

IMPROVING ORDER-TO-DELIVERY PROCESS EFFICIENCY IN CUSTOMISED PRODUCTION

Case: Company X

Abstract

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Title of publication Improving order-to-delivery process efficiency in customised production Case: Company X		
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Abstract <p>This study discusses the tools for process improvement and the importance of efficient processes in businesses.</p> <p>This study was conducted in cooperation with Company X. The purpose of this study was to evaluate and analyse the case company's order-to-delivery process for a specific production line. There was a need to find places for improvement in the process in the case company.</p> <p>The theoretical part of this study examines the features of process work and tools to analyse and develop a process. Sources include literature related to the topic. There are many tools available for process improvement and this study introduces some of them.</p> <p>The research method chosen for the empirical research was a qualitative case study. The case study was executed by semi structured interviews and the data was gathered from the people taking part in the process. The participants were selected from different levels of the process. The interview results were compared to case company's process chart. This way a thorough view of the process in total was formed.</p> <p>The results show that team work is an important factor in efficient processes. The case study process can be improved further by implementing suitable tools by a team within the process. A development plan is introduced. The case company is able use this development plan in their business. The case study research results are applicable to this case study only as such.</p>		
Keywords process improvement, process development tools, process efficiency, order-to-delivery production process, process analysis		

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1 INTRODUCTION

1.1 Research background

A company's daily business consists of many processes. The process flow and participants in a process may differ in the organizational databases and charts compared to the actual everyday work. The process chart is easily forgotten in daily business, when people are used to a certain way of working. Departments focus on silo activities and forget about the process and its efficiency and development. Organizational silos refer to a mentality in businesses when a department or a function lose relationship with other individuals or teams and work on their own, in a "silo" (Cilliers & Greyvenstein 2018, 373). Sometimes it is necessary to update the process charts, just to keep the company up-to-date of their activities. Occasionally the process chart needs to be updated because the process has changed so much, that the process chart description does not match the actual process anymore (Tuominen 2011, 21-29.)

In some cases the need for the update comes from uncertainties when people are not aware of their roles in a process. This study examines one particular order-to-delivery process in the case company. The base for this study is to examine and analyse the order-to-delivery process to find out possible places for improvement. The order-to-delivery process for the case company is viewed from efficiency point of view. Efficiency can be improved by improving processes. Being able to improve a company's business processes results in higher competitive edge and sustained success (Boutros & Cardella 2016, 1).

The author of this study works for Company X. The current process of order-to-delivery in one specific department in the case company is seen as not finished enough and too complicated. There is a need to improve the process and make it more efficient. There are some obscurities about the participants in the process and about the responsibilities of the participants. The process chart exists in the company database, but its accordance to real life is not exact. This particular order-to-delivery process is customer-based: manufacturing is done based on customer order and the delivery dates play an important role. This process is more a project-like manufacturing process than a regular sales and manufacturing pro-

cess. The items manufactured are unique and build only for the particular customer based on their order. So the resulted item from the process variates. This adds complexity to the process.

1.2 Research objectives

The primary objective of this study is to improve the specific order-to-delivery process for the case company. The goal of this study is to create a development plan on how to improve the process, and to represent the suitable tools for improvement work. The goals can be achieved by analysing the differences in the company's process database compared to real life activities. The aim is to find out inefficiencies and to provide solutions to make the process more agile and cost efficient and to make participants more active in the process. One of the goals is to make the participants aware of their role in this process. This way they are more willing to actively improve the process, which makes the process more efficient.

The purpose of this study is to bring valuable information to case company business models, and to create improvements for the specific order-to-delivery process. The study aims to improve the cost-efficiency of the process and to activate and include the participants in process. The case company receives information about their process flow and the inefficiencies, which could then be also improved in other processes.

1.3 Research questions and scope

The primary objective of this study is to improve the specific order-to-delivery process in the case company. Therefore it is necessary to define processes and process improvement to understand the concept.

The main research question is:

- How to analyse and improve a process?

And the sub-questions to help answer the main question are:

- What tools can be used in process development?
- What are the common inefficiencies in processes?

The case company is a medium-sized international company. This study examines the order-to-delivery process of a specific production line. The case company also has similar functions in other countries, but this study refers only to this particular order-to-delivery process chart in Finland. The scope of this study is to focus on case company's specific production line process: the results are scalable to other similar production lines or other business units of the company.

1.4 Research methods

Qualitative research method was chosen to be used for this study. A qualitative research tries to develop insights and understandings from patterns in the data within theoretical framework (Taylor, Bogdan & DeVault 2015, 18-19). This study uses books and publications as a data source for the theory part of process development.

The case study research is based on case company's process chart and the interviews from participants in the process. An interview is a personal method to gather information directly from the people (Kumar 2011, 144). A process chart of the current process flow is used as the starting point for development process. Interviews with the key persons in the process were held via Skype and in person to observe the inefficiencies in the process and to find out the activities of each participant. The method chosen for the interviews was a semi structured interview. A semi-structured interview provides many possibilities for an interview, having enough structure to discuss specific topics, while it gives the participants space to discuss around the topic (Galletta 2012, 24).

The people were selected for the interviews based on their roles in the process to ensure a comprehensive understanding of the process.

The data gathered for this study was analysed using thematic analysis and clustering methods. The conclusions are a combination of the theory part knowledge and the analysis of the research data. The research methods will be explained in more detail in Chapter 3.

1.5 Theoretical framework

This study is divided into four main parts. The study begins with the introduction. This study consists of the theoretical part, the case study research part and results and conclusions part, which is based on the previous parts. As the case study and purpose of the study were already given by the case company, the theoretical framework starts with explaining processes and process development. As the research went further, more ideas were included into the theoretical framework. The research started with acquiring common knowledge on processes and process efficiency and from the findings of that research; ideas such as communication and participation were added. This way the study process went in a circular flow described in the following picture.

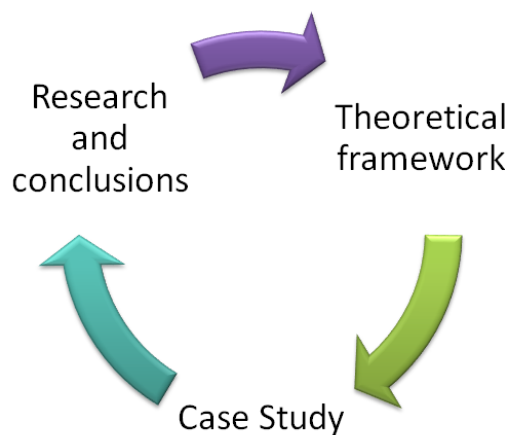


Figure 1. Thesis process cycle

As the case study identified more problem spaces, the study explains more about the theory behind it. This way the case study and the theoretical framework are consistent in the conclusions part.

Theory part of the study begins with the introduction to the concepts of processes. In order to be able to improve a process and to make it more efficient, the study explores ways to analyse and evaluate processes and the tools for process development. The study introduces the most common tools for process improvement, the ones which were mentioned in most of the theoretical data sources.

Getting to know the process improvement tools enables the analysing of the case company process chart. That way the places for improvement can be found and

recommendations made. The study also discusses communication between the participants in business processes. To improve the efficiency of the process, not only changes in the process are needed, but also changes in the way people communicate.

The goal for this study is to improve an order-to-delivery process in the case company. The theory part starts by explaining what the concept of a process includes. To help answer the research questions, the theoretical framework looks as follows:

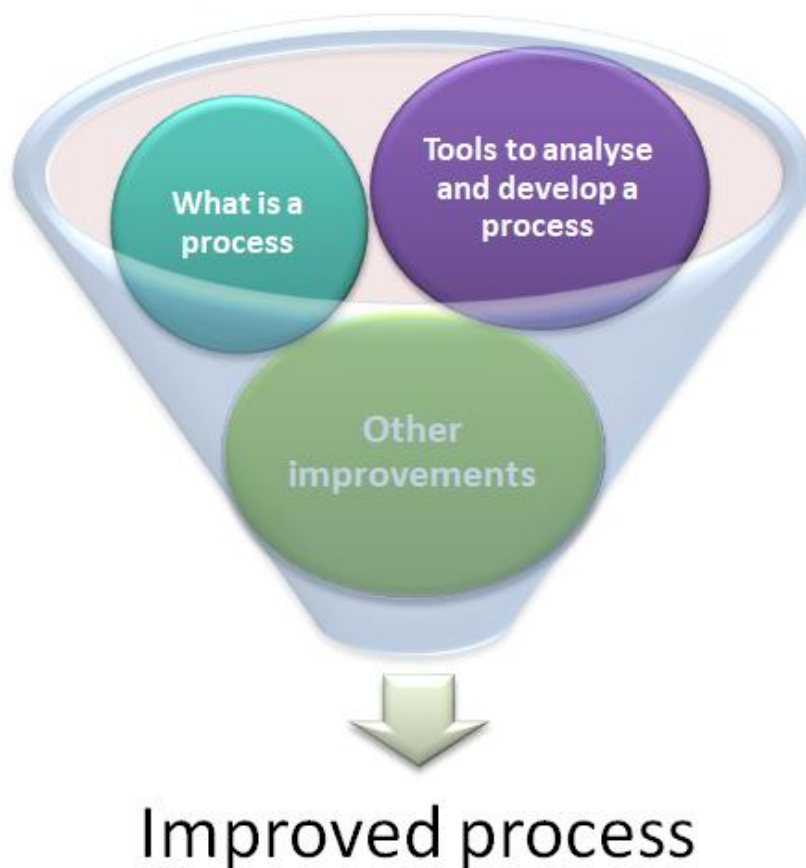


Figure 2. Theoretical framework

All the parts work together to bring a coherent outcome. The theoretical framework seeks to find ways to improve a process and the work behind it involves the explanation of a process and its features and the tools to analyse and develop a process. The research questions will be answered by explaining these concepts. These parts altogether bring a basic picture of process work and how to analyse and improve it.

Goals and objectives for this study are to find out differences between the process map and actual work activities, and this way analyse possible inefficiencies in the process, to make participants more active and aware of their roles in the process and this way improve the overall process work. The goals and objectives will be reached following the figure below.



Figure 3. Goals and concepts

The starting point for this development case study is WHAT: what is the current situation that requires a change. In this case it means that there is an inefficient process with an unclear process chart and there are unclear roles in the process. The approach to handle these problems is to get familiar with the HOW: what can be made to fix the situation? In this case the study introduces the common tools for process improvement. In order to improve a process, the ways to analyse processes and ways to activate people need to be acquainted with. That is how the study gets to WHERE: the goal for the study. In this case this means that the end result should be a more agile process with active participants in it. Also, continuous development within the process and better communication inside and outside the process should be acquired. The importance of continuous improvement is undeniable in order to companies stay competitive (Hirzel, Leyer & Moormann 2017, 1565).

1.6 Structure of the study

The study consists of four parts. In the first part of this study, the introduction represents the background and objectives for the study. The second part, theory, discusses common processes and process improvement methods. The theory introduces the chosen process improvement tools. The theory discusses the importance of good communication flow in processes. The structure of this study is shown in the figure below:

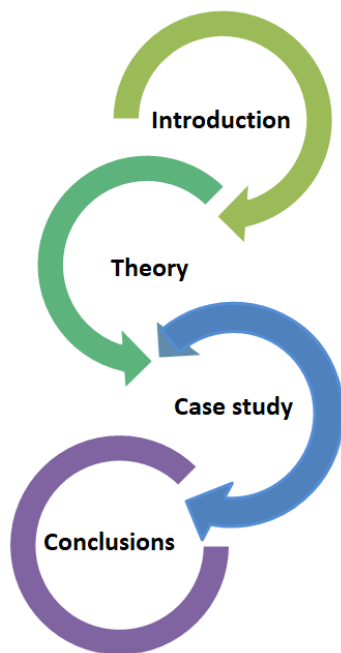


Figure 4. Thesis structure

The case study introduces the case company and the background for this research. The research methods for the case study are introduced. The case study explains the current process at the company and the inefficiencies in the process. The case study explains the results of the research.

The conclusions part gathers the main points and findings in this study. It introduces the recommended actions for the case company. The recommendations act as a guideline to the case company on how to improve the process of this specific order-to-delivery production line. The goal for study is to provide the recommendations for improvement. Finally the conclusions part suggests concepts and ideas for further study and evaluation.

2 LITERATURE REVIEW FOR PROCESS DEVELOPMENT

2.1 Concept of a process

Sharp & McDermott (2009, 37) conclude that a process is a collection of activities with the purpose of getting something done. Process according to a dictionary is “a particular course of action intended to achieve a result (synonym: procedure)” or “a series of actions or operations conducing to an end: especially a continuous operation or treatment especially in manufacture.” Boutros & Cardella (2016, 3) note that there are five components of a process: resources, inputs, activities, outputs and controls.

According to Okes (2013, 11) companies have two types of processes: core processes and enabling (or support) processes. Core processes are the ones facing customers, with the purpose to capture the needs and wants of a customer and turn those into a product or service delivered to a customer. Enabling (or supporting) processes are necessary in order for the core processes to function. Okes (2013, 11-12) categorises them as follows:

Core processes:

- Strategic development and deployment
- Technology development and deployment
- Order fulfilment
- Customer relationship management

Enabling processes:

- Human resource management
- Information technology management
- Financial management
- Regulatory compliance.

Patel (2016, 24) states that the importance of customer point of view should be kept in mind when planning processes and developing them. The output for every process should be satisfying the customer requirements.

Sharp & McDermott (2009, 17) explain a common order to delivery process in four steps: take order, make widget, ship widget and collect payment. The simple process example is visualized below in Figure 5.



Figure 5. Order to delivery process (visualisation from Sharp & McDermott process description (2009, 17))

Sharp & McDermott (2009, 17) state that companies are often losing the process in the functions. This means that we focus on optimizing individual parts of the organization (such as functions of a department) but we forget that it does not optimize the whole company. To be efficient, we should start from the beginning of the process and optimize all functions accordingly. The first process step of “take order” should collect all the information there needs to be to make, ship and collect payment for the widget. The first step should be thorough enough to serve the internal customers, even if it slows down taking the order.

All four of the boxes in the process flow described by Sharp & McDermott are individual functions in companies. But in every organization, all of these activities are related and functions as a part of the same processes, usually serving the same customer and using the same IT systems. Despite of that, they are usually functioning as their own departments and focus solely on their own tasks and activities. They aim to get their job done, but seem to forget that they are only one part of the process. Okes (2013, 9) also includes the customers in the process: both internal and external. Companies exist to serve customers and that is what all departments should keep their focus on.

Many times the actual process is forgotten in daily activities and procedures may be mistaken as processes. A procedure is a synonym to a process, so how can we define the difference? They both mean some sort of an activity.

Sharp & McDermott (2009, 38-57) conclude that a process is a collection of activities that gets something done. The results should be countable. This means that you can count the result that comes out of your process. A **process** is a way for a

company to organize its resources and work to accomplish their target and goal (which is to produce goods or services). A **business process** is a collection of activities to achieve a certain result for the customer (a certain product or service). An **activity** in the process may include many people and departments to take part in it. These activities then have more defined **procedures** and work steps to get the job (activity) done.

Sharp's & McDermott's widget process can be explained in more detail by using these previously introduced concepts of process, activity and procedure.

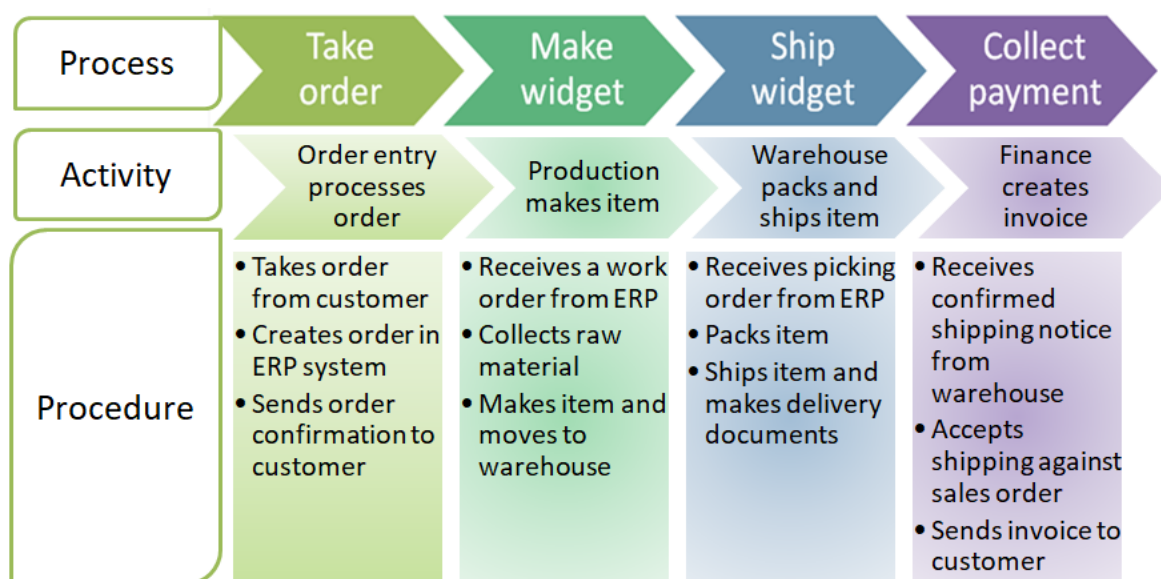


Figure 6. Order-delivery process in more detail (adaptation from Sharp & McDermott 2009, 17)

Figure 6 explains the process in more detail but does not tell us how the activity is done and by who. The line and arrow is one-way in figure 6, referring to a process with a start and an end. However, most processes have a lot of traffic going back and forth and a basic process chart similar to the one visualised in figure 6, cannot show interdependencies between the process participants. That means we need to go into more detail (Okes 2013, 9-11.) The next chapter introduces the concept of process mapping.

2.2 Process mapping

A process chart is used to visualise the process flow. It is a part of a methodology called process mapping. A process map or a process chart is a document that visually captures the flow of the process: inputs and outputs. The process map places the activities to their locations in the process. (Cooper & Moore 2013, 45). What may cause problems for companies, is that process mapping is an internal task, but there appears to be no specific department that is usually responsible for creating and maintaining it. It is mostly executed by technical staff but could be considered to be bought as an outsourced service in order to get an unbiased view. (White 2016, 305).

Process mapping adds understanding of the processes and enhances communication and that way can improve transparency and the efficiency of the process. (Bowles & Gardiner 2018, 1268.) At its simplest, a process map can describe the basic tasks and activities in a process. It is a valuable tool to identify redundant activities and places for potential improvement in a process (Boutros & Cardella 2016, 153).

Tuominen (2016b, 50) explains that the more complicated cross-functional process maps are graphical demonstrations of various levels of detail, with labelled inputs and outputs, moving from left to right and reflecting the flow of materials, activities or information. These process maps have more information about the steps and activities of the process than the simple ones.

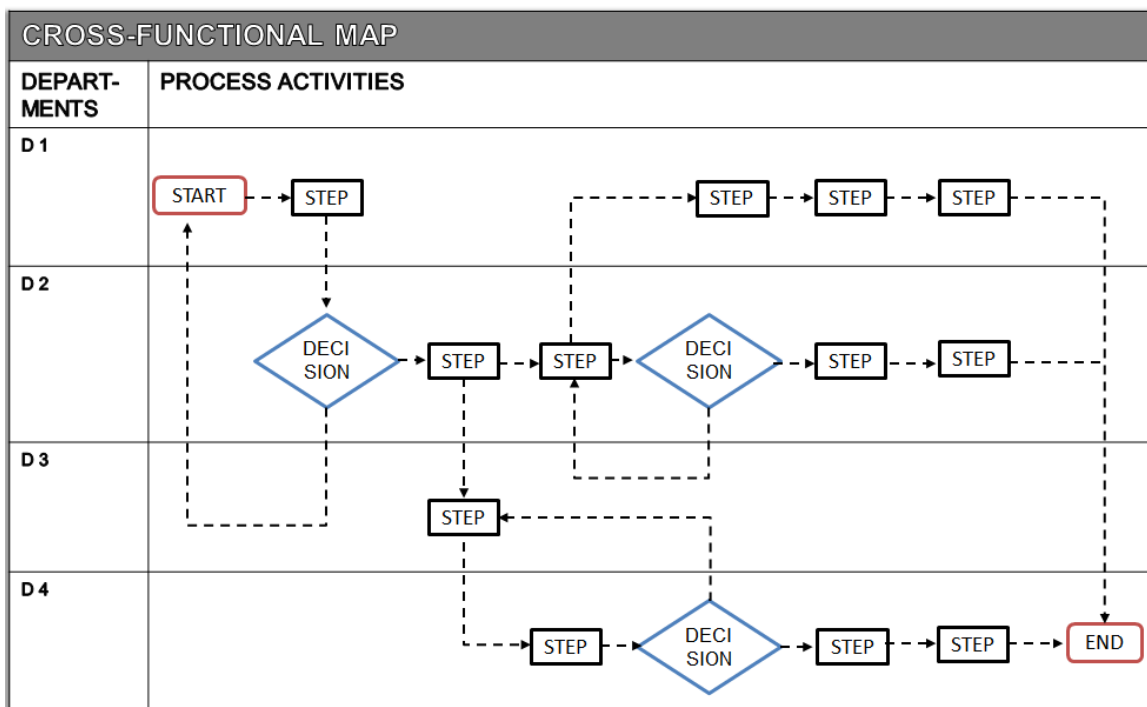


Figure 7. Cross-Functional Process Flow (modified from Boutros & Cardella 2016, 54)

There are four levels of bands in this case process flow shown in figure 7. The cross-functional process flow shows the flow through all these different levels. Usually the levels (bands) reflect the department in a company, for example sales or finance. The boxes reflect a function and the arrows show the flow of the material, activity or information in the process. (Tuominen 2016b, 45).

The different shapes represent a different type of an activity. The most basic process symbols are visualised in figure 8. Understanding these steps gives the possibility to understand and analyse the process flow.






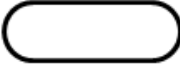

Symbol	Name	Function
	Action Symbol	A single step / sub-process in a process
	Arrows	Show the flow and connections in the process
	Decision symbol	Different decision move from different points of the diamond
	Document symbol	A printed document or a report
	Multiple documents	Multiple documents or reports
	Start / End symbol	Marks the starting and ending point of a system
	Input / Output	Material or information moving

Figure 8. Process symbols (adapted from Smartdraw 2018)

The process chart or process map usually starts and ends with an ellipse-shaped symbol. The process moves according to the arrows. When there is a decision point (diamond shape), at least two arrows move from that symbol. It is usual to have the decision symbol in questions format, such as “Quote accepted?” which is then answered “yes” or “no”. The answers then lead to different steps and the process moves forward, or there is another round until the “end” is reached. (Tuomi-
nen 2016b, 47).

There are problems in the concept of processes and process improvement. A process is easiest to describe, map and standardise when it is inflexible and stiff. The less the process has possible changes and exceptions, the easier it is to map and the work and activities can be repeated. However, when aiming for process development, it usually requires a high level of flexibility and adaptability. These

changes are very difficult to draw, map and repeat. Processes should be kept simple enough for the people participating to understand the activities and process steps. (Leppälä 2014, 169).

2.3 Process analysis

A process is sometimes difficult to explain and analyse only by looking at a process map or process chart. It is important to define a process, a procedure and the difference between a business process and production processes. After that we can begin to analyse and understand a process and evaluate its efficiency. Performance analysis is the first step in performance improvements, so first we need to analyse the process performance and then we can start to improve it. (Van Tiem, Modeley & Dessinger 2012, 123).

There are many ways to analyse a process and its efficiency, but in many cases, the problems will arise without looking. There may be a complete and finished process chart created, but it does not necessarily function. It is common that processes have gaps and overlaps in the architecture, but it does not mean that it will create problems in the process (Sharp & McDermott 2009, 35).

Van Tiem et al (2012, 123) list four main areas for process performance analysis focus:

- desired performance state
- actual performance state
- the gap between desired and actual performance
- causes of gaps in performance

The need to analyse the process performance is to find out the reasons why the actual process performance cannot reach the desired process performance or goals.

Van Tiem et al (2012, 133) state that the first step for performance analysis process is organizational analysis. First, the organization should be analysed to find out the guidelines for the strategy. Company's vision, mission, values and goals should be analysed in order to improve performance accordingly.

A process can be analysed on multiple levels. First, the **conditions** to make a change should be analysed. Van Tiem et al (2012, 133) lists some questions to help analysis:

- Is the change compatible with organisations mission?
- Is the current division of units and departments functional? Is it easy for people to work in groups?
- Is there budget or authority to implement changes?
- Does management support a change?
- Do people have the tools and information to make a change in their work?
- Is support and resources easy to access for people?

After the conditions level, the **process** level should be analysed. Questions to help the analysis are listed as follows:

- Do organisational systems have enough flexibility to support required change?
- Do people have the skills to make required changes in the process?
- Does the workforce have qualities to meet requirements for the roles in the process? Are they skilled enough to be a part of the process?
- Are work procedures or processes supportive to make improvements?
- Is the current workflow designed to work efficiently and effectively?
- Is the work design free of duplications or gaps?

Finally, the **outcomes** level should be analysed. Here is a list of questions to help the analysis:

- Are the goals in departments involved consistent and compatible with the results expected?
- Will a change or improvement contribute to increasing satisfaction of shareholders, owners or others?
- Are people currently rewarded and recognized for behaviour that is compatible with requirements?

- Are current expectations about work compatible with the improved requirements?
- Will an improvement contribute to employee satisfaction?
- Are current productivity levels sufficient to meet the requirements of the change?
- Will a change increase customer satisfaction?
- Are current time requirements for completing work compatible with the change?

All of these questions are facing towards a change: an improvement in the process. Once a bigger picture has been formed of a process, the smaller gaps and inefficiencies will stand out. Process improvement is also change management, as it requires people to adapt to new work methods or work environment. (Van Tiem et al 2012, 137-139)

Boutros and Cardella (2016, 7-9) state that it is important to improve business performance. Process improvement usually makes processes more effective, efficient or transparent. They list the possible benefits of process improvement implementations as follows:

- happier customer
- streamlined operations
- consistent quality
- less waste
- lower costs
- more sales and market share
- improved communication
- higher employee morale

These are all important factors and each of them is worth of development, even though development programs require resources to be planned and implemented.

A company can analyse the process from business management point of view. Okes (2013, 57) introduces the process management maturity matrix that defines the five levels of process management performance. Defining the level of management gives an idea of the agility and adaptability of the process. Using the process management maturity matrix gives an observation on how much the company has concentrated on the goals and objectives they usually have in the strategy. This matrix is a reminder that a business strategy without actions does not result in high excellence. This effective organisational learning with the process improvement focus can be considered a competitive asset. (McCormack & Rauseo 2005, 63).

Table 1. Process management maturity matrix (modified from Okes 2013, 57)

Level		Process management maturity matrix: Assessment Criteria					
		Activities	Metrics	Ownership	Connections	Improvements	Changes
Improved	5	Processes continually improved	Metrics are used to find new opportunities	Process owners make sure that everyone has ownership of processes	Internal customers and suppliers work together	Processes continually improved in line with business objectives	Changes can be implemented rapidly and effectively
Managed	4	Processes are performing acceptably	Metrics are used for feedback	Process owners discuss with team members	Discussions between internal customer and suppliers result in changes	Improvements are implemented with some impact to business performance	Process changes are evaluated, validated and documented
Standardized	3	Processes are documented and personnel trained in them	Standard metrics are in place for most processes	An owner has been identified for most processes	Regular feedback exists between internal customers and external suppliers	A standard process improvement methodology exists	Changes can be reviewed and approved in the process
Repeated	2	Personnel try to copy actions each time	Processes are measured when problems occur	Individuals are responsible for certain parts of the process	Discussions occur between members when there are problems	Attempts are made to improve processes when there are problems	Vague records are kept of process changes
Unmanaged	1	Processes are carried out as each person sees fit	Performance is not measured	Anyone or no one owns the process	Internconnections of processes has not been discussed	Processes are seldom improved	Anyone can change the process

The process management maturity matrix shows how far a process is developed. At the lowest level anyone can make changes and there is not really that many rules or procedures to work. According to Okes, a process owner should be named to monitor and control a process and that way develop and improve it. The

matrix shows the levels of maturity in the process. The higher the level, the more agile the company and the process is to make changes and adapt to them. (Okes 2013, 36)

Evans & Lindsey (2015, 206) see the process map analysis as an important improvement factor. Especially when the cycle times and lead times are calculated, the rooms for improvement can be found. The actual work is a relatively small portion of cycle times and lead times, as little as 15 to 20 percent. This means that there is room for improvement around each work step.

2.4 Process development tools and problem solving

Developing a process can be regular and scheduled maintenance work or the need for a change can come from a problem appearing in the process. Performance improvement is the outcome of making the performance better. Measuring and defining the starting point and ending up with better results equals performance improvement. (Van Tiem et al 2012, 6).

The importance of management and leadership in processes is many times underestimated. According to Young (2010, 29) a team cannot manage without management support. In processes and other cross-functional team work there needs to be clear authority in the team to make decisions and implement them. Some common process development tools are introduced as follows. They are designed to improve efficiency within the process, in the process work or in the communication of the participants in the process. This way there are many levels to process development. The tools are commonly known as business improvement tools or performance improvement tools, but Van Tiem et al (2012, 6) calls them *performance improvement interventions*.

The need for process improvement can arise for example from the following reasons:

- Organisational factors
 - the need to rationalise processes and systems
 - changing business strategy to product leadership, operational excellence or customer satisfaction
 - business goals are not being met

- Management factors
 - maximising the capacity from existing personnel
 - budget cuts
 - creating high performance culture
 - acquiring more control over processes
 - Employee factors
 - training issues or high turnover of employees
 - low employee satisfaction
 - difficulties with business growth and change
 - Customer factors
 - low service quality to customer
 - increase in customer numbers
 - customers requiring a unique process
 - product and service factors
 - lack of agility in business
 - poor service levels
 - multiple similar processes that could be unified
 - process factors
 - gaps in the process
 - lack of documentation of processes
 - unclear roles and responsibilities
 - lack of communication involved in process
 - poor service quality
 - technology factors
 - the purchase of business process management automation tools
 - existing application systems overlap
 - introduction of a new IT architectures or technologies.
- (Boutros & Cardella (2016, 15-17.)

The most common process improvement tools were chosen to be introduced from the many available. The tools that were left without introduction are in Figure 9 in "Available tools" in the figure and the ones that will be explained in this chapter are below "Introduced tools".

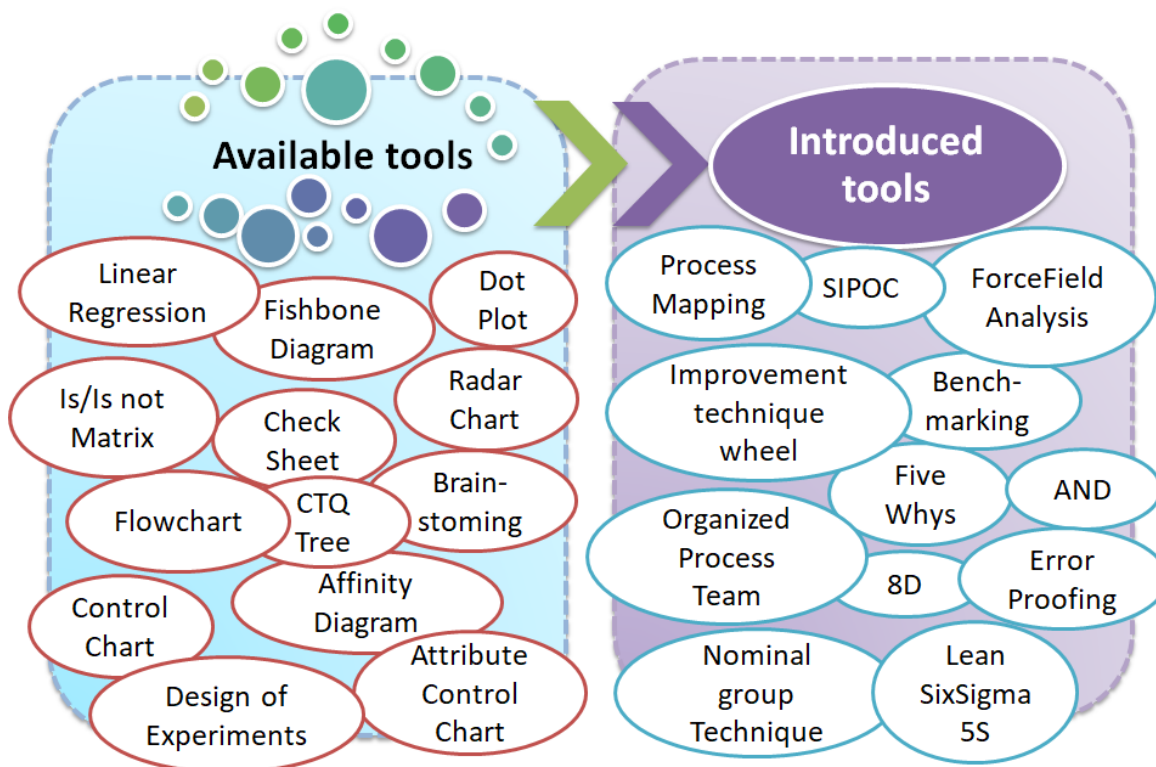


Figure 9. Process improvement tools

The process improvement tools chosen were the bigger umbrella concept of Lean and SixSigma and introduces the tool called 5S. Process mapping was chosen as understanding how to create a process map facilitates the understanding and interpretation of it. However, the tools that were left out from this study are suitable process development tools, but for the scope, limitations and validity of this study, there is no need to explain all of them. Leaving them out does not mean that the tools are any less valid, and the concepts might be mentioned in the study.

2.4.1 Improvement technique wheel

A way to improve processes is to find out the inefficiencies and develop them. Page (2010, 111-112) suggests an improvement technique wheel to be used for this purpose. The improvement technique wheel helps to find inefficiencies in business processes and this can be also used for production processes.

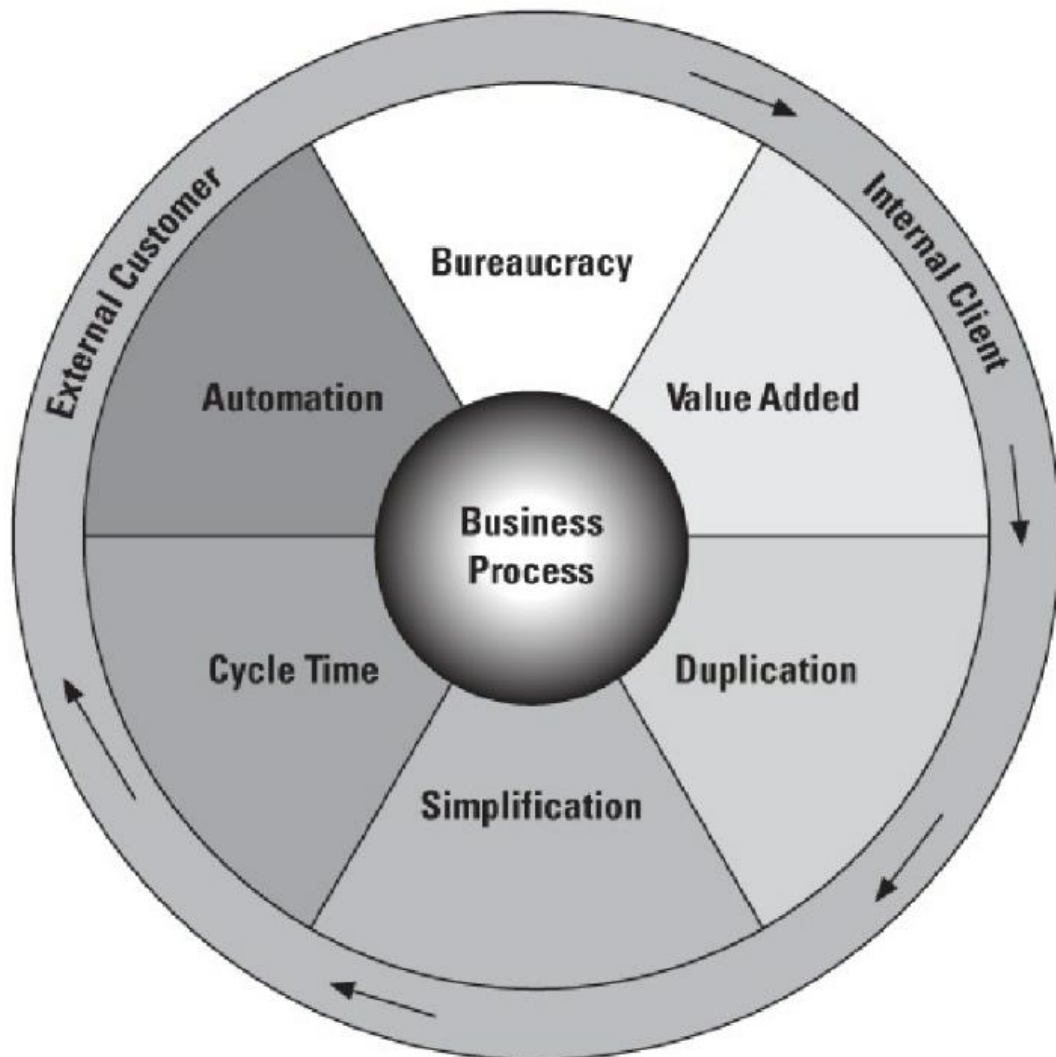


Figure 10. Improvement technique wheel (Page 2010, 112).

The wheel is depicted in figure 10. It is recommended to be used during a project team meeting and to process only one part at a time, so each part in one meeting. It can be noted that there are relationships between the parts, for example reducing bureaucracy also reduces cycle time. (Page 2010, 115) The parts will now be explained briefly in the following:

Bureaucracy

The discussion starts from the top of the wheel, part called bureaucracy. There is a set of questions that can be answered to reduce and eliminate bureaucracy. Here are a few of them:

- Do we generate unnecessary paperwork?

- Do people receive information they do not need?
- Do we make decisions at the right place?
- How many approvals do we have in place? Why?
- How many copies of each document do we make?
- Do we have unnecessary files to fill? Why?

Main point for this part is to find a process flow with least amount of bureaucracy. All the necessary activities in the process should lead to happy customers. If the activity is not necessary or it increases cost, it should be eliminated (Page 2010, 115).

Value added

Page (2010, 116) explains that every step and activity in a process adds costs in form of labour, overhead or other expenses, each of the steps and activities should be evaluated based on the value it adds for the customer. Each of the components in a business process should add value to the product or service provided to customer. When thinking about improving a process, and you are not sure if the actions bring any value to customer, you can ask: "Would the customer pay for this activity?"

Eliminate duplication

Page (2010, 118) states that duplication is more common in "silo" business processes, when groups or departments are not interacting with each other. They all use their own methods to gather and store data, and give out this information only if required. This can be caused by having such separate activities, that the information cannot be shared, or that the departments compete with each other. In both cases, the main purpose (serving a customer) has been forgotten. Duplication can be caused by managerial issues and bureaucracy, where there is a feeling that everything should be accepted and reported by the manager of each department. Possible solutions:

- Create a single source of data (intranet, database, cloud service)
- minimize document storage

- eliminate two people doing the same work

There are cases when the laws and regulations demand a thorough reporting, but in many cases this is just excess bureaucracy that adds cost and does not add value to customer. If it is not necessary for every department to store the same document, the document should be then eliminated and kept in only one department. (Page 2010, 119)

Simplification

Page (2010, 120) explains that simplification can also be called streamlining the process, which means that the complexity of a process is reduced to make it more easy to understand and more efficient in that way. When the process is simple, it is usually more flexible to meet customer needs. These are the wise words by Albert Einstein (Page 2010, 120):

“Simplicity means the achievement of maximum effect with minimum means.”

Going back to Sharp’s (2009, 17) widget example, a common order-to-delivery process has four steps: take order, make widget, ship widget and collect payment. Businesses tend to add complexity into this flow and make things more complicated. However, we do not need to invent the wheel again, and keeping to the simple process introduced by Sharp we can be agile and efficient. There is bookkeeping and reporting that has to be done and documented, but in many cases there are things that can be simplified. Page (2010, 121) suggests these questions to help simplification.

- Can we streamline or eliminate any step of the process?
- How many emails do we send through the process? Are there too many? Why?
- Can we make steps, reports or forms easier to understand?
- Does everyone understand the process?

Not only the internal processes should be considered, but to take the customer into the equation as well. Make the process simple and easy to understand for the customer, and they will return. When the process is simple inside the business, the customer will benefit with lower cost and more agile service. (Page 2010, 121)

Reduce cycle time

According to Page (2010, 121) the cycle time means the overall time from the first step of the process to the last step of the process. If the time spent in each activity is not calculated accordingly, the business can only make assumptions of the cycle time. When a customer demands a certain date for order, business face a problem of performance: are we able to provide this cycle time or not? Empty promises are always a poor choice and it is better to let customer down with the promise of a longer cycle time. Reducing bureaucracy and simplifying the process usually reduces cycle time, but there are some topics to discuss:

- Can an activity be done in a shorter time? How?
- Can any activities be combined or done parallel instead of one at a time?
- Can we reduce handoffs?

Reducing cycle time also leads to a more efficient process. (Page 2010, 123.)

Automation

Automation refers to an activity done with the help of technology. There might be technology implemented in the company, but it is not giving back as much profit as has been invested in it. Businesses should critically evaluate and assess the benefits an ERP (enterprise resource planning) system brings and the potential it can bring if used correctly. (Page 2010, 124.)

2.4.2 LEAN / SixSigma / 5S

Lean is a management tool to improve a business's performance that is developed in Japan for the Toyota Production Systems (TPS). The main purpose for TPS was to find an equation to maximise the production of automobiles with minimum possible resources. (Bradley 2015, 3). **SixSigma** is a problem-solving tool that is commonly used in businesses. Lean and SixSigma are the most popular improvement tools and methodologies and usually implemented at the same time. In that case, the methodology is called Lean Six Sigma (Bradley, 2015, 5.) The popularity can be explained as most of the problems in manufacturing, products and processes can be defined with the terms DMAIC (define, measure, analyse, improve and control) (Shankar 2009, 16).

SixSigma is a business strategy that aims towards perfect processes and products. Lean can be defined in doing things quickly, and SixSigma is about doing things the right way (Sahay 2015, 17-32). A feedback loop (Figure 11) that is commonly used in lean management can be used as a tool to develop a process.

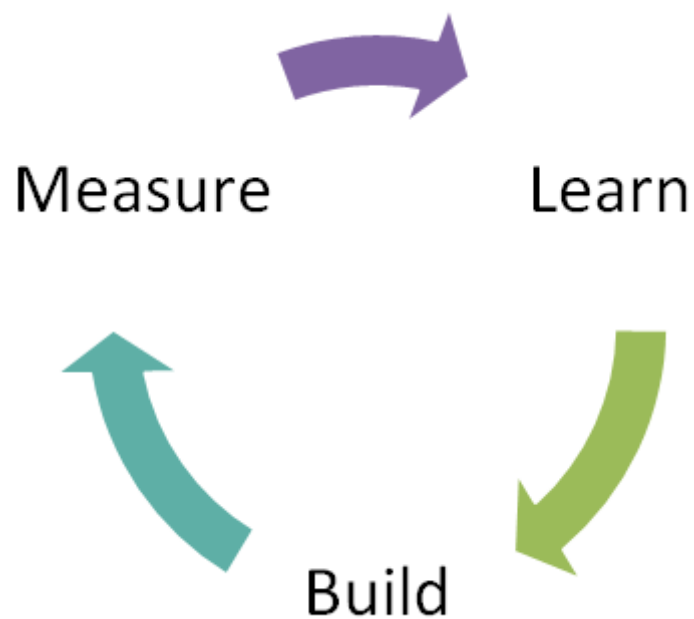


Figure 11. Feedback loop (Ries 2011, 96)

The feedback loop shown in figure 11 can be used to assess and develop a process on a regular basis, as a continuous loop. (Ries 2011, 96).

The more common PDCA/PDSA –cycle or “The Deming Cycle” is also used in lean SixSigma management. It is a refined version from a feedback loop.

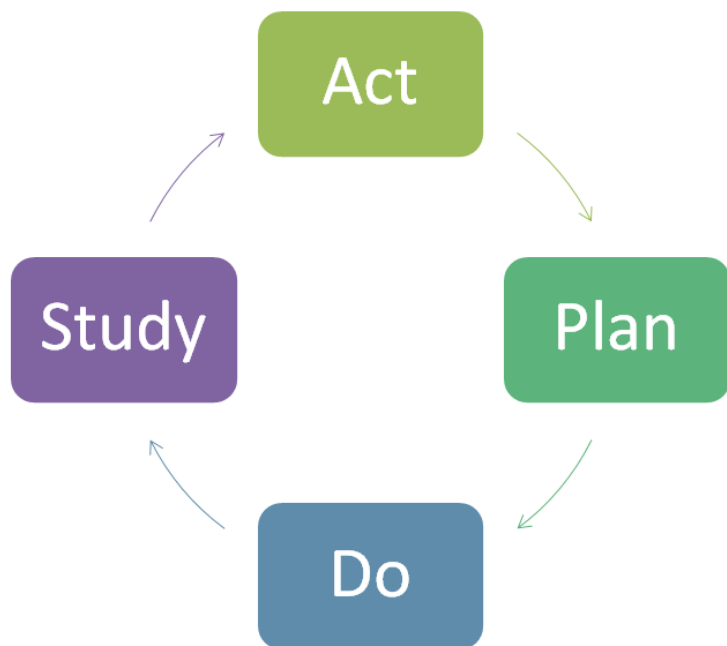


Figure 12. The Deming Cycle (Evans & Lindsay 2015, 204)

The Deming cycle has evolved to be one of the most common process improvement tools that is used for both continuous improvement and long-term organisational development. (Evans & Lindsay 2015, 204).

Lean thinking is a business development methodology based on the methods from Toyota. (Owens & Fernandez & Ng 2014, 84). Lean thinking means a method where all activities in business processes are fine-tuned to peak efficiency. Lean is all about avoiding the so-called waste in processes. (Sahay 2015, 31). The concept of waste and avoiding it means a view of perception where all the activities that are not necessary for production should be eliminated. Lean thinking includes seven forms of waste: waste in overproduction, waiting, transportation, processing, inventory, motion and defects. (Ruffa 2008, 17). Sometimes even more factors are added.



Figure 13. Types of waste in lean (Modified from Boutros & Cardella 2016, 17-19)

Waste can be anything from waiting to transportation if it occurs without a purpose to serve the outcome in the process. Waste is an activity that is inefficient in the process, does not add value to outcome and has no marketable value as is.

(Boutros & Cardella 2016, 17.)

With lean, it is important to look at processes from customer point of view: “What does the customer want from this process?” (Liker & Convis 2012, 92). This means that the processes are not primarily improved to satisfy the company but it is all done to better serve the customer. Lean has become a very popular method for business consultants and analysts to market, however lean should always be applied with case sensitivity in mind. Lean does not work just by applying the principles; it also needs controlling and monitoring to succeed. (Nightingale & Srinivasan 2011, 19).

The **5S** technique is a good way to get started with lean. 5S helps put the working environment in order in two simple steps: 1. Get rid of all the unnecessary things. 2. Ensure a place for the things you need. The name of the 5S technique comes from these five words: Sort, straighten, scrub, systematise and standardise. Sometimes a sixth “S” is added for “safety”. (Sayer & Williams 2007, 153; Bradley 2015, 76). According to Omogbai & Salonitis (2017, 381), the letters stand for sort, set,

shine, standardise and sustain but the idea is the same. 5S is an inexpensive and simple technique to achieve tangible benefits from lean management.

2.4.3 8D

The 8D (Eight Disciplines) tool was developed by Ford Motor Company. It is developed for the automotive production purposes but is suitable to be used in other business areas also (Chlpekova & Vecera & Surinova 2014, 9). 8D tool helps continuous improvement by evaluating the company's ability to solve complex problems. (Broday & Andrade 2013, 382). The tool has eight disciplines that work towards a systematic problem-solving plan. The eight discipline points with short descriptions are as follows:

- D1. Form a team – choose participants for the problem solving process.
- D2. Describe the problem – what is the problem that needs to be solved.
- D3. Interim containment action – verification of effectiveness.
- D4. Root cause analysis – differences and changes evaluation and process flow diagram analysis.
- D5. Permanent corrective action – risk assessment and ensuring that the change will bring improvements.
- D6. Implement and validate – project plan made to validate the improvements.
- D7. Prevention – updating procedures and policies, preventing similar products and processes.
- D8. Closure and team celebration – Before and after comparison, process documented and celebrating the improvement. (Boutros & Cardella 2016, 128).

Patel (2016, 127) adds a ninth step into 8D methodology. The first step is according to Patel discipline called “D0. Start the process” and that is then followed with D1, D2 and so on. With 8D method, it is important to execute the problem solving cross-functionally. The result of 8D method is more accurate, the more functions and departments are involved in the problem solving process. (Yankelevitch & Kuhl 2015, 18).

2.4.4 Five Whys

According to Boutros & Cardella (2016, 126) the question “why?” should be asked at least five times to find the root cause of the problem. Bradley (2015, 44) sees the five whys as a good way to observe processes in total. By observing the “waste” in lean methodology can be reduced. By observing each of the steps in a process the possible waste can be found by asking for the reasoning behind the activities. For example:

- What is this person doing now?
- Why is this person doing that?
- Where is this person going?
- Why is this person going there?
- What is this person waiting for? (Bradley 2015, 44)

It is common that Five Whys method makes more than one problem appear. However, Five Whys then helps to determine the root cause between the problems. (Boutros & Cardella 2016, 126). Patel (2016, 136) recommends that a cross-functional team performs this technique, but states that it brings results when doing it in one team or by one person only.

2.4.5 Activity Network Diagram

The activity network diagram (AND) includes methods of *critical path method* and *program evaluation and review technique*. AND can be used to determine which activities need to be done at the same time and what activities need to be done first in order to be able to make the second activity. AND is a helpful tool for project work and especially bigger construction projects, but it can also be used in smaller processes to show the linearity of activities. In the AND example in figure 14 the nodes represent a task or activity and the numbers estimate the time needed for the work (in figure 14 they are weeks). Following the lines you can calculate the time needed to reach the goal (last node). (Christensen & Betz 2014, 93).

6. Adapt and implement.
7. Continue the development work to reach high performance.

Benchmarking is a suitable tool to increase the company's competitive advantage, as benchmarking methods (such as best practice policies) can bring the production and service levels and quality closer to the levels of the industry leaders. (Boutros & Cardella 2016, 133).

2.4.7 Error Proofing

Boutros and Cardella (2016, 139) explains error proofing as “*a safeguard to reduce the possibility of mistakes or defects.*” Bradley (2015, 103) calls this methodology a “mistake-proof process” with the aim to make the conditions in that shape that mistakes are more unlikely to happen. It can be utilized by analysing the known errors and mistakes that are occurring in the process already. A starting point is a team gathered around the problems to brainstorm ideas which then can solve the problems. These solutions and ideas that arise by brainstorming can then be sorted and prioritized. The best possible solution can then be implemented into use. Casey (2017, 33) suggests that companies implement a strategic error proofing in manufacturing and processes and not just use it occasionally, but incrementally.

2.4.8 Force Field Analysis

Boutros & Cardella (2016, 142) explain the force field analysis as a framework for decisions. The analysis shows and identifies the forces that are affecting the decision-making. The forces can be both positive (driving towards the outcome) or negative (blocking the outcome). The main point for this method is to idealise a wanted change, a goal or a state and then mind map or brainstorm the positive and negative forces around the change. The forces can then be evaluated by their effected weight on the change.

Once the forces have been analysed, a strategy can be built around them. A plan how to weaken the negative forces and strengthen the driving forces needs to be done. Once the plan is made and the needed resources are allocated, the change can then be implemented. (Boutros & Cardella 2016, 142-143).

2.4.9 SIPOC

Okes (2013, 9) explains the SIPOC analysis a tool coming from the SixSigma methodology model. SIPOC enables many ways to measure the performance of an organization. There are five steps to be evaluated according to Okes (2013, 9), Gueorguiev (2018, 39) and Mishra & Kumar Sharma (2013, 529):

- Customers - *Customer feedback is an important measure of how well the organization is meeting the customer's needs and expectations.*
- Outputs – *Evaluating the product or service before it is made available to the customer allows a view on of how well the process is working.*
- Process – *Evaluating a process at all stages within the organization makes it easier to control those processes and the stages.*
- Inputs – *Measuring the suppliers allow the organization to know whether they are meeting the requirements efficiently enough and early detection for variation in supply gives a possibility to ask for compensation.*
- Suppliers - *Evaluation of supplier performance in total.*

SIPOC is sometimes called COPIS. It is a visual tool to show high-level processes. (Boutros & Cardella 2016, 157). The SIPOC analysis can be expanded to include more measurements such as requirements, resources, controls and feedback (Okes 2013, 10).

The SIPOC tool is particularly useful when the following is not clear:

- Who supplies inputs to the process?
- What specifications are placed on the inputs?
- Who are the true customers of the process?
- What are the requirements of the customers?

How to conduct a SIPOC analysis according to Okes (2013, 11) and Boutros & Cardella (2016, 157):

The following steps are used to build the SIPOC analysis:

- Define the process to be analysed and its goal.
- Write the process name in the process box.
- Identify the process owner.
- Identify the outputs produced by the process.
- Identify to whom (customers/stakeholders) each of the outputs goes.
- Identify the inputs required in order to produce the outputs.
- Identify the suppliers from whom the inputs are received.
- Identify resources and controls necessary for operation of the process.
- Ask how the customers and the organization would measure the outputs. These are the output metrics.
- Ask how the process personnel would measure the inputs. These are the input metrics.
- Identify the process boundaries and major steps between them.

The process box can be diagram can be an entire organization, a division within that organization, a facility within a division, a department within a facility, a process or group within a department, or even an activity carried out by a single individual. (Okes 2013, 10)

2.4.10 Team work and collaboration in processes

There is more literature available on “team work challenges and problems” than there are of “team work improvement”. Efficiency is important to have and sometimes difficult to notice. One way to seek places for improvement and more efficiency is to look at the collaboration and team work in the company. Organizational culture may encourage departments to compete against each other. This silo mentality has a negative effect on the team work and collaboration. Silo mentality can be referred as an invisible barrier that is dividing a company into “them” and “us” (Cilliers & Greyvenstein 2018, 375). Focusing on improving team work can have many benefits to processes. According to Smith (2014, 58) the team

members have two tasks: accomplish whatever task they need to do and get better at working together as a team. Efficient team work and collaboration require the input and contribution from each team member. Strong teams of people who have adapted over time to working together can be powerful tools for a company to have (Edmonson 2012, 74).

Management plays a role in team work, as does the relationships between team members. Organisational culture has an effect on team work and in the end, a person's personality plays a role in it. In order for everyone to "play nice" in the team, the management should discuss common rules according to organisational guidance to create a common ground for team work. Everyone should feel that they have the same rules and are treated equally. (Smith 2014, 61).

Effective team work requires the team members to have team work skills. These skills can be advanced and learned, or they may be a part of a person's personality. However, communication skills are among the most important skills to have in an effective team. Smith (2014, 63) concludes the communication skill rule as follows: "Don't talk – listen."

Many times team work and collaboration are discussed with the term "leadership". An effective team needs a manager with leadership skills. The team works at its highest level when the leader or the manager is able to challenge, inspire, enable, model and encourage people. This kind of thinking makes the team members work together towards a shared vision. (Smith 2014, 66).

2.4.11 Organized Process Team

Organized Process team is a group of people who working "*interdependently and cooperatively to meet customer needs or company goals*". The method is to bring together a group of people to think about a specific objective. The groups can be sorted by function, department or then organise them cross-functionally. (Boutros & Cardella 2016, 148). Organised process team is a group of people who are nominated within the team and given a topic or a mind set to use as a point of view. They can then use this perception to observe performance or activities. The purpose is to find out places for improvement and solutions to problems.

2.4.12 Nominal group technique

Boutros and Cardella (2016, 147) explain nominal group technique as a “controlled form of brainstorming” in which the basic idea is for the team members to write down their ideas. According to Boddy (2012), a nominal group technique means a type of brainstorming where the participants are nominally in a group but working individually. The silence shared can increase the potential of idea generation. On the contrary, verbalisation during brainstorming blocks idea generation and innovation. Nominal group technique can be used in innovating new products or when generating improvement ideas to business.

2.4.13 Knowledge management in a manufacturing process

To make processes more efficient, the communication flow between the process participants needs to be evaluated. Knowledge sharing is more than just a flow of information. It is a feature of team work to be able to communicate and negotiate with each other. (Ngwenayama & Bjørn 2009). There is difference what kind of information is shared and forwarded in a process. Data, information and knowledge are many times confused to each other. Becerra-Fernandez and Sabherwal (2010, 17) explains the difference as follows:

- Data is raw facts and useless until it is organized. Data needs to be refined.
- Information is processed, organized and structured data that needs to be communicated to be understood.
- Knowledge is information that someone can use for a specific purpose.

According to Becerra-Fernandez & Sabherwal (2010, 75) knowledge management is an important factor in improving organisational processes. These process improvements have an impact on effectiveness, efficiency and in the degree of innovation in the processes. Effectiveness means that the most suitable processes are used and the best possible decisions are made. Efficiency means that the processes are agile and run with a low cost. Innovation means in this case that the processes are creative and supporting the aspects of effectiveness and efficiency.

Knowledge management is a growing topic as tools and equipment are enabling people to communicate instantly without limitations of time and space. People

make decisions on what information they pass forward and what they do not share with others. Even small talk can have an impact on the team culture, on the relationships between the team members and it can help improve the team culture (Little, Quintas & Ray 2002, 228).

Knowledge management improves the level of knowledge of the individuals and gives them the ability to solve problems that they face on their tasks. Most importantly, knowledge management allows organisations to adapt their processes quickly and that way they can be efficient in changing times. This means that the knowledge needs to be forwarded to process participants to maintain an agile process when the surroundings are changing. One example can be a change in personnel in a department: think about a situation when the most experienced employees are retiring and new employees are hired to take their place. Even though the proper steps have been taken to train the workforce, suddenly the process efficiency drops and people are getting confused. It may be that the data and information are available in work manuals and process sheets, but when knowledge is missing, and therefore the agility and quality of the process deteriorates. (Becerra-Fernandez & Sabherwal 2010, 76 ;Young 2010, 28).

2.5 Implementing improvements

There is no use in developing process performance, if the changes are not implemented into the work life. Implementing improvements can be also called change management. A change is a replacement or removal of inefficient activities in processes to increase the agility and effectiveness (Hamm 2016, 34.) According to Van Tiem et al (2012, 478) a change-focused implementation model called Dublin's I3-model is one of the tools that can be used. It is a sustainable change approach. Dublin's model has three I's:

- Inform /Awareness - generate awareness of change.
- Involve / Engagement – engage people to internalize the change.
- Integrate / Commitment – make the change a part of organisational culture. Involve employees at all levels to take part in planning, monitoring and adjusting the change.

There are many change management techniques to be used when implementing changes and improvements. Explaining and implementing improvements can be a task for project management teams. In some minor cases, the improvement can be implemented by employee development. When making changes into work habits, we also need to make change in personal habits. This can be difficult and people need time to adapt to changes. Occasionally and depending on the scope of the change to be implemented, outside consultants may be used to facilitate the change. (Van Tiem et al 2012, 501-502; Mann 2010, 4).

Without dedicated management, the improvements and changes cannot be implemented. When the support is visible and strong, all levels of employees are more eager to follow and learn the new ways of working (Harvard Business Review 2018, 18). Implementing for example lean management in a business strategy may cause problems because also the behaviour of people need to change. This can be facilitated by changing the total culture of the company in small steps. This is called an incremental change. (Almanei, Salonitis & Tsinopoulos 2018, 1164.)

There can be many reasons to having trouble implementing changes, even when the changes bring improvements and advantages to worker's lives. Bradley (2015, 21) reminds that sometimes workers may fear that the improvements result with decreasing amount of workforce. If more efficiency brings greater output per worker, the amount of workers can be reduced. This problematic thinking can make people unwilling to participate in the improving processes.

3 RESEARCH APPROACH AND METHODS

3.1 Research case: Company X

The case company, Company X, is a medium-sized international company. It is one of the leading manufacturers of housing and building solutions in Europe and North America and the leading manufacturer for infrastructure solutions in Finland. Company X's business in Finland is divided into two main industries: heating and plumbing solutions and infrastructure solutions such as gas, waste water and grey water pipes. This study examines the order-to-delivery process of a specific production line. The case company also has similar functions in other countries, but this study refers only to this particular process chart in Finland. The scope of this study is to focus on case company's customized production line process: the results are scalable to other similar production lines or other business units of the case company. The case study research is focused only to the case at hand and the results are relevant to that case study only. The results of this research cannot be generalised to apply to other cases. (Kananen 2014, 11-12)

A case study research aims to understand and develop new and updated work and activity (Ojasalo & Moilanen & Ritalahti 2014, 58). This case study aims to evaluate and analyse a process in the company and to create recommendations for improvements for the process. The focus for the research is a specific production line.

The need for the improvements comes from Company X's strategy. As Van Tiem et al (2012, 133) states, process development is usually a point in company's strategy, mission and vision. The case company uses a model for profitable growth called PACE (figure 15) in their strategy. The abbreviation PACE comes from product quality (P), agile processes (A), customer centricity (C) and excellence (E). These factors need to be taken into consideration when developing the order-to-delivery process for the production line.

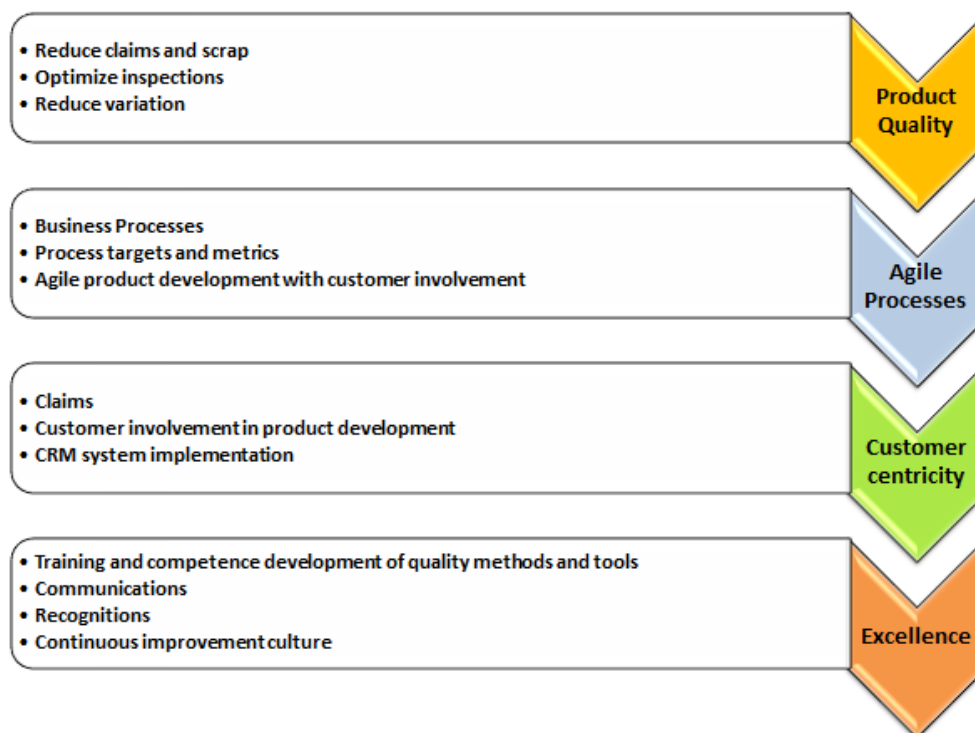


Figure 15. Company X Quality Goals (modified from Company X database)

The factors in this figure show that good quality leads to excellence. One of the factors that Company X is aiming to develop in their strategy is agile processes, which we are now concentrating in this case study.

The order-to-delivery process analysed in this case study is case company's customised sales department. It is a production line that manufactures products from customer order. Exceptional to this production line, the products are usually sold with the assembly and installation included. This makes the process more a project-like case. A project defined by Young (2010, 15) is *a temporary endeavour to achieve some specific objectives in a defined time*. The concepts of process and project do not differ a lot, but usually a project is temporary and occasional whereas a process is repetitive and continuous (Smith 2014, 156.)

The production line has been working for a limited time in the facilities and there is a demand to increase the production. However, the production line works only to produce customer ordered products, so there is no possibility to make products ready beforehand for inventory. These products are built from customer order and they can vary from the smallest chamber up to a 20 kilometre marine pipeline. There is variance in the outcome of this production line, but the common factor is

the designed and customized background. This adds complexity to the process and it acts more like a project-like production line than a regular production process.

The company's current process involves nine levels of participants in total. Most of the process levels handle this processes steps as any other step they have. For example for finance department, this process procedures and activities do not differ from any other sales and production process.

The company process map is divided into two figures for this study purposes to facilitate the analysis. Some functions are left out for competitive reasons. The participants are referred only by their levels in the process. Describing each function and activity is not necessary for a thorough evaluation. Process map analysis brings data about the flow of materials and information from the start to the end. IT explains some of the activities there are for the company to satisfy customer needs.

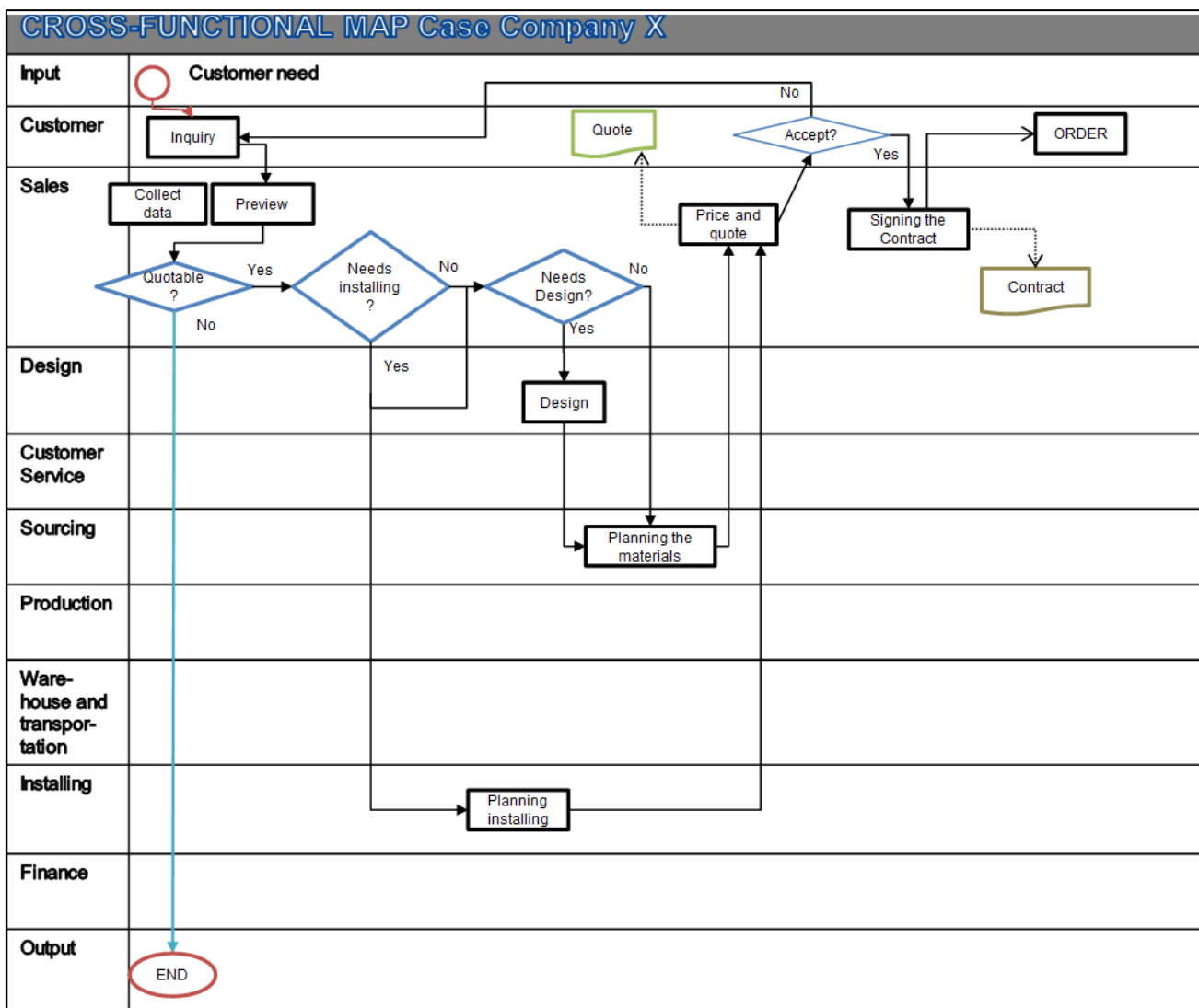


Figure 16. Company Process map part 1 (modification from Company X’s database 2018)

This process will be explained and evaluated in part 4.2. The above figure shows the beginning of the process, from the first contact with the customer to the point when an order is made. According to Berends & Lammers (2010, 1045) analysing a process is a part of organisational learning. The process analysis can be executed by following the steps and the process flow.

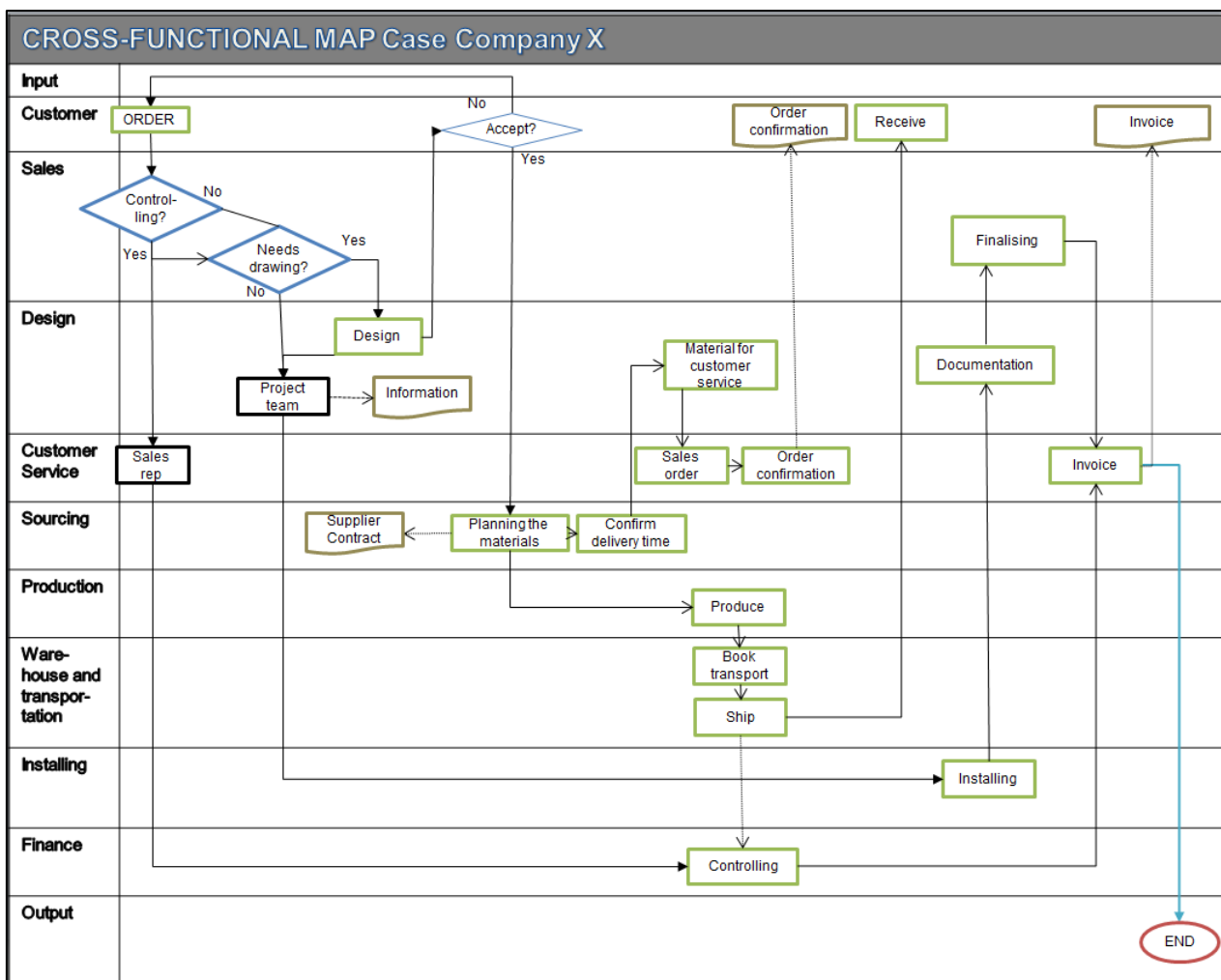


Figure 17. Company Process map part 2 (modification from Company X's database 2018)

Figure 17 shows the middle part and the end of the process. It is continuance from figure 16, and starts with customer order. Figure 17 ends with a satisfied customer. This process will be evaluated in more detail from efficiency and communication point of view in Chapter 4 of this study.

3.2 Research process

The case study first started in June 2018 when the researcher contacted the company she was working in for an available development project. The manager level persons suggested the topic for the research. The case study started with discussions between the researcher and the manager level persons.

There was a need to evaluate and analyse the current process for a specific production line. The case study was decided then to examine and analyse a process flow in the specific production line.

The researcher began to go through the theory part of process improvement and process analysis. The topic and the scope were specified to be process improvement and process development. The scope was specified to be only this one particular production line. Quickly after the introduction to theory material also the interviews were executed in order to get a good understanding of the process flow and the participants and their roles. The interviews were scheduled individually and executed via Skype or in person. The interviews took place between June 2018 and August 2018 due to summer vacations of the interviewees. The interviews were written down in themes and analysed quickly after the interview to get a good picture of the subject.

Table 2. Research process timeline

Activity	Time
Case study topic agreed with Case Company	June 2018
Thesis topic accepted by Lahti University of Applied Sciences	June 2018
Thesis supervisor provided by Lahti University of Applied Sciences	August 2018
Getting to know the process: Interviews executed	June-August 2018
Getting to know the topic: Theory base	June – December 2018
Case study research analysis	December 2018
Case study results	January 2019
Conclusions and recommendations	January 2019

The case study research begun with an open question: how could this one particular process be improved? The discussion with manager level people gave the impression that some changes could be made to the actual process map and perhaps some improvements made for the process itself.

The case study timeline was between June 2018 and January 2019. There was no schedule planned for the case study, and the research began quite rapidly after the decision on the topic. The timeline can be seen from table 3 below.

Table 3. Case study research timeline

Case study research timeline	
Case study topic agreed upon and case material interview with management personnel	June 2018
Interview with Sales level person	June 2018
Interview with Sourcing level person	July 2018
Interview with Production level person	July 2018
Interview with Warehouse and Transportation level person	August 2018
Data analysis from interviews	September 2018
Data analysis from process chart	October 2018
Combining the data into results	November 2018
Creating the conclusions based on data analysis results and literature	December 2018 – January 2019

The case study timeline was not planned in advance, but mostly the case study research progressed according to researchers own resources and available time. The interviews were divided for three months due to summer vacations and the busiest season in the company. Therefore, not all of the participants were able to take part in interviews in the beginning of the summer.

The original research plan was changed a few times and the research questions were modified as the study progressed. The terminology and the theory part base were modified also the further the study went. This is typical for a qualitative research study, as it requires some flexibility to be executed and finished. (Hirsjärvi et al 2009, 164).

3.3 Research methods

This part introduces the research approach, the research methods and the data collection and data analysis methods chosen for this study.

3.3.1 Research approach

This research was executed as a case study with the approach of process analysis and process improvement. A case study refers to a study of a phenomenon (Swanborn 2010, 13). Most commonly used research methods in qualitative research are interview, questionnaires, observation and data gathered from different written documents (Tuomi & Sarajärvi 2018, 85; Swanborn 2010, 13). An interview is a personal method to gather information directly from the people (Kumar 2011, 144). A qualitative research done by using some form of interviews is a common way to gather data for a case study. An unstructured interview is a discussion type of interview, where the aim is to get the interviewee represent their experiences of the subject matter. (Hirsjärvi & Hurme 2008, 46.) A semi-structured interview can be called a thematic interview, where the acquired data can be qualitative and quantitative. A thematic interview method was chosen for this case study. Most importantly a thematic interview is based on discussion themes instead of specified pre-made questions. The benefit of this method is that it can bring up themes and information that could have not been thought of in a questionnaire. (Hirsjärvi & Hurme 2008, 48) The role for the interviews was to enable the researcher to gather enough sufficient data to understand and analyse the process in case. A thematic interview should include questions that aim to acquire answers that have information related to the problems that are indicated in the case study. The purpose is not to ask just any questions, but to find the meaningful answers. (Tuomi & Sarajärvi 2018, 65).

An interview can also include some observations about the attitudes and the mindset of the person. This enables the researcher to obtain more information than with a closed questionnaire. In a discussion type of interview situation people are more likely to discuss matters more openly and thus providing important and valuable information to researcher compared to a closed questionnaire. (Hirsjärvi & Hurme 2008, 34). Acquiring data via interview helps find out more about the process than

with closed questions for example. The discussions in this case study were executed by using semi-structured interview method. The researcher usually knows something about the topic when using a semi-structured interview as a method. By using semi-structured interview, the researcher wants to give an interviewee the possibility to lead the conversation to the direction that may produce data that cannot be captured otherwise. Semi-structured interviews can have a set of questions in it, but it still allows the conversation to go from side to side (Swanborn 2010, 13).

3.3.2 Interviews

The target group for the interviews was suggested by the case company representatives. Two of the interviewees are company representatives providing the guidelines for case study. Four others were participants in the process. Six people were then interviewed in total.

The benefit of an outside researcher is that people are more likely to speak their minds, as they might be too polite to discuss negative things when asked by their superior. However, the challenge of an outside researcher can be that the participants have trust issues for someone they do not know. They may give more vague answers out of uncertainty. One of the challenges can be that the researcher is not familiar with the topic and may take additional time to be acquainted with the subject matter. Occasionally having an inside researcher can have a negative impact on the results as they feel that they already know a lot, and they may lead the conversation into wrong directions. They might also interpret the discussion in a biased way, if the participants are familiar with each other. (Eriksson & Kovalainen 2008, 58).

An interview is usually the main data source in qualitative research (Hirsjärvi 2008, 205; Tuomi & Sarajärvi 2018, 73). By having an outside researcher made it possible for the interviewees to speak more openly about the topic. This way the study received enough valid data for analysis, as otherwise the data could have been superficial.

In order to be acquainted with the subject matter, a researcher should use different methods to gather data about the topic. One of the methods to be acquainted with

the subject of improving processes is to review and analyse the process flow chart and other documents related to that. (Swanborn 2010, 21.) The interviews provided a good aspect to the process steps and activities in real life.

The company representatives were interviewed by a thematic interview. The interviewees were asked about the background of this process. There were not a set of questions for the interview, but themes to explore the idea. The themes were concerning the process and were phrased as top-level themes: current situation, problem space, background and goals. This way an overall picture of the process could be formed.

The interviewees for the process were selected based on their part in the process, so that each relevant step in the process was represented. The selection of the target group is important in order to get a valid information base on the subject. In the case company the target group for interviews were suggested by managerial level persons and the researcher made the decision that it was sufficient to get a good understanding of the process stage. This was based on Hirsjärvi & Hurme's (2008, 59) approach, that selecting the target group based on hierarchy, it is sufficient to provide enough data for understanding the experiences of the participants. When a person from each hierarchy level is interviewed, a sufficient view of their experiences and a view of the whole process or entity that you are studying will be received.

A decision was also made to interview each person individually instead of a group (focus group) interview. This is because it is very unlikely that all participants in group interviews would actively participate in discussion. Group dynamics has a great impact on the behaviour of the group and the level of discussion in the group. It is common that someone dominates the discussion and this can result in a biased interview. (Hirsjärvi & Hurme 2008, 63)

The interviews were held via Skype or in person. The interviews were open discussion with a common structure, known as semi structured interview method (Galletta 2012, 45). The structure was formed by thematic questions as follows:

Question number 1: Role

What tasks or activities do you have in this process? What are your responsibilities in the process?

Question number 1 aims to find out the current situation of the participant role in the process. The question enables the interviewees to reflect themselves as a part of the process. This helps them to put themselves on the process map and discuss their views on the process. The purpose of this question is to facilitate the process map analysis for the researcher and also open the discussion about a process instead of a procedure. The interviewees can reflect on the tasks and activities they do for work in general and for this process. They also can reflect on their responsibilities in the process, and maybe realise their importance in the process.

Question number 2: Information flow

Where do you get your information about the process activities? What are the information channels you are using? Who is the person you can contact in case of need? Who to contact if that person is not available?

Question number 2 opens the discussion to the flow of information. Lack of communication is one of the reasons behind inefficient processes. This question aims to find out the communication flow between the process participants. This question tries to find the answers about the process efficiency and knowledge. Knowledge sharing is more than just a flow of information. It is a feature of team work to be able to communicate and negotiate with each other. (Ngwenayama & Bjørn 2009). This question also aims to find the quality of information that is shared and forwarded.

Question number 3: Process

What is the previous step in the process? What is the next step in the process? How would you describe the process in total? How would you describe it from your part?

Question number 3 about the process in general can lead the conversation into the problems that may occur in the process. A discussion on themes instead of specified pre-made questions, like “what are the problems you have in the process?” can bring up information that could have not been thought of in a questionnaire. Keeping the questions on a common and neutral level makes the interviewees more likely to discuss the problems that occur. The purpose is not to ask just any questions, but to find the meaningful answers. (Hirsjärvi & Hurme 2008, 48; Tuomi & Sarajärvi 2018, 65). Question number 3 also aims to find out how aware participants are of the process flow and the steps in the process. The purpose is to find out how interactive participants are in the process or if they just do their part of the work (and not consider the process as an entity.)

Question number 4: Tools

How do you manage the information? How do you manage contacts?

Question number 4 is a common question to open the discussion about the process flow and information, similar to question number 2. For some situations and steps in the process, it is necessary to share data and for some situations it is knowledge that should be shared. This question aims to find out the relationships and the level of communication in the process in order to find the information gaps and possible inefficiencies in the information flow. This question tries to find the answer about the process efficiency in the level of available equipment. The purpose is to find out if the participants have suitable tools to manage the process and information and the capability to use those tools.

The purpose for the interviews was to get a bigger picture of the process flow and the role of the participants in it. Goals and objectives for this study are to find out differences between the process map and actual work activities, and this way analyse possible inefficiencies in the process, to make participants more active and aware of their roles in the process and this way improve the overall process work. These questions help understand the activities the participants have at the moment and then compare the activities in the process map. That way the differences and inefficiencies can be noticed.

All of the participants were helpful with the study and agreed to do the interview. All of them provided to answer any additional questions if they would have occurred. This could be seen as that they all wanted some change and update in the process. The interviewed persons are not named in the study and are only referred as “interviewee 1, interviewee 2” and so on. They are recognisable only for the researcher and for research purposes.

3.4 Research data and data analysis

The data analysis was chosen to be executed by qualitative data analysis methods. The data for this study was gathered from Company X's personnel via semi-structured interviews. The process flow map came from Company X's process management system. Comparing the process map from the system to the actual activities the participants have in real life based on the interviews enables the researcher to find the differences between them. These notifications can then be compared to the theory base to define which is more correct: the way people are now doing their work, or the way that has been described in the process map. It is usual that research methods overlap and bring different perspectives. The outcome should be the same despite of the method used. (Keegan 2009, 72.)

The process analysis would have been difficult without interviews to provide for the understanding of the process. Similarly the interviews without the process chart would have been only superficial for the purpose to get to know the topic. The interviews were executed to get a good understanding of the process flow in the case company.



Figure 18. Data analysis phase cycle (adapted from Ruusuvuori, Nikander & Hyvärinen 2010, 12)

The contents of the interviews were written down in text form, i.e. transcribed. It is important that the researcher is familiar with the acquired data from interviews, so it is recommended that the researcher does the transcription personally (Hirsjärvi et al 2008, 218). The transcriptions were not written down in word-to-word. According to Vilkkä (2015, 89) that is not necessary as long as enough text is gathered to receive a thorough understanding of the topic and the interview themes. The interviews were transcribed on a thematic level using standard language instead of literary language. Discussion that was not related to the topic was not transcribed. The purpose was to get the interview main points available for the researcher to make analysis. (Ojasalo et al 2014, 110). All notes relating to an interviewees person and identity were left out.

The transcribed data from interviews was sorted thematically. The interviewees were divided into their represented departments in the process. The main points

arising from the interviews were gathered together, i.e. clustered according to categories. Clustering is a method to get the data into different categories to help doing the analysis (Tuomi & Sarajärvi 2018, 36). The categories were then gathered in groups from the process efficiency point of view. At this point, the researcher was looking for the thematic patterns across interviews and comparing them to the process chart. This facilitates the analysis and brings a more valid result for the study (Galletta 2012, 125).

There is some role in the interpretation of the researcher. The way people say things may affect the meaning more than what they are saying. It is important for a researcher to stay as neutral as possible and handle the data as nonbiased as possible. This way the data received is accurate enough for analysis and research. (Kananen 2014, 94). In this case, the research questions and the question structure for the interviews was at a common and neutral level to avoid making impressions. If the questions would have already implied that there are problems in the process, the interviewees might have not suggested any improvements to the process at all. This means that some sensitivity needs to be taken into consideration in interviews, when the questions can be interpreted to be targeted on someone's personal behaviour or actions. (Hyvärinen, Nikander & Ruusuvuori 2017, 249).

The purpose of this study is not to find out inefficiencies in the actions and activities of the participants, but to find ways to facilitate the flow of information and ways of work.

4 RESEARCH RESULTS

4.1 Interview results

The interviews were discussing the current process flow and mainly the interviewees were explaining the topic from their own point of view. The entity of the process was not discussed that much. As each of the participants in the interview represented a different part in the process, the answers varied. For some of them, being a part in this process did not show in any way in their daily life. For this reason, for example the finance people were not interviewed for this case. This process moves as usual business in their daily work activities. Occasionally they have additional tasks with manual invoicing afterwards from this process, but most likely, the sales department has already included everything in the original order. There is no claim that the total process efficiency is not affected by the actions that finance department does, but for this case, that part was left out.

The manager level and director level persons offered a guideline for the process and were not asked the same questions as other participants. However, they (manager and director level) provided a lot of useful material and knowledge to be used in the results.

For some departments, such as design and installing, this process means work. They are not needed for a regular order-to-delivery process where the goods are already manufactured or the production is otherwise continuous and the customer does not require any help with installation. Then the goods are simply shipped from warehouse to the customer. However, those departments (design and installing) play a big role in this customised production line, when the goods are being manufactured especially and uniquely for the customer, and the installation is required to suit the customers' schedule.

The findings and themes from the interviews are listed in accordance with the interview questions in order to make it easier to follow:

4.1.1 Role

What tasks or activities do you have in this process? What are your responsibilities in the process?

For these questions, most of the people knew their answer. They know exactly what they do for work. The tasks and activities were mostly easy and simple for them all to explain, but the responsibility was more difficult. Some felt that they have a lot of responsibility in the process, and the tasks are highlighted for this process. Meaning that for example sales level has a lot more to handle when receiving an inquiry from the customer, than what they handle with a regular order.

Sales

For comparison, a regular order is processed in ERP system as: enter items, receive estimated delivery times according to inventory, agree with customer, make order and send order confirmation. For the customised production, the sales level part is a lot bigger and there is more responsibility.

We have a lot to worry in sales, making sure that the process moves forward and asking around if the supplied components will come in time to meet the schedule. And if we can manufacture the products in time. And lastly if we can ship them in time. Interviewee 1

Sales need to allocate the installing teams and make sure they have enough work to do, and on the other hand that they are not over-worked. They need to do this with customer schedules. Interviewee 5

I need to gather a lot of data from the customer to be able to give a quote. Design team, installation, sourcing, production and transportation costs should be somehow calculated to the quote and informed to customer. We leave some room for discrepancies and give the customer a notice of the right for price changes. At the moment it is not possible to give the customer an accurate quote. It sometimes feels unprofessional. Interviewee 1

In the interview it came apparent that the prices are very difficult to estimate to the quotes. If looking for a competitive advantage, the prices should be lower than of

the competitor's. If the price in the quote is too low, all manufacturing and transportation costs are making a negative

Production

The role is clear also for the production level. They know what to do and that is to create an environment where the ordered item can be produced. There is a feeling of responsibility as many of the price calculations are done in this part of the process. This level gathers the components from the order and divides them as the components from own production and the components that need to be outsourced.

A lot of things need to be taken into consideration here – the production resources, our own production and outsourced components.. and to be able to estimate a lead time for the finished good. Interviewee 4

There is only a few persons in this department who have the ability to make the calculations and be a responsible participant in this process. That was one of the concerns for the role based on the interview.

There is not really anyone else who can do this, well maybe some, but I think we should train some new people to do the tasks as well.. Usually there is much time available, so I can plan these ahead of time.. So it is not a problem if I am away from work.. Interviewee 4

Sourcing

The sourcing role is to order components from other business units of the company or from outside suppliers. The components should be agreed to arrive for production within scheduled times. Mostly the role for sourcing in this process is the same kind that they have in usual business processes. Based on the interview, the process role is clear.

I order the components from our inside or outside suppliers. The timeline is between 4-8 weeks depending on the size of the project and that is usually enough time. Interviewee 2

The sourcing role is responsible that the correct components are available for production at the right time. Based on the interview, this does not usually cause any problems

Warehouse and transportation

When the product is ready, it needs to be shipped to the customer according to the project schedules. This role is responsible for the accurate shipping times for the finished goods. In this role there is some flexibility, but it does not necessarily have to do with this exact process. There are regular orders that need special transportation or express deliveries. It is however more common that these customised items need expedited shipments or special trucks.

When to items are ready to be shipped, I get the dimensions and pictures so I can then book transportation. Usually the timeline is really short for these products – sometimes not less than 30 minutes time to book transportation for the product. Interviewee 3

Transportation is a cost that is estimated to the customer order. The more expedited and express the delivery is, the more it costs. Same thing is with the bigger products that need special trucks for the delivery. The warehouse and transportation role is to find the most affordable transportation when there is time enough, and the fastest and usually more expensive transport when there is little time. The main role is to ship the product according to customer requirements. If there have been any delays in the process so far, this is the last step before installation where a company can stretch to meet the schedule.

4.1.2 Information flow

Where do you get your information about the process activities? What are the information channels you are using? Who is the person you can contact in case of need? Who to contact if that person is not available?

These questions showed many challenges to the interviewees. They all had some contact to communicate with when problems occur or they had questions. However they were not sure all the time, if that was the correct person.

It is very important that people know what do when something isn't going according to the plan. Interviewee 6

Cost estimations are usually too low, because the design many times costs more than is expected. And when partial deliveries are made, the freight cost is calculated only once. Delivery time is hard to estimate, as sourcing sometimes takes a lot of time. Interviewee 4

Sales

The sales process starts with a project meeting where timelines are agreed on with sales people, design people and installation people. That is the starting point for information. The sales level felt according to the interview that the information could be a big problem.

If something goes wrong, the information is very hard to get. I need to ask people around and sometimes it takes a lot of time as I try to find out who knows the answer or has the right to decide something.. The customer maybe waiting for a quick reply and I cannot get anyone to answer me. That is the worst possible situation. I don't want to tell the customer that I don't know. There should be better ways to communicate between the team. Interviewee 1

According to the interview, the sales role has many information flow responsibilities. They need to balance between the customer with their changing needs and with the process in the company to keep everyone informed. When a customer's project schedule changes (as they sometimes do) not only the production of the item need to be postponed, but also the installation team need to be informed. Based on the interview, they feel that the information about the participants in the process is missing.

I don't always know who the customer is that I need to inform. Is it an inside customer or outside? No matter how many phone calls you make and emails you send, there is always someone who doesn't get the information.. in the busiest season when we have vacations, you don't know who is substituting the person you need to contact. And

when you finally find out, that person does not know what to do.. Interviewee 1

It seems that a lot of time and effort is used just to get information and to be able to forward the information. According to interview, the channels that are in use to send and receive information are emails and phone calls. Neither of them are efficient enough when agile reactions are needed.

Production

For production point of view, they usually need to move between sales, sourcing, warehouse and production. The usual contact is sales level, as they should have all information about the requirements of the product. Obviously, production needs to be asking sourcing level for the product components and their timelines.

If there are some changes in the order, usually sales inform about it quickly. Sometimes we need to ask about the components, if we are waiting for some part to arrive, but usually we get the parts in relative time. And if the parts come late, we can work overtime to finish the product. Sometimes there are problems with equipment and machinery and we cannot be in time – then we inform sales and they inform the customer. Interviewee 4

Based on interviews the main channel for information is phone calls and emails. The problem seemed to be that there are multiple productions pending and there are plenty of emails coming from each one. To keep up with the productions, a record has to be kept. In this case it is an excel file, where the progress of each production is marked.

Sourcing

Sourcing works between sales, design and production. Usually the components and parts are ordered well in time. There are not that many obstacles to keep in with the schedule. The information moves by email and phone calls. The complexity of the work depends on how complex the product is. In bigger projects they could be 20 kilometre marine lines with multiple different components, and in smaller projects the need is for a small part. Usually the information about possible

delays and such comes in time. Usually there is enough time to ask from another supplier for the part.

Warehouse and transportation

Warehouse and transportation level needs the information of the delivery time, dimensions and weight of the product and delivery address. Occasionally sales level gives a notice in advance when there is an express delivery coming. If the product is unusually big or heavy, so that it needs special delivery. Sales usually also inform if the product is to be delivered relatively far. The sales order exists in the ERP system, but the dimensions and weights are usually missing. That is because the items are unique and it would be impossible to create new items to ERP system for every project. The information comes from sales or production and the channel is emails or phone calls.

I prefer to have two days for planning the transportation, because then the freight cost is better. It would be good to know if we need to take that into consideration, and who I could ask about it. Sometimes it's difficult to get the information about the shipment locations and the contact persons at the location. The transportation companies need that info, and it is not available in many cases. Interviewee 3

The information about the product and delivery times is missing until the point when the product is ready to be shipped. Usually at that point the responsibility shifts from production to the warehouse. Based on the interview there is not enough power given to warehouse and transportation level to make decisions on the costs of delivery. Once again, the process must take a step back to ask sales level for the break even.

4.1.3 Process

What is the previous step in the process? What is the next step in the process? How would you describe the process in total? How would you describe it from your part?

The silo effect can be seen in this part of discussion. Almost all of the interviewees discussed a strong “we do” and “our department” aspect and the customer centricity was only a concept, not a procedure.

There is a lack of doing things together, for the customer. We just do our work and sometimes that is not enough. Interviewee 1

There are some gaps in the process flow that need to be improved. Interviewee 5

Sales

Sales get the specifications of the order from customer and design level. Sales make the order and send order confirmation to customer, so in this case sales also act as the customer service level in the process. The next step is the design level to make the product specifications and drawings. According to the process map, the next step is the handing over the project to the customer. Based on the interview, there are many steps before that.

I need to ensure that everything goes as planned. I have made the order and there are so many variables after that. It's time-consuming to make sure everything is ok. I get grey hair from the deliveries, especially in the beginning (when this customised production started) the deliveries were always late. I couldn't get any reason why, not to mention any information beforehand to inform the customer. I just had to come up with explanations. Interviewee 1

Production

Production is the next step after the design team has planned the materials and sourcing has ordered the possible components. Sometimes the production can make all the components themselves. The next step is to deliver the product to warehouse and transportation level in a ready to ship -condition.

Once the product is ready, we take it to the warehouse. We try to give information in advance but sometimes it's not possible. We have done our part and hope that the product gets delivered in time We usually agree on what time the product needs to be ready to be shipped that day. Interviewee 4

Sourcing

The sourcing level orders components and parts according to design level specifications. The next step is for the production to make the product when the components and parts are available. The process is usually simple and straightforward.

My part is to order the components and give estimation on their arrival. Usually there is plenty of time, so delays are not that common. Interviewee 2.

Warehouse and transportation

For the warehouse and transportation level, the previous step is when product has been finished and is ready for delivery. Based on the interview, there is some frustration in this step.

There would be no problem if these products could be handled like any other. But these are usually in a hurry or the delivery address is distant and difficult to reach.. Or then they are shaped in a way or they weight so much that they need a special truck. It's not that simple to book and for the same day delivery... Interviewee 3

The next step is for the customer to receive the product and the possible installation team to move to the location. However the delivery to be in time seemed quite difficult, and the lack of power was one of the factors.

Sure we could send the product to the site in two hours, but the cost will be at least double for the freight. If there really is a hurry to deliver, so can we just ship it? Interviewee 3

The additional freight cost should be stated somewhere, or agreed on a level of maximum cost, a cost range. If the delivery time has a week included for transportation, the freight cost remains low. But in the case of it being two hours, the cost will be noticeably more. If the project prices have been agreed upon with the customer, these additional costs are for the company to pay for itself.

4.1.4 Tools

How do you manage the information? How do you manage contacts?

The way information is stored and shared makes an impact on the process efficiency. The data and information is something that each process step needs to be able to do their work.

Sales

Sales level usually has more information and data than many of the other participants. Some information is stored into the company's ERP system and some are shared and stored manually, or by emails and phone calls. The contacts are sometimes a difficulty, but according to interview, some improvements have been made.

I try to inform everyone and actively ask about the progress of the process, but sometimes people treat these orders as any other order.. which they are not. Interviewee 1

There have already been improvements in the process as participants stated in the interviews. They often referred that "At start" or "In the beginning" when this type of production started in the company, there were many problems. There were a lot of uncertainty of the correct contact persons and the information did not move along in the process. Already the situation is looking better.

Only a few people are able to make the calculations to customers, from which I can then make the order. For the production and shipping.. Sometimes I don't know who to contact if my contact person is away. This is a very serious problem, if the absence is longer and no one gives me any answer. This must be changed. Interviewee 1

Production

For production level the tools to handle information was an excel file and pen and paper. This made it difficult for anyone outside the process (or inside the process) to follow up on the progress.

One of the problems is that I just have to remember all of this.. and if there are many projects at the same time, I need to check my papers..

Interviewee 4

For production, the contacts are mainly for the design level and sales level. They know the people and usually the ones who substitute as well.

Sourcing

Sometimes keeping up with the purchases is difficult as there may be multiple projects going on at the same time. There can be dozens of components ordered from suppliers and someone needs to know to which project those are for.

I usually know whom to contact when needed. I keep track on the components with the purchase orders. Interviewee 2

Warehouse and transportation

For the warehouse and transportation level, the information comes from sales orders. Some additional information comes from sales in emails and some (such as the dimensions and weight of the product) comes from production. This data is usually stored to company's ERP system. Some of the information is added manually on shipping papers.

Some information, like a phone number to the location, needs to be asked separately, and sometimes the contact person is missing from the customer's end.. all of this makes it more difficult to deliver on time.. Interviewee 3

4.2 Process map analysis

The process in the case study is a specific production line manufacturing products from customer order. The production is customised to serve the purpose of the customer. Not to get lost with the process steps that go inside the company: the most important purpose of the process is to bring the customer the correct product in great condition in exactly the right time for a profitable cost. Sounds simple, but as there are multiple functions between the order and the delivery, the efficiency of the process is very important. The process map is divided into two separate figures to facilitate the analysis.

The process begins with a customer need. The customer makes an inquiry and the sales level previews the quote. The first end of the process comes if the inquiry cannot be processed and the inquiry does not then move forward. According to Sharp & McDermott (2009, 17) gathering all the data that is needed to make, ship and invoice the product is important at this point to reduce the feedback steps from the following steps. This means that if the production level does not have enough information to make the product, they need to return the production order back to the sales people for reorganising. This adds “waste” according to lean methodologies. Time, money and resources are wasted when the process goes back one step.

The process moves on to design part, where the plan for the project is made. Estimating the delivery time is done based on the production lead time and availability of installing personnel. A time estimate is given to customer along with the approximate cost calculation to be accepted or not accepted.

After the offer has been accepted, a sales order is then created. The sales order enables production level to make decisions on which components are made, or already in inventory and which components are ordered from suppliers. Sourcing now gets the initiative to make purchase orders for the required components. At this point the likely arrival time for the components is confirmed.

Once the components are all at the production location, the ordered item can be produced. Once it is ready, it moves to warehouse and transportation level for delivery. An invoice is created once the product moves out of the factory. According to customers schedule the product is then delivered to the specified location and installation team arrives to do the assembly and installing. Finally, the customer receives the invoice and the ordered item is already installed at place. It can be said that the process map had a conclusive base and the flow from the start until the end was connected with relevant steps.

The analysis was done by first placing the participants on the process chart to build a picture of the process. The process map was color-coded to facilitate the analysis.

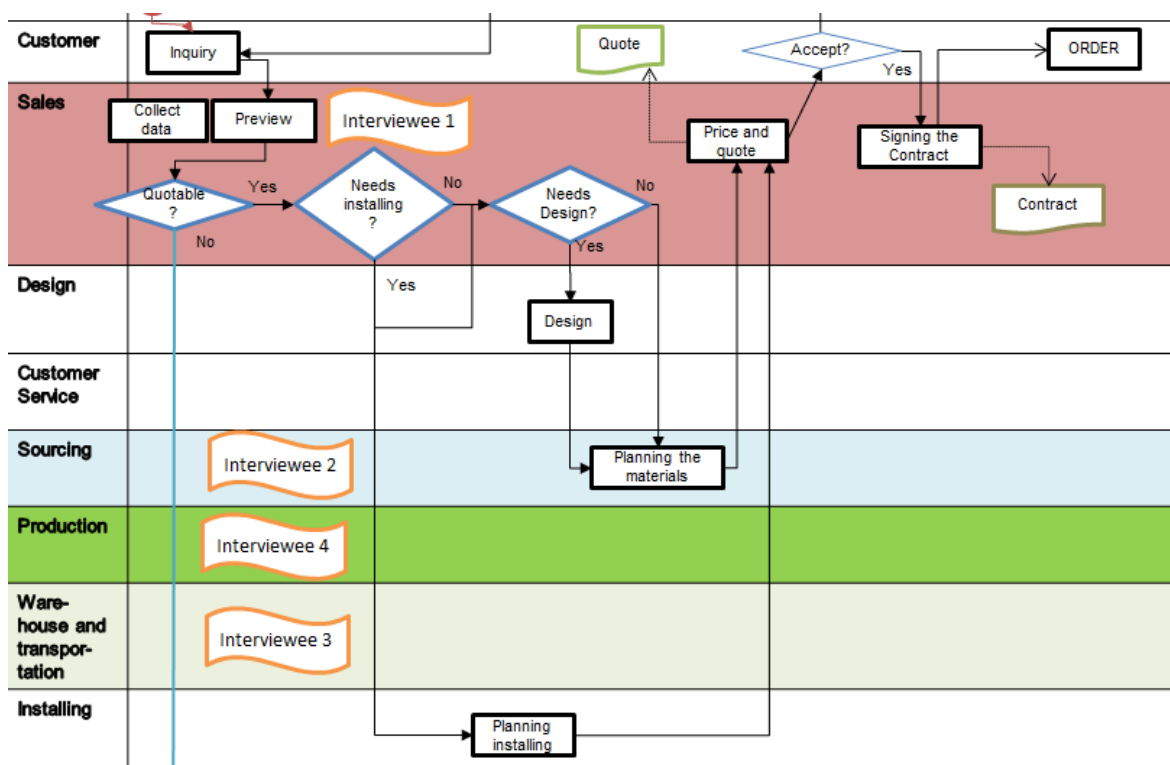


Figure 19. Process map colour-coded (modified from Company X database 2018)

The process was then followed based on the process map and on the interviews. The process begins with a customer need. Sales seems to have significantly more steps than the other levels of the process map. It came apparent that the same person in sales could also be responsible for the customer service work and keep in contact with both internal and external customers. They also evaluate the need for installing and plan the resources. It is important that the people in installing are employed at a steady level, so that they have enough work and not too much. The sales level personnel handle this balance. Up to the point when a customer gets an order confirmation, the sales level has the most responsibilities and activities. It is important that all necessary information is now gathered from the customer about the project, to ensure an efficient delivery on time.

The things that arose from the interviews from this process part, were that sales level should have a more educated tool to estimate prices and delivery times for the customer to make a sale. Now, the information flow goes back and forth before the customer is provided with enough information to accept the order.

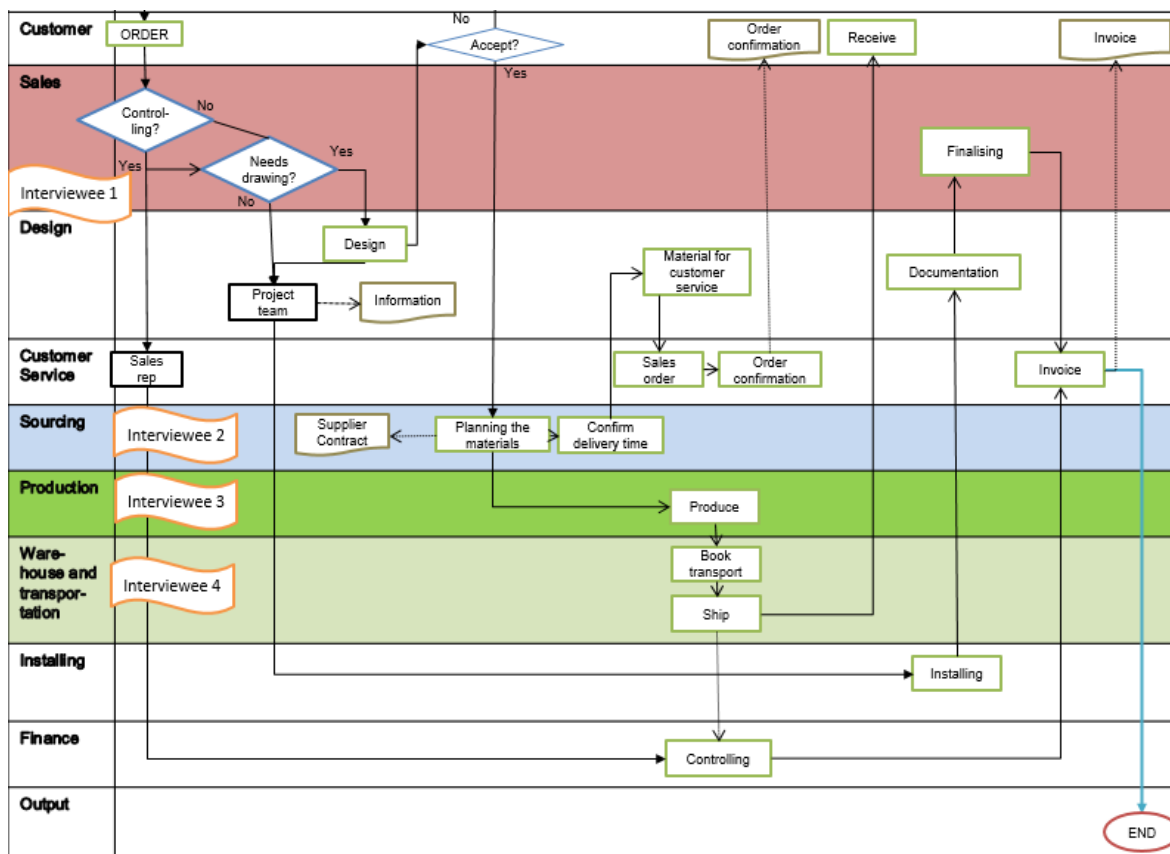


Figure 20. Process map colour-coded end (Modified from Company X's database 2018)

The part that starts after the customer places an order is described in figure 20. Following the process line, first the sales level decides and allocates the need for a sales representative and design activities for the product. At this stage, the order goes back to the customer to be accepted. There are many variables at this stage. Usually the material supply and production works in time, but the communication flow seems to be inefficient. If there are some changes in the process, the changes are not communicated within the process.

From the acceptance of the design by the customer, the process starts moving on to sourcing, production and shipping. When usual order to delivery –processes end when customer receives the goods, this process continues with possible installation. Once it is done, the project is documented and finalised and considered closed.

5 CONCLUSIONS

5.1 Answers for research questions

This study examined the tools for process development in the case company. The interviews and company's process charts are the main source for data in the case study part. It is common in a case study for the researcher to use different methods to gather data. In this study the research environment was not known well, the stakeholders were not identified fully and the subject is based on researchers own experiences and assumptions. One data gathering method was reviewing and analysing the process flow chart and other relating documents. Enough basic knowledge made it possible to start discussions about the common tasks of the participants and information sharing and communication practices in the process. (Swanborn 2010, 21). These discussions were executed by using a semi structured interview method. Based on interviews the researcher could form a picture of the actual process flow and compare it to the process chart.

The main research question was:

- How to analyse and improve a process?

There are many tools and methods to analyse a process. It can be done by looking at the process map, or by doing a process map itself. There are also many tools and methodologies to improving a process.

It showed that the case company had already invested and implemented in quality control and measure systems, and processes were evaluated at some level. Adding the metrics and measurements into process activities can offer necessary information that can then be analysed. Based on the analysis and finding the root causes of the problems, the process can be improved. Finding out the inefficiencies in the process makes this possible.

The sub-questions to help answer the main question were:

- What tools can be used in process development?

This study introduced more than ten different tools for process development that can be used. Most popular of them is Lean SixSigma that includes methodologies such as 5S in it. Tools such as SIPOC, 8D, Five Whys and Force Field analysis

are good tools for process improvement. There are also many process improvement tools and methodologies that can be used on the case process.

Applying these tools requires some team work to be effective. An outsider could implement these tools but the best result can be achieved if a team within the process goes through these techniques and find the rooms for improvement that way. The tools can be used for continuous improvement. A process should not be evaluated and analysed only once, but at a regular basis. Usually some problems already exist when the need for improvement comes apparent. Maintaining good quality means that the tools should be used regularly. Quality can mean so many things in a big company – the quality of products, the quality of work life, and the quality of the processes itself. Quality can also mean the quality of service.

- What are the common inefficiencies in processes?

In many cases, the lack of process documentation itself is the biggest problem. In this case, the process map already existed. The lack of communication and the lack of team work are many times problems, and in this case there is room for improvement in that sector.

Waste from lean methodology is a way to diminish inefficiencies. The wastes are things that create costs but do not add value to the product. They include things like processing, motion, man-hours, waiting and searching.

5.2 Reliability and validity of research

A decent knowledge of the case process is formed by observation, theory and interviews combined. (Tuomi & Sarajärvi 2018, 64). The interviews are opinions and conclusion of the participants at a particular time and the answers may have personal bias in them. This is natural to qualitative research. The result of a research can be considered reliable when two evaluators can reach the same conclusion or understand the conclusion of a third person. (Hirsjärvi & Hurme 2015, 186).

Validity comes out of interpretation and the likeliness that the best available tools and concepts have been used to study a phenomenon. Validity can also come out of generalization, which means the ability to use and implements a research result to other research. However, each situation and research is unique and cannot be

used as reference as such. It is easier to define reliability and validity in quantitative research, but more difficult in qualitative research. This is because the data and material used in research is usually gathered by interview. This way the data analysed reflects the understanding and opinions of the researcher and the interviewee. (Hirsjärvi & Hurme 2015, 187-189).

This research is valid in the context and scope it has been executed in. The results should not be generalised, as they are only relative to the case. (Hirsjärvi & Hurme 2014, 189).

5.3 Recommendations and development plan

This study evaluated and explored a process in the case company. Based on the results of this study, a development plan on how to improve the process further is created. Suitable tools for the improvements are included in the development plan. The importance of team work and communication was noted based on the study and the aspect is included in the plan. The case company is able use this development plan in their strategic development. The case study research results are applicable to this case study only as such. The development plan should include topics such as process, team work, communication and information technology. The process can be improved by developing these topics. The development plan is described in figure 21.

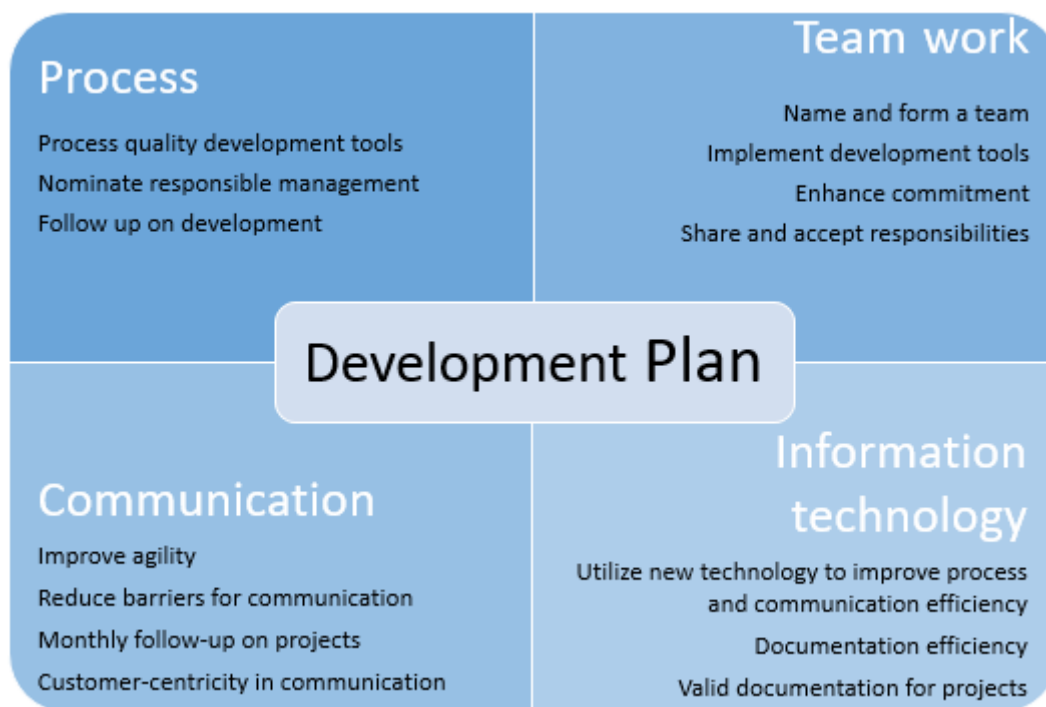


Figure 21. Development plan model

The development plan is divided into four parts: process, team work, communication and information technology. Based on the study and the results, these are the main topics to be handled. The parts will now be explained in more detail as follows.

Process

The starting point for the process development plan is process itself. Subtopics include the implementation of process development tools to improve quality. Process quality is an important point and improving processes is a continuous activity. The company should invite all employees to contribute in the improvement process. Contributions can be as simple as reporting on issues and communicating efficiently.



Figure 22. Development plan process point

Quality enables reliability in production and delivery. It works to develop more agile processes in order to be more efficient in customer –facing activities and customer service and more cost-efficient in production. Quality enhances the customer experience. It optimizes inspections and testing, which makes better products, which results in improving customer loyalty. It also lowers costs with less returned sales actions. Quality management also activates all personnel to participate in development of processes.

A new process model should be developed for the case company. Developing processes in the business should be an ongoing process and include as many people as possible. It should be made possible to make changes and enhancements to the process easily and to test and adapt new working methods. If possible, a common tool to organize both the process phases and the communication flow would be important to implement and develop.

To reduce uncertainty in the process, a responsible manager or team leader should be nominated to control the entire process flow and communication in it. In addition, the company ERP system should be modified to service the process better. At the moment the ERP system gives information about what has happened, but not the reasons behind. Some form of follow-up on the process progress should be available and easily accessible to process participants. This will have an effect on the communication efficiency as well.

The process can be improved with different emphasis. Depending on the focus and the company strategy and business values, the main points for improvement can be internal, making the workflow fluent and efficient and cost-effective or external, to serve the customer to the highest standard, even if it would increase

costs occasionally. At least the level of flexibility should be agreed within the project/process team, that the promise to customer is kept. Given a guideline for performance, a single participant can have more responsibility and make decisions to better serve the customer. This way the bureaucracy is reduced, which results in more agility.

Team work

Team work is a highly valued asset when it is working efficiently and it can be a problem when not that efficient. It came apparent in the study that the participants were not that aware of the other people in the process.

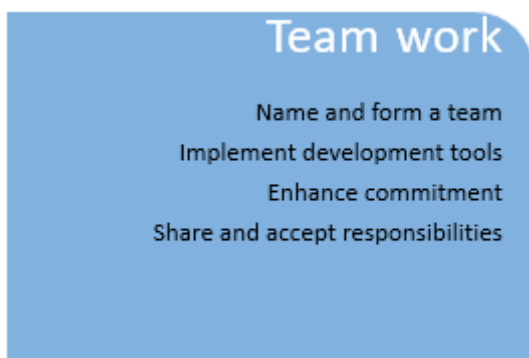


Figure 23. Development plan team work point

Okes (2013, 56-58) recommends a Business Process Management Team to be built to gather data and metrics and then bring out the information of the performance of the process. This team could meet up regularly and monitor the process progress. A role for a responsible person or a team should be initiated. That operator role could manage the process and oversee it. The responsible team or person would then work towards satisfying the needs of both external and internal customers. The main purpose for this person is to serve as a facilitator in the process and not act as a manager for the people. The responsible person is playing an important role to share information, especially when things are not going as planned.

Some employees may want to take part in competence development and do auditions to find out places for improvement in the business processes. Development is an on-going process all the time, and in all of the departments and functions.

Usually the person who does the job, know how to do it more efficiently, when sometimes a complete stranded to the topic can bring a solution simply by asking “why?”. People can be stuck to their working habits and making changes can be either refreshing or stressing. By emphasising team work and its importance, also the commitment of the people can be improved.

The development tools are best implemented within the team. This cooperation would decrease the amount of resistance to change and taking part in the development can improve the feeling of commitment.

Communication

The focus points under the communication part are pictured in figure 23. To enhance communication, a responsible person could be appointed to take the process into control. This would give all the participants a known person to turn to when they have questions and problems. This could be a role to serve both the internal process participants and act as one of the contact persons from customer point of view. This person’s responsibilities would be taking care that information is shared and received, and to facilitate any changes that need to be made into the process flow. This person could also inspire and encourage team members to take part in the improvement process and aim for high excellence.



Figure 24. Development plan communication point

To improve communication between the team, there should first be a named team. The current state of the process does not encourage team work. Each participant

does the activities independently, but to increase efficiency, the feeling of belonging to a team can facilitate the quality and agility of the work. With more communication, the agility of the entire process can be improved. The simplest way to improve the level of communication in the team is to organise a workshop for the participants.

To improve business processes and process management, some follow-up of the development is important. This ensures that improvements are implemented and changes are happening.

Companies can find a competitive advantage when including the customer into the planning and designing a product. Though many companies already do this, it would be recommended that a customer-facing interface would be built, where the customer could plan, design, alter and follow-up on the production. The current ERP systems allow some level of traceability, but with more developed IT systems, this could be enabled. This production line was making customised products already, so the next step is to give the customer a more active role.

Information technology

The focus points under the information technology part are pictured in figure 24. In the era of developed AI (artificial intelligence) and high quality calculation and forecast systems, the benefits that IT (information technology) can bring to processes should be explored. Some of the development resources should go to implementing digitalisation to make processes use less paper and manual work and to have more efficient documentation in digital form. An information management system should be taken into use to gather common and local documents into one tool. Emails and telephone calls are not the best practise for creating, sharing and maintaining information.



Figure 25. Development plan information technology point

Based on the interviews there is some frustration about the information flow. If the goal is to keep everyone informed, there will be dozens of emails. Most people get annoyed and stressed with them and delete them. That way crucial information can be lost. In order to give everyone relatively accurate and sufficient information, meaning that the information is filtered based on people's needs, someone needs to do a lot of work. In addition, at the moment there is not a responsible person for that task. According to the interviews, a responsible person is missing from the process.

Information technology can also provide services for automation. Many functions in the process could be implemented into an ERP system tool. Making the process more digital brings more agility and more transparency in the process. A digitalized process could give an opportunity to involve the customer into the process and to give them a possibility to follow-up on the progress of production. This would also facilitate production and delivery functions. Now the outsourced components arrive to the factory at "some point" (Interviewee 3, 2018) but no one really knows when. Digitalization could bring the option for on-time-tracking of the production. For the warehouse functions, the biggest problem seems to be short lead-time from production to delivery. With digitalization and better information flow, the warehouse part can get a few more hours more time to book transportation for the finished goods. Now, the finished goods arrive at the warehouse (or premises) and most commonly need to be shipped rapidly. The less time there is between the finished production and the delivery demand, the more the transportation costs. There is a possibility the delivery will be late for this reason, and the customer left unsatisfied. Information technology can facilitate this aspect.

5.4 Proposals for further development and research

Knowledge management

For a production process where machinery and many specific procedures are in use, it is important to ensure that if the knowledge is shared in teams. A company is looking for problems if there is only one person having responsibility of a process step or activity. The risk is great that one person's absence can cease an entire production line. Sharing the knowledge and training people to have skills that are more versatile in the workplace brings the invested resources back with more competitive workforce. In addition, the benefits that digitalisation can bring to this aspect needs to be evaluated.

Sustainability in business

Sustainability and eco-friendliness in products and production is a growing trend and important for businesses to assimilate. Van Tiem et al (2012, 26) sees sustainability as a driving force for businesses, as it emphasises recycling raw materials and finding solutions to save power, materials and time. The way of the world really makes us react to the usage of water, other materials and electricity. With an energy management system a company can reduce energy usage and make processes more fluent for the people, the machinery and the factory.

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Company X process flow map. 2018.

Interviews

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Interviewee 2. 2018. Sourcing level. Company X. Interview via Skype 24.7.2018.

Interviewee 3. 2018. Warehouse and transportation level. Company X. Interview in person 30.8.2018.

Interviewee 4. 2018. Production level. Company X. Interview in person 5.7.2018.

Interviewee 5. 2018. Manager level. Company X. Interviews in person and emails June-December 2018

Interviewee 6. 2018. Director level. Company X. Interviews in person and emails June-December 2018.

APPENDICES