order to improve the repair process.

By determining different factors impacting the repair units, this research aims to suggest what improvements that could be taken in order to improve the repair process and how a strategical mindset is important in order to reach success in the after sale service market. To summarize, this research aims to understand;

- 1. How is the current repair process at the case company organized?**
- 2. What is important to consider when improving the case company's repair process?**
- 3. How should the case company's after-market department form their strategy?**

1.4 Scope and delimitations

The scope of this master thesis is to examine the repair process of in-house manufactured repairs at one specific site at the case company. A comparison with two other sites of the case company will be included in the research. By in-house manufactured repairs it means that the study will not include repair units which are outsourced and repaired by sub-contractors. The study will cover the repair process from incoming repair units to finished repairs ready for shipment to the customer. The earlier and later activities in the repair process will not be included in this study. Other relevant activities, such as customer agreements, procurement and warehouse, related to the repair process will also be included and presented in order to get a broader understanding. However, these will not be further analyzed.

The suggested improvements will cover identified key changes to improve the repair process. The suggestions will not cover improvements of repair pricing, offerings or fixed pricing. It is also decided that this study will cover the suggestion of improvements but not the implementation phase.

1.5 Project outline

This report consists of eight chapters, which each of them includes several sub-chapter associated to the subject of matter. The following chapters are included in this research report:

Introduction

This chapter will introduce the reader to the research. The chapter will include information regarding the background, scope, aim and research questions of the thesis. Also, a description of delimitations will be presented.

Literature review

This chapter will present theory, literature and frameworks which have been identified to be relevant to the topic of the research. The literature review will provide the reader with a theoretical view of how to create a successful after-sales service and additional theories on the subject.

Methodology

The methodology chapter is divided into two parts, research methods and research approach. The research method part introduces different methods that can be used in a research project. However, the research approach will outline the methods the authors choose to use and how those methods are applied to this research.

Empirical findings

This chapter presents all the findings that have been collected throughout the research. The findings come from observations, interviews, workshops and it-systems. This chapter is presenting the collected data, without any interpretations from the authors.

Current state- The repair process

This chapter will answer research question 1 by presenting the current state of the repair process at the case company. This is a result of all empirical findings combined into an outlined process map.

Analysis

This chapter is taking the findings and putting them in relation to the relevant literature review. The theoretical review in combination with the findings generates the analysis and in the end, conclusions could be drawn.

Results and improvement suggestions

This chapter is providing the reader with a summary of the improvements suggestions. It answers the research questions and sums up the research in its whole.

Discussion and further research

This chapter is discussing the research result from a critical point of view. It is a discussion regarding possible further research areas that could be of relevance for the case company.

Conclusion

This chapter summarizes all conclusions that have been drawn in this research.

2

Methodology

This chapter introduces applicable methods that could be applied in a research. The chapter is divided into two main parts; research methods and research approach. The first part, research method, presents the methodology behind chosen methods. The second part describes the approach which has been used in this research.

2.1 Research methods

There are two different types of research methods, qualitative research and quantitative research (Bryman & Bell, 2003). Qualitative research covers information which is collected in non-numerical forms. Such forms can be written field notes, interviews, focus groups, video recordings and observations and are based on chosen individual's opinions (Easterby-Smith, et al., 2015). A qualitative approach is argued to be more explorative than quantitative research, therefore, a qualitative research is argued to restrict the use of numerical and statistical comparison (Easterby-Smith, et al., 2015). If a comparison were to be used, a quantitative research approach would be more preferred (Easterby-Smith, et al., 2015). A quantitative research usually aims to collect evidence in a numerical form and usually involves a large number of samples, and quantitative data can be gathered through surveys, structured interview forms, observations and databases (Easterby-Smith, et al., 2015). The two research methods may seem similar in data collection methods, however, it is rather the intended use of the outcome that may separate them (Easterby-Smith, et al., 2015). Easterby-Smith (2015) argues that during recent years it has become more popular with a mixed method of data collection methods, meaning that both quantitative and qualitative methods are used in the same research. By mixing data collection methods, the research may increase in validity and generalizability of the result (Easterby-Smith, et al., 2015). One approach of mixed data collection is a triangular approach, called triangulation. Triangulation means that data collection methods can supplement each other in order to reveal the truth from different perspectives (Bryman & Bell, 2003; Easterby-Smith, et al., 2015).

Qualitative data can be analyzed in several different ways (Easterby-Smith, et al., 2015). Two common analysis approaches mentioned by, Easterby-Smith (2015) are content analysis and grounded analysis. Content analysis is a good approach when testing pre-set hypotheses and theories, or building new theories (Easterby-Smith, et al., 2015). According to Easterby-Smith (2015), grounded analysis can be considered as a more "open" approach as the researchers tend to sympathize with research participants and tend to build theories generated from the data (Easterby-Smith, et al., 2015). Grounded analysis tends to be more open to new findings and to understand the meaning of the findings in the specific context (Easterby-Smith, et al., 2015).

A case study is a study which focuses on one specific, or a smaller number of companies, activities or individuals over time (Bryman & Bell, 2003; Easterby-Smith, et al., 2015). A case study can either be used in order to study a specific phenomenon or a comparison between similar phenomes in different settings (Easterby-Smith, et al., 2015).

2.1.1 The process of process improvement

One way to address and manage processes is to apply the Business Process Management Lifecycle mentioned by Dumas, et al., (2013). The Business Process Management (BPM) Lifecycle follows six steps in order to manage processes, illustrated in Figure 1. Dumas et al. (2013) argue that large processes which involve several operations within the organization are harder to manage and that there is a trade-off between manageability and impact. The feasibility of managing the process may be influenced by previous initiative changes that have failed and the cooperation of the people involved in the process changes.

Step 1. Process Identification

The first step of the BPM Lifecycle is to identify which process that needs to be improved. Some processes are more strategic important than others and some may be showing recurring problems. To assess a strategic important process it requires that the organization has clear and specific goals of their strategic course. It is also argued that in order to determine a dysfunctional process, the organization needs quantitative performance of each individual process to determine which process to assess. The process that should be addressed is the process which generates most strategic value or has the highest recurring problems, or both.

Step 2. Process Discovery

The second step is to create an understanding of the process by gather and organize information. The information of the process can be gathered by using three methods; Evidence-based discovery, Interview-based discovery and work-shop based discovery. Evidence-based discovery can include three different methods; Observations, document analysis and automatic process discovery. The process discovery step also includes mapping the process and the activities and evaluating the quality of the findings.

Step 3. Process Analysis

The third step of the BPM Lifecycle focuses on analyzing qualitative and quantitative findings made in the previous step by using several different analysis methods. The three process performance dimensions are time, cost and quality. The analysis highlights what parts of the process that are more critical to improve than others.

Step 4. Process Improvements

The fourth step performed in order to identify changes and suggest improvements to reach higher or preferred performance and become more efficient. Several improvements could be suggested, analyzed and compared to be able to make it suitable with the chosen metrics of performance. The result of this step is often the “preferred” process which is the plot for the next step, process implementation.

Step 5. Process Implementation

The fifth step is the step of taking the actually suggested improvements into practice. This step includes two parts; process automation and organizational change management. Process automation refers to improving and changing the IT-systems in order to improve performance. Organizational change management refers to the planned activities which need to be able to change the employees work.

Step 6. Process Monitoring & Control

The last step of the BPM Lifecycle is to monitor and control the changes and to verify the outcome of the changes. During this step, new issues could be identified which creates further process improvements. This means that the cycle starts all over again by continuously improving the processes.

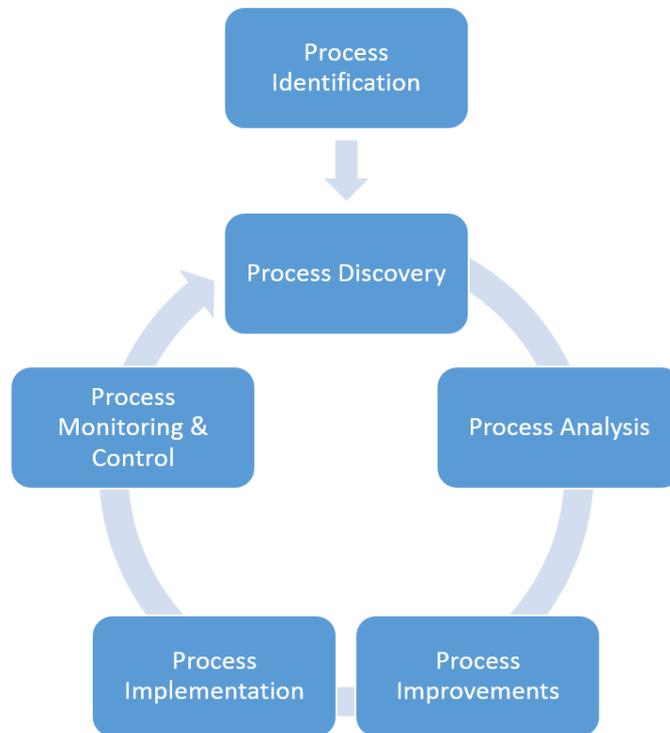


Figure 1- Business Process Management Lifecycle - Modified from Dumas, et al. (2013)

2.2 Data collection

There are several different types of data collection methods which could be used in order to perform a research. In the following sections, the methods appropriate for a research will be presented.

2.2.1 Literature review

A literature review is partly conducted to help the researcher create a deeper understanding of the subject selected for the research (Easterby-Smith, et al., 2015). It is also an opportunity for the researcher to identify, analyze and present what is already known and researched regarding the chosen subject (Easterby-Smith, et al., 2015). It is also argued by Easterby-Smith, et al (2015), that if a literature review is conducted properly and is well-written, it increases the chances of framing the research in a relevant way and also help to define the specific topic

focus. Different types of literature reviews mentioned in the book written by Easterby-Smith, et al (2015) are stand-alone reviews, which are reviews published as a separate article, and reviews which are a part of a larger research as a start or introduction.

Two different literature review types mentioned is; traditional literature review or systematic literature review (Jesson, et al., 2011; Easterby-Smith, et al., 2015). The traditional literature review is commonly presented as a summary of chosen literature, which is considered, by the researcher, to be the most relevant (Jesson, et al., 2011). If choosing to perform a systematic literature review, the researcher tries to find, analyze and sympathize all relevant literature on the chosen topic (Petticrew & Roberts, 2006; Easterby-Smith, et al., 2015). A literature review can be defined as the action of reading literature regarding the research subject, or the choice of literature which the project aims to work with (Easterby-Smith, et al., 2015).

2.2.2 Interviews

It is argued by Gill, et al., (2008, p.292) that *“The purpose of the research interview is to explore the views, experiences, beliefs and/or motivations of individuals on specific matters...”* Independent on the structure of the interview, the method is appropriate in the following circumstances (Easterby-Smith, et al., 2015).

- When the aim is to create a greater understanding of the interviewee’s situation.
- When it is of importance to create a base by an understanding of the interviewee’s opinions or thought about a specific area of matter.
- When the situation does not have a clear step-by-step process and might be of high confidentiality.

There are several types of interviews where three different types are the most frequently used; structured, semi-structured and unstructured interviews (Gill, et al., 2008). Structured interviews are mostly conducted with a strict questionnaire, and no extra room for follow up questions or side tracks, therefore, this type of interview is easy to administer and make clarifications with (Gill, et al., 2008). The semi-structured interviews are structured with a few key questions, which forms the frame for the interview, but is also open for going into sidetracks and follow-up questions that might lead the interview in a new direction (Gill, et al., 2008). Semi-structured interviews are considered to be the most important way of conducting interviews due to its ability to analyze the outcome (Gillham, 2005). Unstructured interviews are determined as very time-consuming and difficult to both organize and participate in (Gill, et al., 2008). There is not a predetermined questionnaire, rather open-ended questions without a structure, where the interviewee could find it confusing or difficult to find the meaning (Gill, et al., 2008).

Trailing is a method described as being the first attempt for the researcher to test and practice the written questionnaire on someone who will not be a part of the chosen interviews (Gillham, 2005). The person who is participating in the trailing session should preferably have knowledge of the area in order to be able to give relevant feedback on the questions and the structure of the interview (Gillham, 2005).

The factor of becoming biased when using interviews as data collection methods is considered to be a crucial factor that needs to be dealt with correctly (Easterby-Smith, et al., 2015). In-depth interviews are aiming to create an understanding of thoughts and opinions and somewhat opens up for the biased facts (Easterby-Smith, et al., 2015).

2.2.3 Observations

During the literature review, the authors concluded that observations have been found to be defined in many different ways dependent on the setting of the observed situation. However, a well-known definition, written by Gorman & Clayton (2005, p.40.), stated that observations are studies that “*involve the systematic recording of observable phenomena or behavior in a natural setting*”. According to Easterby-Smith, et al. (2015), it is not very common to use observations as a data collection method in a business and management research. However, they also state that it could be very useful when studying teamwork, managerial issues and soft factors.

There are different types of observations; complete observers, observers-as-participants and participants-as-observer. (Easterby-Smith, et al., 2015). The complete observer means that the observation is conducted on distance and no interaction is performed (Easterby-Smith, et al., 2015). The observers-as-participants is defined as an observation where the researcher is a participant, but try to not affect the situation at all (Easterby-Smith, et al., 2015). The third one, participants-to-observers, is also explained by Easterby-Smith, et al (2015), to be a more engaged participant. The fourth one, complete participant, is explained to be a regular employee or a consultant, with a full focus on participating (Easterby-Smith, et al., 2015).

2.2.4 Workshops using focus groups

According to Sork (1997), a workshop is an active, hands-on learning session where participants interact and collaborate with each other to increase their knowledge within a specific field. A focus group is a group composition of individuals with a relation to a chosen area of research (Gill, et al., 2008). Participants should be selected based on their relation to the topic in order for them to provide insights and opinions. (Krueger & Casey, 2015). According to Gill, et al., (2008) the group formation is very important since the interactions among the group members are the key factor when trying to create a productive workshop. Group members which have previous relations to each other may be more productive since the members are more comfortable with each other and dare to challenge each other (Gill, et al., 2008).

According to Krueger & Casey (2015), focus groups can be used for planning, decision making, advising and learning. Its purpose can be to suggest ideas, clarify potential options or to evaluate findings (Krueger & Casey, 2015). It is also used as a tool for planning, setting goals and developing organizations by trying to understand the employee’s concerns and ideas (Krueger & Casey, 2015). According to Gill, et al., (2008), focus groups can be used to clarify or question data that has been collected through other methods. Focus groups can be motivational and productive, but also un-productive and time-consuming (Krueger & Casey, 2015). Waste of time is mostly dependent on two factors; unclear purpose and inappropriate processes (Krueger & Casey, 2015). Hence, it is important to plan the workshop (Krueger & Casey, 2015).

According to (Krueger & Casey, 2015) workshops should be considered when the researcher aims to;

- Understand a range of opinions, perceptions or ideas of the focus group.
- Understand the differences or similarities between different groups of people (business departments)
- Merge knowledge from different groups of people in order to generate new ideas.
- Identify factors which are influencing employee's motivation, or opinions.
- Pilot-testing

Focus groups are based on people's experiences, knowledge and understandings, which makes it important to consider that emotions and irrational thoughts could become a part of the result (Krueger & Casey, 2015). It is important to consider the fact that people might have a preconception against either the subject, other participants or the workshop leader, which could influence the involvement or attitude during the workshop (Krueger & Casey, 2015).

2.2.5 Process mapping methods

It is important to understand the process from input to output (Martin & Osterling, 2012). Process mapping is used to visualize process steps, workflow and activities. The visualization helps to clarify the process steps necessary to conduct a specific process and is easy to communicate to all stakeholders (Damelio, 2011). As processes can be fragmented from core processes to sub-processes, the process map can differ in the level of detail (Boutros & Purdie, 2014). The detailed process map of each sub-process can be kept up-to-date as the process changes (Dumas, et al., 2013). According to Harvey (2015), process mapping is a key deliverable and without a visualization of the process, it is impossible to analyze it properly.

2.2.5.1 Cross-functional process mapping

A cross-functional process map, or a swim lane diagram, is a process map which clarifies both the flow of the process and which work center that is responsible for the specific activity (Damelio, 2011). A swim lane diagram consists of lines drawn between the different work centers or business units, which separates and clarifies which work center that is carrying out the activity and when in the process it occurs, see Figure 2 (Damelio, 2011).

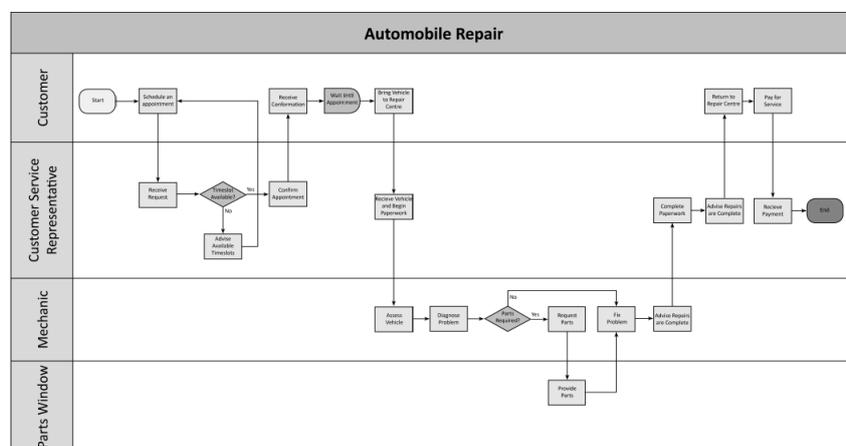


Figure 2- Example of cross-functional process map (Boutros & Purdie, 2014, Chapter 2)

2.2.6 Quantitative Data Collection

Quantitative data is gathered either through primary data collection using surveys and observations, or secondary data sources such as existing databases (Easterby-Smith, et al., 2015). Primary data may be more suitable for the research since data can be collected to match the need of the research and the quality of the data can be guaranteed (Easterby-Smith, et al., 2015). Secondary data sources may be more time-efficient, however, the quality of the secondary data may be questionable since the researcher do not have the control over how the data was collected, nor if the data is correct (Easterby-Smith, et al., 2015).

2.3 Analysis method

This section presents the chosen analysis methods and its methodology.

2.3.1 Affinity- Interrelationship method (AIM)

The affinity-interrelationship method, AIM, is a problem-solving tool for analyzing qualitative data (Alänge, 2009). The method was created by combining two of the seven management tools, affinity diagram and the interrelationship diagram as well as it was inspired by a method known as; “step-by-step” by Shoji Shiba (Alänge, 2009).

The method includes ten essential steps, which makes it a method easy to follow and perform as a beginner in qualitative analysis (Alänge, 2009). There is an AIM- instruction where detailed information about the method and its criteria’s are presented (Alänge, 2009). This instruction includes information regarding, how many people that should attend, how the layout of seating should be placed, how to write on stick notes and how to combine data etc. The AIM does not always end up with a solution or a result of the written issues or question (Alänge, 2009). However, it often generates an analysis and creates a common understanding and greater knowledge of the regularly complex issue (Alänge, 2009).

2.3.2 Cause- and- effect diagram

The cause and effect diagram, also called Ishikawa or fishbone diagram, is an analyzing tool to simplify and visually define problems and issues that impact the chosen area (Maylor, 2011; Dumas, et al., 2013; Bhasin, 2015). Issues are found and categorized into either, self-selected project specific categories, or with pre-set categories such as the 6M; Man, machine, measurement, methods, material and Milieu, can be used (Dumas, et al., 2013). The major issues can be further divided into smaller causes and problems, which can be broken down even further if necessary. The degradation is completed when the major issue has been broken down to an understandable level of detail and when the user is satisfied with the result and the causes (Maylor, 2011; Bhasin, 2015).

Once the degradation has been completed, the root-cause to the problem can be identified (Bhasin, 2015). The root-cause is the single bottom issue that has a negative impact on the overall problem (Bhasin, 2015). The root-cause may also show up several times in different issues (Bhasin, 2015).

2.3.3 Categorizing and coding

As volumes of qualitative data are gathered, it may be difficult to find a systematic and useful way to analyze such amount of unstructured data. Hence, open coding can be used as an analysis tool (Easterby-Smith, et al., 2015). Coding is a method used when qualitative data needs to be classified, reorganized, find patterns and when categories need to be found (Saldana, et al., 2011). The categories are sets of codes and a collection of findings, which are similar or related to each other (Easterby-Smith, et al., 2015). The codes is usually words, sentences or short phrases (Saldana, et al., 2011)

2.4 Research approach

In this study, qualitative research methods were used for both the data collection and analysis. However, a small part of the data collection and analysis was based on quantitative data, such as statistics and numbers, collected from the company's IT-systems. The mix of using both quantitative and qualitative approaches combined created a better general picture, where for example the quantitative research became the ground when choosing a subject for the qualitative research approach (Blaxter, et al., 2010). The thesis has also been using a triangular approach, by including three sorts of methodologies. Triangulation is argued to be appropriate to use in research when trying to increase the assurance of the accuracy of the data (Easterby-Smith, 2015). This research have applied triangulation, as seen in Figure 3, by collecting data through;

1. Qualitative data sources, such as in-depth interviews and observations with people involved in the repair process.
2. Secondary data sources, such as books, articles and journals.
3. Collecting and validating data through workshops and study visits with employees at three different sites at the case company.



Figure 3- Illustration of how triangulation was applied in this research

The research started with performing a literature review as the first type of data collection. It was conducted in order to create a better understanding and a base for further analysis. Both frameworks, relevant theories and methods regarding processes and after-market was identified and used further on.

To understand the subject of the master thesis, observations and interviews with repair related business departments were conducted in an early phase of the research. The data created a deeper understanding and became the foundation for further interview/question template. The next phase of data collection was primarily further interviews and workshops, both informal and formal, and constitutes the largest part of qualitative data to address the critical phases of the repair process. Quantitative data, such as lead times, the cause of delayed repairs and number of repaired units, was gathered by collecting former statistical data from the case company's ERP-system and databases.

The data that was collected through literature review, observations, interviews, workshops and databases provide the foundation to visualize a cross-functional process map of the current situation. The process map was further analyzed and resulted in a clearer understanding regarding issues and hinders in the process.

To analyze the data that has been gathered and mapped, different analysis tools were used. The qualitative data was firstly categorized and became the base for a cause-and-effect diagram. This step generated a deeper understanding of the problems and root-causes for each issue.

When analyzing the quantitative data collected from the IT-systems, there was a focus on the time perspective, comparing the total lead time (time spent in the repair process, usually measured in days/hours) and the actual time spent on repairing the unit, accumulated time (measured in hours). These two parameters compared to each other made it possible to identify the most time-consuming activities and cause of the delay, due to the information that was found in each unit's process log. The analysis resulted in conclusions, regarding different areas of the process and these conclusions were processed into alternative improvement suggestions.

The different methods were used in serial and parallel in this research. However, some methods were used more than others, which is illustrated by the size of the circle illustrated in Figure 4.

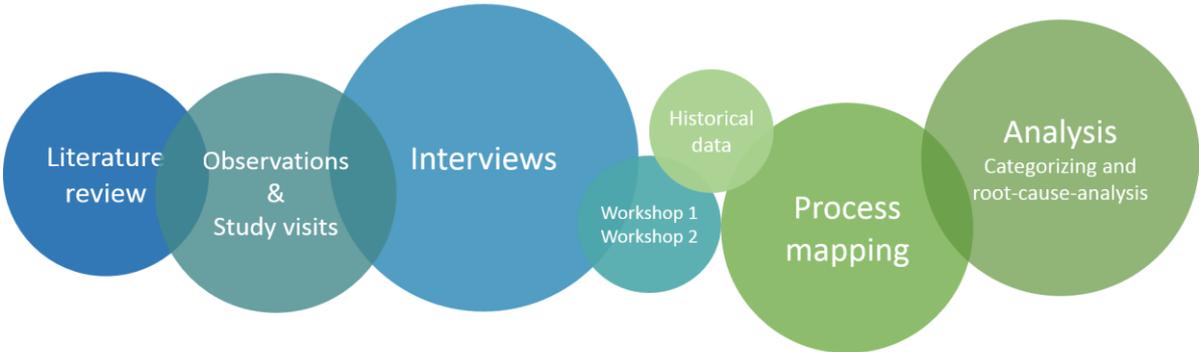


Figure 4- The research method journey.

2.4.1 The research process

The master thesis has partly followed a research process in order to understand and create suggestions for improving the repair process. The research process was presented in the research methodology and formed by Dumas (2013). The following steps have been used in this master thesis:

Step 1. Process identification

The case company presented what process they wanted to be the focus during this research; an after-sales repair process. The process was identified as a “slow and inefficient” process, hence, was in need of improvements. The repair process was considered to be a process which could affect the business greatly if getting an increase in its performance.

Step 2. Process discovery

This step included the part of collecting and organizing information about the process to create a greater understanding of the process. It was collected through observations, interviews, study visits and workshops. All data that was collected was gathered and formed a process map, the current state.

Step 3. Process analysis

This part of the research consisted of performing an analysis on all the collected data. To do this, different methods were used; Categorizing, Cause-and-effect diagram and Affinity-interrelationship model (AIM).

Step 4. Process improvements

This part is consisted of suggesting the improvements for the case company. This was done during the research, but mostly at the end of the research and the final presentation.

2.4.2 Literature review

In order to create knowledge, a literature review was performed. The literature review consisted of theories and frameworks within the chosen area of research, and by using that as a base, the empirical findings and results became more trustworthy. The data gathered in the literature review was collected through scholar databases, such as Chalmers University Library (online), Google Scholar and ScienceDirect. The data was collected through relevant books borrowed from Chalmers Library. The literature review had the focus on after-market services, measurements and metrics, process improvement, process management, process mapping and strategy.

To find inspiration for the scope of the project, previously written reports and research articles within the same area of the subject was read. Understanding different methodological approaches and finding applicable articles created a general knowledge that added value to the research. Also taking part of former studies conducted at the case company and previously made analyses made on the repair process formed an understanding of the topic.

2.4.3 Interviews

The data from the interviews constitutes the largest part of total collected data. Interviews were conducted already from the second week of the project, however, those interviews were of a more informal character, in order to clearly understand the repair process, what the study would include and how to frame the research in a relevant way.

Throughout the study, interviews have been planned and conducted in a structured, scheduled order. The order of interviews was carefully considered dependent on the interviewee's role in the process. Therefore, the employees that work early on in the process were interviewed in the beginning and the process participants who operated later on in the process were further interviewed. One exception was the top-level managers at the production site, who were interviewed two weeks into the study, due to a wish that the knowledge that could be gained from those interviews would be important and relevant when continuing to interview the employees within the process. The choice of employees to interview was made due to the involvement in the repair process. The interviewees were also chosen by recommendations made by department managers. The after-market manager and the business developer were the supervisors of this master thesis and there was a close collaboration with both of them during the whole research. Due to daily discussions and collaboration, it was considered not necessary to formally interview them. The organizational structure, of the people involved in this research, is illustrated in Appendix A. The employees whom where interviewed is illustrated in Table 1 below:

Table 1- Number of interviews conducted, at the case company, during the research

Employee position:	Number of interviews:
Coordinators	6
System tester	4
Production planner	2
Procurement	1
Sub-project manager	1
Production department manager	3
Manufacturing manager	1
Supply Chain manager	1
Production manager	1

To get the most out of the interview, the interview template was carefully prepared and adjusted to be able to correctly analyze the data. The interviews were conducted in a semi-structured way, with a pre-developed questionnaire and open-ended questions. There was a trialling of the interview questionnaire conducted with the manager of the after-market department. This was made in order to test the questions and have the chance to rewrite and tweak words and phrases to ensure understandable and relevant questions. This was done in order to validate the relevance of the questionnaire. All interviews were performed by the two authors, where one of them was asking the questions and the other one was taking notes.

The pre-developed questionnaire, see Appendix B, was used as a template and was the foundation in the interview. However, side tracks were encouraged throughout all the interviews. The questions were formed in a broad and open way in order to let the interviewees' competencies and knowledge steer the conversation instead of making the questions deciding the direction of the discussion. The questionnaire was developed after the literature review was done, due to the fact that a more thorough understanding of the subject was collected. The questionnaire was developed in order to analyze and compare the result of each interview. There were minor changes in questionnaire dependent on the interviewee's role and relation to the repair process. These changes were carefully considered due to the complications that could occur if the questions were too different and not create the ability to compare the results from different interviews.

Each interview was summed up by shortly repeating the discussed subjects to get the chance to add additional data if anything was forgotten during the interview. The interview was ending with a task, which the authors kindly asked the interviewee, to do after the interview was finished. The task was to create a flowchart of the process, and to mark experienced, bottlenecks and/or streamlined parts of the process. This task was handed out for the authors to get visual data on what the interviewees know about the repair process and clarifications of issues and/or favorable activities, see Appendix C.

Interview with management

The interviews conducted with the top management were performed to understand the "bigger picture" and get a more holistic view of the process and its connections to the overall supply chain. The interviews did not concern any specifics or details about the repair process but rather the impact it has on the supply chain and different production departments. The logic behind the choice of interviewing top management early on was that it could increase the knowledge and understanding strategies and goals from a larger perspective. Hence, provide the authors with better analytical approach before interviewing employees working in the repair process.

Interview with people daily involved in the process

The interviews conducted with the employees daily involved in the process resulted in the largest amount of data collected. When choosing employees to involve in the data collection, the decision was based on knowledge and position the employee possessed. The selection of employees was also a discussion with the managers in each department to get the most appropriate employee with relevant knowledge. The selection of interviewees was based on their knowledge and relation to the repair process.

2.4.4 Observation

The observations that have been a part of the data collection has mostly been attending different meetings, such as; morning meeting, strategic meetings and after-market department meetings, to be able to understand the actual process as it is performed in the daily work, and not the "paper-version" or planned process. The meetings were chosen, due to its agenda and associations with the repair process, in collaboration with the supervisor. Each part of the

process has been observed during the same time period as the employees in that department were interviewed. During the research, the authors attended to daily morning meetings during ten weeks. After these weeks the authors only attended one day per week, when repairs were the focus. The strategic meeting occurred ones a week and the authors attended three weeks.

Observations were important due to its ability to create a “common knowledge” about the subject of the research. The data was collected mostly through notes, but also quick sketches, due to the existing prohibition against photography.

2.4.4.1 Study visits

Further observations were made during study visits at two of the case company’s production sites where after-sale services and reparation is performed. The study visits were planned in order to collect data from the two sites after-market departments and understand how their repair process worked. The data from the study visits were also used for a comparison between the three sites.

2.4.5 Workshop 1

The workshop was conducted to jointly create ideas of how to improve the physical transportation in the repair process and to share knowledge among the process participants. The workshop was also conducted to verify previous findings in the research. The workshop was led by two workshop leaders, the authors of this research. The authors presented the exercises and kept track of time for each exercise, while the members discussed and analyzed the subject. Before the workshop was performed it was trailed with the after-market manager, to confirm the agendas relevance, see Appendix D for workshop 1 content.

The workshop included twelve people, who were divided into three focus groups. The focus groups were previously set by the workshop leaders in order to divide the expertise as evenly as possible among the groups. The members consisted of people from business departments that are affected by and operates with repairs. The workshop consisted of three service coordinators, four system testers, one business developer, two production planners and two sub-project managers, see Table 2. The workshop was designed not to include any managers since the input from those who work hands-on with repairs was preferred and not the upper management perspectives. Almost all members were familiar with each other from the beginning. The material provided were pencils, color pens, post-it notes, tape and A3 papers.

Table 2- Amount and position of participants in workshop 1

Employee title	No. of participants
Service coordinator	3
System testers	4
Business developer	1
Production planner	2
Sub-project manager	2

The workshop was one and a half hour and designed to consist of four exercises, illustrated in Figure 5, below. Each exercise was timed so that all exercises could be performed within the given time-frame. The first exercise was a five-minute exercise where the members were asked to individually during one minute, write post-it notes of why and to whom repairs are important. After one minute the members were asked to share and discuss their notes with the group members for four minutes. The exercise was done in order to stimulate the member’s minds and to reflect upon why repairs are important. It also got the members to start to discuss their thoughts within the focus group.



Figure 5- Illustrating the agenda for workshop 1

In the second exercise, the focus groups were asked to, during ten minutes, draw the current repair process. The process maps were to include for example; who is responsible, what IT-system that were used and what documents that were needed for each activity. The exercise enabled the group to jointly discuss the current process, communicate and draw the current state. After the ten minutes, each group was asked to present their map for the other two groups. This allowed all groups to get insight from each other’s findings.

In the third exercise, the members were asked to individually, during three minutes, write down issues or difficulties that they personally experience in the current process. After three minutes, the members were asked to share and discuss it with the rest of the members in their focus group. The discussion was continued for seven minutes so that every member had the opportunity to share their opinions.

In the fourth exercise, the focus groups were asked to, during 15 minutes, create new ways of working that could solve the issues that they had presented in the earlier exercise. The focus groups were encouraged to be creative when addressing the issues. After the 15 minutes, the focus groups were then asked to, during five minutes, present the new process for the other two groups. After the presentation, the other groups gave feedback, asked questions and discussed solutions with all three group involved.

After each group had presented their new solution and when the discussions were ended, the workshop leaders asked all members to give direct feedback of the workshop.

2.4.5.1 Validation of workshop 1

The findings generated from the focus groups in workshop 1 were compiled and presented to two upper management groups at two different times. The first management group was the production manager and his team that consisted of department-managers and assistants. The second management group was the sub-management group within the supply chain management department. The same presentation was held at each management meeting. At both meetings, the presentation rather became a discussion between the authors and the managers where findings were further explained and evaluated.

The presentations resulted in that the authors were asked to further establish a supporting document of the responsibility of the transportation within the repair process, as well as clarification of the inbound and outbound shelves in the repair process, see Appendix E. The document was then communicated to all workshop participants for verification, feedback and validation before a final document was sent to the after-market department manager for further actions (see Figure 17).

2.4.6 Workshop 2

Workshop two was focusing on performance and strategic goals in the after-market department. It was conducted to verify previous findings of the case company’s strategic approach at the after-market department and to create possible future strategic goals. The workshop was also held in order to inform the after-market department members about the importance of strategic goals and performance. The workshop was designed to generate ideas and it was inspired by the affinity interrelationship method (AIM), with the use of focus groups and were led by two workshop leaders, in this case, the authors. The workshop was trailed with the after-market manager and approved to be performed. See Appendix F for workshop 2 content. The workshop included 15 people from the case company’s after-market department from three different sites, six people from site 2, two people from site 3 and seven people from the site 1, where the research was performed, illustrated in Table 3. Eleven of the participants in the workshop had similar work descriptions, service coordinators. The other four participants consisted of an after-market manager, one business developer within after-market and two newly arrived master thesis students who focused on the repair process of another site.

Table 3- Amount and position of participants in workshop 2

Employee title	No. of participants	Site
Service coordinators	5	1
Service coordinators	4	2
Service coordinators	2	3
Business developer	1	1
After-market department manager	1	1
Thesis students	2	2

The workshop was a two-hour session, designed to consist of one pre-exercise and three timed exercises, where the second exercise included four sub-exercises, see agenda in Figure 6. The material provided was A3 papers, post-it notes, color pens, tape and pencils. The workshop leaders divided the participants into four groups. Each group consisted of a mix of people from the different sites, so that knowledge and characteristics from each site could be shared and discussed within each group. Some members knew each other from the beginning and some members were new to each other. Since some people were unfamiliar with each other, a pre-exercises were held before starting the workshop. The pre-exercise consisted of a short individual presentation of each member and an exercise where the members had to place themselves in order to how far away they lived from the site where the workshop was held.



Figure 6- Illustrating the agenda for workshop 2

The information briefing was held by the two workshop leaders in order to present themselves and inform the participators of the importance of strategic goals and performance. The briefing was held to quickly educate the participants. The presentation was about ten minutes. The briefing was built upon SMART-goals, described in section 3.4.1, on how to set performance and strategic goals as these are easy to understand and mediate.

The first exercise was a discussion exercise, where each focus group was asked to write down and discuss what performance and strategic goals the after-market department has today. The focus groups were instructed to visualize performances and goals from the perspectives of the customer, the individual and the company.

The second exercise was a brainstorming exercise, inspired by the AIM, where each participant was asked to individually, during five minutes, generate and create goals and performances on post-it notes which they thought could be important and relevant. The focus groups were asked to, during ten minutes, discuss each participant's suggestions and give feedback to each other. After the discussion, the focus groups were asked to, during seven minutes, categorize their goals and performances and present the categories to the other focus groups. After the categorization, each participant was asked to distribute three points to the performances and goals which they found most relevant or important.

During the third exercise, the focus groups were asked to, during ten minutes, jointly generate goals and performances, which could be shared and communicated among the sites. Then, the focus groups presented their generated goals to the other focus groups.

2.4.7 Historical data

In order to know how many repairs that were handled at the company each year, turnaround time of each repair, effective time spent on each repair, cause of delay and most recurring repairs, the authors collected secondary quantitative and qualitative data from two IT-systems, the log system and the time. The data consisted of all closed customer owned repair orders, two years back in time. The reason for choosing a two-year span was due to that the repair became traceable when the case company changed the after-market IT-system, otherwise, a longer span would be preferred. When the data was extracted to Excel, the authors could sort out the number of repair units, most recurrent repair units and the turnaround time of each repair unit. The accumulated effective work time of each repair unit was manually extracted from the second IT-system. Due to the impossibility to extract data for only repairs, the authors had to manually search for the accumulated effective time on each specific repair unit. Hence, the authors choose to deepen the research into the seven most recurring repairs and choose only the best two or three best and worst case of each repair unit. The cause of delay could also be extracted from the first computer system, however also only manually in text-form. The cause of delay was

collated with the specified recurring repair units in a final document. The final document included 53 repairs that were deeper analyzed and consisted of the following factors:

- Opened and closed repair orders over the last two years
- The ten most recurring repairs
- Two to three best and worst case scenarios of each repair unit
- Cause of delay or cases of best practice.

Since many of the repairs included activities that were outside the research limitations, such as sub-contractors, seven repair orders were refined and further analyzed, as can be seen in Table 11.

2.4.8 Process mapping

Process mapping has been a widely used tool in many different context and settings during this research, some of them in simpler versions than others. Process mapping has generated a better understanding of the existing repair process from different perspectives. In the beginning of the research, the authors wanted to get a better understanding of the existing repair process. Therefore, each interviewee was asked to sketch and provide a process map of the repair process, based on their knowledge and perspective of the process. The process maps were then collected and could be further analyzed in order to get a deeper understanding of the existing repair process, illustrated in Appendix C. Not all interviewees fulfilled the task, but the authors considered the amount of process maps that were handed in to be enough to get a broader understanding of the process. In total, eleven process maps were gathered.

During the research, existing process maps created by the case company was gathered and analyzed. The existing process maps were collected through study visits, meetings and through the case company's intranet. The process maps enabled the authors to understand the repair process, both at the site targeted for the research, but also in comparison to other sites.

Process mapping was also used as a tool to communicate the repair process with the focus groups during the workshop. During the workshop, the focus groups drew the current repair process which then enables them to point out areas of interest within the process and also clarify specific parts which were unclear to others. Process mapping was also used to visualize and generate a new process during the workshop.

A cross-functional process map was used to generate the current state of the company's repair process. The current state process map visually explains the different step, activities and relations within the repair process.

2.4.9 Analysis

The analysis of the interviews was performed by categorizing the data and trying to find patterns and similarities. Different interviews were analyzed with different approaches. The analysis performed on the data collected by the interviews with the service coordinators was decided to be handled as one source of information. The coordinators have the same position and work tasks and the relevance of describing the collected data separately was eliminated. There were

a common understanding and opinion and the authors did not see the point in describing each coordinators opinion separately. Therefore, in the chapter of empirical findings, there is an aggregated version of the coordinator's data. This procedure was used when analyzing the data that came from employees within the same department and equal employment position.

On the other hand, when analyzing the data provided by the managers, it was decided to analyze it separately and present each managers point of view in the empirical chapter. This decision was taken based on the fact that there was a great differ in the managers' positions.

2.4.9.1 Categorizing

The data collected through interviews at each business department showed similarities when compiled, hence, the findings were categorized with headers related to the nature of the issue. See Appendix G for categorized interviews. All interviews with employees within the same business department and equal job descriptions were therefore categorized. For example, the interviews with the coordinators revealed similar findings, hence, all interviews were categorized into specific areas of issues. The same went for production department and the system testing department. However, the interviews with the managers were more unique with different perspectives and responsibilities and were not categorized. The categorization made it easier for the authors to compile a large amount of data and point out specific areas of interest.

2.4.9.2 Cause-and-effect diagram

The cause-and-effect diagram was used to visualize and analyze findings from interviews, observations and workshops. The Ishikawa diagram was designed to address the issue of what factors that negatively affected the repair process. Since there were no clear commonly categories of all the findings made from the data collection, the diagram was designed by using the structure; Man, Machine, Management, Measurement, Material and Method, where milieu was replaced by management since it was considered to be more appropriate in this case. The issues which have been discovered through interviews, workshops and observations were distributed into the diagram under of the 6M's, illustrated in Appendix H and Appendix I. The issues were then further degraded into more specific details or root-causes. The result from the Ishikawa was then introduced and discussed with the supervisor at the case company. The authors then choose to further investigate the factors that had become re-occurring or evident as critical issues during the research. The factors were presented to the after-market manager, the supervisor, and jointly agreed upon which were to be further analyzed.

3

Literature review

The master thesis has its roots in the literature of after-sales services and continues with literature and previously performed researches connected to that subject. One large area of relevance will be process improvements and innovations with a focus on processes within the after-sales. In order to fulfill the aim of the research, there has been an extensive focus on finding appropriate theories and methods which could increase the possibility of making relevant suggestions for improving and creating a strategy for an after-market department in a large manufacturing company.

3.1 After-sales services

After-sales services are defined as the services provided after a product is sold and could make the product investment more valuable to the customer (Owida, et al., 2016; Black, et al., 2017). The phenomena of developing a strategy that involves service offerings after a product is purchased is called servitization (Kuijken, et al., 2017). After-sales services can include different types of services depending on what industry it is functioning (Black, et al., 2017). However, typically it is the service of providing the customer with additional material, spare parts, maintenance, warranty issues, modifying and updating products and repair services (Black, et al., 2017). The importance of after-sales services have been discussed for decades and already in 1983 it was, for example, argued by Lele & Karmakrar (1983), that in order to offer the best possible value to your customers there need to be a mix of a great product and a post-purchase support.

Due to the variety of after-sales services, both with an operational and strategic approach, it is highly dependent on the interactions and decision-making between engineering departments (construction, technicians, and manufacturing), market departments (sales, procurement, and marketing) and logistics departments (delivery service companies, warehouse, and inventory) in order to work (Gonzales-Prida Diaz & Marquez, 2014). Smith (2005), argues that collaboration and knowledge sharing within organizations is positive for both adding and creating new value, as well as to achieve common goals. It is argued that if a customer lacks experience in cheap and relevant after-sales services it may result in less sale of products, hence, relevant and efficient after-sales services increases the chance of a competitive product (Black, et al., 2017). It is also discussed by Rahman & Chattopadhyay (2015) that in order to offer reliable products it is not just the design and construction of the products that is essential, it is in fact, a great after-sales service.

In order to stay competitive, the factor of differentiation is crucial (Legnani, et al., 2013). Customer requirements for services change all the time and nowadays the choice of supplier is depending more on the product lifetime experience, including after-sales services, than just a purchase of a product (Legnani, et al., 2013). It is also argued by Bastena, et al. (2011) and Owida, et al. (2016) that there is a risk of customer choosing a different supplier for spare parts or repairs, if the original manufacturer does not offer the customer a sufficient after-sales service, which could result in losing profit and negatively impacting growth. Also, it is argued by Kuijken, et al. (2017) and Owida, et al. (2016), that when offering a combination of products and services, it usually makes the customer locked up in a long-term relationship with the manufacturer.

The after-sales services have been found to be primary sources of revenue, profit and chance of an increased competitive advantage, independent on which industry the company is working in (Seth, et al., 2005; Shahrouzi Fard & Medhi Hosseini, 2015; Owida, et al., 2016). From a profitability perspective there is generally more profitable to sell services than products (Oliva & Kallenberg, 2003; Murthy, et al., 2004; Bastena, et al., 2011; Owida, et al., 2016). According to Wagner & Lindemann (2008) a case study made by Dennis and Kambil (2003), argued that the after sales services contributes approximately with 25% of the revenue, and between 40-50% of the profit, when considering firms within the manufacturing sector. According to Young-II (2013), after-markets enable stable growth and are less dependent on economic fluctuation, meaning that after-market services are more stable than new sales in economic uncertainties. Young-II (2013) also argues that well-managed after-sale services can increase the customer loyalty and increase competitiveness.

It is common that companies often forget, or not prioritize, to form an after-sales strategy when introducing a new product to the market and arrange it when the product are in need for a service connected to the after-sales (Gonzales-Prida Diaz & Marquez, 2014). If the after-sales services are not thought through, it could result in missed opportunities in reducing costs, increased customer satisfaction and improving the product quality (Seth, et al., 2005; Gonzales-Prida Diaz & Marquez, 2014; Szwejczewski, et al., 2015).

3.1.1 Product-Service Systems

The integration of after-sales services and sales of a newly produced product is commonly called product-service systems (PSS) (Szwejczewski, et al., 2015). However, there is no established definition of PSS, it is just a phenomenon of mixing product and services in order to create the best of both worlds for the customers (Kuijken, et al., 2017). Tukker and Tischner (2006, p. 1552) is saying that it is “*a mix of tangible products and intangible services designed and combined to that they are jointly capable of fulfilling final customer needs*”, which is a definition commonly mentioned (Tukker, 2015; Kuijken, et al., 2017). Kuijken et al. (2017) are arguing that almost every company could say that they are offering PSS. In the article written by Szwejczewski, et al., (2015) it is argued that in order to be able to offer a mix of PSS’s the company needs to consider the after-sales already during the new development of the products, which often is ignored or missed.

The strategy of servitization involves the offerings of PSS's (Chang, et al. 2014; Kuijken, et al. 2017). The PSS that manufacturing companies offers to its customers is referred to as one or more product functionality and one or more related services (Kuijken, et al., 2017). Either a manufacturing company includes services offerings in their business proposal, or a service company starts selling products in order to offer the physical product which they later could perform services on (Santamaria, et al. 2012; Kuijken, et al. 2017).

The value of offering PSS's is connected to the fact that a company could improve their position in the value chain, by selling services with higher profit margins than the new product and by creating a more unique and custom specific offer (Tukker & Tischner, 2006).

3.1.2 Repair services

Mehdi Amini et al. (2005), argues that the repair service is one of the most important management services and generates competitive advantage and customer loyalty if managed to meet demand. Reparation of products can be carried out either in-house, at sub-contractors or by a third party (Bannick, 2009). According to Bannick (2009), there are several challenges to consider when forming a repair depot strategy. These challenges involve supply chain logistics, product support, environmental considerations and partnership (Bannick, 2009). As argued by Bannick (2009), material handling and inspection at arrival may be more or less complicated. Some companies may need to decontaminate or sterilize repair units before receiving the product at the depot which may complicate the depot. Traceability is another challenge raised by Bannick (2009). Regulations or customer agreement may require documentation of what operations the repair goes through during the repair cycle. Another issue raised by Bannick (2009) is the long life cycle of products leading to obsolescence. One example is that that spare parts may be obsolete, requiring the company to purchase end-of-life inventory or identify alternative suppliers that can manufacture obsolete parts. Another issue may be that the electronic parts within the product may be fully functioning, however, the housing of the product may be impossible to repair (Bannick, 2009). Another issue is the requirement for functional tests of the repair unit. This may be complex due to missing revision documentation of the product or outdated unreadable flash files (Bannick, 2009).

According to Mehdi Amini (2015), which also refers to Blumberg (1999) and Kambil (2003), managing operations within a repair service could include further challenges:

- The demand is typically inconsistent, fluctuating and uncertain which could lead to a low usage of inventory parts.
- Large inventory of repair parts which might be expected to be required.
- Need for a customer specific repair process due to requirements from different customers. Seldom standardized processes.
- Often need of a quick process, short lead times and throughput times.
- The need of well-managed coordination among several departments involved in a repair process.
- Being able to have a flexible capacity regarding inventory, resources, processing and transportation.

3.2 Strategic approach

According to Mintzberg (1987) “*strategy is a plan – some sort of consciously intended course of action, a guideline (or a set of guidelines) to deal with a situation*” (Mintzberg 1987 p.11). According to Varadarajan & Clark (1994), there is a hierarchical concept of different types of strategies. Varadarajan & Clark (1994) states that Miles and Snow (1978) reasons that corporate strategies are decision carried out at the highest management level within the organization which focuses on what business the company should compete in (Varadarajan & Clark, 1994). Business strategies focus on the company’s competitive advantage and how the company should compete (Varadarajan & Clark, 1994). Functional strategies have been found to be explained in different ways (Varadarajan & Clark, 1994). Sharma & Fisher (1997) explain functional strategies as strategies that are established around the company’s different organizational functions such as marketing, R&D and financial department (Sharma & Fisher, 1997). The functional strategies can be further broken down into sub-strategies, or actions, which are more detailed activities of how to reach the strategic goals within the organizational business functions (Sharma & Fisher, 1997). Amongst the common and the most effective functional strategies is the productivity strategy, with sub-strategies that can include cost reduction programs, continuous process improvements and cycle time reduction (Sharma & Fisher, 1997). Bishnu & Tom’s (1997) study of functional strategies revealed that productivity strategy is considered as the most important strategy when improving a company’s competitiveness. Bishnu & Tom (1997) also argues that combinations of sub-strategies can increase a company’s competitiveness, compared to one single dominant strategy.

A strategy is used to communicate a common goal to the rest of the organization members, as well as motivate, align and inspire people within the organization (Mintzberg, 1987; Maylor, 2010; Grant, 2016). According to Grant (2016), strategies which lack information on how to be implemented is poorly formulated strategies. Implementing a strategy requires that it is broken down into shorter sequences and activities so that these can be monitored and measured (Grant, 2016). This is however argued to be a huge concern. Norton & Kaplan (2005) states that departments within the organization have difficulties to understand and align their operations with the strategy, hence, activities are carried out without having a strategic guidance. They also argue that many companies fail to achieve their performance targets due to strategy unawareness among the employees (Norton & Kaplan, 2005). In their research, they argue that “*If the employees who are closest to customers and who operate processes that create value are unaware of the strategy, they surely cannot help the organization implement it effectively.*” (Norton & Kaplan, 2005). According to Grant (2016), “*the central challenge of management is coordinating the actions of different organizational members*” (Grant, 2016, p. 17.) This is also argued by Kolbusa (2013), who states that the strategic gap, the gap between the organization’s division and the intended strategy, needs to be closed. To solve this, Kolbusa (2013) argues that it is important to first set the vision of what the company wants to achieve and then set the work in action.

In order to translate strategies into actions, every strategic plan needs a detailed outlined strategic action plan, operational plan or tactic plan (Nolan, et al., 2008; Kolbusa, 2013). The strategic action plan outlines the changes within the organization needed to succeed with the

strategic goal. An integration action plan includes changes that are necessary within the company's organizational business units (Nolan, et al., 2008).

3.2.1 Organizational changes

Changes within an organization could create employees being uncertain about the future (Sharma, 2015). It is important to manage these situations so that the changes within the company does not become fearful to employees, rather seen as an initiative that is accepted and sustained (Sharma, 2015). If a change is poorly managed, it can turn employees against changes, as well as decrease efficiency and lead to increased staff turnover and sickness (Campbell, 2014). It is up to the managers to expand the plans into visions and goals (Harvey, 2011). These visions and goals need to be compelling and understandable in order to get everyone involved and eager to participate in the change (Harvey, 2011). According to Boutros & Purdie (2014), strategic plans should be continuously reviewed and updated to keep the employees on track with the strategic goals and objectives. It is however also stated by Maylor (2010) that all participants in the organization are responsible for the strategy and its potential improvement. It is argued there is a general opinion that management is in control of framing and improving the strategy, but the individual employee could, as any manager, suggest improvement and ideas (Maylor, 2010).

In order to successfully perform changes within an organization, it is important to make sure that the involved people are understanding what the changes will cause and what benefits the change will bring (Sharma, 2015; Loid, 2016). Loid (2016) is expressing the journey of change in five steps. These steps need to be completed in order for the changes to successfully be implemented. The steps that are mentioned by Loid (2016) are; attention, trust, problem, hope and determination.

3.3 Processes

Process is a widely used expression and used in different context (Berman, 2014; Boutros & Purdie, 2014). According to Dumas, et al., (2013), every organization, regardless of purpose, manage processes both large and small, formal and informal. A process is a set of interrelated activities that are carried out in timely, logical sequences that uses resources such as people, systems and tools to transform inputs into preferred outcome (Becker, et al., 2003; SS-EN ISO 9000/2008, 2008; Dumas, et al., 2013; Boutros & Purdie, 2014). According to (Harvey, 2011, p. 11), a process is defined as "*shared, clearly defined, and well-controlled ways of doing things together*". Processes are the core assets of an organization as they include the value added activities and actions to get from unfinished work to complete work (Chang, 2005; Berman, 2014). Well managed processes are important since an organization can outperform a competitor who offers the same kind of product or service by simply manage their processes better (Dumas, et al., 2013).

There are different types of processes, as seen in Figure 7. Operational processes are an organization's primary or core processes. These kinds of processes involve sales, marketing, logistics, services and manufacturing (Dumas, et al., 2013). Supporting processes are processes

that support the core process. These processes consist of processes such as finance, Information technology, and services (Becker, et al., 2003; Boutros & Purdie, 2014). Processes can be broken down into sub-processes, activities and procedures, necessary to conduct the process (Boutros & Purdie, 2014; Berman, 2014). A sub-process is a part of a larger process and consist of related activities that are carried out to achieve a particular goal (Dumas, et al., 2013). Processes are preferred to be broken down into sub-processes since it is easier to monitor and manage sub-processes than large complex processes (Boutros & Purdie, 2014). The sub-processes is then divided into activities which, are instructions of how to carry out specific procedures (Boutros & Purdie, 2014).

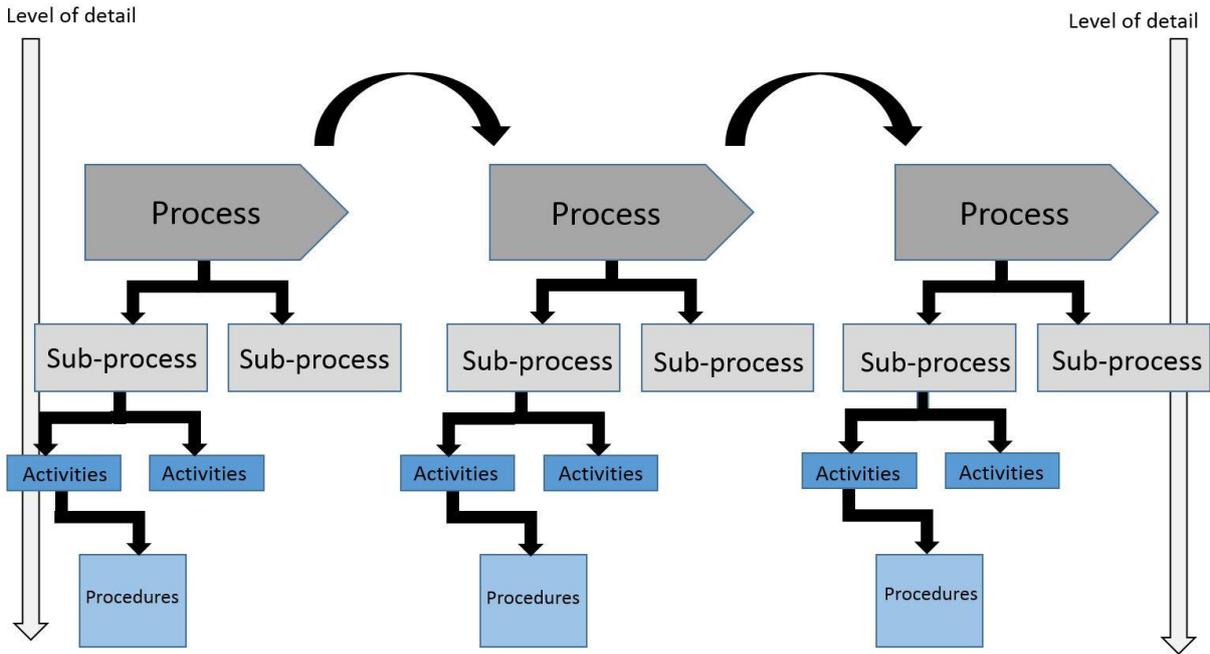


Figure 7- Process hierarchy (Modified from Boutros & Purdie, 2014)

Processes usually consist of several actors or stakeholders which are involved in, influencers or are influenced by the process in different ways. These stakeholders can, for example, be the process owner, process participants and different management teams (Dumas, et al., 2013). In processes, participants should be avoided to be referred by their names since individuals tend to frequently change within an organization. Instead, participants should be mentioned by the role that clarifies what specific role it is that should carry out the activity (Dumas, et al., 2013). Harvey (2011) also argues that in order to manage processes daily it requires activities such as; monitoring, early fault detection, quick corrections, learning and improvement. When trying to form a process, these activities might cause a lot of challenges and difficulties which require the organization to design the process logically (Harvey, 2011).

Dumas, et al., (2013) argues that split responsibilities in processes may lead to ambiguous directives of what department that has the responsibility to carry out a specific task. This may lead to unnecessary conflicts among departments. Reducing overlapping between departments can solve the responsibility issues and increase the responsiveness. However, it may also have negative impacts on the organization by becoming less flexible and more queuing may occur

(Dumas, et al., 2013). It is argued by Sharma (2015) that it is common with unclear descriptions about responsibility and that employees tend to only feel responsible for the specific part of the process which they operate in. This results in that there are no one who has the overall responsibility in the process (Sharma, 2015).

3.3.1 Process improvement

Process improvement is ongoing operations used to change an existing processes to become more efficient, effective and to meet new demands or objectives (Chang, 2005; Jeston & Nelis, 2008; Dumas, et al, 2013; Boutros & Purdie, 2014). In order to improve, processes need to be managed continuously, which involves tasks such as measuring, monitoring, controlling and analyzing (Chang, 2005). Improvements are vital for company's success and process improvements must be undertaken, or the process may simply become ineffective (Wysocki, 2004). Improvements are done to define and analyze the current situation and to increase performances and to meet new goals and objectives (Boutros & Purdie, 2014). Process improvements can involve activities such as employee morale, cycle times and elimination of wasteful activities (Boutros & Purdie, 2014). Process improvements do not always need technology to achieve higher performance, it is rather more important to get the process correctly flowing before implementing new technology (Jeston & Nelis, 2008).

A business process is seldom unchanged, due to customers change in requirements and new industry conditions, therefore the improvement of the process design is a key factor when striving for an improved business performance (Hammer, et al., 2007; Kohlbacher & Gruenwald, 2011).

3.3.2 Process ownership

It is argued by Chang (2005), Hammer et al. (2007) and Sharma (2015) that there should be an appointed process owner, meaning that one person should have the overall responsibility for the process. The process owner should be responsible for the performance, the design, deployment and improvements of the process (Chang, 2005). A process owner is someone in charge of monitoring the whole process spectra and is of vital importance in order to have a working process (Hammer, et al., 2007; Sharma, 2015). However, not only the appearance of a process owner is needed but several personal traits and characteristics should be shown by the process owner (Kohlbacher & Gruenwald, 2011). Two important characteristics are; firstly, that the owner have a leadership experience or knowledge, secondly, that the owner has the authority to coordinate, improve and analyze the chosen metrics, also manage the resources needed for improvements and implementations (Siemieniucha & Sinclair, 2002). Although, it is also argued that the process owner should be the person responsible for the continuous improvements and optimization of the process (Kohlbacher & Gruenwald, 2011).

The embedding and usage of metrics is strongly connected to responsibility, due to the need of updating and analyzing the data, hence, someone needs to be the owner of the metrics in order for it to be successful (Hammer, et al., 2007). It is concluded by Kohlbacher & Gruenwald, (2011) that there is no purpose of having a process owner without any metrics to measure the performance and there is neither no purpose for metrics and measurements if there is no process

owner appointed. It is only the combined implementation of the two factors, metrics and process owner, which will improve the organizational performance (Kohlbacher & Gruenwald, 2011).

3.4 Performance measurements

Measuring performance is both relevant when trying to transform and improve a process, also when trying to steer that transformation into the right direction (Sharma, 2015). According to Legnani & Cavalieri (2012) and Legnani, et al (2013) monitoring and measuring are key factors for a company to succeed as a service-product company. By monitoring it is meant that there is a need to control the metrics implemented, in order to increase the effectiveness and performance of the process (Legnani & Cavalieri, 2012). The phenomena of using measurements regarding specific steps in a process are usually used as an everyday tool in the operational work (Hammer, et al., 2007).

It is argued by Legnani, et al (2013), that an after-sales department could be seen as a cost center, a profit center or an investment center, which increases the complexity when trying to measure the performance. Therefore, it is suggested that several metrics should be implemented in an after-sales department to successfully compare the performance (Legnani, et al., 2013).

Hammer, et al. (2007), is presenting the seven deadly sins of performance measurement and how to avoid them, by listing seven factors that need to be avoided in order to perform well.

- **Vanity:** Do not use metrics that you know will make you look good, it will not increase the performance.
- **Provincialism:** Metrics within the same company should not be contradictory. Different departments might work “against” each other when striving towards good performance.
- **Narcissism:** Choose metrics dependent on what the customer want to have, do not choose it due to what you plan or wish.
- **Laziness:** Do not guess what to measures, it is important to know why metrics are chosen and why they matter.
- **Pettiness:** Do not measure to small things, look wider, what is good for the company?
- **Inanity:** Consider possible consequences when implementing metrics Employees will try to improve it the selected area of the metrics, and that might cause a de-prioritization in other activities.
- **Frivolity.** Be serious about metrics, instead of accepting bad performance, always try to find the root-cause when problems occur.

It is also stated in the article that although metrics are designed correctly, it will not add any value unless it is embedded in the process and used as a measurement tool (Hammer, et al., 2007). A good metric needs to be comparative to be able to relate it to other time periods, business units or competitors (Croll & Yoskovitz, 2013). It is also stated that metrics should be understandable, a rate/ratio, and it should change the way you behave (Croll & Yoskovitz, 2013). To determine whether a process is good or bad, clear process performance measures should be stated in advance (Croll & Yoskovitz, 2013). Some commonly used metrics can be

cost, quality or time-related metrics such as cycle time and throughput time (Dumas, et al., 2013).

By the time a process is being transformed or improved, it is important to design the right kind of metrics (Sharma, 2015). It is also argued by other researchers that metrics needs to have a few characteristics in order to be valuable for the company, and the characteristics commonly used called SMART (Specific, Measurable, Attainable/Achievable, Realistic and Time-framed) (Maylor, 2010; Croll & Yoskovitz, 2013; Sharma, 2015).

3.4.1 Hawthorn effect

The Hawthorn effect was the result of a study conducted at a Hawthorn plant, in Chicago, between 1924 and 1927 (Freivalds & Niebel, 2009). The conclusion was that management found their employees to perform better at work if they were expected to perform better (Freivalds & Niebel, 2009). In other words, if the employees were expected to produce X amount of product, they did, but if the expectations were lower they did not (Freivalds & Niebel, 2009).

Observing and monitoring employees could therefore improve their performance, hence, the employees will unconsciously increase their productivity if knowing that they are being monitored (McCarney, et al., 2007; Freivalds & Niebel, 2009).

4

Empirical findings

In this chapter, the empirical findings are presented. To understand where the findings origin, each specific section introduces a new part of the process and the collected data is presented, as illustrated in Figure 8. It starts with the findings collected to get the holistic view of the process and continues to follow the specific steps of the researched process.

All findings provided in this chapter are only information gathered through the different data collection methods. The data collected from interviews does not include any reflections or assumptions by the authors. However, the observations are somewhat interpreted by the authors.

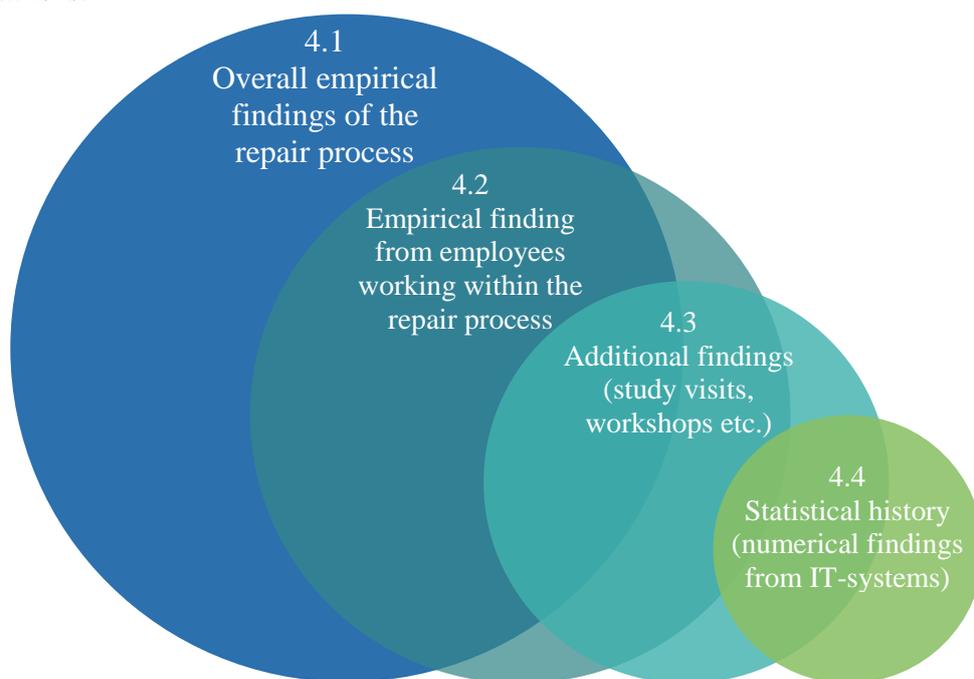


Figure 8- Structure of chapter presenting the empirical findings

4.1 Overall information about the repair process

This section consists of the findings that are related to the repair process in a general matter. It presents the findings of the current state of the repair process and how it is organized and functioning. Figure 9 is illustrating, with a green quadrant, where in the process this chapter is focusing on.

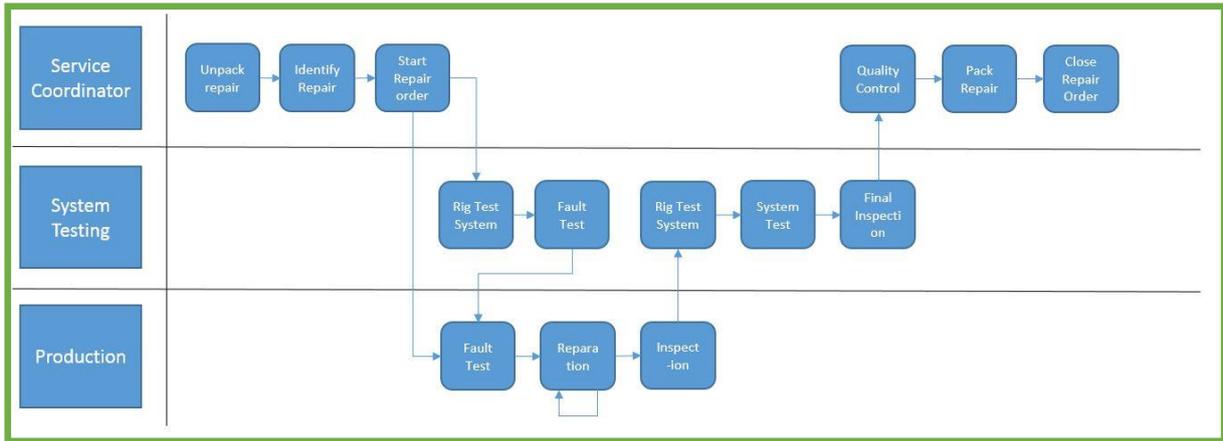


Figure 9- Illustrating where in the process the findings are found.

4.1.1 The repair process in general

The case company handles approximately 800 repairs each year. The repairs could be any type of product that is a part of a whole radar system. The amount of time spent on the repair is dependent on the complexity of the product and who needs to be involved in the reparation. However, there is an average lead time of 115 calendar days, when calculating all repairs, during the last two years, as seen in Table 2. Some repairs are repaired by the case company and some repairs are repaired at a sub-contractor. There are also different kinds of service contracts dependent on the customers' requests.

Table 4- Historical data of repairs

Amount of repairs in two years:	1668
Amount of different repairs:	497
Average lead time all repairs last two years (calendar days):	115

4.1.1.1 Different repair contracts

The repairs are being handled differently dependent on what kind of service contract the customer has with the case company. There are mainly two categories of contracts, and within those two there are several levels of details.

Repair contract

If a customer has a repair contract, it means that the case company will repair the broken unit according to the agreements in the contract. The company estimates the costs of the reparation and sends the offer to the customer which then has the possibility to either approve or decline the offer. There are in some contracts also details about the maximum amount of time allowed to be spent on the reparation.

ABC-contract

When a customer has a contract called ABC it means that if a unit breaks, the case company will be noticed and a spare part will be taken from a customer owned inventory (BFPREP) and sent to the customer. Later the broken unit returned to the case company and, if it is repairable,

it will be repaired and put back into BFPREP. If not repairable, the case company purchase a new one and puts that one into BFPREP. This type of contract is comparable to a kind of subscription of spare parts and repair service.

4.1.2 Responsibilities of transporting the repairs in-house

The physical flow of the repairs is mostly being handled by one specific employee, the system testing planner (STP), visualized in Figure 10. The STP has the main task of planning the work for the production department, system testing. However, the STP has been borrowed to other departments due to resource issues and has responsibilities that consist of three work positions. The STP is also handling all the manually hand-delivery of repairs between all different departments. The repairs are being transported in-house, between several departments located on different floors. The STP is the only individual at the case company who do these transportations daily and when not present the repairs stagnates.

Between the different production departments, there is a production planner who transports the repairs. That is, however, the only transport with repairs that is not handled by the STP.

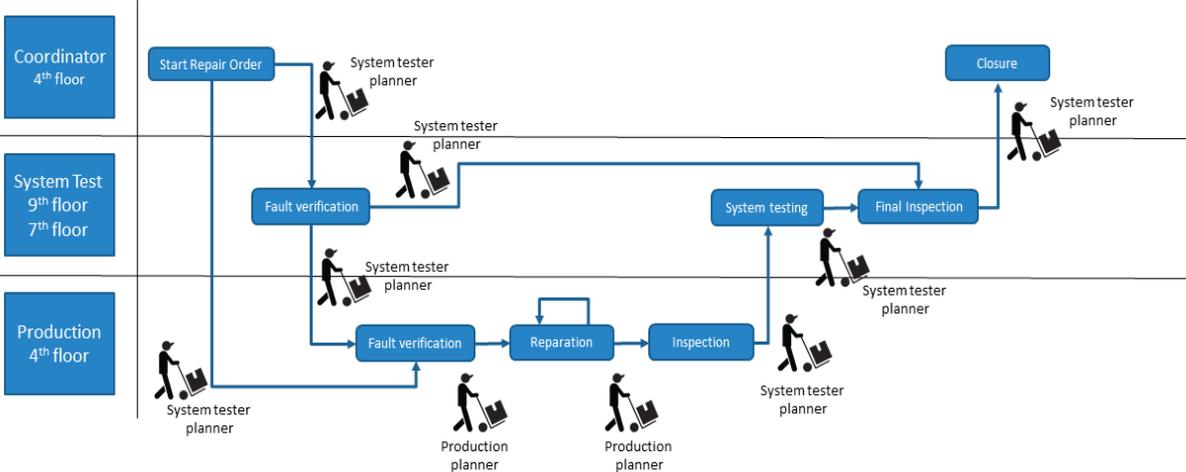


Figure 10- Illustrating the transportation of repairs in the current process.

Three weeks into the research the STP became absent. The position was supposed to be temporary refilled by another production department manager, in order to keep the process running. This was experienced to be more difficult than planned and lots of work was left behind.

4.1.3 Interviews with management

The following section presents the findings from the interviews with different managers. The findings are not interpreted with any thoughts or analysis made by the authors.

4.1.3.1 Interview with production manager

The production manager has the overall responsibility regarding everything related to production at the company’s site. The production manager supports the middle management by

providing Key Performance Indicators (KPI), analyzing and establishing strategies. However, the production manager argued that strategies of how to manage repairs are broken down and carried out on the middle management level. The production managers do not work hands-on with the repairs, but rather pro-actively by setting guidelines of how to solve difficulties related to repairs and the process.

The production manager claimed that the repair process is one of the most important processes and a typical “bread and butter business”. The reason for that is that between 20% and 30% of the company’s revenue comes from repairs and margins of repairs are considerably higher than margins of new production. The production manager argued that the importance of repairs is well known among all managers and employees within the company. However, the production manager also claimed that repairs are to some degree invisible from an upper management perspective, meaning that it only appears as financial numbers on charts and that the actual flow usually sorts itself, without any upper management involvement. Economical transactions from repair services are usually small but in high volumes. According to the production manager, the existing repair process is poorly managed and there is a need for improvements.

Responsibilities

According to the production manager, there have been some organizational changes during the last couple of years. Business units have been divided and physically relocated. Areas of responsibilities have changed during the organizational restructuring, but overall, people are performing the same kind of tasks and amount of work as before. The production manager also argued that the overall management and monitoring of repairs is poor, both from a management perspective and the people working hands-on with repairs. The production manager stated that: *“We do not keep track of our repairs, nor how they are managed. People who manage the repairs should keep track of them. That is where it all starts”*. According to the production manager, the coordinators should be responsible for the repairs and that they previously were, but not anymore. If there is a contract established with the customer, the sub-project manager is responsible for the repair, but if there are no contracts, it is the coordinators. However, the production manager was uncertain regarding the responsibility of the repair and argued that it would be better if there was only one “owner” while being repaired and that should be the coordinator who receives and starts the repair order. The production manager also believed that if the coordinators would follow up the repairs along the repair process, the repairs would be repaired quicker.

Prioritization

According to the production manager, there are no problems with prioritization between repairs and new production. There are however some issues to plan repairs in the production as the demand is fluctuating. As repairs are managed in the same production line as new production, it creates a conflict. The case company works with frozen plan, meaning that the production plan is set in advance. Repairs are difficult to forecast the incoming amount of repairs varies which might interrupt the production plan. When the production plan is interrupted, both new production and repair operations are delayed. This results in that operations are re-planned and delivery dates of repairs are set further ahead. When the delivery dates are set further ahead, it

leaves the repair inactive due to the attempt to stick to the initial production plan. According to the production manager, the decision of what is going to be prioritized does not take time. There are always managers that are available to make decisions if necessary and there is an open communication between different business units to sort things out. If necessary, the production manager is responsible for what should be prioritized, and what not. But usually, such problems are managed and sorted out on a lower management level.

Communication

According to the production manager, the communication between the company's business units has improved but is still not good enough. The production manager discussed that the importance of the repair process has been communicated within the case company. However, the production manager also argued that there are many people involved in the repair process and that the repair process should be easier to track and information of who is going to do what with the repair should be mapped out more clearly. This has not been done before since individuals involved in the repair process had clear working structures and a better overview of the repairs. This approach made the company dependent on individuals and when organizational changes replaced these individuals, the processes were lost.

IT-systems

According to the production manager, the ERP-system is not an optimal IT-system for after-market services. When implementing the ERP-system, a supplement was considered, however, this was too expensive to implement and therefore precluded from the new IT-system. Another computer system which is used to document the history and the actions of the repair units. According to the production manager, the ERP-system is the foundation of what operations that the repair needs to undergo, whilst the log system is rather a log-book where employees' notes can be written down. The log system is not a correct way of working, but rather a tool to preserve historical notes about repair units.

Other thoughts

The production manager reasoned that there is too "little noise" about repairs, which is a negative silence. Employees' need to raise awareness of repairs and the overall company needs to get a clearer picture of how it is managed today and the issues related to the process. It is also important to get a better view of where the repair is during the repair process. It is also important to know that if there are no components in stock, it could very well take a couple of weeks to repair something.

4.1.3.2 Interview with supply chain manager

The supply chain manager (SCM) is organizationally below the production manager and has a more direct responsibility for the supply chain, see Appendix A. The SCM is not directly working with the repair process in the daily work but rather has the overall responsibility regarding the business units that are handling; material feeding, inventory, customer agreements, procurement and sales.

The SCM's, general opinion about the repair process, was that it has been a change in the attitude regarding repairs during the last years. The SCM argued that when the organization started to change its structure of the after-market department, attitudes and processes started to get lost. It has been experienced that even if there have not been a change in the process when people are regrouped, it tends to lose processes anyway.

Responsibilities

According to the SCM, the overall responsible person should be the manager for each production department. Each of those managers should be responsible when the repair is at their specific production department. When the operation at their department is completed, the repair and the responsibility will be handed over to the next department. There has been an issue due to that one responsible person has completed the tasks and leaves the repair to the next department without giving a notice about it. The SCM argued that it is in those cases the repairs will be forgotten and becomes late without a valid reason.

The SCM stated that there is an ongoing process of employing a team leader for the after-market department and the service coordinators, to increase the overview on the repairs. This team leader would be responsible for actively measuring and following up on repairs. Also, control what hinders that cause's the late customer delivery. As it is today, this overview is spread out on all the coordinators and there is no joined understanding and responsible attitude.

Prioritization

The SCM is of the opinion that situations where no prioritization need to be made. It should always be first in-first out. There is a frozen plan for two weeks forward in all production department and it should be set, hence frozen plan. However, the SCM also argued that there is an exception when handling repairs due to the fact the repair order is automatically started in the system when the service coordinators are done with their tasks. In the serial production, each shop order is planned in a specific time slot and the material is ordered in order to be fully set when starting to work on the order. In the case of the repairs, the orders start directly and then the bench test is done and materials that are necessary for the reparation is ordered.

Communication

The SCM argued that the people who work with the repairs are great communicators and have great contacts. However, the SCM also stated that there is a problem when issues are solved by utilizing personal relationships. For example, if one person is friendly with another employee, asking for a favor, it tends to go faster than if it would have to get in line and be taken care of in the correct queue.

IT-systems

The SCM is of the opinion that the IT-systems that are used today is not used to its full potential. There are many functions that could be implemented in order to ease that process. One specific example is the lack of overview could be solved, or at least eased, by using the ERP-system in a larger extent than today.

Other thoughts

The SCM claimed, *“that a company becomes great at those things you measure, and at the moment we are not measuring repairs, but rather the serial production.”* The SCM also stated that the case company needs to become more aware of the repair process.

4.1.3.3 Interview manufacturing manager

The manufacturing manager is managing eight production departments at the site where the research is conducted. Almost all production departments are involved in the repair processes, however, there are a few of them that are handling more repair units than others.

Responsibilities

Regarding responsibilities, the manufacturing manager argued that the service coordinators should have the overall responsibility. However, each production department should “own” the repair when it is connected to their work center. It is also mentioned, by the manufacturing manager, that the after-market manager should be the overall owner of the process and take an operative responsibility. It is also discussed that it should be an issue for the production if all the repairs were presented on the same dispatch list as the regular serial production.

The manufacturing manager stated that the complexity of the repair process has its roots in the fact that a lot of business units are involved in just one repair order. Each new business unit or person that becomes involved increases the complexity and the responsibilities for repairs.

Prioritization

The manufacturing manager had a feeling that the attitude among people working hands-on with repairs has been better. It is mentioned, that repairs are un-prioritized compared to the newly produced products, even if it should not be.

Communication

The manufacturing manager claimed that the communication between different production department works mediocre. The departments that are involved have issues when communicating that operations are complete and it is time for the next departments to handle the repair. The difference between a repair process and the serial production is that the serial production has a specific demand. However, in the repair process, there is only a need date which is the demand. Hence, no production department will look for a repair if it does not show up the planned day.

IT-systems

The production departments have mentioned that there is an issue with mixed repairs and new production in the system since it is hard to distinguish repairs and new production units. According to the manufacturing manager, this issue might be causing trouble when trying to get an overview of the repairs and the specific location of it.

Other thoughts

The manufacturing manager was of the opinion that there is often too vague descriptions of the errors from the customers, which results in a lot of guessing and estimating. Another issue that the manufacturing manager has been experiencing is that production departments have problems knowing what needs to be done. The process of the repair is not standardized due to the different components that need to be repaired, which makes the physical transportations different from case to case.

The manufacturing manager argued that the lead times for repairs are much longer compared to the serial production. However, that is due to the fact that the orders are open while, for example waiting for the customer's confirmation on the offering. Hence, lead times for repairs has a lot of waiting time.

According to the manufacturing manager, there are some strategic goals and performance measurements. Some of the performance measurements raised are lead time precision, delivery precision, accumulated work time and manufacturing cost. However, the manufacturing concludes the statement with "*I Think*".

4.1.4 Observations

In the following section, the findings from different observation session will be presented. It is divided into sections to understand what type of situation the observation was collected in.

4.1.4.1 Observing morning meetings

The morning meeting is held in order to follow up projects and production departments that are facing some kind of issues. These issues could be related to late incoming material, capacity and resource planning etc. It is a quick stand-up meeting that visualizes the problems that have to be dealt with the coming week. It is a meeting where all department managers and related to production is invited to attend. However, everyone is invited to participate if there are subjects discussed related to their work. During the meeting, it has been found that the general knowledge about repairs in the production flow is inadequate. There is observed to be few people that understand the value of repairs and how much higher margins it is on repairs compared to newly produced products. The awareness of repairs has been raised during these meetings.

During the research, the decision from the managers to bring up repairs once a week has been made. Meaning that once a week, repairs are being brought up and discussed. The repair agenda is however still new and due to lack of measurement, the information about repairs is not complete.

It was also identified that there was a misunderstanding regarding repairs and spare part, which are two differently treated kinds of services. Even though there are two different teams handling repair and spare parts there is often a discussion referring to them as one process. As the authors started to talk to employees about the repair process, the discussion often ended up about spare parts.

There has also been understood that all kind of repairs (internal, external, customer owned and company owned) are being treated and measured as “just repairs”, even if there are huge differences when handling different repairs. Every morning there is an updated number presenting how many open orders that the production is handling, however, there is also one number showing how many of these open orders that are repairs. These numbers are always read out loud by the one leading the meeting, however, there is seldom a reflection on the numbers, just a statement.

Situation X

When attending in morning meetings during several weeks, at the system test department, it was observed that a repair was left on a shelf with a note on top without anyone taking responsibility for it. Following questions were raised; why is it just laying here? Who is responsible? And what should you do with it?

An operator took a look at the case and concluded that it was a repair that had a very specific fault, which could not be tested at this site. The note stated that it probably had to be transported to another site in order to perform the test. The authors took the order number and asked the service coordinators what this was and if they had any information regarding it. As a coincidence, a project manager contacted the service coordinators two days later and asked for that specific repair. It was not until then there were actions taken to make any progress on the repair. It was left on a shelf for 7.5 months, without no one feeling responsible and it had to be asked for in order for them to start working on it.

4.1.4.2 Observing strategic weekly meetings

There were weekly meetings with the managers of the supply chain management team, where goals and actions are categorized, discussed and planned. These meetings involve six managers and occurred weekly during one hour. The meetings are casual and create a feeling of openness and creativity. There is a whiteboard where all goals and actions are presented with stick notes. The stick notes are written together, during the meeting, and placed where it is most suitable. Each stick note is discussed and previous weekly plans are moved to the next stage if action were taken. The whiteboard and the sticky notes are of general view for all employees within the company.

These meetings were experienced to be a possibility for the managers to jointly set goals and discuss matters that intertwines between the different business units. The findings made from the observation was of general character and not specifically related to the repair process. However, it was found that the attendance to the meetings varied and that the meetings sometimes were left out for weeks. This left the whiteboard and the post-its notes inactive. However, it was not to the authors’ knowledge whether the actions were further executed.

The authors asked the coordinators within the after-market department if they ever looked at the whiteboard and followed up the strategic actions. The answer was that they did not. Nor did the coordinators experience that the actions were communicated to them.

During the research, it was noticed that the weekly strategic meeting ceased. The observations were pointed out to the after-market manager and the answer that was given was that the meeting had been de-prioritized. It was also mentioned by the after-market manager that the meetings ceased approximately the same time last year.

4.1.4.3 General observations

This section will present relevant findings that have been observed during the researchers time spent at the case company. The data presented in this section is gathered through informal situations such as lunch discussions, attending stand-up meetings, observing situations in the production departments etc.

Improvements

It has been observed that several production departments have a procedure to manage continuous improvements at the department. The foundation of the procedure is a Plan, Do, Study and Act (PDSA) worksheet, where employees can contribute and follow up suggestions of how to improve certain activities within the department. These improvements also covered the management of repairs at the production department. However, it was discovered, in one of the production departments, the improvements suggested to the worksheet was not managed or followed up. When the authors asked why the suggestions were not followed up, they received the answer that there was no time, nor any resources to carry through the suggested improvements.

An observation regarding the IT-systems was that there is a resistance to learning new ways of working. IT-systems are continuously changing and being updated and there are employees that are resistant to follow the changes. Recently major changes have been made regarding the administrative work performed by the service coordinators. The new directives to administrate the repairs in the IT-system will result in that all repairs will have the same documentations and history. Up until recently, repairs were administrated differently depending on what kind of operations that needed to be completed.

Organizational changes

During the research, it has been discussed that there are plans and ongoing reformations of the after-market department. The departments have had issues of getting resources in time, due to the fact that it is being de-prioritized compared to new production. Because of this issue, there is an idea of forming an after-market department which consists several new resources needed. As an example, it has been decided that a resource from procurement will be a part of the after-market department team in order to have full focus on purchasing material for the after-market projects, instead of being forced to choose between after-market and new production.

After-sale strategies

During the research, it came to the authors' knowledge that there are some strategic actions that take place before selling a product. It was found that the company's integrated logistics support department calculate the time to breakdown of products. These numbers indicate when products are assumed to break down and what units that are most probable to be replacement first. This

information is communicated to mainly be used to provide the customer with details about what spare parts the customer should buy.

There are repair contracts which are established with customers before products are sold. These contracts include criteria's regarding lead times of repair, the maximum cost of repair and penalty costs when missing the delivery due date. It has been found that the communication to the after-market is absent when these contracts are established.

4.2 Findings from interviews within the repair process

In this section, the empirical findings from interviews with employees within the repair process are presented. The findings are summaries from the interview notes and do not include any conclusion, analysis or interpretations made by the authors.

4.2.1 The service coordinators

This sections will present findings from the service coordinators who have the first and last contact with the repair units that is in need of reparation, illustrated with a green quadrant in Figure 11. The coordinator's main task is to start the repair order and to close the repair procedures before sending it back to the customer. The coordinators are the employees that constantly work with repairs in the after-market department.

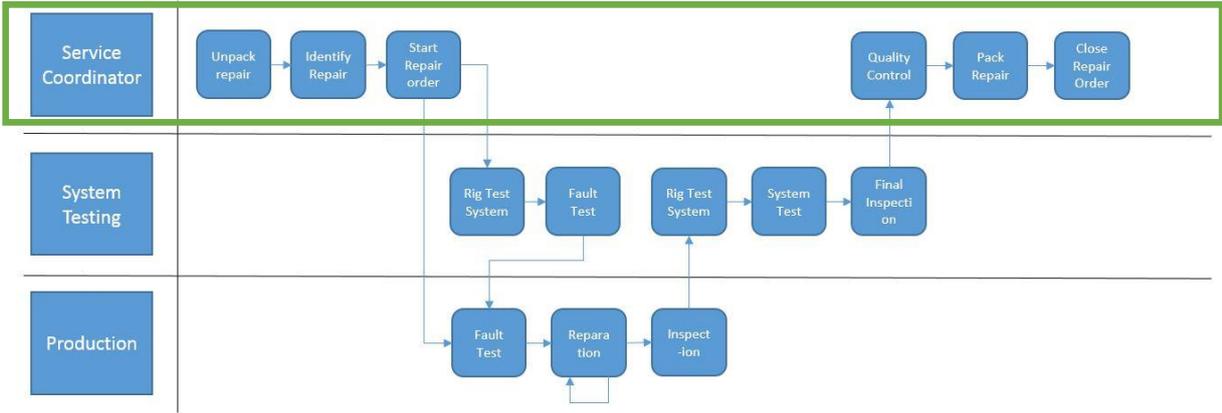


Figure 11- Illustrating wherein the repair process the service coordinators are working

Communication

The group of coordinators is a close working team with a lot of collaboration and communication. The team has one common e-mail where the most urgent requests of repairs are sent. This e-mail is daily read by all the coordinator's and is considered to be a great tool to be able to quickly respond to their customers' requests. It was however explained by the service coordinators that when the repairs come in for a reparation, it is common that it misses documentation regarding the product, the customer and its error. This is experienced to be very time-consuming.

As a coordinator, it is considered very beneficial to have a great network of contacts and to know people in the right departments. As seen in Figure 12, there are several departments that

are co-operated with in the everyday work. Coordinator - *“The more people you know, the quicker you get things done”*.

It has been explained that there is a lack of communication with the sales department before products are sold. When products are sold, agreements are established between customers and the case company. These agreements include instructions regarding services provided by the after-market department. However, these agreements are established without consulting the after-market department, nor the after-market manager. Hence, agreements are made without knowing whether the after-market can manage the promised criteria's.



Figure 12- The after-market departments co-operations map

System-testing

The area of system testing constitutes several different issues. From a coordinator’s perspective, the experiences regarding system testing are that it has a long turnaround time and that the repair units tend to be forgotten when it is supposed to be tested.

However, it was also discussed by the coordinators, that there are too few systems at disposal for testing the repairs, which could be one of the causes for the long turnaround times. It is expressed by the coordinators that it could be a waiting list for the systems, a resource problem for a specific competence or that the repairs sometimes get de-prioritized.

The system-testing planner is supposed to be planning all the tests and prioritize the units in a correct order. However, the last few months that specific person has been between three positions, which have resulted in a less detailed work plan and often a stack of units gathered at the planner's desk instead of being properly distributed to the system testing department. This is something that concerns all the coordinators and that is experienced to be a bottleneck.

IT- systems

The segmented IT-systems was a huge concern and an irritation among the coordinators. The IT-systems are not considered compatible, which makes it difficult for the coordinators to perform the work tasks in a structured and effective way. There are several systems that need to be used and updated for each repair and there is little collaboration between the systems. The system used for each repair is the following:

The ERP-system: The overall ERP-system used by everyone at the case company.

The log-system: A system where the progression is noted in text, easy to search history.

The time report-system: A system which handles each products specific time reporting and material cost.

The shipping system: Historical delivery monitoring system. (Also handles all licenses which are needed for products)

The product serial number system: Create signs and serial numbers for each specific part in a product. The case company requires their own part number.

The order start system: Start the orders, manufacturing operations are generated, and this is connected to the order start in the ERP-system.

The transportation request system: Create transport-requests and send orders.

There was a common opinion that it would be beneficial to have systems that are compatible and could offer functions that would streamline that part of the process. Also, it is experienced that different departments use the IT-systems differently. It is considered to be a large knowledge gap regarding the IT-systems that causes confusion.

Resource issues

It is argued by the service coordinators that the project managers (PM's) often are very busy and does not have enough time to spend on the repairs that are connected to their project. Each PM has responsibilities that need to be completed in order for the coordinators to perform their job. These responsibilities consist for example of filling in a project-card, which is an information file where all relevant information on the project should be communicated. The information is necessary in order to know what customer it belongs to, what kind of service agreement there is and if there are any other necessities that need to be considered when handling that specific customer's repairs.

Another finding that was stated by the service coordinators is that there is a lack of resources in the procurement department. There is often a long waiting time to get a reply from procurement regarding repairs, and somewhat felt like the after-market is de-prioritized compared to the serial production, from a procurement perspective. It was, however, also

argued by the service coordinators that procurement is dealing with resource issues and that it might be the reason why there is long waiting time.

Another time-consuming task which is connected to the resource issues is the preparations of offers. The offers are prepared by the coordinators and adjusted and finalized by the sales department, before being sent to the customers. The offers are dependent on information about; what errors are found, in the first error test, how much time that will be spent on the repair, what material is needed to perform the reparation and other costs that might be added. All this information must be gathered to have a complete offer to the customer. However, when sending a repair to a sub-contractor, there is a waiting time for their offer, and then being able to send it to the end customer.

Due to the fluctuation in demand and the varying amount of repairs coming in for reparation it is difficult to plan the capacity for the service coordinators. It was discussed by the service coordinators that the only time they know they will have a heavy workload is just before summer or Christmas break.

Monitor the repair units

Due to the findings from the interviews with the coordinators, it was explained to be an almost non-existing overview monitoring of the repairs. Each coordinator somewhat monitors repair units, which is in the process but generally, the coordinators start the process, by handling the incoming repairs, and finishing it, by preparing for the delivery back to the customer. In between those parts of the process, there is very little monitoring, observing and verifying that there is a progress on the repair unit.

The current monitoring is conducted in such way, that each coordinator is expected to look at its individual units to see if it is where it should be in the process compared to the estimated time plan. If not, the coordinator should try to find the person that is supposed to be working on the repair unit and ask why the situation looks like it does. It is therefore explained by the service coordinators that a lot of time is spent on chasing information regarding repairs.

4.2.2 System-testing

During the interviews with the system testing, the focus was to further understand the repair process and foremost what implications and difficulties this production department were experiencing. System testing is a different production department compared to the other ones, due to the complexity of testing the complete, finished, products to ensure that everything is correctly built and working properly. Regarding the repair process, system testing is involved two times during the process, explained in Figure 13. Firstly, a failure test is performed in order to analyze what defects the product has and what might be the cause of errors. After the product is repaired by the appointed production department system testing, will make a final test of the product to ensure that it is working correctly again. The difference between a system test and an error test “bench-test”, at a production department, is that the system test is performed in a complete system and easier detects faults, whilst the bench-test only detects specific faults. The

interviewed employees working in the production department, system testing, are referred to as system testers.

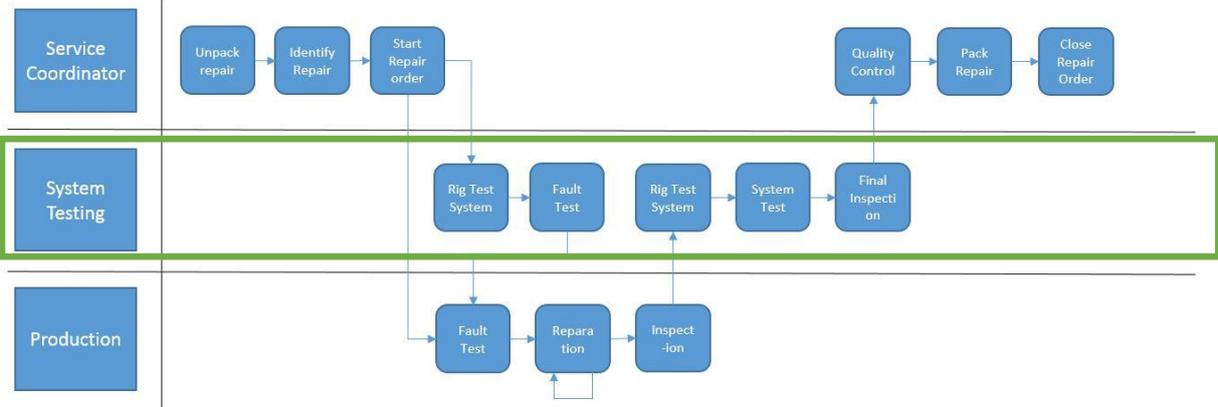


Figure 13- Illustrating wherein the repair process the system testers are present.

The process

According to the system testers, there are several elements in the process that are not working efficiently today. There was a common concern about the process of receiving and delivering the repairs physically. It was explained that the repair units could show up anytime, anywhere, hence, there is not a standardized process for this procedure. It was mentioned that there is a plan of having a set manufacturing plan, called frozen plan, for the next two weeks and stick to the plan, however, it will never work if new units enter “from the side” all the time. There is also the factor of a varying, unknown amount of incoming repairs that could cause difficulties. It was also argued, by system testing, that the documents that follow along with the repair unit show a delivery date for that specific order. However, that date is the last delivery date and very difficult to relate to if the activity is at the beginning of the process.

Another challenge the system testers experienced was the fact that there is never a warning if an order becomes late. It was argued that it should be some kind of a sign or warning stating that that specific order will be late in a couple of days unless it is taken care of. Due to all the exceptions, in the frozen plan, it is difficult to keep track of what orders to prioritize or not. This challenge was related to lack of monitoring and the fact that system testing experience that there is no one monitoring the repairs.

Communication and unified process

According to the system testers, the main issue is that there is not a unified process or order handling, neither by themselves or the other departments. It was considered to be of concern that each specific person does a task in its own way and another person does in another order or with other tools. An example of this is when a repair is delivered to system testing, for the error verification, and each time there is different documentations attached. The coordinators handle the orders differently and that results in different ways of presenting information and delivering the repair orders. It was argued, by the system testers, that it would be more efficient and understandable if each repair order would consist of the same kind of information and be delivered in the same way.

Resource handling

At the system testing, the performed work relies upon functional test systems. These systems are “prototypes” of the real ones and are used to test different parts or units. This is done by simulating the normal environment and conditions for each repair. When interviewing system testing there was a commonly expressed opinion, that these test systems are too few and often reserved for a specific project over a long time.

Another concern that was expressed was the complexity of planning the work task that requires specific competencies that only certain people possesses. If an individual is absent there are tasks that cannot be performed. It was explained that in this industry, and foremost within the repair service, there are very old and outdated products that return to the case company for reparation. These products therefore rely upon employees with knowledge from the time period these products were a part of the product family. This type of knowledge is difficult to spread onwards, which means that for each person that retires with the competence, the company will have a more challenging time to repair those types of products.

It was also discussed that another issue that will occur in the near future is that new products will soon be released on the market and to test those product new investments in test systems are needed.

Prioritization

The interviews resulted in the insight that no prioritization should be made. Each order that comes in should be handled with the date of arrival when being scheduled. The first in- first out- principle should be in place, however, this is not how it works today.

The test systems are constantly reprogrammed and re-built to be able to test as many repairs as possible. The rebuilding takes time and is often very complex and if several units can be tested in the same structure of the test system the order of tests can be rescheduled.

It was stated that there are some criteria's the repairs must fulfill in order to be tested in a system test. These criteria's are that the repair unit can not contain any loose material, it cannot smell burned or show other types of physical, visual defects. If a repair would be integrated into a system without looking for these criteria's, the whole system could be destroyed.

Documentation & Information

The mutual experience was that there is an inadequate description of the defect from the customer, which complicates the first fault test. It was commonly expressed that if the customer would add a description of the defects, it would be easier to know what to look for and where to start. Now the repairs are tested without knowing anything about its history or its errors, which is expressed to be very time-consuming.

Responsibilities

The topic of responsibility and, mostly the lack of it, was discussed and questioned by all the system testers during the interviews. There was a unified opinion that there is a gap in the

process where no one is appointed as responsible for the repair orders. There was, however, different opinions on who should be responsible for the repair order. There are suggestions that the coordinators, the after-market manager, the project leaders and also a manufacturing planner should be responsible. However, there are several system testers that argued that the coordinators are the most appropriate persons to be responsible. There was a common opinion that the responsibility division between the system testers are correct and clarified. Each employee has its own area of responsibility and possesses the tools and knowledge to perform appointed tests.

IT-systems

Regarding the IT-systems and activities concerning each repair order, it was a mix of opinions. The system testers had different opinions about the tasks that consist of administrating the repair orders in different IT-systems. The system testers work with several systems, for the same order, depending on what activity that is performed. There are systems that are connected to documentation about the products, logs to follow the history of the order, handle material orders, report operation time and finish the operation activities.

4.2.3 Production department manager

The production department manager is managing a specific production department. There are eight production departments at this site and all of them are product unique. Each production department manager has a team of a production planner, a material planner and a project planner. Furthermore, there are production technicians, operators and testers within each production department. As illustrated in Figure 14, there are three main steps that the production departments are responsible for.

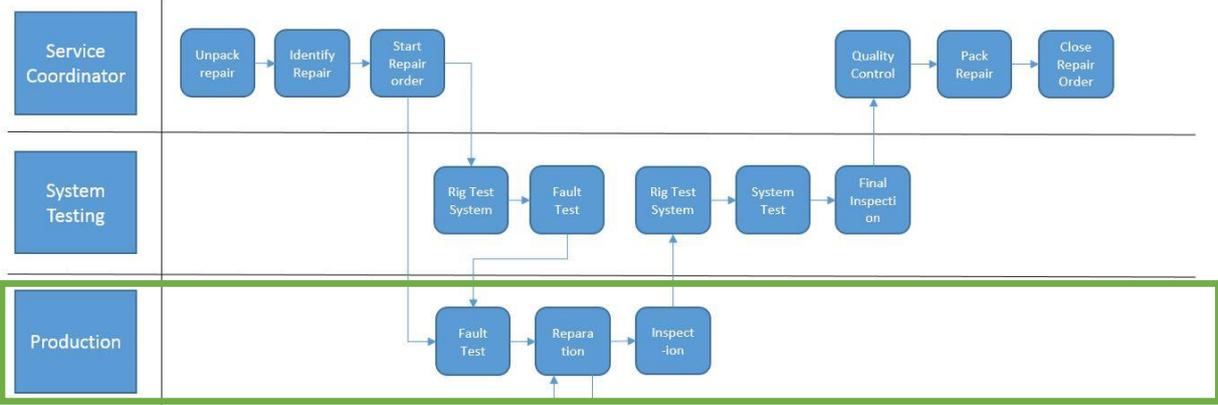


Figure 14- Illustrating wherein the repair process the production is occurring.

Responsibilities

According to the production department manager, it should be the service coordinators who should have the overall responsibility for the repairs.

Prioritization

Each production department does this differently but everyone tries to work with the frozen plan, at the same time prioritize products that need special treatment, which usually results in a

clash. However, the production department manager considered prioritizing to a kind of tradeoff situation. It is argued to be difficult to know when and how to prioritize.

Communication

The communication between the production departments works differently dependent on the employees involved. Usually the project managers, production planners and coordinators are communicating with each other without involving the production department manager, unless there is an issue that needs to be discussed among the management.

IT-systems

The production department manager claimed that the IT-systems is lacking a good overview of the overall status of the production department. The production department manager argued that it is messy with different systems for different tasks and that it feels like extra work due to the several places that need to be handled to manage one order.

Other thoughts

The production department manager expressed that the general opinion about repairs is that it is embarrassing that a reparation can take up to a year. There are employees at each production department which have very special competencies. This is an issue due to the fact that when one of them is missing some tasks are left behind.

4.2.4 Production planner

A production planner is working at a specific production department and plans the production in general. The main tasks are connected to the material, capacity and production planning, for both the serial production and repairs. The production planners are the main collaborators between the production departments and are supposed to be the overall organizer.

Responsibilities

The production planner was of the opinion that there is a difference in the responsibility depending on which project the repair belongs to. Some projects have an appointed employee handling repairs, whereas other projects have a shared responsibility. However, repairs that belong to projects which are old and sometimes even defunct it is more difficult to appoint someone responsibly. When the repair is in different production departments, each production planner is responsible for the repair and that the reparation is conducted as soon as possible.

Prioritization

According to the production planner, the repairs should not be a part of the frozen production plan, especially if the repairs are customer owned. The production planner argued that it usually takes a lot of time to fault search the repairs, and it is not smart to wait three weeks, just to stick to the frozen plan. Therefore, the production planner discussed that it should be prioritized to start the repair process to be able to have time with offers, material procurements etc.

Communication

The production planner was of the opinion that it is too many surprises regarding repairs. The repairs usually just show up on the desk and there is never a prior notice. There are few products that come to the production department with a prior notice. In those cases, the planner has the chance to plan for the repair, both capacity and the material.

There is also a lot of communication regarding repairs that are becoming late in the near future. However, it is usually communicated to late and therefore too late, hence, even if a prioritization would be done the delivery will be delayed.

IT-systems

There are several systems which are required to handle in order to fully complete a repair order. Each person working in the production department have tasks that need to be done before the order is complete.

Other thoughts

The production planner was experiencing a resource issue regarding specific competencies and being able to handle all production orders at the production department.

The production planner stated that it would be beneficial if all different projects would have agreements with the customer regarding service. As it is today there is only a part of them who have agreements. The agreements could generate a better collaboration and the service would hopefully be smoother and quicker. These agreements could, for example, consist a paragraph stating that the product is allowed to start repairing without a set offer/quotation, which would result in a lot more efficient work in a production. Today an error might be found in a product and the operator can easily say which component that needs to be switched, but even if this is identified the customer needs to confirm and “order” the reparation before the component can be switched. This generates a lot of started orders with a ticking lead time, even if the product is just laying on a shelf waiting for a customer to reply to the offer.

The production planner argued that there is a general attitude towards repairs which is quite bad. A lot of production operators thinks it is messy and difficult to handle repairs, everyone does it, but not with any enthusiasm. Not the actual work of reparation, but rather all the documentations and procedures connected to a repair. There is usually insufficient documents regarding construction, material and quality requirements and especially descriptions of reparations and test equipment.

4.3 Additional findings

In this section, the findings gathered through workshops and study visits will be presented. The two workshops consist of several exercises, where each is summarized in a table at the end of each section.

4.3.1 Workshop 1

The workshop generated information to why repairs are important to the firm and to whom. It generated opinions, issues and thoughts regarding the current repair flow. It also generated an outcome of how a new process could be designed and managed, based on the issues raised during the workshop.

Exercise 1

According to the focus groups, repairs are important to the company in many ways, illustrated in Table 5. The most common opinion was that repairs are important due to the income it generates from offering repair service. Repairs are important because it generates a confidence among the customers due to the fact that the company can offer a repair service for these expensive and complex products and quickly can provide the customers with a working product. Repairs are also important because it establishes a continuous relation with the customer with the potential to generate additional sales, continuous cooperation and sales of new products. Another aspect of why repairs are important to the company is that no one else can provide the kind of service that the company offers. The focus groups also argued that repairs are important to the customers, the company and for the employees.

Table 5- Summarized findings exercise 1- workshop 1

Why and to whom are repairs important?	
Why:	To whom:
<ul style="list-style-type: none"> - For the company's economy - Create confidence among our customer - Provide after-market services for the customers - Provide customers with working products - Continuous cooperation with customers - Keep good relation with customers - Additional sales - No one else can provide the service that we offer 	<ul style="list-style-type: none"> - For the customers - For the employees - For the company

Exercise 2

The workshop generated three current process maps of the physical flow of the repair, as well as who manage the transport, what documents that needs to be included and what computer system that are used where, see Appendix J.

Exercise 3

The third exercise generated issues regarding the current repair flow. The issues were categorized into six areas which are presented below and summarized in Table 6.

Physical flow, hand over and transportation

Some people in the focus groups raised the issue of decontamination of arriving repairs. The issue was raised due to the lack of a proper decontamination process, which results in insects and dirt being a part of their everyday work. Many people argued that repairs may lie too long on shelves, waiting for a decision to be made. There were issues regarding the current actual hand-over of the repair and that it was non-functional. There was also a concern regarding the storage of repairs while they were waiting for actions to be made.

Computer systems

According to the focus groups, there are too many IT-systems that are necessary to use while managing the repairs. The systems, which exist today are also too complex and time-consuming.

Resources

The focus groups argued that there are, at some departments, lack of resources, both in terms of workforce, but also machinery and testing equipment. At some departments, there is scarce knowledge which is hard to replace if these individuals are absent. Hence, repairs are left un-repaired.

Documentation

During the workshop, there were many issues regarding documentation. Firstly, fault descriptions from customers are seldom included in the return of the repair, this makes it difficult to know what the problem is. These fault descriptions may also be difficult to interpret. Also, documentation of where and whom the repair comes from is sometimes missing. Documentation regarding when the repair needs to be finished at each business department to be complete within deadline are also missing. Sometimes the shop order is not properly filled out and completed and sometimes operations are not closed.

Prioritization

The focus groups also argued that all departments have difficulties knowing whether the repair unit is in a rush or not. Usually, if the repair is in a rush, someone has to notify each business department in order to make them aware that the repair needs to be prioritized.

Lead time

According to the focus groups, there are several issues that affect a repair unit's lead time. In some cases, there are long waiting times to complete an invoice. This is due to the necessity to test the product in order to know how what error the repair suffers from, what material that needs to be purchased, how long time it takes to conduct the reparation and the different tests that need to be completed to properly search the repair for errors. Once the offer/invoice is completed, it takes excessive time to send the invoice to the customer. Once the offer/invoice has been sent, it may take several months before the customer accepts the offer. If the repair needs new material to be repaired, there are long lead time for procurement of new material. Some repairs also need to be repaired at sub-contractors which may take a long time.

Table 6- Summarized findings exercise 3- workshop 1

What are issues related to the current repair process?	
Category	Details
Hand over and transportation	<ul style="list-style-type: none"> - Decontamination at arrival - Too long shelf-time - Lack of hand-over and transportation process - Not enough storage space for repairs - Lack of visibility and monitoring
Computer systems	<ul style="list-style-type: none"> - Too many computer systems - Complex computer systems - Time consuming
Resources	<ul style="list-style-type: none"> - Scarce knowledge - Lack of test systems - Long resetting times
Documentation	<ul style="list-style-type: none"> - Not properly performed fault reports - Lack of customer documentation and information - Lack of fault report from customer - No notification from customer when repairs are being shipped - Lack of properly performed Repair Orders
Prioritization	<ul style="list-style-type: none"> - Not knowing whether the repair needs to be prioritized or not
Lead time	<ul style="list-style-type: none"> - Lack of offer/invoice process - Waiting for procurement - Waiting for repairs at sub-contractors

Exercise 4

Based on the previous exercises, the focus groups generated new ideas of how to solve the issues, see Table 7. One group argued that the physical flow of repairs could be managed by using the existing internal transportation system. Another group argued that it would be difficult to use the existing internal system since the repair then needs special packaging between all departments which would take unnecessarily long time. Another focus group argued that the after sale department needed a planner that could follow up and distribute the repairs in the house. However, the other two groups argued that this would be good, but that the actual movement should not be a part of the planners' job. Also, the ownership of the repair while being repaired on another business department should not be the planners' responsibility, but the planner for that specific business area. The third group argued that the actual movement of the repair should be done via the one who handles it at the movement. The responsibility that the repair would be distributed to the next department should be handled by the one who has performed the last activity. Also, the responsibility of the repair should be held by the one who currently operates on the product. This idea was accepted by the other groups and further issues were discussed. According to the focus groups, clarifications of all business units were to be established as well as the routing system of where the next step in the repair process the repair

should be moved. The focus groups also agreed on that daily fixed transportations should be made on each work center, if any repairs were to be moved.

Table 7- Summary of generated ideas, exercise 4- workshop 1

How to solve the transport issue within the repair process	
Idea 1 - Use internal transportation system	Discussion:
Idea 2 - Employ a new production planner to transfer the repairs	Discussion: - It is not the production planner’s job to singly move the repairs.
Idea 3 - Transfer repairs using PUSH-system	Discussion: - Lots of unnecessary movement of employees - Daily transportation from each department - Clarify work centers - Clarify inbound shelves

4.3.2 Workshop 2

The second workshop generated knowledge within the field of performance measurement and strategic goals with after-market departments from three sites. The workshop generated information about current performance and strategic goals as well as future possible and preferred performance metrics and strategic goals. The workshop also generated, which performances and goals that are most important and relevant to address according to the participants. All notes, ideas and thoughts are illustrated in Appendix K.

Exercise 1

The first exercise, the focus groups discussed and displayed current performance measurements and strategic goals from the different sites, summarized in Table 8. According to the focus groups, site number 2 and number 3 measures turnaround time (TAT) of some repairs, depending on the contracts, but not site 1. Some customer agreements include agreed turnaround time of repairs, however, both turnaround and delivery precision of concerned repairs were found not to be measured. All sites argued that they measure the total number of repairs by number of open repair orders. All of the sites agreed that it is important not to override the cost of reparation, meaning that the cost of reparation will not override 50% of the cost of a new product or the agreed cost in the agreement. The employees at site 2 work differently when managing customer projects and repairs. They act as after-market project managers and service coordinators. By combining these two roles, their responsibility is wider. Hence, they measure more in order to keep track. At site 2 they also measure the net margin of repairs, internal response time to customer and internal operation time.

Table 8- Summarized findings exercise 1- workshop 2

Current strategic goals and performance measurements carried out at the after-market departments'	
Current performance measurements	Site
Turnaround time of repairs	2&3
Total number of open repair orders	1,2&3
Important not to override agreed repair costs	1,2&3
Net margin of repairs	3
Internal response time to customer	3
Internal operation time	3

Exercise 2

The second exercise resulted in findings of what could be possible to measure and what measurements that could guide the after-market departments decisions in order to increase performance, summarized in Table 9. The second exercise also generated goals and directives to what the after-market department should strive towards, from the participants' point of view.

The first focus group argued that it is important to know if you are doing a good job. The group argued that it should be possible to evaluate your work and measure your performance. The focus group also argued that to do so, working instructions must be clarified and established. The third focus group claimed something similar to the first focus group. In their case, work efficiency should be measured, meaning that the work which is spent on repairing a unit is the right kind of work.

The third group also said that it is necessary to secure utilization in production for the repairs, meaning that repairs should be included in the production plan. The first focus group argued that in order to plan capacity for repairs in production, forecasting repairs is needed. This was also mentioned by the fourth focus group. The participants also claimed that they wanted to become an own department with own resources, meaning that resources should be dedicated to the after-market department. Such approach would include a separated supply chain, machinery and employees in sales, procurement and production. The first focus group also said that there should be clear goals with the decided performance measurement and statistics, otherwise they could not see the purpose of having performance measures at all.

The second, third and fourth focus group argued that the process time, both value added and non-value added time such as waiting time, administrative time and through-put time on each work unit in the repair process should be measured. The fourth focus group also said that the system should somehow alert if the repair would be late. The second, third and fourth focus group discussed that the delivery precision and time spent on offers, both establishing but also customer response time, should be measured (Procurement & sub-contractor). The second, third and fourth focus group claimed that the response time for procurement should be measured in order to measure how long time it takes to establish an order, to send an order to sub-contractor. All focus groups argued that the total time of a repair repaired by sub-contractor should be

measured. The second focus group also said that it is important to know where the repair is in production, but also that all administrative work should be performed directly when an activity is carried out and not later. All four focus groups argued that the turnaround time on repairs should be measured. The second focus group reasoned that it is important to measure the turnaround time more specific by how many repairs that flow within the company each week, month and year, but also how many repair orders that are started and closed during each period of time. The third focus group also stated that the revenue of repairs should be measured on a detailed level and communicated to the after-market department. The third focus group discussed that the total cost of repairing a unit and the turnaround time should be compared. Last but not least, the second and the fourth focus group argued that the company's customer satisfaction should be measured. The fourth focus group also reasoned that the delivery time to the customer should be measured.

Table 9- Summarized findings exercise 2- workshop2

Possible goals and measurements within an after-market department to increase performance	
Focus group 1	<ul style="list-style-type: none"> - Clarify work instructions - Evaluate the work you are performing - Forecast repairs to plan capacity - Clearly formulated goals and performance measurement - Turnaround time
Focus group 2	<ul style="list-style-type: none"> - Measure value added time - Measure non-value added time - Delivery precision - Better monitoring of repairs by knowing where the repair are in production - Measure establishment of offers - Measure customer response time on offers - Response time of procurement - Response time of order confirmation and shipment from sub-contractor - Turnaround time - Customer satisfaction
Focus group 3	<ul style="list-style-type: none"> - Evaluate work efficiency within the repair process - Secure utilization of repairs in production - Measure value added time - Measure non-value added time - Delivery precision - Measure establishment of offers - Measure customer response time on offers - Response time of procurement - Response time of order confirmation and shipment from sub-contractor

	<ul style="list-style-type: none"> - Turnaround time
Focus group 4	<ul style="list-style-type: none"> - Forecast repairs - Become an independent after-market with their own resources and supply chain - Measure value added time - Measure non-value added time - Better monitoring of repairs and detecting late repairs - Delivery precision - Measure establishment of offers - Measure customer response time on offers - Response time of procurement - Response time of order confirmation and shipment from sub-contractor - Turnaround time - Customer satisfaction - Delivery time

Exercise 3

The third exercise generated goals and visions that the departments could strive towards, summarized in

Table 10. The results were provided by each focus group and later discussed among all focus groups. Two focus groups said that the after-market department should have the possibility to unify their working methods and to share resources between sites. By this, share and follow the same routines and work instructions in the computer systems so that the repair could flow between the different sites, without the necessity to change owner when being transferred.

All participants agreed that the after-market departments should become more united between the different sites, to learn and share knowledge. There should be regular after-market meetings and workshops between the sites where specific fields of interest should be addressed. The groups admitted that there should be effective communication forums where they could communicate to solve specific issues. They all settled that they should work to continuously improve the process by helping each other over different sites. All participants agreed that the after-market department of each site worked differently and that no one could answer for what the after-market department meant for the case company. They all came to the conclusion that

they should be an internal customer to their own company and that the after-market department should be identified as a separated, yet an integrated part of the case company.

Table 10- Summarized exercise 3- workshop 2

<p>Goals and visions of an after-market department</p> <ul style="list-style-type: none"> - Unify work procedures to share resources between the sites - Share knowledge among the sites to improve procedures - Meetings and workshops within specific fields of interest - Communication forum - Become an “internal customer” within their own company

4.3.3 Study visits

The study visits revealed that the case company’s different sites managed the after-market department and repairs slightly different. One of the two sites visited managed their after-market department with full control of customer communication, procurement and coordination, something which the other two sites did not. This site managed both military, governmental and commercial customers with different preferences which influenced the department. The site also managed more performance measurements such as lead time and turn over time. The second site had another approach to the supervision and responsibility of repairs. The coordinators at the second site monitored and supervised the repairs while they were in for reparation and forced them into production. The two sites also provided the authors with their repair process maps and can be found in Appendix L and Appendix M.

4.4 Quantitative data

The final document generated from secondary historical quantitative and qualitative data extraction from IT-systems included total numbers of opened and closed repair orders over the last two years, the seven most reoccurring in-house repairs, two to three best and worst case scenarios of each repair unit and cause of delay or success, see Table 11. The total amount of repair units during the last two years were 1668, 834 each year, where there are 499 different repair units during the last two years. The accumulated average lead time of repairs were 140 days.

In total, 53 repairs were deeper analyzed. Found through the extracted data were that repairs generally could vary from 10-531 calendar days or 7 to 380 work days. Within the same product category, they could vary as much as 510 calendar days (21-531 days). The cause of delay that was found most recurring among these 53 repair units was that they were sent to sub-contractor,

awaiting offer to be approved by customer, miscommunication or that they were laying on a shelf at one of the business departments without any reason.

The most accumulated efficient time spent on a repair was 62%, where it was repaired in-house and tested within 11 calendar days, or 8 work days. The worst repair that was repaired in-house were 1.96%, where there was miscommunication among the business departments and the repair was forgotten, even though it only had to be modified. This took 147 days where 40 of these days the repair were waiting for a decision to be made and another 82 days spent on a shelf due to misunderstanding in using different computer systems.

The most recurring repair unit, in total 65 units during the two last years, can differ between 17-91 calendar days (12-66 working days). The accumulated effective work time on these two units differs between 3.9% and 17.2%. The cause of delay was due to that the repair was lying on a shelf for 36 working days, only when tested it was shown that there was no fault found on the product.

Table 11- Seven most reoccurring in-house repairs, during the last two years

Part No.	Amount of repairs (2 years)	Lead Time (Calendar days)	Lead Time (Work days)	Lead Time (h)	Accumulated work time (h)	Effective work time (%)	Cause/ Information
A	65	92	65,7	525,7	20,5	3,90%	System test: Inactive 36 w.days (workdays) Result= NFF
A	65	17	12,1	97,1	16,71	17,20%	No information!
B	19	250	178,6	1428,6	67,09	4,70%	OK to start repair MIV ¹ : 95 c.days (calendar days) Await offer: 52 c.days Prepare delivery: 51 c.days
B	19	250	178,6	1428,6	19,69	1,38%	MIV: 76 c.days (repair and re-test) Await offer: 111 c.days Delivery preparations: 32 c.days
B	19	23	16,4	131,4	10,3	7,84%	NFF in to BFPREP
B	19	64	45,7	365,7	29,6	8,09%	MIV: 15 c.days 23 days from written offer to delivery. (FAST ORDER CONFIRMATION FROM CUSTOMER)
C	19	182	130,0	1040,0	37	3,56%	Awaiting decision: 3 months
C	19	163	116,4	931,4	28,8	3,09%	System test: 62 w.days , result= NFF MIV: 67 w.days (Repair and lack of resource)
C	19	147	105,0	840,0	16,45	1,96%	Awaiting decision: 40 w.days (miscommunication in IT system- would only be 26 w.days, otherwise)
C	19	32	22,9	182,9	6,85	3,75%	NFF - put into BFPREP
C	19	28	20,0	160,0	12,05	7,53%	Modification, return to customer
D	16	112	80,0	640,0	77,24	12,07%	25 w.days waiting for COC. ²
D	16	108	77,1	617,1	62,31	10,10%	20 w.days waiting for delivery
D	16	10	7,1	57,1	20,57	36,00%	No information!
D	16	34	24,3	194,3	35,2	18,12%	Modification made- into BFPREP

¹ MIV: Microwave production department

² COC: Certificate of conformance- Documents for quality control

E	14	96	68,6	548,6	86,36	15,74%	From decision of lacquer, to shipment for lacquer: 17 w.days. Lacquer: 7 w.days.
E	14	84	60,0	480,0	71,79	14,96%	Bench test in DIG ³ : 34 w.days
E	14	28	20,0	160,0	49,65	31,03%	Awaiting delivery after reparation: 6 w.days
E	14	26	18,6	148,6	59,8	40,25%	Waiting for material from other site: 9 days.
F	4	138	98,6	788,6	83,62	10,60%	System test: 55 c.days
F	4	160	114,3	914,3	87,04	9,52%	No information!
F	4	107	76,4	611,4	67,55	11,05%	2015-06-23: To system test 2015-08-19: Email about progress (still no test)
F	4	52	37,1	297,1	19,1	6,43%	OK in error test!
G	13	138	98,6	788,6	37,83	4,80%	Waiting order confirmation: 56 c.days
G	13	127	90,7	725,7	20,52	2,83%	Put into BFPREP after reparation.
G	13	126	90,0	720,0	54,6	7,58%	Waiting order confirmation: 21 c.days
G	13	51	36,4	291,4	13,1	4,50%	No information!

³ DIG: Digital units production department

5

Current state- the repair process

The repair process, illustrated in Figure 15, refers to the process where the products, called repairs, goes through in order to be repaired or modified (also presented in Appendix O, on a larger scale). The process illustrated and explained below is the current state of the repair process at the case company and provide the answer to research question 1. **How is the current repair process at the case company organized?**

They grey marked areas in the repair process map is not further explained due to the delimitation of the research. The process starts with an incoming repair with an often unknown defect, which needs to be repaired. Due to the products complexity and different functionalities the further steps in the process differs a lot. However, the process involves many different departments that are required to help each other in order to complete the reparation.

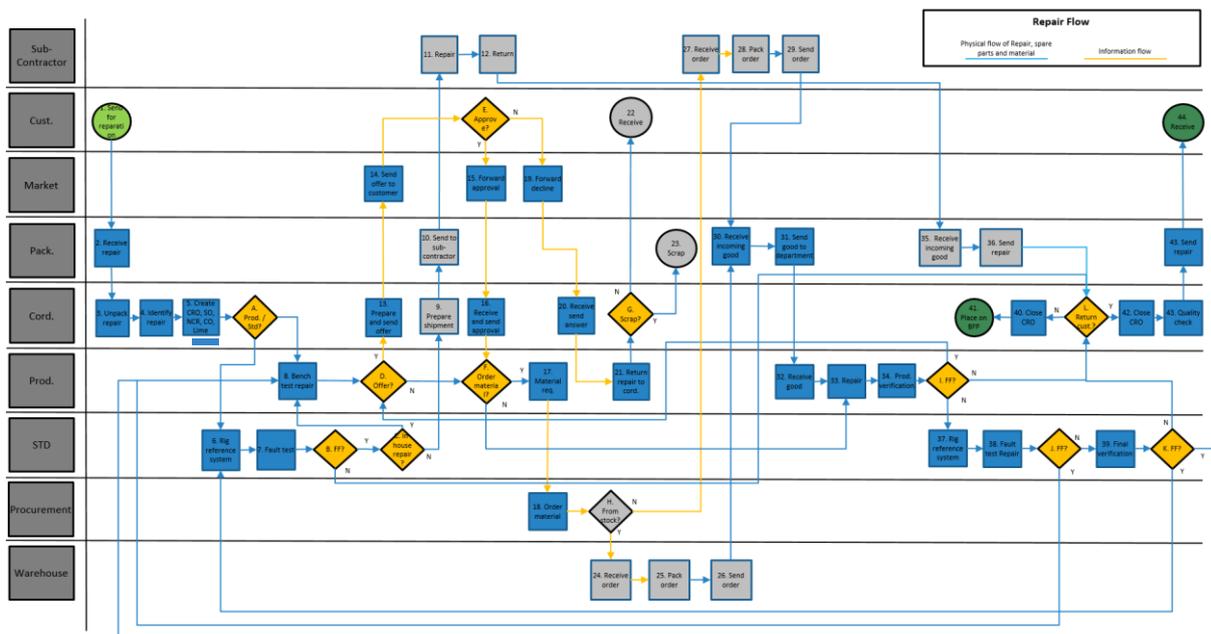


Figure 15- Illustrating the current state of the repair process.

1. Customer sends repair unit to case company due to un-functionality
2. Receives repair unit (Goods receipt)
3. Unpack the repair unit (The service coordinators)
4. Identify repair unit, customer agreement and possible repair history (The service coordinators)

5. Create CRO⁴, SO⁵, CO⁶, NCR⁷ (The service coordinators)
- A. Visual judgment, Decision: System test or production** (The service coordinators)
6. Prepare reference system (System operator)
7. Fault test of repair in reference system (System operator)
- B. Fault found? Yes: To production / NO: Back to repair coordinators**
- C. Repair in-house? Yes: different production department/ (NO: send to sub-contractor)**
8. Bench test in production (Production operator)
- D. Make an offer before repairing the repair unit? Yes: prepare an offer. No: Check material need**
9. Prepare for shipment to sub-contractor (The service coordinators)
10. Send to sub-contractor (The service coordinators)
11. Repair at sub-contractor
12. Return from sub-contractor
13. D-yes: Prepare offer and send offer to sales department (The service coordinators)
14. Send offer to customer from sales department (added margins) (The service coordinators)
- E. Approve of offer/ Order confirmation by customer. Yes or No?**
15. Yes: order confirmation by customer to sales department
16. Get the order confirmation from sales department and forward to the production department involved. (The service coordinators)
- F. Material need? Yes or no?**
17. Yes: Make material request to procurement. (Production/product planner)
18. Order material (Procurement)
19. E) NO: Offer declined
20. Gets the declined offer, informs production. (The service coordinators)
21. Production return repair to coordinators (Production planner/operator)
- G. Scrap or return the unrepaired unit?**
22. Customer receives the unrepaired unit
23. Scrap the unit. (The service coordinators)
- H. Order material by sub-contractor or is it in stock?**
24. Yes it is in stock. Warehouse gets pick-list request
25. Pick the order and pack it for delivery to production (Warehouse)
26. Send order from warehouse
27. No material in stock. ORDER received by sub-contractor
28. Sub-contractor manufacture/ pick the order
29. Sub- contractor pack and send the order
30. Goods receipt receive material from warehouse or subcontractor
31. Deliver material to production departments (Internal transport)
32. Production department receives the material

⁴ Customer Repair Order: The order where everything is summarized (CO, SO, NCR and costs)

⁵ Shop Order: The order which illustrates the required operations that need to repair a unit, hence “the recipe”.

⁶ Customer Order: Demand-driven order

⁷ Non-Conformance Report: The document where all operations performed is reported and explained.

- 33. Repair the unit in appointed production department (Production/operator/technician)
- 34. Bench test the repair for functional verification (Production operator)

I. Fault found. Yes or no?

- 35. From 12) Goods receiving receives repaired unit from subcontractor
- 36. Send the repaired unit from subcontractor to coordinators
- 37. I) No fault found- system testing prepares a reference system for system test
- 38. System test- final fault test (System operator)

J. Fault found in final system fault test? Yes or no?

- 39. No fault found) Final verification/inspection of repair (Final inspector)

K. Result of final verification? Nor fault found or Fault found?

L. No Fault Found) Return Repair to Customer or Put in BFP-REP

- 40. Place Repair in BFP-REP⁸, close case; SO, CRO and CO (The service coordinators)
 - 41. Prepare for delivery to customer (COC), close case: SO, CRO and CO (The service coordinators)
 - 42. Good receiving packs and send the repair unit
 - 43. Customer receives the repair
-

Firstly, the repair is sent from the customer (1) and reaches the goods receiving where it is received and noticed (2). The repair is placed to the shelf where the coordinators unpacks the repair (3), in order to identify what customer it belongs to, what service agreement that customer has, what kind of product it is, possible repair history and verify if there is an error description from the customer (4). There is occasionally an issue trying to identify the repair unit, due to lack of information from the customer. A package without any information about what customer it comes from and what type of product they have sent, tend to become a troublesome case. Usually, the service coordinators have experiences and can identify the repairs after some struggling detective work. However, it is expressed to be both time-consuming and frustrating for the service coordinators to handle.

The next step (5) in the process is to start a customer repair order (CRO), a shop order (SO), a customer order (CO) and a non-conformance report (NCR). These documents are all created in the ERP-system and make the repair unit a part of the production dispatch lists. This step also includes administrative work in additional IT systems which are supporting the repair process. Examples of these systems are the ERP-system, the log-system, the time report-system, the product serial number system, the transportation request system and the order start-system, further explained in section 4.2.1.

The next step (A) is to decide where the first fault verification of the repair should be performed. Some repairs are tested in a complete system in order to identify the possible error(s) and after that being able to decide if and how the error(s) could be fixed, this is called a system test (7). However, there are some repairs that cannot be tested in complete systems due to different criteria's, mentioned in section 4.2.2, and are instead sent directly to the appointed production

⁸ BFPREP: Customer owned inventory: Explained in section 4.1.1.1

department (8) for a more specific error test, a bench test. This is usually decided by the coordinator or in consultation with other experts.

If the repair is suitable for a system test, there are reference systems that should be prepared (6) in order to install the repair unit and perform the test. There are sometimes difficulties in finding an available system to test the repair in, since other projects share the same system test equipment. When the reference systems are modified, in order to simulate the unit's operating environment, the system test is performed (7) by system operators. If there is no fault found (NFF) (B), the repair is delivered back to the service coordinators for further handling (L). If the system test results in an error verification which is a fault found (FF), it needs to be considered for reparation (B). However, if the repairs does not fulfill the criteria's for a system test it is sent to the appointed production unit and a more detailed fault verification, bench test, (8). Independently on how the first error test is performed and that there is a fault found, the following step is the same (B).

When the first error test is complete, the next step of the process is dependent on whether the repair is originally manufactured by the company or if it purchased by a sub-contractor (C). If the repair is originally manufactured by the case company, the repair is transferred and repaired at the appointed production department (8), dependent on the specific error(s). If the repair is purchased, it is packed and sent to the original manufacturer, i.e., subcontractor, and repaired or modified by them (9-12). After reparation at subcontractor it is received at goods receiving (35-36) and send to the service coordinators, for further actions.

Dependent on what customer the repair belongs to there are different service contracts involved, mentioned in section 4.1.1.1, which makes the following step take different directions (D). Some customers have agreements which states that the reparation can be started without them having to confirm the offer for repair. In that case, the reparation could start as soon as the fault test is complete, however, there is usually some material needed (F) in order to repair, hence a material request needs to be made.

In another type of service agreement an offer needs to be prepared and send to the customer, and in order for reparation to start that offer needs to be confirmed by the customer (13-16). This activity often takes a very long time and especially the waiting time of the confirmation of the offer. There is a collaboration between coordinators and the market department in preparing the offer. The service coordinators are preparing the offer with the amount of time spent on the repair, the accumulated cost of material etc. After that, the sales department adds margins and additional costs before sending it to the customers. This collaboration has been experienced to be complicated and slow, which makes the lead-time longer than necessary.

If the offer is declined (E), the sales department receives the declined offer and forward it to the service coordinators. The coordinators then inform the production department (20). The production department sends the repair unit back to the service coordinators (21) where a decision is made whether the repair should be scrapped, which is usually due to a very high cost

of reparation of old products or sent back to the customer without any changes made (22-23 and G).

If and when the offer is confirmed by the customer (16), there is a check for material need (F). If any material is needed, in both cases (D) of repairing right away or wait for offer confirmation, procurement is involved in purchasing material (17-18). The material could either be ordered by a subcontractor or material exist on stock (H). If there are material in stock, the warehouse will receive a material request, pick it and send it (24-26). If the material is order is via sub-contractor, the material request is sent to them and manufactured/picked and sent by sub-contractor (28-29). Either way, the material is delivered to the goods receiving (30) and continuously distributed to the different production departments (31) which take care of it (32).

The reparation is performed (33), sometimes in several production departments, dependent on the error(s), and an additional bench test is made (34) to make sure the product is functioning again. If FF (I) the production unit continues to repair the unit until it is approved in the bench test, however, if the bench test results in NFF (I), after being repaired, the repair goes back to system test again.

The system test is again performed (37-38) and if NFF the final inspection is made (39). If there is FF the repair is sent back to the appointed production department for further repair (8). The final inspection that checks the overview of the product, its belonging documents and if everything is correctly performed or not (J). If the final inspection results in a FF, the repair must be modified and the flaws must be fixed. This must be handled by either production department, system test, coordinators or the final inspector, whoever is appropriate for the flaws. If there is NFF in the final inspection the repair is sent to the service coordinators. The repaired unit can either be placed on inventory or sent back to the customer (L). The choice is dependent on the customer agreement, due to the fact that some customer's already have received a new functional product and the repaired unit instead placed on the customer owned inventory.

However, independently if the repair is sent back to the customer (44) or placed on inventory stock (41), there are administrative work that is handled by the coordinators (40&42). The repair shop order, shop order and customer order need to be closed in the ERP-system and all document needs to be correctly reported. At last a quality check is made by a quality manager (43) and a certificate of conformance. Additional, all delivery and shipment documents are created and planned. This is, however, the last activity that happens before the repair leaves the building and delivers to the customer (42-43).

6

Analysis

In this chapter, the analysis will be presented. The analysis is based on the empirical findings, conducted at the case company, the literature review and in combination with the authors' sympathized assumptions.

6.1 The repair process

The studied repair process is a process which contains several activities in sequences that are necessary to perform in order to repair or update a broken product to become fully functional again. Some of the main activities are the identification, administration, the fault test, reparation, verification and inspection, which is simply visualized in Figure 16. From an organizational point of view, the case company's primary processes are sales and manufacturing of new products. Becker, et al. (2003) and Boutros & Purdie (2014) explanation of processes is that services can be seen as both operational and supporting processes. From the case company's perspective, the after-market and repair service can be considered as a supporting maintenance process to the company's products. As new products are developed, these needs to be repaired over a longer period of time.

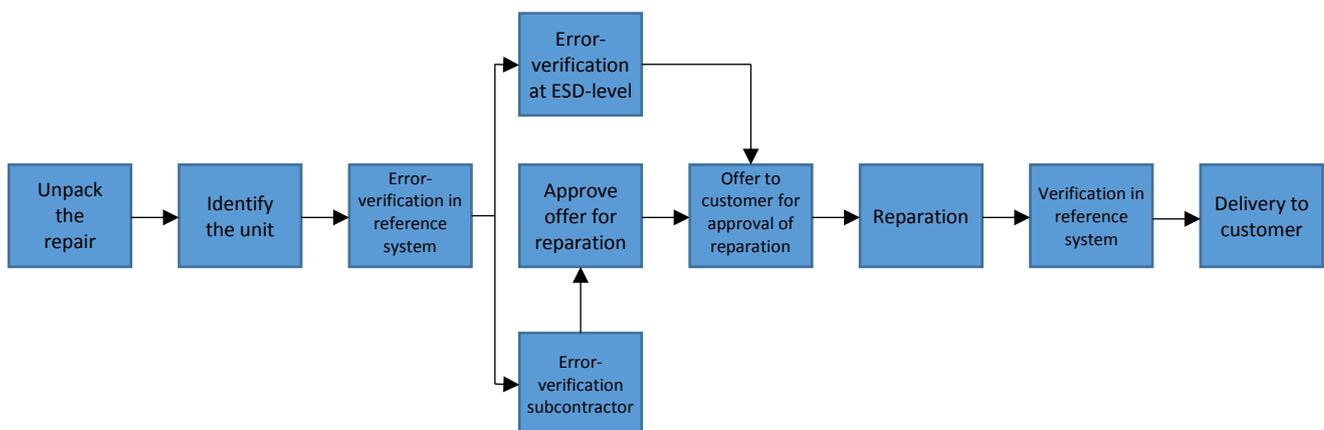


Figure 16- Existing repair process map provided by the case company.

The repair process can be easier managed by breaking it down into sub-processes that are necessary in order to conduct the reparation (Boutros & Purdie, 2014). In this case, the company has an existing, simplified, clarification of the repair process which covers the main sub-processes of the repair process, as illustrated in Figure 16. This illustration is however somewhat too general to be used as a tool in the process, and as argued by Damelio (2011) an unclear processes map is difficult to understand and communicate. The sub-processes in the repair process is then broken down into more or less structured activities and procedures. These

activities are, however, not clarified in the process map in Figure 16, but rather communicated to the employees at the different departments. There is another process map, found at the case company's intranet (see Appendix N), which is old and outdated. It can therefore be argued that based on these process maps, the authors clearly see a lack of an updated and complete process map of the current repair process, due to the fact that a correct and updated process map could increase the understanding and alignment of the repair process (Damelio, 2011; Harvey, 2011). The newly created processes map is presented in chapter 5.

The process maps that were collected, after each interviewee did the task they were asked to do, presented in Appendix C, has provided the authors with an overview of the existing repair process and the common knowledge of the repair process among the employees. As the process maps have been collected, it has become clear that the common knowledge of the repair process diverges. The quality of the collected process maps may, of course, depend on the individuals' ambition when drawing the process map and their relations to the repair process. It could, however, be further discussed that each interviewees map was different due to the fact that they work in different parts of the repair process, hence, they have diverged perspectives. The maps were marked with red areas, which indicated issues. These marked areas were linked to the interviewees' process position. It was also found that each interviewee has presented their "general opinion" about the repair process and each presented case was somewhat different from the others. Therefore, as argued by Mehdi Amini, et al., 2005, a standardized process for all kind of repairs might be difficult and irrelevant to strive for.

The repair process is dependent on an active cooperation between several departments at the case company. There are usually several departments and people that are involved in a process, trying to influence it or getting influenced by it (Dumas, et al., 2013). The complexity of a process increases as the amount of departments and process participants involved is increasing, stated by the manufacturing manager, section 4.1.3.3, and as concluded by Kluza (2015), it could also be other types of resources that increase the complexity, than just employees. According to Mehdi Amini, et al. (2005) one of the main challenges in a repair process is to manage the coordination between all involved departments, which has been found to be a challenge at the case company as well. The challenges were also mentioned by the production manager, section 4.1.3.1, as an issue due to the fact that the coordination of departments takes time and the transparency of the process is not good enough, to allow different departments to easily work together. It was also argued by the manufacturing manager, section 4.1.3.3, that the greatest issue regarding the repair process is the many departments and process participants' involvement and opinions.

6.2 Process improvements

Based on the interviews and observations, there are few existing procedures for continuous process improvements of the repair process. Some of the production departments managed improvements by using a Plan, Do, Study, Act cycle (PDSA). However, these suggestions are not always followed through and some of the ideas posted on the PDSA board is more than three years old. When the authors asked the employees at the department why it was not

managed, the answer was that there was no time, nor any resources to follow up on the suggestions. This could cause difficulties in a long-term perspective due to the importance of changing and improving processes constantly, which is also argued by Chang (2005), Jeston & Nelis (2008), Dumas, et al (2013) and Boutros & Purdie (2014). As stated by Campbell (2014), managing changes is crucial, to not have employees turning against changes, becoming inefficient and unsatisfied. By using PDSA as a changing tool, but not finalize any suggestions, might lead to frustrated employees with trust issues. Trust is an important factor to consider as it is one of the steps, needed to understand, in the journey of change presented by Loid (2016).

There are some changes and improvements in the after-market department, affecting the service coordinators' work tasks. A business developer, specialized in the after-market services, works full time on managing improvements of the repair administration management. These improvements mainly consist of implementing new ways to administrate the repairs in the IT-systems. The business developer does not only manage improvements at one specific site but also at other sites where repairs are managed. This enables possibilities to adapt and imitate sites processes to each other, share knowledge and find a unified way of manage repairs. It is however stated in literature (Jeston & Nelis, 2008), that new technological changes is not always the best path, but rather to focus on employees understanding the process and its different activities.

When a change is implemented it is of concern that it is communicated why it is made, how it will work and how it will affect each employee (Loid, 2016). The authors would argue that this is one of the major issues in the repair process. Changes are made but seldom communicated in an efficient way. This results in that several employees do not know how the new processes work and most important, why the change was made and what the advantages of the new way of working are.

During the research, it has been expressed that the way of treating repairs have become worse than before and as a consequence, a decrease of a positive attitude towards repairs. However, this view was not mutually shared among upper management and workers. Upper managers expressed that the attitude to repairs had become better, but the ones who daily manage the repair argued the opposite. Both the production manager and supply chain manager argued that this may due to the organizational changes performed in previous years.

As the research focus was to improve the repair process one of the first thoughts that came to the author's minds was to eliminate activities that might be unnecessary, in order to streamline the process and shorten the lead times. Elimination of wasteful activities and shortening of lead times are argued by Boutros & Purdie (2014) to be activities in process improvement. The existing sequences of activities, within the repair process, was studied and one activity that was found to be questioned was at the service coordinators department, where incoming repairs are forwarded to either the appointed production department or system testing department. From the interviews with system testers, section 4.2.2, it became clear that repairs that have errors such as; burn marks, visible outer damages or that it contains loose parts, were sent straight to appointed production department, since these may damage the test systems. These exceptions

are however too few to consider when trying to improve the process. The decision taken about where the repair should be tested is only dependent on the service coordinator's knowledge and experience, which for example could be difficult if an inexperienced coordinator would make the decision. Therefore, the question whether all repairs could be sent to appointed production department, instead of being sent to the system testing department was raised. The system testers and service coordinators, seen in section 4.2.1 and 4.2.2, argued that if a repair has no fault descriptions, from the customer, it would be time-consuming and difficult to send it directly to a production department for error test, since it would require several tests to detect the errors, while a system test could detect all errors in one test.

According to both the service coordinators and the system testers, the repairs could be sent directly to the appointed production department, however, this was more dependent on the customer's fault description. In some of the customer contracts, the customer is obligated to fill in a fault description, in some contracts this is not agreed upon. Hence, some repairs with a complete and reliable fault description could be sent straight to the appointed production department. However, since there are several of hundred different repairs each year, it can be argued whether such exception would make the process more unambiguous instead of having one consistent flow.

Even though eliminating steps in the repair process is one way to go about when improving the process, it is difficult to do so due to the required quality assurance that the case company promises their customers, it is of high importance that the repair goes through all activities in the process. Instead of trying to shorten the process by eliminating steps, the authors would argue that it would be more sufficient to streamline the activities within the process.

6.2.1 Measurements & Metrics

From observations and interviews, it has been found that there is a lack of monitoring the repair process. Neither of the involved departments has relevant metrics which shows any statistical history on the performance of the process, which results in a lack of increasing performance. This is argued by Legnani & Cavalieri (2012), Legnani, et al. (2013) and Berman (2014) that it needs to be considered when trying to increasing performance. A well-known citation stated by Peter Drucker is that "*You can't manage what you don't measure*" (McAfee & Brynjolfsson, 2012, p. 60). It is important to monitor the process by using metrics and monitor these measurements. In order to increase the performance, by using metrics, it is vital to have relevant and correct metrics for the specific purpose (Hammer, et al., 2007; Croll & Yoskovitz, 2013).

According to the manufacturing manager, it is unclear whether there are performance metrics or not related to the repair process, see section 4.1.3.3. Found by the authors was that the only metric that is monitored, in this research called Metric 1, is the number of customer-owned repairs that have an open order, in all different production departments. This metric is relevant if the purpose is to see how many orders that could be handled at the same time. However, if the metric never is compared to anything else it is useless (Croll & Yoskovitz, 2013). Metric 1 is only showing a total number of repairs that are started in the ERP-system, however, it does not say if anyone is working on the repair or if it is forgotten. Therefore, it is argued by the

authors that this metrics should not be used for that matter. However, it is argued that a metric like an amount of “open orders” is useful to monitor fluctuations in the demanded capacity. Due to the characteristics of the repair process, being very unpredictable and impossible to forecast, it could be a helpful tool when trying to analyze if there are any periods where the amount of incoming repairs increases. However, this metric must be monitored for a relatively long time before it could be used as a guideline, which makes it an “uninteresting” metric to start using in the beginning of metrics-measurement. The seven sins of measurements by Hammer, et al. (2007), is presenting a sin called “Laziness” which means that there should not be any guesses on what to measure, the company must know what they want to measure.

As argued by the production manager it is of relevance to be transparent to be able to see the progress of this process, and foremost, to be able to act when issues appear. The production manager, as well as the supply chain manager, are of the opinion that the case company will increase the performance in the areas where measurements are implemented and continuously monitored, argued in sections 4.1.3.1 and 4.1.3.2. However, the urge for metrics must be thought through before implementing them. Another mentioned deadly sin (Hammer et al., 2007) is “Vanity”. This refers to the importance of using metric that will increase the performance instead of choosing metrics based on what you know will make you get good measuring results. An example is that if the case company would measure the delivery precisions, it will result in a 100% precision due to that the orders are moved forward in time when it becomes late. Consequently, according to the system, there is never a late order, but towards the customers the orders are late. Therefore, this metric is not relevant according to the vanity factor presented by Hammer et al. (2007).

Another of the seven sins of measurements is “Inanity”, which is a relevant factor to analyze in this matter. Inanity means that it is important to know what the outcome of an implemented metric could cause. When a metric is introduced, it increases the probability that the employees will start working to perform well towards that specific metric. Consequently, the result could be that other tasks, which are not measured, will be deprioritized. It is therefore of high importance that the metrics chosen are the most appropriate once (Hammer, et al., 2007).

For example, Metric 1 could be divided into smaller metrics to concretize what the numbers imply. To compare the metrics, it would be of value if each department would know how many repairs they had this instant and the ability to look back at historical numbers. It would probably also increase the easiness of monitoring and controlling the progress of the repairs. The ability to compare and see metrics over time was also something that was raised during an interview with a system tester. Another possible division could be that Metric 1 should be divided into where in the processes the repair is, which department is responsible right now. This type of metric would open up the possibility to give a specific department the responsibility of a repair order.

If being able to monitor the repairs it would also create a possibility of visibly communicating the current status. Each department could easily see what the backlog looks like and what units that might become late in the upcoming days. The visibility could generate a better

understanding and also a tool that could help to plan the next step in the process. If work center A visually communicates what units that are in progress, work center B could start planning for those units to come.

The current monitoring is insufficient in that matter that it is not a structured process and it is only a task that the service coordinators are supposed to do each Monday, but never a task that is performed regularly together or with someone else but the coordinator itself. Both the supply chain manager and the production manager, as can be found in 4.1.3.1 and 4.1.3.2, is of the opinion that if the repairs were to be monitored the repair process will have shorter lead times.

The authors of the research managed to generate relevant metrics, although, this was done by mixing data from different IT-systems. The procedure of getting the right data was complicated and had to be done manually. The findings indicate that there were data available, however, it has not been used to monitor repairs. Hammer et al. (2007) mention frivolity as one of the seven deadly sins in metrics, meaning that it is important not only to find interesting metrics but also to improve by finding the root-cause of the problem. A purpose of the generated data was to find good and bad practices to why some repairs were late and why some were not. By identifying the good and bad practices, it was possible to find the cause to delay linked to the bad practices. Some of these root-causes found were the lack of offer approval and lack of responsibility to carry out specific activities in the process which is further analyzed in the next paragraph. Another purpose of generating data of this kind was to introduce metrics as tools for the after-market department. As the metrics visualized the turn-around-time and the accumulated work time it became evident to the after-market department how much time is spent on each repair and efficient the process actually is. The average turnaround time of repairs was found to be 115 calendar days, which is difficult to tell whether it is good or bad. Since the measurement was made on all company manufactured repairs, which are several different types of units with specific problems. It can be argued that it would be better to measure each unique product to get an average turnaround time of each repair. However, with the several hundred amounts of repairs, the average turnaround time was rather a general guideline for how long turnaround time a repair could have.

After discussing metrics and measurements with the business developer it was concluded that the ERP system is compatible when measurements are desired. As mention in section 4.2.1, by the service coordinators, there are new directives of how to handle the repairs in the IT-system. According to the business developer, these changes have opened up possibilities to generate valuable and historical data which could be measured.

6.2.2 Responsibilities & work guidelines

One evident finding from the quantitative data, interviews and observations, was that repairs suffered from long inefficient shelf-time. This was found due to the lack of responsibility of either perform the activity in the process or due to the transportation of repairs, which according to Sharma (2015), is common in processes in general. One of the production planners, who have taken responsibility for managing the actual in-house transportation of the repairs, became absent for a longer period of time. It became evident that the production planner was,

individually, handling all the repairs transportations between all different production departments. Therefore, the repair flow became stagnant and the repair units were left behind.

Dumas et al. (2013) argue that tasks should not be appointed to a specific individual, but rather a specific role. In this case, the movement procedure and other procedures such a closure and documentation of repairs were carried out by a self-appointed person, the production planner. When the production planner became absent, another person was appointed to fill in. However, the procedure carried out by the production planner was not documented, which made appointed person unaware of how to perform the activity. There was a lack of documentation about how to perform the procedures, which according to Boutros & Purdie (2014) is needed in order to have a functioning process.

The way of transporting repairs was not considered as an issue until the production planner left. During the workshop held by the authors, the issue of the physical flow of repairs and the lack of a system tester planner was raised. The authors asked the focus groups if they thought that the responsibility of moving the repairs should be the production planner responsibility, whose actual job is to plan the work at the system testing department. They all agreed that it should not be. Instead, they all agreed that the previous department should have the responsibility of moving the repair to the next department.

As opposed to Dumas et al. (2013) several activities within the repair process are linked to roles that consist of only one individual. This may be due to specific fields of expertise. This is an issue that has been raised by both managers and employees. It was noticed when employees with specific competencies were absent or occupied with other work, the activities become stagnant. The issue of individual responsibility was partly discussed in workshop 1. The workshop resulted in several new ideas and thoughts regarding the transportation. The final idea, that no one should single perform the transportation of repairs, were presented and aligned among all participants. The idea had its foundation of using a push-system-approach, where the previous process participant would hand over the repair to the next department. This idea also opened up for further improvements of the repair process, such as clarification of routings and production departments.

Another factor that has been identified by the authors that have been raised during both interviews and workshops is that the employees have insufficient work descriptions. The work descriptions found on the case company's intranet are both outdated and unclear. Lack of work descriptions makes the areas of responsibility unclear. It has also been expressed that employees take on tasks which are not within their areas of responsibility. Work descriptions should be established so that the employee know what is expected of them and what their responsibility is. During conversations with service coordinators, it has been expressed that old tasks which previously been someone else's responsibility, has been forgotten and fallen within their responsibility, even though it has nothing to do with after-market services. Since no one else is responsible for those tasks, the service coordinators have managed them. This has influenced their possibility to perform their work tasks and left repairs negatively affected. As the organization has changed during recent years, the work guidelines have not. The authors would

argue that it is possible to frame the work descriptions in a much more efficient way than today, and preferably form it together with the involved team. During the interviews with system operators, it was mentioned that people perform tasks differently regarding the administrative work within the repair process, see section 4.2.2. This could also be seen among the employees within the same departments. This was seen to be very confusing as there were no clear guidelines of how to conduct administrative work when handling repairs.

It was found that due to the lack of responsibilities in the process today there are repair units left on a shelf and forgotten. Situation X, explained in section 4.1.4.3, is a result of a situation like this. The non-existing monitoring results in that the repairs that become late are detected when it is already too late, and there is no possibility to save time or prioritize it. The authors argued that if appointed people are responsible for a specific task or parts of the process, or even specific repair units, it would result in a better monitoring and fewer repair units being left behind and forgotten. This phenomenon is also argued by Chang (2005), Harvey (2011) and Dumas et al. (2013). It is also stated that if responsibilities are split between many departments it could lead to ambiguous directives, and confuse the process participants (Dumas, et al., 2013). The authors would argue that this is evident at the case company and its repair process. Several changes have been made and the split responsibilities complicate the process severely. Observations made during study visits revealed that another site manages their repairs by monitoring them continuously. This research does not cover enough evidence to state that this way of managing repairs is more efficient. However, the authors would argue that there is a higher grade of control and knowledge of the repair progress.

6.2.3 Process ownership

One factor which became evident throughout the research was identified when the authors asked all interviewees of whom were responsible for the repairs. Almost all answers were split, even among upper management. Some claimed that it was the service coordinators, some argued that the employees that handled the repair at a specific activity were responsible and some argued that it was the after-market department manager or managers higher up in the hierarchy. No answer was considered as wrong since it was found that it was not stated who had the responsibility, nor the ownership of the process, which is argued to be a disadvantage in a process (Chang, 2005; Hammer et al., 2007; Sharma, 2015).

The authors has found that the person who had an overview of the repair process at the case company, was the self-appointed production planner without the authority and appointed responsibility to control and develop the repair process, which is one of the characteristics that, argued by Siemieniucha & Sinclair, 2002, is important to possess as the process owner. This resulted in that the production planner kept the process running on a daily basis, without having the authority to improve and increase the performance of the process.

The authors also looked for more descriptions of the process ownership at the case company's intranet. What was found was that the process owner was "Services within sourcing and supply for electronic defense system production". It was also stated on the intranet that the process owner was responsible for continuous improvements and measurements of the process. In

comparison to the literature by Chang (2005) and Hammer et al. (2007), that there should be an appointed process owner, it can be argued that the findings are contradictory as a business department is appointed to be the process owner. However, it was also found that this information has not been updated since 2012, which makes the information outdated and not considered to be continuously updated, another important factor to regard (Kohlbacher & Gruenwald, 2011).

As argued by Kohlbacher & Gruenwald (2011), metrics and process ownership are strongly related and that the one is useless without the other is somewhat hard to conclude. In the case study, the authors would argue that an operative process owner could contribute to overall improvements in the repair process, without the use of metrics. However, the use of both would be the foremost preference.

6.3 The strategic approach of the after-market department

The after-market department at the case company is seen as a function within the organization, where functional strategies such as productivity strategies can be carried out. As explained by Bishnu & Tom (1997), the incentive to improve the repair process can be seen as a sub-strategy in order to improve existing processes within a company's after-market department. Presented in Bishnu & Tom (1997), a study regarding functional strategies revealed that these kind of strategies are important and can increase company's competitiveness. Several researchers also state that that customer's choice of supplier is linked to sufficient after-sale services (Bastena et al., 2011; Legnani et al., 2013; Rahman & Chattopadhyay, 2015; Owida et al., 2016; Black 2017). It has also been found that companies' future sales may very well be rooted in the after-sale service (Kuijken et al., 2017). Hence, setting clear strategic goals within the after-market department, such as improving the repair process, is an important strategy to increase the company's overall competitiveness and to secure future sales and customer relation.

During the research, it has been stated that the case company strives to re-enact the after-market department to become more independent than before. As found in literature, changes may become fearful to employees and may be difficult to implement (Harvey, 2011; Sharma, 2015). To take on these organizational changes, it is important to align the strategic vision of becoming an independent after-market department with employees. Several articles found argues that it is important to involve and align employees to focus on the same goals in order to successfully implement and work with strategies (Mintzberg, 1987; Norton & Kaplan, 2005; Kolbusa, 2013; Grant, 2016). Hence, it can be argued that it is important to establish strategic directions and constantly update the goals and keep the employees on track.

Generally, the after-market department and the repair process has become more heedful to upper management since it was introduced to the morning meetings. During this research, repairs and the repair process has become a subject which has been discussed once a week during these meetings. It has been observed that these discussions have resulted in a broader understanding of the repair process and generally better knowledge regarding repairs, which is argued to be progressive according to relevant literature (Mintzberg, 1987; Norton & Kaplan,

2005; Kolbusa, 2013; Grant, 2016). Based on the literature findings, it is argued that involvement and understanding of the underlying impact of an efficient repair service process increase the chances to create a better process (Loid, 2016). In the beginning of the research there were few people that could state why and if repairs were important for the case company, but after repairs were brought up during morning meetings, and constantly being asked questions by the authors, it could be argued that it is been brought “up to the surface” and a widely discussed matter.

The authors would argue that this change towards focusing on the after-market and the repairs process is somewhat connected to the theory regarding Hawthorn (Freivalds & Niebel, 2009). The Hawthorn effect concluded that when being observed the performance increase, which is the case that has been experienced at the case company. Although, the authors cannot confirm that the performance has increased or that the process has become better, since measuring the performance has been non-existing during this research. However, it could be argued that it has been widely discussed as employees have started to question and reflect on the repair process. This analysis is also based on that several employees have provided the authors with feedback stating that they are experiencing a “repair-process-boost” and that due to all attention it gets, the better it works. As presented by Jung & Lee (2012), the factors of; trust, sharing information and an improved relation between organizational department and employees, could be a better investment than to focus on new resources or physical work conditions.

During the research, it has been discovered that there are few, if any goals and visions related to the after-market department. According to the production manager, the business of the after-market department is somewhat unsupervised and unknown by upper management and strategic actions are carried out on a middle management level, see section 4.1.3.1. As argued by Gonzales-Prida Diaz & Marquez (2014), it is common that companies do not prioritize an after-market strategy, something that can be argued as consistent at the case company. The authors have attended to weekly strategic meetings carried out by the supply-chain management team, see 4.1.4.2. During these weekly meetings, deficient actions were pointed out, categorized and set to a time-plan which the managers strived towards. However, these actions were found not to be communicated as common goals for the after-market department, nor the people involved in the repair process. Since these strategic goals are of general character and available for all employees within the organization, the authors asked the coordinators if they ever looked at these goals. The answer was that they did not participate or look at the goals, nor did they feel the need of knowing what was going on.

As argued by Grant (2016), a successful strategic implementation requires that the strategy is broken down into smaller milestones, coordinated and communicated among the organizational members as a common goal. Kolbusa (2013) argues that it is important to close the strategic gap between the organizational division and the intended strategy, meaning that strategies must be clearly communicated to the concerned departments. Both the communication and the involvement of concerned employees can be argued to be insufficient. As strategic goals are set at the weekly strategic meetings it seems like only the after-market manager is using them as guidelines, and not the whole department. Further, it has been observed that the weekly strategic

meetings have been left out the last couple of weeks. When the after-market manager was asked why, the answer was that the meetings were of lower priorities. Argued by Norton & Kaplan (2005), strategy execution is influenced by the lack of periodic management meetings focusing on strategy execution. In order to improve strategic execution, it is therefore important to have continuous meetings where strategy is discussed.

6.3.1 After-sales strategies

According to the production manager reparation is a typical “*bread and butter business*”. The production manager stated that the repair service at the case company is a high marginal service which has a significant impact on the case company’s profit, if managed effectively. It is argued that 20-30% of the case company’s revenue is generated from after-market services, see section 4.1.3.1. This statement aligns with the literature found that profitability is considerably higher from service compared to the sale of new products (Oliva & Kallenberg, 2003; Murthy, et al., 2004; Bastena, et al., 2011; Owida, et al., 2016). However, the production manager argued that the process must be improved for the company to grow financially, see section 4.1.3.1.

Argued by Szwejcowski, et al., (2015) it is important to frame an after-market strategy during the new development phase of a product. It has been found that the case company has some activities related to after-sale strategies before selling the product. It has been found that the each new product manufactured, has a numerical value of number of possible repairable and replaceable units. These numbers indicate that each complete product has several of thousands repairable and/or replaceable units. A finding related to these is that the case company calculate a products time to breakdown. However, these numbers are difficult to use in a forecasting matter since it is unclear how much a customer uses the product. The time to breakdown rather indicates to the company and the customer of what products that might be needed to be replaced or repaired in the future

Observations have revealed that there are customer agreements concerning the after-market department, see section 4.1.4.3. These agreements have been found not to be established in conjunction with the after-market department and thus, it creates a conflict. It has been revealed that the company promises the customers things that, in reality, is difficult to accomplish for the after-market department, explained by service coordinators in section 4.2.1. An example is that agreements include promised amount of days when the customer should have an offer (cost and time) for the repair. However, the amount of days is never accomplished due to that the case company must get an offer from their supplier before being able to send an offer to the customer. Hence, the authors would, therefore, argue that the after-market department should take part of the establishment of customer agreements.

It has also become evident from interviews that both coordinators and system testers, seen in section 4.2.1 and 4.2.2, lack documentation regarding the customer and a fault description of products when sent for reparation. This has been found not to be included in the customer agreements, something which can be argued should be included in customer agreements in order to reduce unnecessary work. It can also be argued that if these documents are included in

the return, it will most likely simplify the repair process and the reparations can be conducted quicker.

Another after-market strategy is BFPREP which makes it possible to supply customers with products quickly if they break down. However, not all customers chose this type of after-sale solution due to high costs.

6.3.2 Repair service complexity

Even though Henry Ford, in the early 1900's said that "*A business absolutely devoted to service will have only worry about profits. They will be embarrassingly large*", companies are still trying to increase the profit and create growth, in other ways than focusing on services (Koudal, 2006, p. 1). This is also the case for the case company of this research. It has been found through the data collection, that there are a confusion and a lack of understanding of why the repair service is important for the company. Even if the production manager stated that there is a general knowledge of the importance of repairs, it was noticed at the morning meetings that only a few managers could say why repairs were important.

There is also a diverged opinion on what affect that repairs might have on the company. This confusion is creating a chasm between employees and according to Mintzberg (1987), Kolbusa (2013), Loid (2016) and Grant (2016), the alignment within the organization is crucial when trying to increase performance. There are many employees which have been working closely with the customers in different setups, and it is evident that those employees truly understand the importance of an effective and structured repair process. However, it has been observed that the employees that do not have the same type of customer experiences are not working with repairs with the same enthusiasm.

After-sales is complex in many different aspects, however there is one factor that is constantly impacting the case company's daily operations. The factor of uncertain and inconsistent demand, explained by Mehdi Amini, et al (2005), of a repair service makes is difficult to plan or predict the future. When questions asked, to the service coordinators, about predictions or forecasting of repairs, the answer was that they thought that it is impossible to know when and how many repairs that will be received the upcoming time period. Currently, several customers send repairs without a notice, documentation or error-description. This is experienced to be a problem, by the majority of interviewed employees. However, this issue could partly be solved by changing the criteria the case company requires from their customers. It has been widely discussed by the employees that, if sending a repair, the case company could require a notice and tracking information regarding the specific repair order. The authors would argue that if comparing to other repair services, in other industries, there are few cases it is possible to send a broken unit somewhere without letting the service company know about it and expect it to be repaired. In order for the case company to perform an efficient job, it has been expressed by employees that there would be an advantage if there would be a pre-notice about an incoming repair, and also a complete error description. The only time-related answer that was given during the interviews was that the amount of repair usually increase just right before Christmas and summer break. The only given explanation for this is due to the fact that the customers

might have a spare part inventory that they use to replace the broken unit. Therefore, instead of sending a broken unit, for reparation, at the time it is replaced by a spare part, it is gathered with other broken units and sent collectively to the case company before going on a longer break. This assumption, made by the coordinators, is just a guess and not based on any facts, which makes it difficult to act upon it. There is never any adjustments in the resources, who are working with repairs, the consequences are therefore even longer turnarounds times on repairs when they occur during these breaks.

7

Results and improvement suggestion

This chapter will present the results and the final improvement suggestions. Research question 2, “What is important to consider when improving the case company’s repair process?” will be answered in section 7.1. The third and last research question “How should the case company’s after-market department form their strategy? Will be answered in section 7.2.

7.1 Suggested improvements

In this chapter suggestions of how to improve the repair process are presented. These suggestions are the answer to research question 2. In order for the case company to improve the repair process, the authors suggest the following.

7.1.1 Measurements

As no metrics were identified to be used in the repair process, the authors suggest that comparative and understandable performance metrics regarding the repair process should be established. The authors also suggest that in order for employees to see the benefits of using metrics there must be clear goals related to each metric where progress can be tracked. As no metrics were used to improve the repair process, the authors suggest that the metrics should be monitored in order to identify and improve critical activities. The authors also suggest that the metrics should be visually and easy accessible so that performance within the repair process can be followed up by process participants and other stakeholders.

7.1.2 Responsibilities

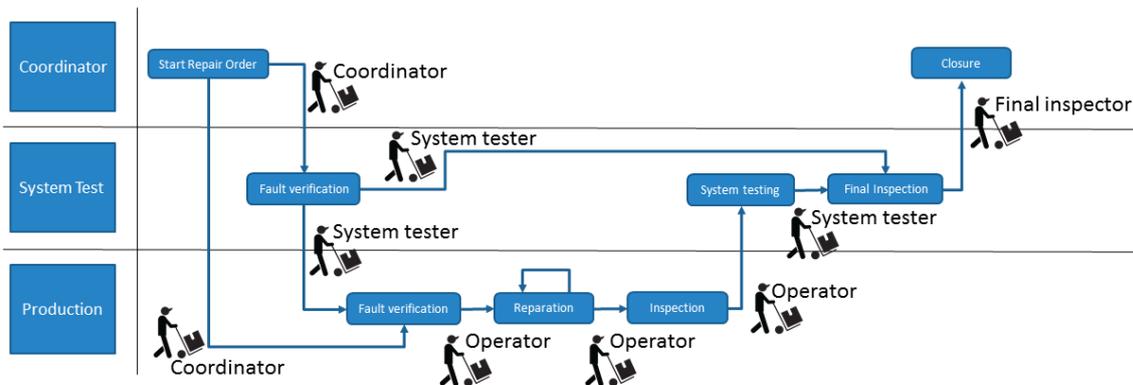
As responsibilities were evident to be unclear within the repair process, the authors suggest that clear work instruction should be established. The authors suggest that these work instructions should be established by the process owner in conjunction with concerned process participant. The authors also suggest that to make employees feeling confident about what is expected from them, clear role descriptions should be established.

7.1.3 Process owner

The authors found that the repair process lack of an appointed operative responsible person with the authority to drive and implement improvements. Hence, the authors suggest that a process owner should be appointed to own and continuously maintain the repair process. The authors suggest that the operative process owner should have the overall accountability of what to measure within the process and to monitor the performance. The process owner should have an operative position in order to be a part of the daily work with the authority to execute continuous improvements. However, the authors argue that the process owner should have an impartial position within the repair process in order not to become biased.

7.1.4 Transporting the repairs in-house

Due to the stagnant transportation of repairs causing unnecessary discussions and delays, the authors suggest that the previous department is responsible for the transportation to the next department, see Figure 17. The suggestion is based on pushing the repairs through the process as activities are completed. Documentation with a process map and work descriptions of each activity was developed, verified and planned to be implemented, see Appendix E.



To start with: Transportation daily, if there are repairs that are ready to be transferred.

Figure 17- Illustrating the new process for transporting repairs

7.2 After-market department strategy

During the research, the authors have found that there is a lack of clear strategic goals and objectives concerning the after-market department. Apart from the previous improvement suggestions that were presented above, the authors propose that:

1. Clear functional and sub-functional strategic goals and visions should be established within the after-market department.
2. The goals and vision should be a mutual establishment between managers and employees so that all member are aligned and strive towards the same goals and objectives.
3. Established goals and visions should be followed up in order to track progress and clearly communicated on weekly basis within the after-market department.
4. Strategical meetings should be reestablished and restructured in order to address and follow up strategical goals and objectives.

8

Conclusion

This master thesis has focused on a case company's in-house repair process and the functional strategy of the after-market department. In the beginning of this master thesis, the case company expressed that there was unawareness of the current repair process and that there are needs for improvements. The after-market services provided by the company is an important source of revenue that has a significant impact on the company's profit. The case study was performed to identify the case company's current repair process and to find factors that could be improved regarding the repair process. The study also investigated the company's after-market department's strategic approach and the importance of a functional after-market department strategy. In order to address these areas, three research questions were established which generated three different results.

Relevant literature within the chosen areas was gathered and reviewed in order to create knowledge within the field of the research. Empirical qualitative data was gathered and confirmed through interviews, observations, study visits and workshops with concerned employees. The data was collected by open-ended interviews to get knowledge regarding the current repair process and issues related to the process. Furthermore, interviews and workshops were conducted to deepen the understanding and verify previous findings. Study visits were conducted to compare how the after-market departments operate at different sites. Further observational findings were found by attending different department meetings, strategic meetings and upper management meetings. Quantitative data was gathered and consolidated from the company's IT-systems which contained historical documentation of repairs turnaround time, accumulated work time and cause of delays. The validity of the data was evaluated by confirming recurring findings from different approaches and by discussions findings with the case company's employees.

To answer the first research question, a cross-functional process map of the current in-house repair process was established. The visualized process map contained the physical flow of repairs and the informational flow related to repairs. A detailed description of the included activities, as well as a listing of the main activities, were established.

Several issues were identified and these issues became the factors that were the answer to research questions 2. To improve the repair process the authors suggest that the after-market department should focus on implementing performance measurements as an objective, as this was found to be non-existing. Metrics makes it possible to detect where in the process inefficiency occurring. The authors also suggest that a process owner should be appointed in order to establish and maintain the repair process, responsibilities and directives regarding the

repair process. The physical transportation was found to stagnate the repair process just a couple of weeks into the research, due to resource issues, and by focusing on solving that issue, the suggested improvement, presented in section 6.2.4, was implemented quickly, already during the research. The suggestion was based on interviews and a workshop that was held with involved employees.

Findings were further interpreted with literature and expounded in the analysis. The analysis revealed that the case company lacked clear functional strategic directions within the after-market department, which formed research question 3. As few goals and visions were established and communicated within the after-market department, misalignment among both employees and managers was evident. Therefore, the authors suggest that clear objectives should be established and communicated within the organization and the after-market department.

9

Discussion

This chapter will generally discuss areas of the research that has not been addressed in the research questions but has been identified as important subject and possible future work.

9.1 Validity and reliability

To conduct research there needs to be a combination of academic literature and reality (Kuada, 2012). An accurate correlation of these two factors is ensured by discussing possible critique towards the chosen methodology. The ensuring is usually analyzed from two different perspectives; validity and reliability. Validity aims to understand what the research is presenting and what was planned to present, and reliability explores if there is a possible chance of reproducing the research by choosing the same methodology (Kumar, 2011).

The result of the study is based on the authors' previous knowledge, mixed with the theory of literature and findings made at the case company during the research. Whether the research is possible to recreate and generate the same result is arguable. The study performed is based on a snapshot of the current performance at the case company, hence, findings are likely to be different in the future.

In terms of reliability, larger parts of the quantitative data were collected from interviews with different participants within the company, it can be argued whether the findings are influenced by employees' personal opinions which are in their favor. Since data has been gathered from several departments within the company, it is easy to become biased by the studied department, which may lead to preconceptions of activities carried out at other departments. The ability to distinguish valid data and favorable data is hard to define. The authors have validated findings through different types of data collections approaches, carried out both individual and in groups through interviews and workshops etc., to interpret valid data. Another perspective of validity is that the authors have been present at the case company during the complete research, in order to sympathize and understand the complete culture of the company. The authors have conducted a thorough literature review within the field of the study. The authors have been critical of the sources found to, as good as possible, ensure that the data has collected is valid.

9.2 Future improvements

This section will introduce subjects that the authors would argue to be important to consider. The subjects have been identified during the research but due to limitations they have not been analyzed or deeper understood.

9.2.1 Offer handling

There have been many observations and discussions regarding the great amount of hours spent on the offers written to the customers, which also can be seen in Table 11. Seven most reoccurring in-house repairs, during the last two years. The offers are constantly an issue due to different factors. It can either be a lack of information from suppliers/sub-contractors stating what the reparation will cost or what actions that will be performed. This results in inadequate offers which customers usually not accept. It has been noticed that other sites handle offers differently, due to different kinds of customer, military and civil, and the authors are convinced that the offer handling could be improved even at the site where the research is performed.

There is both a lot of administrative hours spent on preparing the offers, and even more hours spent on waiting for information and subcontractors. There has been a discussion regarding fixed pricing, and its ability to influence the amount of hours spent administratively. There is a possibility that these hours could be reduced by looking into fixed pricing or at least partly fixed. For example, the first error test could have a fixed price for a specific product in order to quicker come to a complete offer for the customer to consider.

9.2.2 IT-systems

It has come to the authors understanding that new directives of how to administrate repairs in the ERP-system were recently introduced to the after-market department. These changes were considered to be quite large and by its nature, many issues are raised regarding the new way of working. It can be argued that many concerns will be solved along the implementation and that learning curve will increase the productivity of the new system. However, it is seen as a positive implementation as repairs should be easier to track and easier to generate metrics.

During the research, it has also been observed that there is a common opinion about the diverged IT-systems. The opinion is that there are too many systems, the systems are too complex and the time spent on trying to figure out how the system work is more than the time actually spent on the repairs. This was also clearly stated by the service coordinators, the list of IT-systems for each repair is visualized in section 4.2.1. There was a comment by the system tester manager stating that the operators that are quick and technically competent, might spend more than half of the time on the administrative work instead of just working with what they are good at. This is considered, by the authors, to be one of the major frustrations that the employees experience. A situation that was mentioned to the authors, was that an experienced operator returned from a work trip and realized that larger parts of the administrative work in the IT-system, had been changed during the absence and hence, it was unclear of how to administrate the repairs in the system. This implies that there are changes going on regarding how to administrate repairs and indicates that clear work instructions are needed in several areas.

The fragmented IT-system issue has also been discussed with an appointed business developer, which is of the opinion that there is a possibility to minimize the amount of systems just by adding/start the functions in the ERP-system. The ERP-system was introduced two years ago and is not yet explored fully. There are a lot of functions that are unused, which could be substituting several of the other programs. An interesting finding can be seen in Appendix P,

where much data from the log-system can be integrated into the ERP-system. There has been noticed that there is a resistance to change regarding the use of IT-system. However, the authors suggest that the company should further investigate the possibility to integrate several functions in the log-system into the ERP-system, in order to exclude unnecessary administrative time and the usage of multiple IT-systems.

9.2.3 Customer demand

The findings from interviews, observations and workshop revealed that there is generally little knowledge about customer demand within the after-market department. The interaction between the customers and the after-market department is limited and the communication which is performed between coordinators and customers are based on unique interaction with specific customers. The workshop revealed that site 2 managed their customer relation on their own as the department were more separated from the company. It was argued that the after-market department at that site had more knowledge about their customer.

According to Legnani, et al. (2013), it is important to understand customers demand in order to compete on the market. Legnani (2013), also argues that customer chooses their supplier based on the product's lifetime experience, meaning that repair service has an impact on future relationship and sales. If not providing the service demanded by the customer, it is hard to outcompete competitors, satisfy customer need which might lead to decreased sales. A large part of after-sales theory discusses the perspective of the customer, therefore it could be argued that it is of large relevance to make sure that the after-market department is well educated about it.

The authors would argue that the after-market department should create better knowledge regarding their customer needs. To further improve the after-market services, the authors suggests that the after-market department should evaluate their services by sending questionnaires to the customer of how they experienced the service provided by the company. This may indicate what service the customers expect and more importantly, what they want.

9.2.4 Delivery precision

By coincidence, a business developer from another department introduced the authors to metrics regarding delivery precision related to the after-market department. However, these metrics included both spare-parts and repairs which made it difficult to use as data in this research. One problem found with this metric, as relates to the vanity sin, explained by Hammer et al. (2007), was that when repair orders were considered to be, or become late, the delivery date was administrated forward in time. This results that when metrics are collected from this data, there is a 100% delivery precision since orders were never late, according to the system. The observations were discussed with the after-market business developer, which was already familiar with the phenomena, the decision to stop moving forward the delivery date were taken. Instead, it was decided to set the customers accepted delivery date in the system, and when it was not met, the delivery became late.

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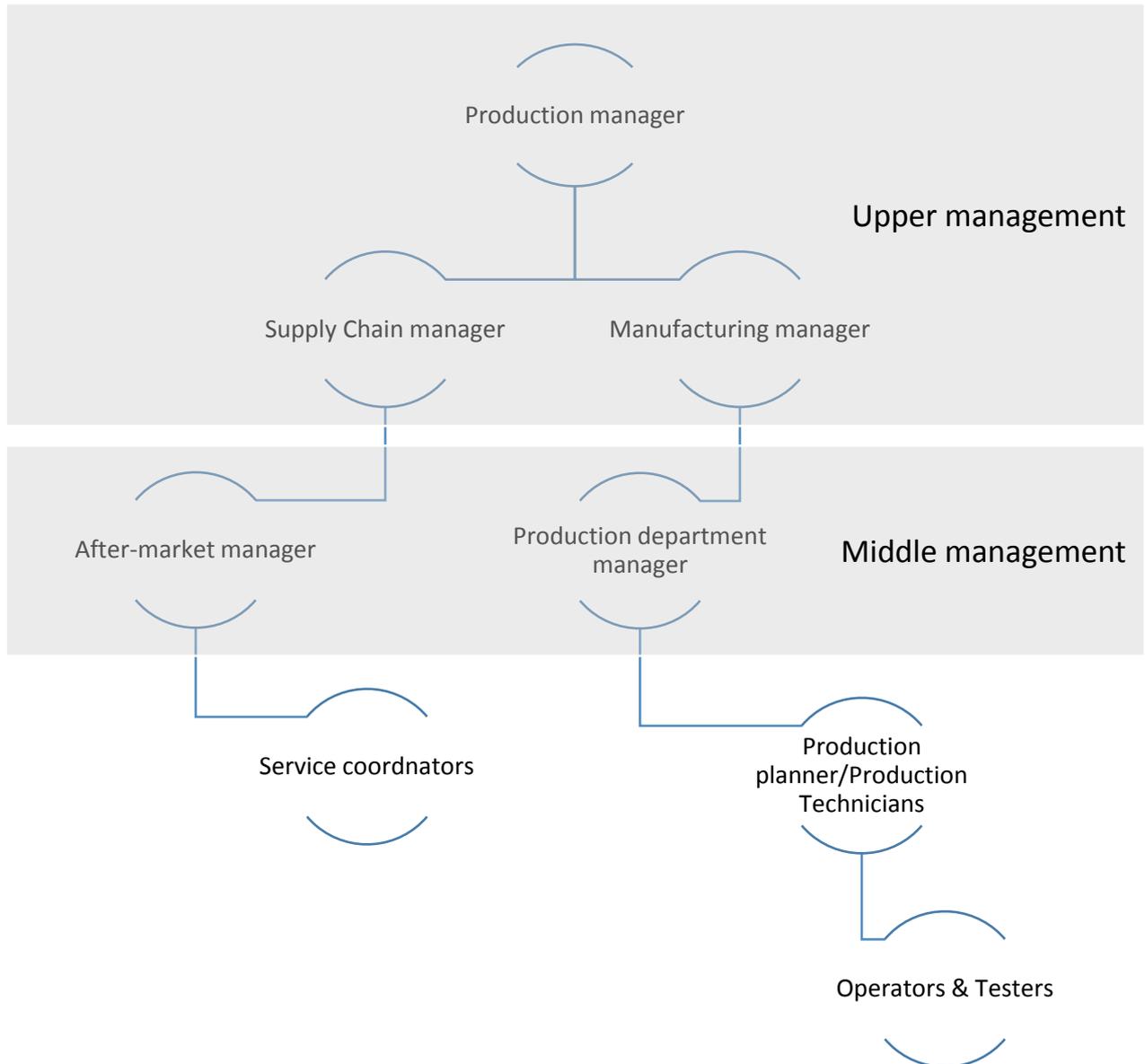
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Appendices

Appendix A- Organizational structure



Appendix B- Interview questionnaire template

1. Describe who you are and your position at the company.
 - a. What works tasks do you have related to the repair process?
2. How has the organization changed regarding the repair process during the last couple of years? (New department have been formed for example)
3. Is there any goals and strategy regarding the repair process?
4. How do you think that the attitude regarding repairs is? What is your attitude, generally in the house and compared to the serial production?
5. How does prioritizations work when it comes to repairs? Compared to how it works with new production?
6. How is responsible for the repair process?
7. What is your perception regarding following aspects?
 - Communication
 - Documentation
 - The cooperation between different departments
 - Planning of repairs
8. Is there an issue or a question that is experienced that often occur regarding repairs?
9. What improvements would you focus on in the repair process?
10. Do you have any other thought, insights or feedback?

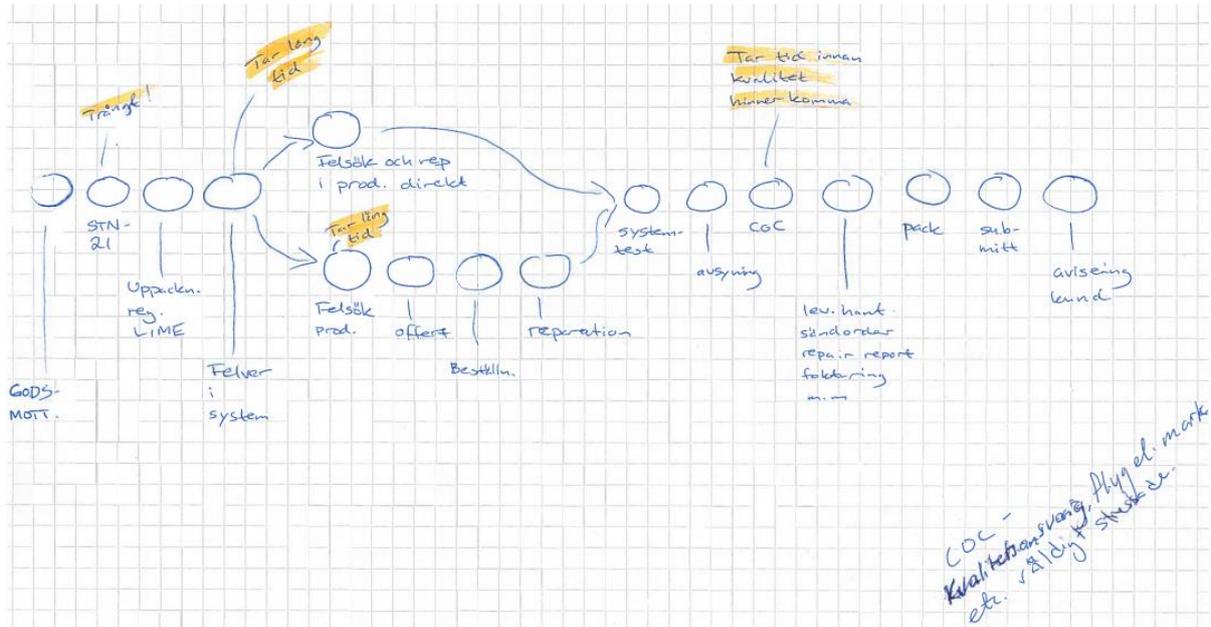
The task: Can you visually map out and explain the repair process. Please mark difficulties and advantages on the map.

If we have any question after the interview, would it be okay to contact you again?

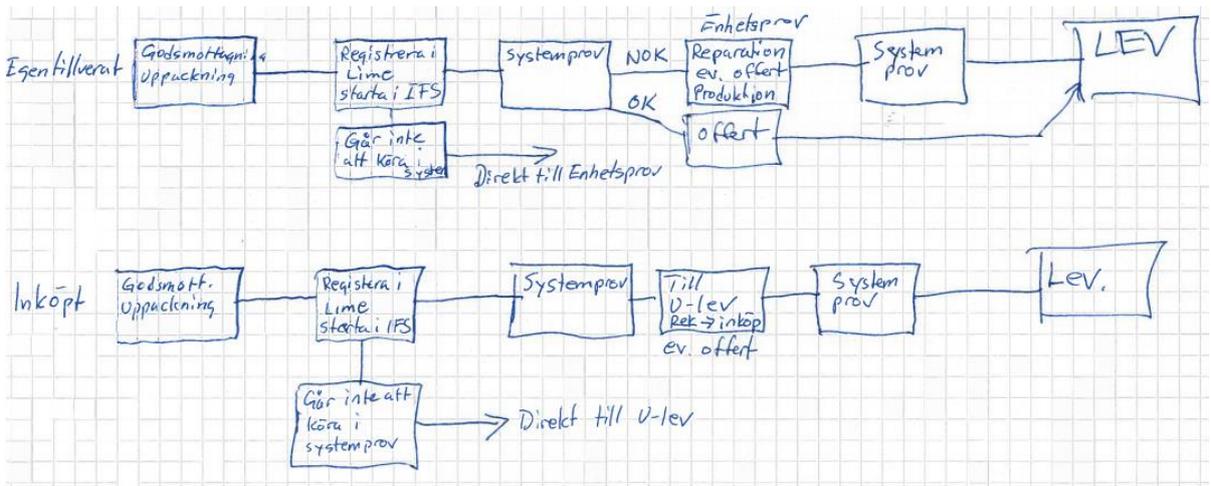
Thank you for your time and engagement!

Appendix C - Employees process maps- interview task

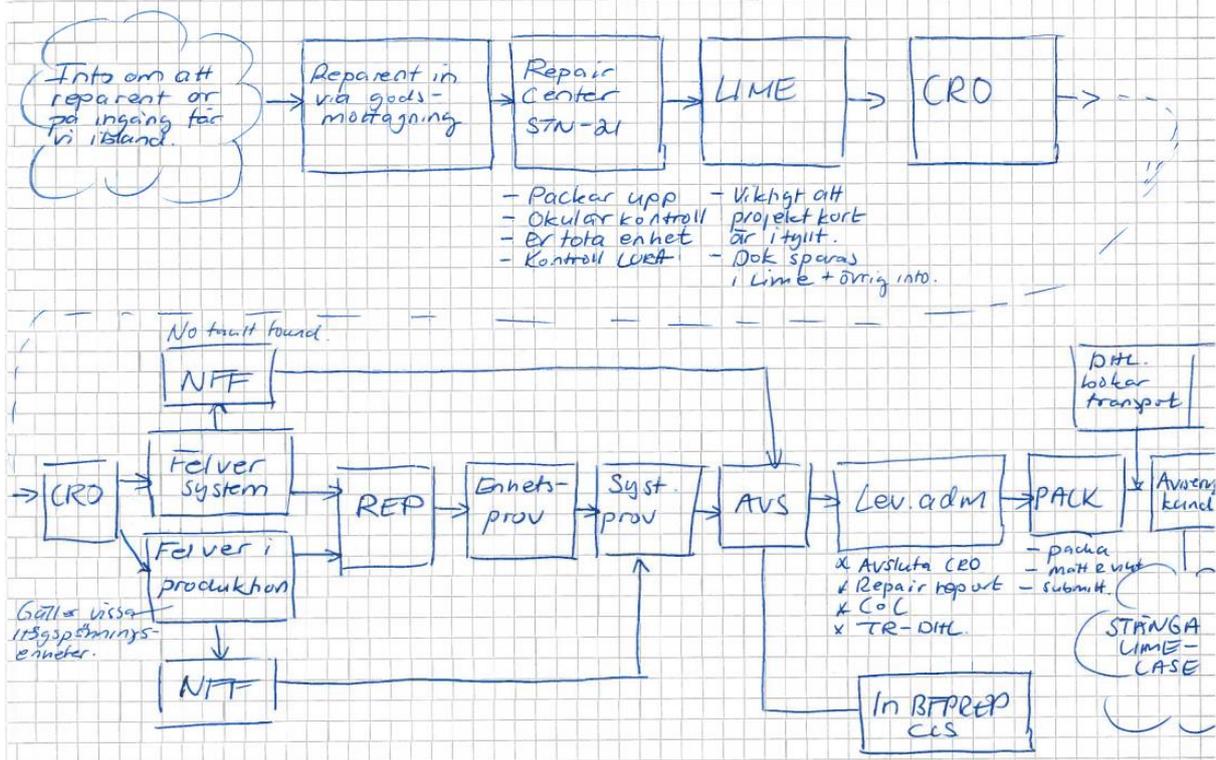
Service coordinators 1



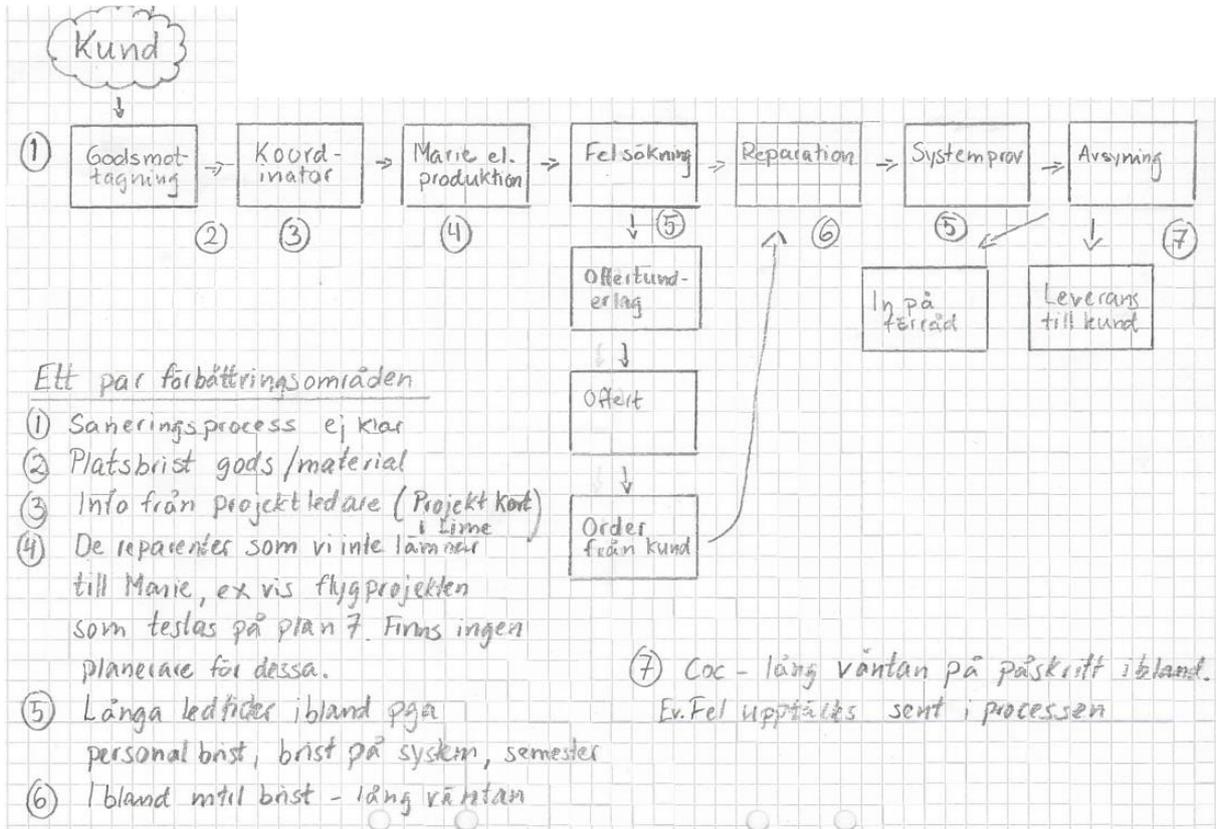
Service coordinators 2



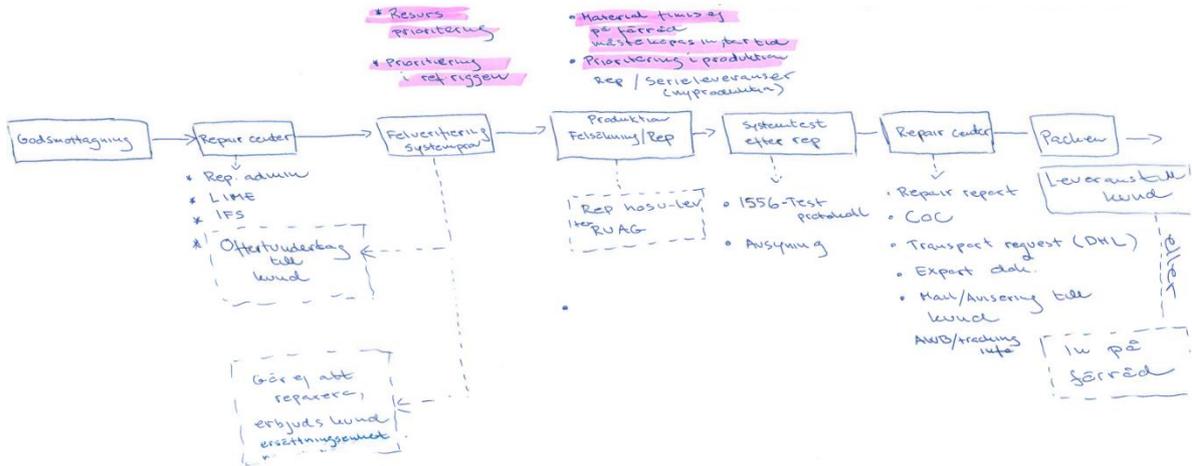
Service coordinators 3



Service coordinators 4



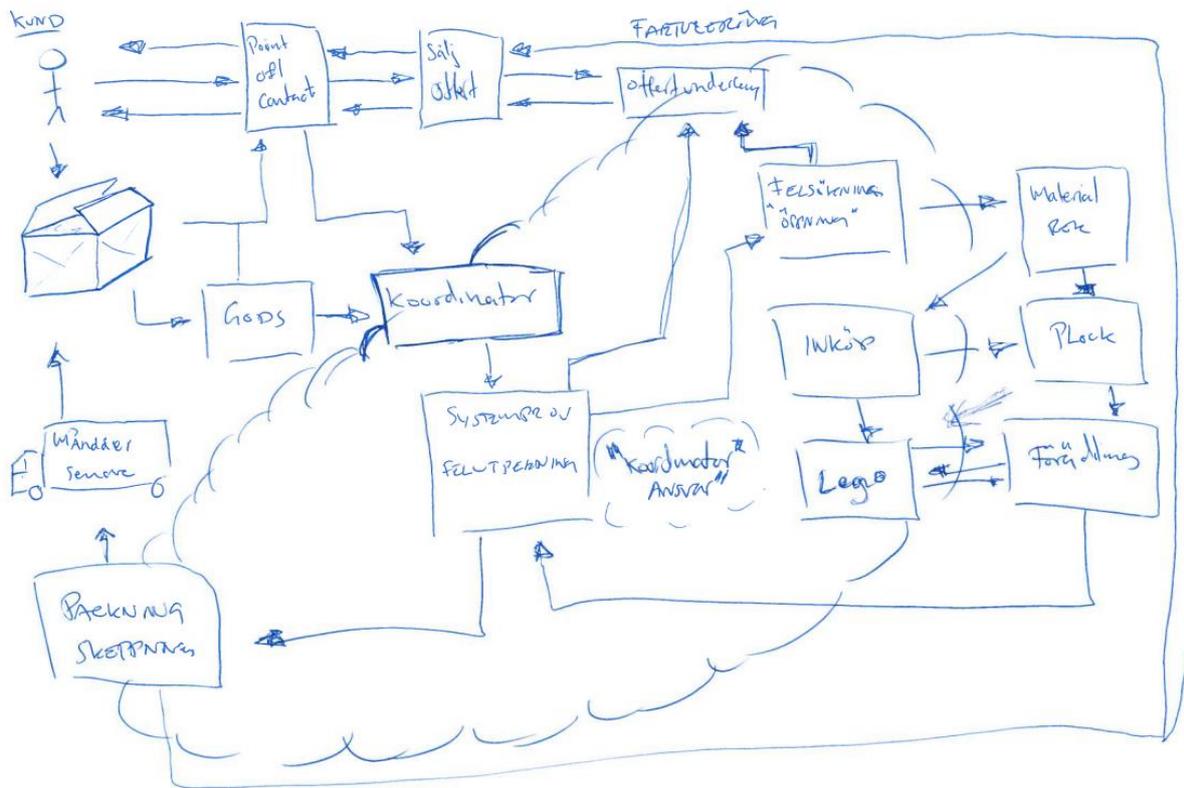
Service coordinator 5



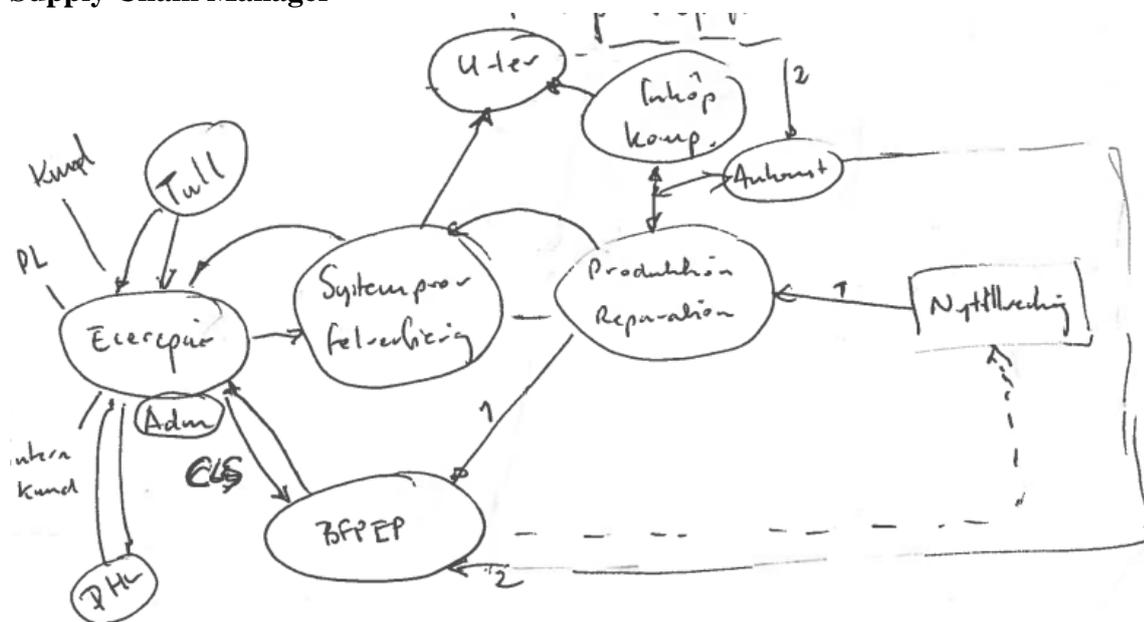
Manufacturing manager



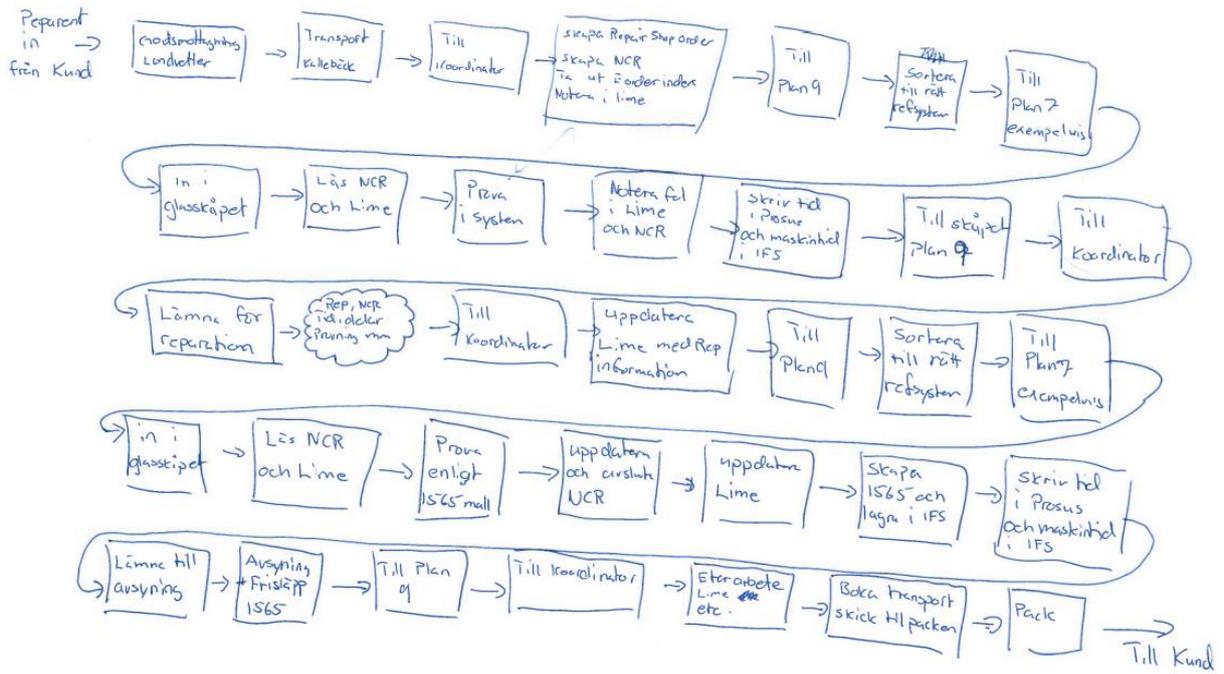
Production manager



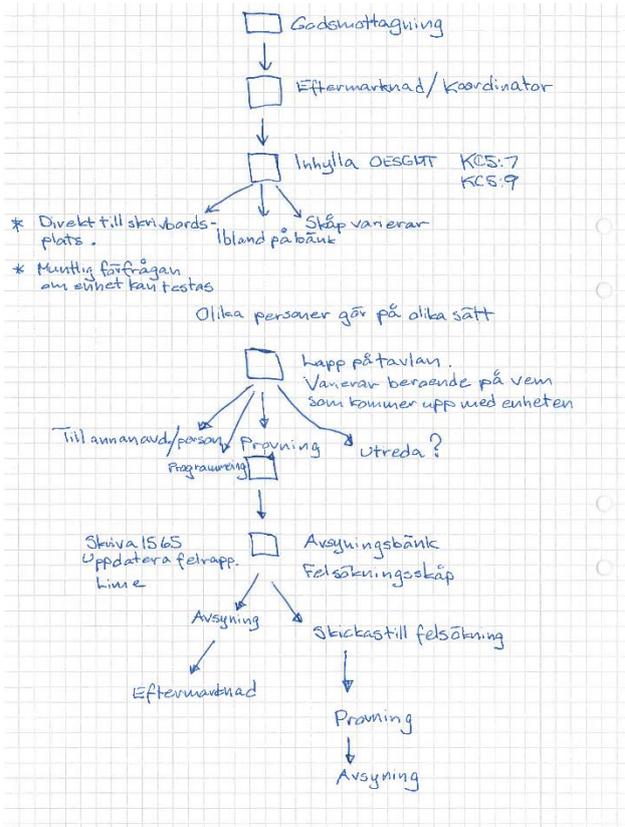
Supply Chain Manager



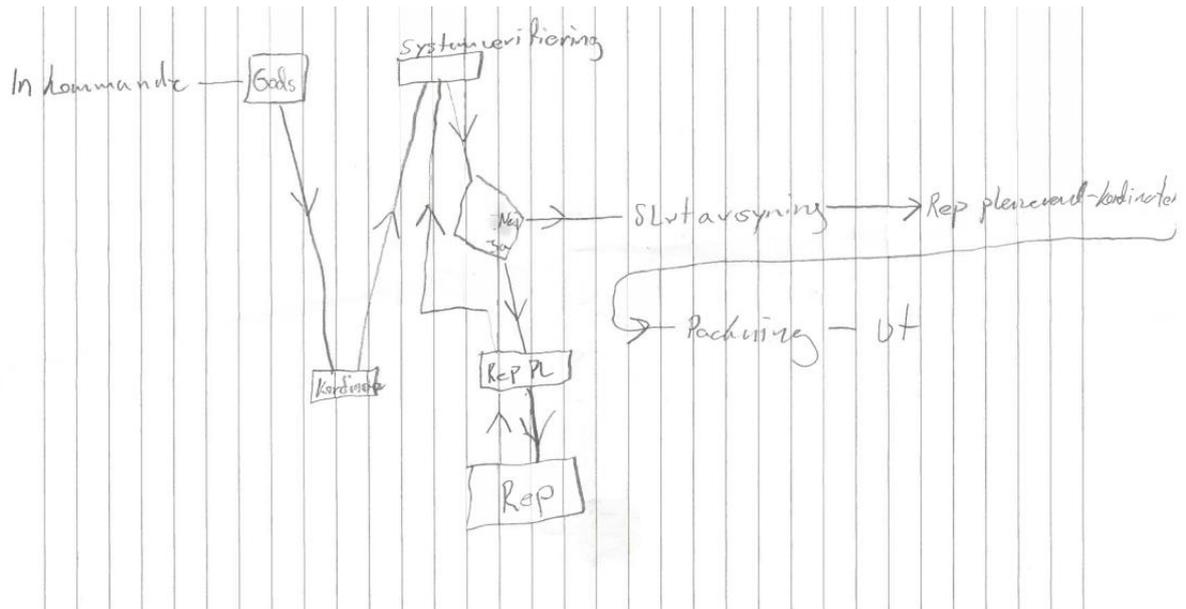
System tester 1



System tester 2



Final verifier



Appendix D- Workshop 1- Agenda

Introduction

Grouping, according to the whiteboard.

1. Introduce Eric & Anna (**1min**)
2. Today's Agenda (**4min**)
3. Exercise 1: Why repairs matters? There is no rights or wrongs. (**5min**)
4. Today's situation (**5min**)
 - Why workshop and our experience.
 - Extremely dependent on individuals. Understand each-others perspective and shared understanding.
5. Exercise: Draw current repair flow, Movement and document (10+10=**20min**)
 - When does the repair transfer, and between which departments.
 - (Who, when, how, document)
 - Present in front the rest. (3min)
6. Exercise: Brainstorming issues (5+5min = **10min**)
 - What are our issues in each activity? Write individually on post-its (**5min**)
 - Discuss within the group and place them on process map (**5min**)
7. Exercise: New repair flow process (**15min**)
 - Based on previous problems and individualism.
 - (Who, when, how, document)
8. Presentation of new solution (**15min**)
9. Outro (**5min**)

Appendix E- Work description of new transportation process of repairs.

Repair coordinators:

1. Unpack and identify repair unit
2. Start SO,CO,CRO and NCR
3. Print SO
4. Finish operations in the ERP-system
5. Deliver repair unit and SO to the next work center/operation according to routings

SHELFS FOR REPAIRS



*The repair coordinators should have more shelf for incoming and outgoing repair (BFPREP, project specific, laser, etc), however those shelves do not affect this process or the other involved people.

System test:

1. Identify and divide repair unit to appointed system operator.
2. Test the repair unit
3. Fill in NCR
4. Finish operations in the ERP-system
5. Deliver repair unit and SO to next work center/operation according to routings

SHELFS FOR REPAIRS



Production unit:

1. Identify and divide repair unit to appointed production operator.
2. Test the unit
3. Repair the unit
4. Fill in NCR
5. Finish operations in the ERP-system
6. Deliver repair unit and SO to next work center/operation according to routings

SHELFS FOR REPAIRS



Appendix F- Workshop 2- Agenda

1. Introduction about us and our master thesis
 - What the workshop will focus on
 - Our thoughts on the subject
2. Grouping exercise (**10 min**)
3. Exercise 1- Group discussion (**10 min**)
 - What are the goals / metrics in the after-market department today?
 - *Dimensions / Measurement for you?*
 - *Target / measurement for customers?*
 - *Target / Measurement figures for SAAB?*
4. Exercise 2- Group discussion
 - Write individually and add on A3 (**5min**)
 - Discuss everyone's goals / metrics (**10min**)
 - Create heading and categorize all the notes (**7min**)
 - Vote for the "best" goal / metric (**3min**)
 - Present for the other groups! (**5 minutes**)
5. Exercise 3- Group discussion (**10 min**)
6. Outro (**5min**)

Appendix G- Categorized interviews

Sammanställning intervjuer systemprov

Tillgång till riggar

Lång väntetid

Specifika riggar behövs

Resursproblem

Prioritering i riggar (görs av planerare)

Kunskap om produkter och systemtest (ofta onödiga systemtest)

Systemprov på mekaniska produkter är svårt att få tid till då de enda två resurserna som finns ofta är borta/upptagna.

Mycket stillastående på 9an

Många olika IT program

Nya sprintar hela tiden gör det svårt att lära sig det.

Hög admin. Belastning på planerare

Information i The time report-system är viktigt

the ERP-system är ej förlåtande (gör man fel får man börja om)

the ERP-system , Easy repair, the log-system, etc

Projektkorten är dåligt ifyllda, vilket gör det svårt att hitta info om projektets datum, system moddar (PL/DPLs ansvar)

Underbemannade projektledare

Väntetid på PL- sämre än tidigare

Närhet till materialet

Närhet till godsmottagningen

Kommunikation i ABW blir svårt

Bra med stort kontaktnät

Härlig gruppdynamik mellan koordinater

Genomloppstid av reparationer är höga

Forecast kring reparationer är näst intill omöjligt

Kontinuerlig uppföljning på reparationer är näst intill obefintlig

Kategorier:

Systemprov/Fel.Ver

IT-system

Underbemannade resurser

Fysiskt flöde

Kommunikation

Kontroll på reparationer

Service Koordinatorer:

- Tillgång till riggar
- Lång väntetid
- Specifika riggar behövs
- Resursproblem

- Systemprov på mekaniska produkter är svårt att få tid till då de enda två resurserna som finns ofta är borta/upptagna.
- Underbemannade projektledare
- Prioritering i riggar (görs av planerare)
- Kunskap om produkter och systemtest (ofta onödiga systemtest)
- Hög admin. Belastning på planerare
- Närhet till materialet
- Närhet till godsmottagningen
- Genomloppstid av reparationer är höga
- Forecasta kring reparationer är näst intill omöjligt
- Kontinuerlig uppföljning på reparationer är näst intill obefintlig
- Många olika IT program
- Nya sprintar hela tiden gör det svårt att lära sig det.
- the ERP-system är ej förlåtande (gör man fel får man börja om)
- the ERP-system
- Easy repair
- the log-system
- Information i The time report-system är viktigt
- Projektkorten är dåligt ifyllda, vilket gör det svårt att hitta info om projektets datum, system moddar (PL/DPLs ansvar)
- Kommunikation i ABW blir svårt
- Bra med stort kontaktnät
- Härlig gruppdynamik mellan koordinater

Kategorier:

Processförbättringar

Communication and arbetsätt

Resurshantering

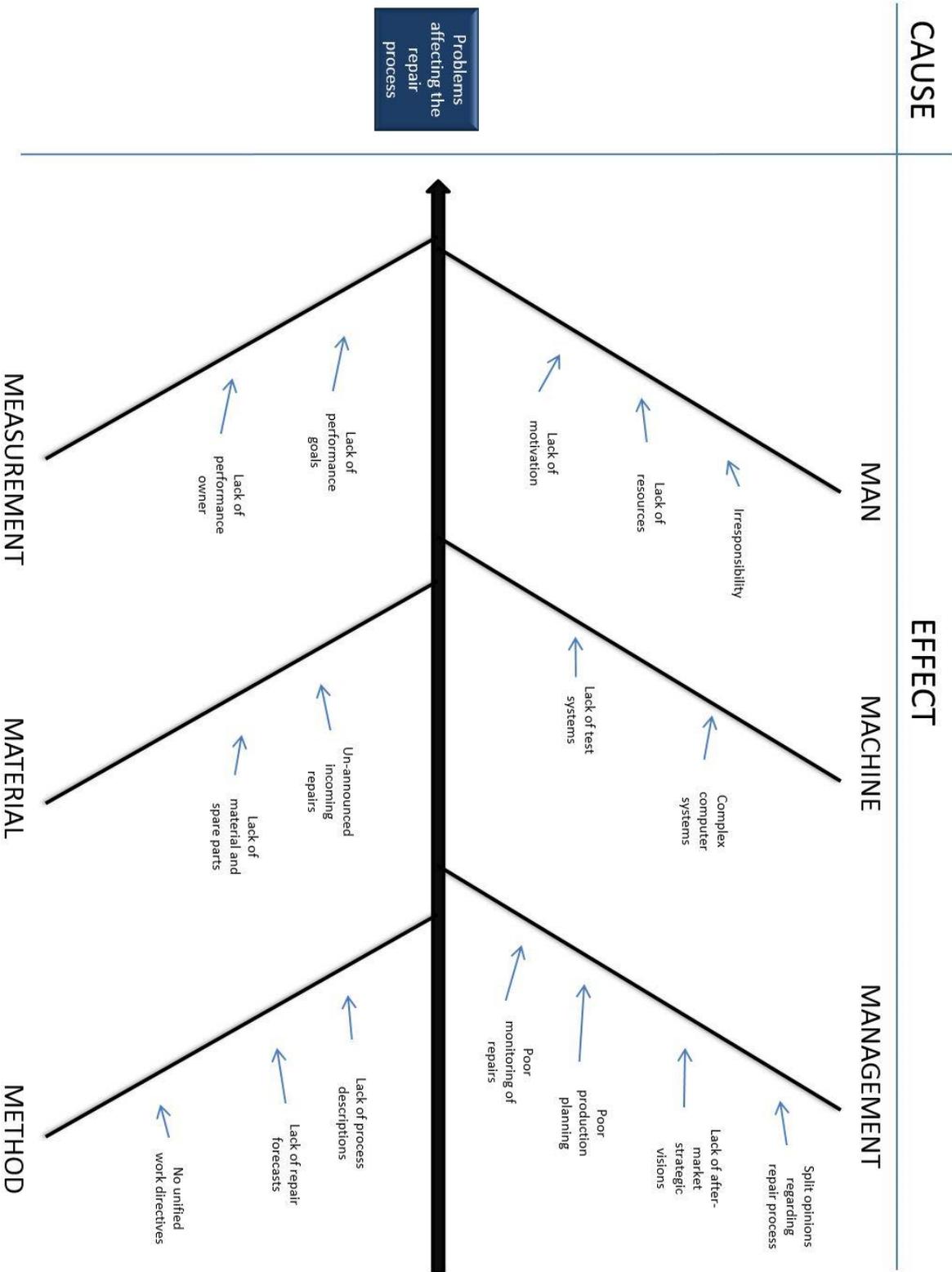
Prioriteringar

Dokumentation

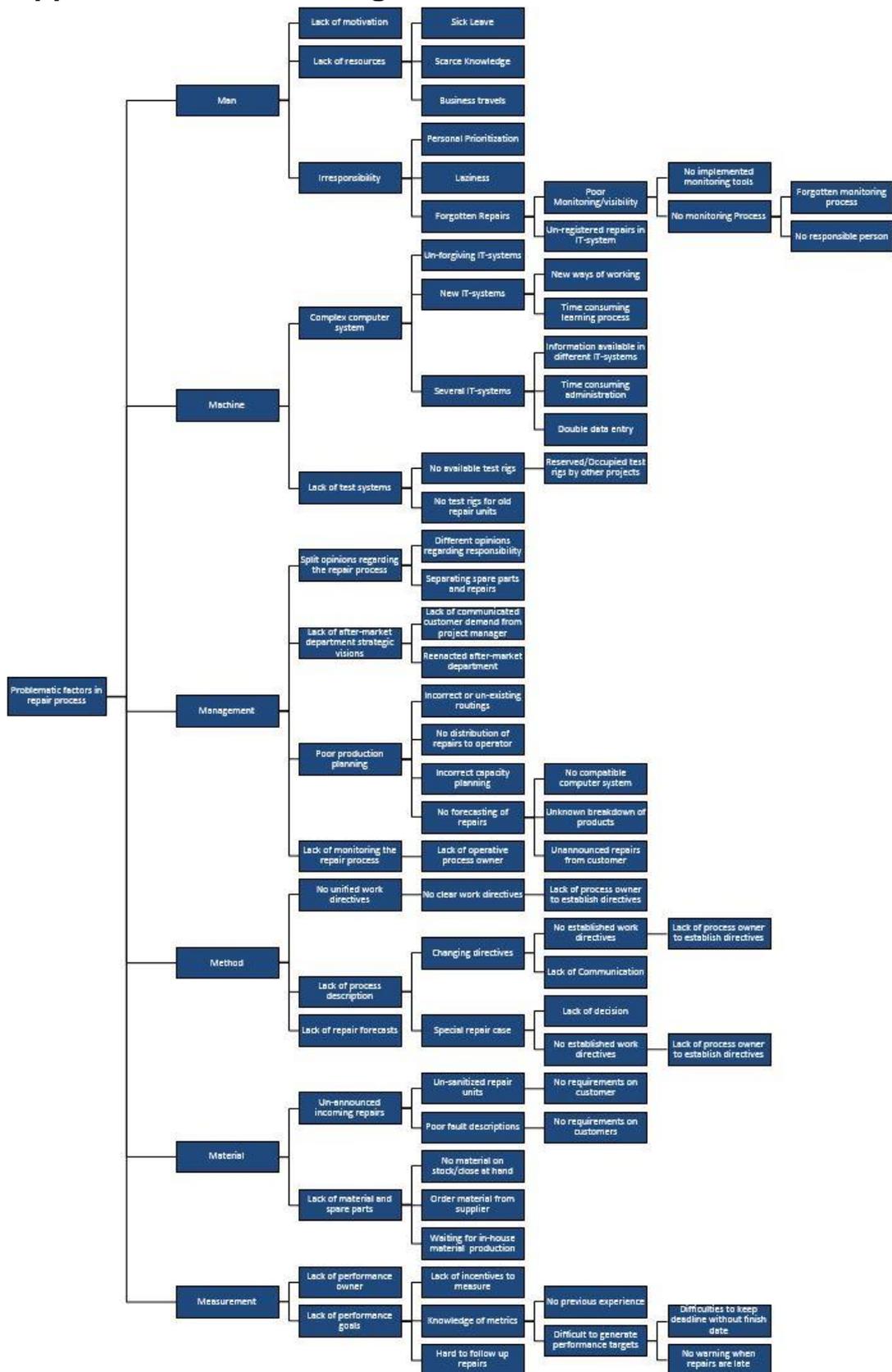
Responsibilities

IT-systems

Appendix H- Ishikawa diagram- Main cause/effects

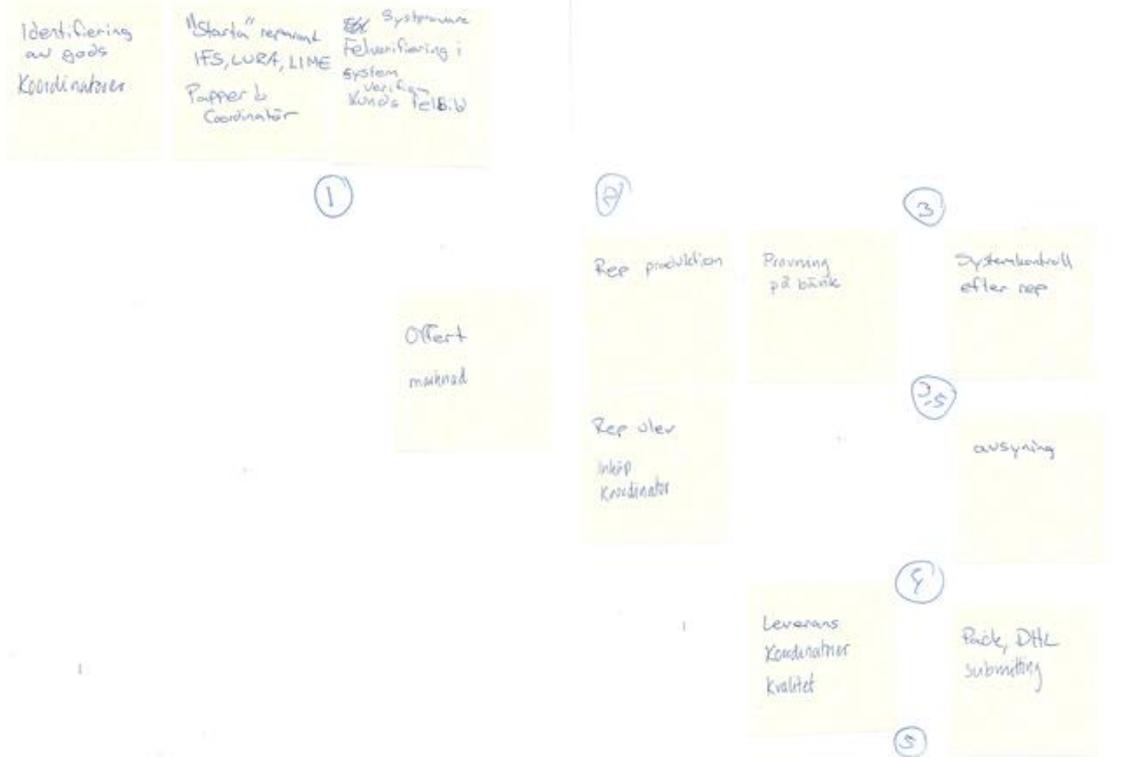


Appendix I- Ishikawa diagram- Detailed effects

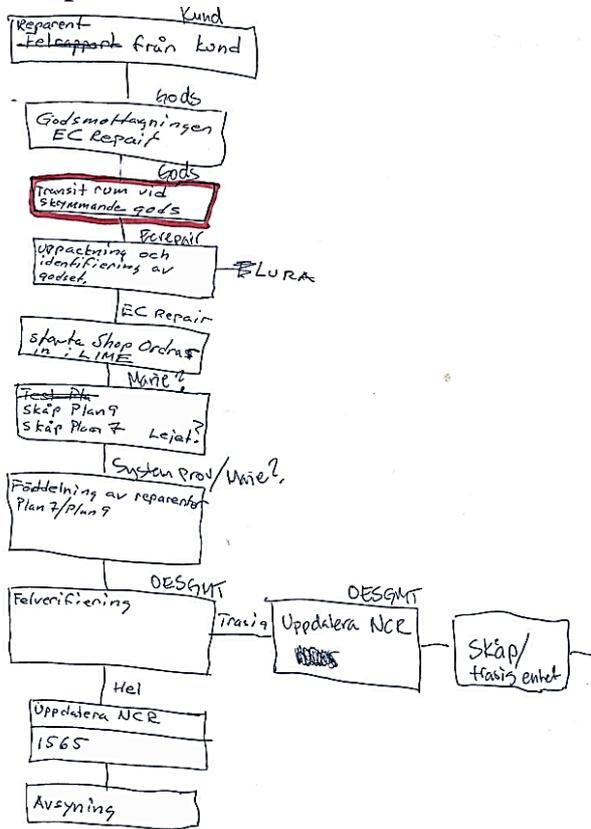


Appendix J- Workshop 1- Exercise 2- results

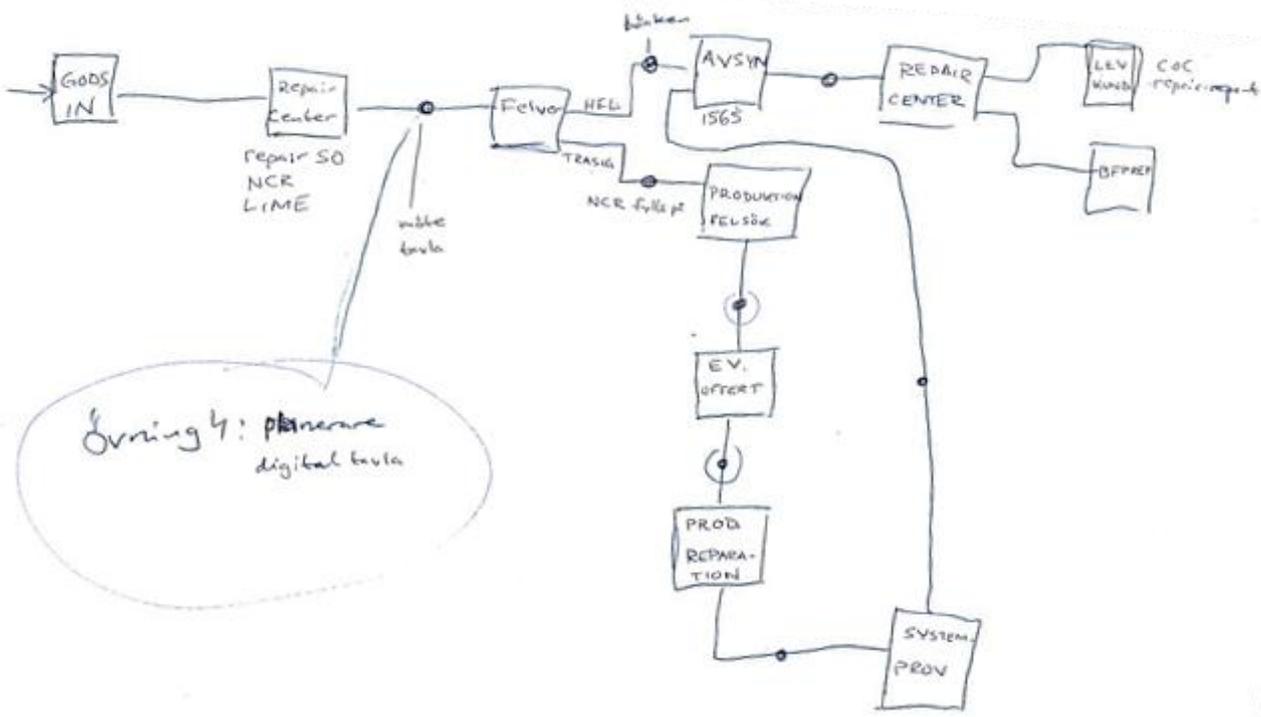
Group 1



Group 2



Group 3



Övning 4: planera digital tola

Appendix K- Workshop 2, results

2.

Effektivitet/process

Effektivitet
Gör vi rätt saker?

Kostnad Ans
Turnaround tid.

hur väl håller
prod. sin operations
tid?

Ledtiden för hela
flödet

T.a.T. på
reparatur.

ADM1

• Administrativt arbete
+ kostnader

Våra admin tider
på reparatur

Admin
kostnad
för att
starta
en rep.

Insp

hur lång
tid tar
det för
u-lev att
reparera
våra verktyg

• Servistider
• ~~tid~~
• Tidrapportering
• Admin tid

SANNOLIKHET

Se över meta-data typ är
- förekommer sannolikhets
frekvent??

☞ Hur många/ofta
apparaterna behöver
service för att beräkna
sannolikhet för att lösa in
reparaturer.

KVALITE

Kvalitetskontroll
till
kund

- MÄTNING PÅ
KVALITETEN (BEROENDE
PÅ KUND)

ROUTING

Är våra "standard-
beredningar" rimligt
tidsatta?

Ändringar i
planer (skjutningar
i tiden)

2.

TAT

Antalet
✓ Dagar till offert

Lovad
Utleverans till kund

TAT med beräknad
tid för kundsvaret
jämför reparaturer
som ullev + i huset

Ligg tid

TAT på samtliga
reparaturer
(Intern TAT på ej kontrakterade
kunder)

Ledtid per operation
(i genomsnitt)

- MÄTA GENOMLOPPSTIDEN
I REP-KEDJAN -
SYSTEMET SKA "VÄRDA"
ROT NÄR REPARATUREN
"FASTNÄR"

Direktid vs
Stid.

Offert

Offert utvärlds
lar tid/precision

Svar på
offerterna
Hur lång
tid tar
det att
svara på offert!

DELUPPFÖLJNING

INKÖP / U-LEV

Förädlingstiden
På varje station /
process

Responstid för Inköp
Väntetid
ESO
Reg → TR

Leveransen
→ Offert
→ lev
→ "Operation"
"funktion"

Leveransprecision
för Lego (ESO)
Tid hos
U-lev

Genomlopps tid
hos varje instans
Tex systemprover

Liggtid - last
Ratio %
använd tid
Genomlopps tid

MÅL
Att alltid vilja bli
bättre och prova
nya lösningar.

VERKSTAD

SUMMERING/ UPPFÖLJNING

Att "idse"-operatörer
till "100%" vet varft
alla reparanter är

Saldofel i lager.

Omsättning

Hur många
reparanter flödar.
Stängda varje vecka
Starktids -||-
månad

Att alla operatörer
och planerare mu...
alltid gör det administrativa
arbetet direkt.

Kundnöjdhet.



1.

30 dagars köttid
PBL

30 dagar
offert
Singapore

180 dagar
Tat
CPF

90 dagar
Tat
CPF

Lovad leverans
enl. PO

Requester
leveransprecision
24h-30 dagar

Kvalitet
CoC
reparanter/reservdelar

2.

Veta om man gör ett bra jobb?

Tydliga
ansvar...
Vem gör vad?



- Vilka arbetsuppgifter finns?
- Vem ska göra vad?

* Vad gäller
för resp. projekt.
Måtte vara definierat
för att kunna
mätta \therefore sätta mål.

Det måste finnas ett
mål med ett mätetal
annars ~~det~~
är det inget intet att
ha mätetal.

Kapacitet

Säkerställa %
Beläggningsgrad
i produktion

bli en egen avdelning
med egen resurser.

Anställa ytterligare
minst 1 person för
avlastning.

Turn Around tid för under
(Förmåga i förhållande
till underhållsstruktur)

Vete vilken
kapacitet som
behövs för
effektivitet

Turn Around Time

Bruttomängd

Interns Svårigheter

Interns operationstider

- Leveransdatum till kund
- TAT på vissa projekt
- Leveransprecision för reservdelsbeställning (JFA)
- Antalet öppna repair-SO
-

Vision

Veta hur varandra
och en själv jobbar

Jobba litvärdigt i Olli

- eftermarknad /SO
- offerter?

Förankra
vad eftermarknaden
betyder för Saab

Träffar med
jämna mellanrum
workshops!



Vision

Kunna dela resurser
mellan Siter

Ensat arbetsätt
över Siter

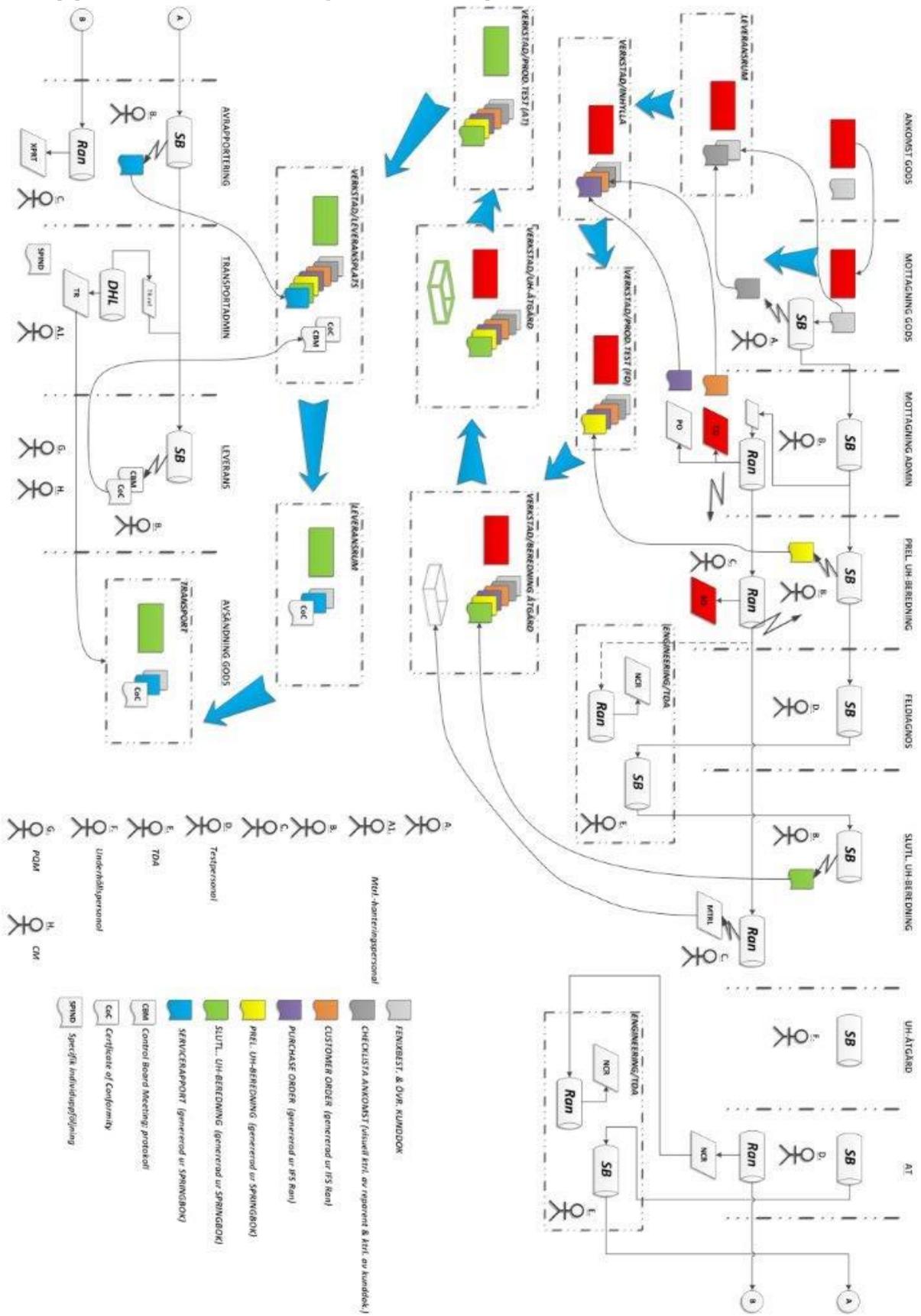
siker

Alla ska ska använda
IFS på samma sätt

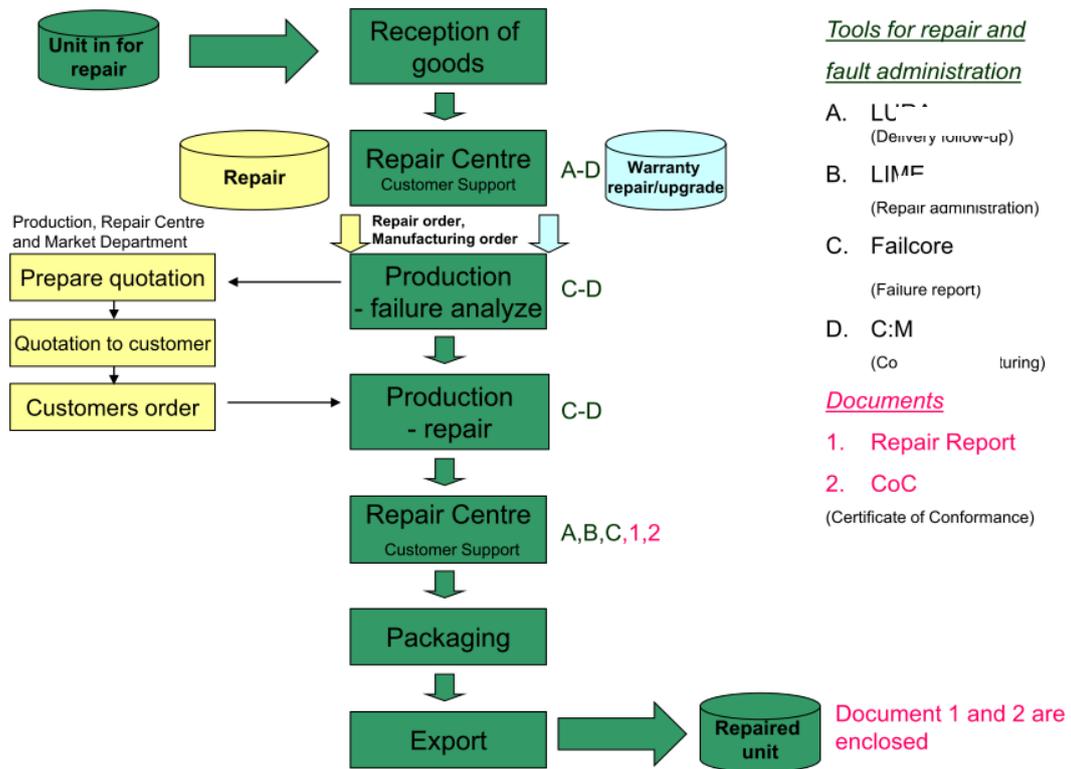
Månatliga workshops
med fokusområde

Effektivt kommunikations
forum

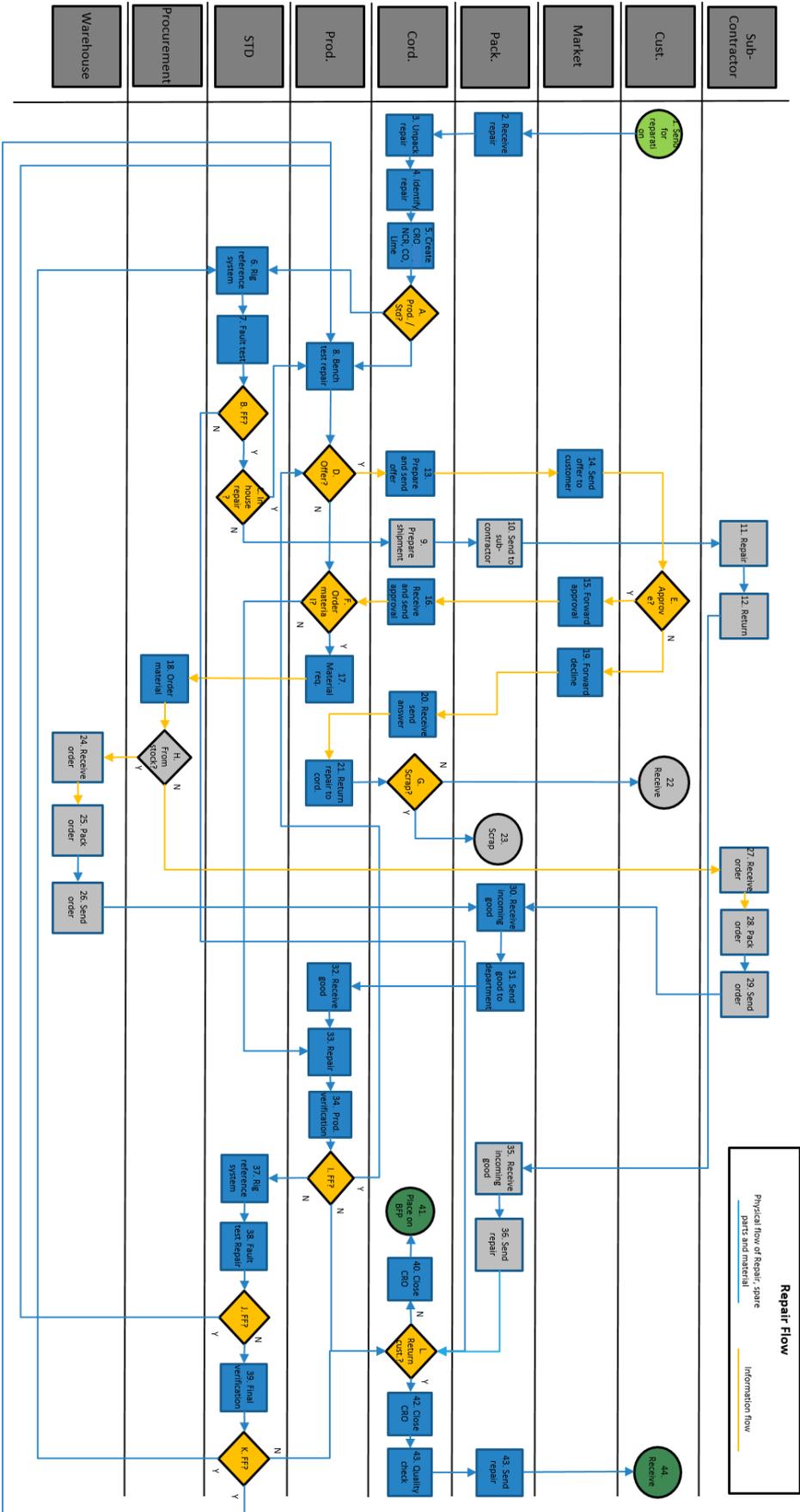
Appendix M- Site 3's process map



Appendix N- Old process map of the repair process



Appendix O- The repair process



Appendix P- Functions of the log system integrated in the ERP-system

Method* Repair Project Request Relation Customer Order / CRO

Customer Details
 Customer Reference Business Prospect (Quotation) Purchase Order - Manual Purchase Order Customer Information Purchase Price 0,00 U*

Details
 Part number* Description Serial Number* Qty* Bartrack Number Number Workcenter R-State SW/In

TK [redacted] [redacted] [redacted] 1 [redacted] [redacted] [redacted] [redacted] [redacted]

References and Economy
 Order Number* Ship Order Purchase Order /FS NCR DHL TR ID ISP Number Invoice Number
 Accumulated Cost SEK Accumulated Cost Divided by TK 0%

Dates
 Start Date* Quotation Due Date Quotation Sent PO Received
 2016-06-28 2016-09-27 2016-09-27
 Delivery Due date Estimated Delivery Date Actual Delivery Date ETA at Customer
 2016-09-28 2017-03-16 2017-03-16 Case Closed

Comments

Planning
 Code Internal Due Date

DPL Dates

Sub Contractor
 Sub Contractor Sub Contractor prt no Sub Contractor Serial Number RMA-Reference M/P Buyer
 [redacted] [redacted] [redacted] [redacted] [redacted] [redacted]

Documents
 Quotation Basis/Cost Report Material Preliminary Description Repair Report
 [redacted] [redacted] [redacted] [redacted]

Links Fields Invoicing

Created by (System) [redacted]

Filter

11