

# **Creating and implementing a business process model**

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## MASTER'S THESIS

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### Abstract

This thesis has been made for a focus group working with customer delivery projects, delivering auxiliary equipment to LNG powered vessels globally. The market for LNG powered vessels is rapidly growing due to IMO's newly implemented rules and regulations related to vessel emissions. This in turn also lead to an increased demand in bunkering infrastructure.

The purpose of this thesis is to create and implement a business process model (BPM), that should stand as a support pillar for the focus group in their daily work. The intention of the BPM is to provide a better understanding for the complete process and find areas where lead time could be shortened, costs lowered and quality improved.

Some of the theories on customer requirements, lean office and business process modelling have been used as a base when shaping the BPM. First the customer expectations are defined, then, based on value stream mapping, the process takes form. Using theories of business process modelling, the process can be made visual using business process modelling notation standards.

The result is a first draft of an implemented BPM for the focus group of this thesis. The model explains the end-to-end process in detail, and hope is, that over time the BPM will have a positive impact on lead time, cost and quality.

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Language: English                      Key words: Lean Office, Customer Requirements, Business  
Process Modelling

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## **EXAMENSARBETE**

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### **Abstrakt**

Denna avhandling har gjorts för en fokusgrupp som arbetar med kundleveransprojekt, som levererar kringutrustning till LNG-drivna fartyg globalt. Marknaden för LNG-drivna fartyg växer snabbt på grund av IMO:s nyligen implementerade internationella regler och förordningar gällande fartygsutsläpp. Detta leder också i sin tur till ett växande behov av bunkringsinfrastruktur.

Syftet med denna avhandling är att skapa och implementera en business process modell (BPM), som skall stå som en stöttepelare i fokusgruppens all dagliga arbete. Avsikten med en sådan BPM är att ge en tydligare förståelse för helhets processen, och att försöka hitta områden där ledtiden kan förkortas, kostnader kan sänkas, och kvalitén kan förbättras.

Några teorier kring kundkrav, lean office och business process modellering har använts som grund i formningen av en BPM för fokusgruppen. Först och främst bör kundens krav definieras, sedan kan man med hjälp av en värde flödes kartläggning forma processen. Genom att använda teorier kring business process modellering, kan processen visualiseras genom användning av standardiserade business process modell notationer.

Resultatet är ett första utkast på en BPM för fokusgruppen i denna avhandling. Modellen förklarar detaljerat helhetsprocessen, och det finns hopp att denna BPM med tiden skall kunna ha en positiv inverkan på ledtid, kostnad och kvalitet.

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Språk: Engelska

Nyckelord: Lean Office, Customer Requirements, Business Process Modelling

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# OPINNÄYTETYÖ

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## Tiivistelmä

Tämä opinnäytetyö on tehty kohderyhmälle, joka työskentelee asiakastoimitusprojektien kanssa. Kohderyhmä toimittaa apulaitteita aluksille jotka käyttävät LNG:tä polttoaineena. LNG:tä polttoaineenaan käyttävien laivojen kysyntä on kovassa kasvussa johtuen muun muassa IMO:n äskettäin toteuttamista alusten päästöjä koskevista kansainvälisistä säännöistä ja määräyksistä. Tämä johtaa myös tankkausinfrastruktuurin kasvavaan tarpeeseen.

Opinnäytetyön tarkoitus on luoda ja implementoida Business Process Model (BPM), mikä toimisi kohderyhmän jokapäiväiseen työn tukipilarina. Tällaisen BPM:n tarkoituksena on antaa kohderyhmälle selkeämpi käsitys koko prosessista, ja samalla yrittää löytää alueita, joissa voisi lyhentää läpimenoaikaa, alentaa kustannuksia ja parantaa laatua.

Joitakin teorioita koskien asiakasvaatimuksia, lean-toimistoa ja liiketoimintaprosessimallinnuksia on käytetty perustana BPM:n luomisessa. Ensiksi määriteltiin asiakkaiden vaatimuksia, jonka jälkeen arvovirran kartoituksen avulla pystyttiin muotoilemaan prosessia. Sen jälkeen prosessia visualisoitiin, käyttämällä liiketoimintaprosessimallinnuksen teorioihin perustuvia liiketoimintaprosessimallimerkintöjä.

Tuloksena on ensimmäinen luonnos BPM:stä tämän opinnäytetyön kohderyhmälle. Malli selittää yksityiskohtaisesti koko prosessin, ja toiveena on, että ajan kuluessa tällä BPM:llä on mahdollisuus vaikuttaa positiivisesti läpimenoaikaan, kustannuksiin ja laatuun.

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Kieli: Englanti

Avainsanat: Lean Office, Customer Requirements, Business Process Modelling

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# Abbreviations

This section lists the abbreviations used in the thesis.

AoO	Acknowledgement of Order
BPD	Business Process Diagram
BPM	Business Process Model
BPMN	Business Process Modelling and Notation
EXW	Ex Works
FAT	Factory Acceptance Test
IMO	International Maritime Organisation
KPI	Key Performance Indicators
LNG	Liquified Natural Gas
NoC	Notice of Contract
PM	Project Management / Project Manager
PO	Purchase Order
POR	Purchase Order Requisition
RFQ	Request for Quotation
SOR	Sales Order Review
VSM	Value Stream Mapping

# 1 Introduction

This thesis has been made on behalf of a global leader within the marine technology business in order to improve the internal business processes of the company. Simon Elvnäs states in his book *Effektfull*, that leadership is connected to two words; influence and process. *Influence* is something that causes us to do what we do, it leads us and guides us in our actions in different situations. *Processes* refers to something that systematically happens both regularly and continuously. (Elvnäs, 2017, p. 27) According to Sörqvist, a process is described as a natural flow of material, products, information and individuals that occur in the business when work is done. (Sörqvist, 2013, p. 111)

Ever since machines entered the work floor in the first industrial revolution (1784-1870), productivity has been increasing with the help of technological innovations, improvements in the ways-of working in the organizations, and with the use of information technology. (van der Aalst & La Rosa, 2016, s. 2) In today's production processes the product itself is often related to information, that may be provided as a service.

Sörqvist explains that smaller processes are usually working well if seen from a local perspective. But when put together into the bigger picture there are, however, flaws that will disable the complete process from being effective. Hence there are numerous ways to improve the processes (Sörqvist, 2013, p. 111)

## 1.1 Background

In 2017 there were according to Keller 118 LNG powered vessels in operation globally. The number has grown to 143 LNG powered vessels in 2019. There is another 135 LNG powered and 135 LNG-ready vessels in the pipeline. (Keller, 2019) In other words, the market is rapidly growing leading to an increase in demand for bunkering infrastructure, as these vessels will need to be refuelled somehow. The market is also growing due to more strict emission regulations set out by the International Maritime Organization (IMO). (Keller, 2019) As of 1<sup>st</sup> of January 2020, IMO has implemented a new limit for sulphur emissions in order to reduce the health and environmental impact from ships. All ships that do not operate under the limit for sulphur emissions set to 0.5%, will be banned. (International Maritime



Organization, 2019) One “easy” way to reach the limit of 0.5% sulphur oxide emissions is to use LNG as fuel, as it could reduce the emissions of nitrogen oxides and sulphur oxides with as much as 90 to 95%. (Saul & Chestney, 2018)

In an interview with a member of the management team for the department including the focus group of this thesis, it was stated that the new IMO rules and regulations will have a great impact on today’s market, seeing an increased usage of LNG as fuel in the marine market. “It already has a great impact, otherwise we wouldn’t be here”, says the member of the management team. Other alternative fuels might emerge but there is a common belief in the marine business that LNG will still increase its market share. The member of the management team explains that the competition is very strong in the marine business and that this requires organizational processes related to roles and responsibilities to be of good quality, otherwise work cannot be done efficiently enough. (Management Team Member, 2019)

According to Bruzelius & Skärvad organizations tend to strive for efficiency, both for what they define as outer and inner efficiency. (Bruzelius & Skärvad, 2011, pp. 100-101) The outer efficiency focusses on customers and other external stakeholders, whereas the inner efficiency focusses on the company’s own resources. The outer efficiency is about doing the correct things in creating value for the customer, while the inner efficiency is more about doing the right things in a correct way, in other words, how resources are utilized. Bruzelius & Skärvad also state that rapidly growing businesses who want to take advantage of their strategic position, are often required to shift focus towards outer efficiency to be able to react rapidly and be more flexibly in managing resources and the organization itself. (Bruzelius & Skärvad, 2011, p. 103) Such a rapidly growing business will sooner or later have to shift focus back towards inner efficiency, to streamline the ways of working.

## 1.2 Problem area

The focus group in this thesis is working with delivering auxiliary equipment to LNG powered vessels. With the constant increase in the number of vessels, it is important that the demand is met by the supply. To be able to meet the increasing demand, the focus group is handling more and more customer delivery projects with shorter and shorter delivery times. Rapid increase in demand has led to unclear way-of-working and late delivery of

documentation that might result in late changes to project specific design and an overall late delivery of the project. Some late deliveries can be avoided by changing mode of transportation from sea freight to airfreight, but it will obviously have a negative impact on cost.

Over the last five years, the focus group has grown from consisting of a Manager, Project Engineer, Mechanical Engineer and a Purchaser, to a team of 18 members in different roles with different responsibilities, working directly with delivery projects. Ljungberg & Larsson state, that when a business is growing, the accountability areas often change or are redefined in some way. Organisation charts might get more details or responsibility areas to increase clarity and divide responsibility. Here the intention is to clarify who is responsible for what, but the business will risk becoming more divided as the business keeps growing with more and more separate responsibility areas. (Ljungberg & Larsson, 2019, p. 51)

“Our internal processes are not in place. Our department is currently experiencing so called “growth pain” as we have rapidly grown over the last couple of years...” says the member of the management team. New roles and responsibilities have emerged, and the focus group has not been able to keep all processes up-to-date. Some processes are good, some not so good. Currently the group is not directly following any visualized business process. An end-to-end process exists, but its last update was in 2016, when the team consisted of three persons. There is a clear need for an improved business process within the focus group. (Management Team Member, 2019)

### 1.3 Purpose of Thesis

It is common for organizations to define the mission, vision, and strategy of a company to be able to reach the goals it has set. In other words, a purpose is defined. (Bruzelius & Skärvad, 2011, p. 135) Much like within a company, a purpose is to be defined for this thesis. Today the focus group is experiencing an increase in market demand and struggles with their internal processes as explained in the previous chapter, yet the vision of the focus group is clear; “we need to be able to deliver our products on time, on quality and within budget.” (Management Team Member, 2019) To get there a strategy is needed. According to Bruzelius & Skärvad, strategy is best explained as the way a company should do work to achieve its goals. (Bruzelius & Skärvad, 2011, p. 159) As illustrated in Figure 1, the vision

is fundamental for determining a company's goals. The mission should state where we are today. A vision should answer the question, where do we want to be? Whereas the strategy should answer the question; How are we going to get there? (Bruzelius & Skärvad, 2011, pp. 138-139) The "How?" will be the focus of this thesis.

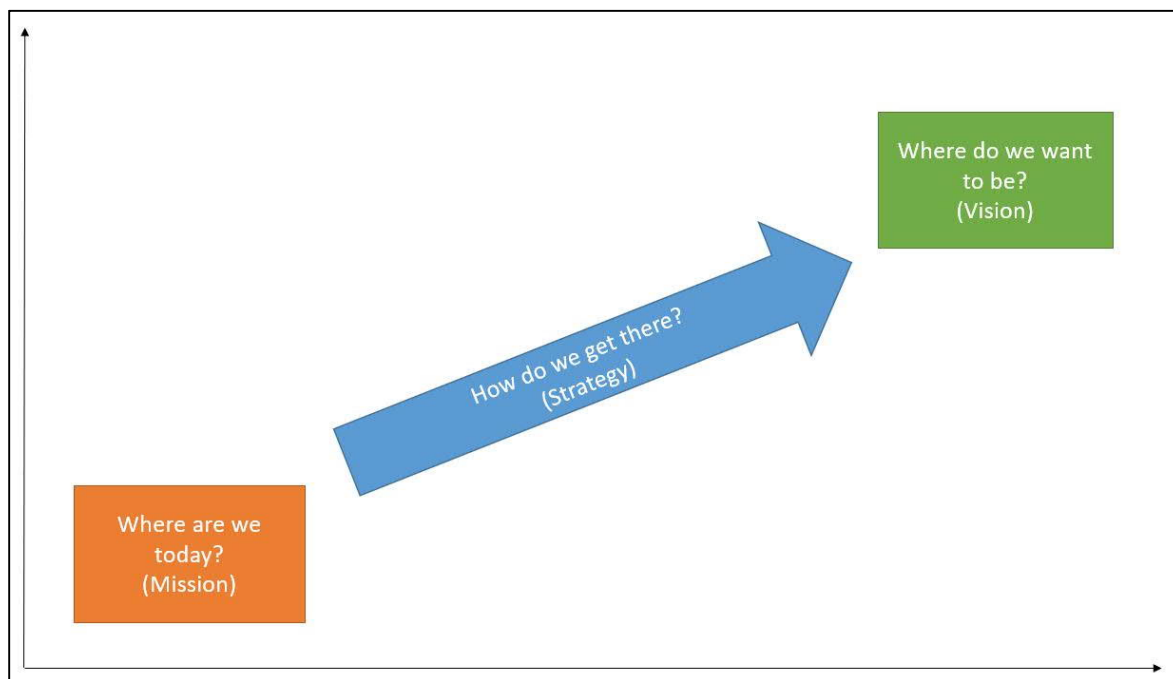


Figure 1. Illustration of mission, vision and strategy. (Bruzelius & Skärvad, 2011, p. 139)

The purpose of this thesis is to create and implement a Business Process Model (BPM) and update the current end-to-end process for customer delivery projects, related to the focus group. The intention is to provide a better understanding for the complete process and find areas where lead time could be shortened, costs lowered and quality improved. The goal for the BPM is to visualize the end-to-end process and give a better understanding for the different roles and responsibilities for different team members. The BPM could stand as a foundation for future development within the team. According to Sörqvist there are several recorded benefits from companies opting to improve their processes. Improving your company processes is said to improve the general picture and understanding among co-workers, the focus on customer requests improve, process work gives a good foundation for improvement and the ability to change is improved. Also process work is said to simplify a too complex organization, and as process organizations often sets high demands on its leadership, the focus to improve leadership within the organization will increase. (Sörqvist, 2013, pp. 114-115)

Handling the vast number of projects today, requires constant follow-up and the team and its processes need to develop to be able to deliver on time, on quality and within budget. The company believes that a business process model could help the team figure out a way to improve certain steps in the value chain from received order to delivered product.

#### 1.4 Limitation

The focus group in this thesis, are handling one of two main products provided by the specific department within the company. Initially the work in this thesis was thought to include the whole department with the two main products in focus. After discussing the limitation of the thesis with the managers within the company, it was made clear that this thesis will be limited to only create a BPM for the needs of the focus group of one of the products. The whole department is also in need for a BPM, but such a task would be too demanding for this thesis and the given time-frame. Further development will be done after the thesis for the creation and implementation of a BPM for the whole department.

Within the company, BPM implementation is restricted to certain information channels with limited access. Due to these restrictions, I will not be able to fully implement the BPM once created. When created, I will hand over the ready BPM to the management who can review it and implement it through the desired information channels. The BPM will be made available for the members of the focus group regardless of information channels.

#### 1.5 Outline of thesis

The outline of this thesis is clear. In chapter 2 some theory about customer requirements, lean office, and business process management will be discussed. Once we have discussed different theories surrounding the main subjects of this thesis, the methods I intend to utilize in empirical work will be explained in chapter 3. In chapter 4 I will present the results and discuss how well the purpose has been reached. The thesis is concluded in chapter 5 including the final discussions and proposed further development.

## 2 Theoretical frame of reference

The main objectives in this thesis are found within the theories of customer requirements, lean office, and business process management. The customer requirements will be important as the main objective for the focus group in their daily work is to manage and deliver customer specific projects. Lean office will bring the theories of lean production into the office environment to try to streamline the way of working. Finally, the theories surrounding business process management will focus on how processes are to be created to best shape the daily work of the focus group.

### 2.1 Customer requirements

“The customer is always right!”, is a very common phrase to throw around, but is the customer, always right? According to Sörqvist, the amount of information collected from the customers is only a fraction of the huge amount of internal information that is collected. (Sörqvist, 2013, p. 91) To fully understand customer requirements, it is important that the customer is defined. Who is the customer? According to Bloomenthal, a customer is “an individual or business that purchases another company's goods or services.” (Bloomenthal, 2019) The thing with customers is, that not only should you be able to keep them happy, you should also try to look at your own business through the eyes of the customer in order to fully understand your own business, and the value chains and processes in it. This should help you focus on what is important to the customer and improve it. (Sörqvist, 2013, p. 91)

Ljungberg & Larsson state that all businesses have customers and defines a customer as a stakeholder that need or receives and uses the result of the business. If a business does not have customers, there is no need for the business. (Ljungberg & Larsson, 2019, p. 17) Not all businesses might use the term customer, but all businesses must understand the meaning of having a customer. Just as explained by Sörqvist, Ljungberg & Larsson describes that one of the more valuable aspects in order to develop one business is to be able to look at your business through the eyes of the customer. It is worth listening to satisfied customers, but dissatisfied customers provide a much more valuable approach in the development of a company. Ljungberg & Larsson mention that the goal is not to have dissatisfied customers, but to first make them satisfied and compensated for their dissatisfaction. Later you should

talk to the customer to be able to realize why the customer was not happy with the product or service. Even if there would be only one customer who was dissatisfied, there might certainly be several more with the same issues, they would just not speak up and be heard. (Ljungberg & Larsson, 2019, pp. 17-23)

Bruzelius & Skärvad state that customer centricity is nothing new to organizations. Today it has become more important to focus on the customer than before, as almost all work being done in different organizations, is judged based on the value it creates for the customer. (Bruzelius & Skärvad, 2011, p. 212) The customers today have more options and have good knowledge of their different suppliers and what they can be provide, which is why companies today must be able to manage the requirements set out by the individual customer related to product design, mode of transportation, price etc.

### 2.1.1 Customer needs and expectations

Before starting to manage different requirements, one must understand the needs of a customer. According to Project Management Institute, collecting requirements is defined as a process to determine and document different needs of stakeholders, or in this case customers, to be able to meet the objectives of a project. (Project Management Institute, 2008, p. 105)

Sörqvist state that the degree to how well a customer is satisfied, is depending on how well the needs of the customer can be met. (Sörqvist, 2013, p. 98) It is often difficult to determine, as the needs tend to be very complex. To make things more interesting, the needs of the customer often vary over time depending on the situation. (Sörqvist, 2013, p. 100) Rotar & Kozar explains that according to the Kano model developed by Noriaki Kano in 1984, customer needs can be divided into three categories; *Basic needs*, *Performance needs* and *Attractive needs*. (Rotar & Kozar, 2017, p. 343) The model developed by Kano is mainly used for analysing customer needs and determining product requirements. The model can be graphically explained to show how the different needs affect customer satisfaction in Figure 2.

The requirements that can be derived from the basic needs are essential to achieve customer satisfaction. These basic needs will not improve customer satisfaction, but if they are not

fully met, the customer will not be satisfied. Sörqvist explains that one of the best ways to determine these needs is to discuss them with the customer. These needs will most likely be highlighted in the discussion as they are very important to the customer. (Sörqvist, 2013, p. 98)

Performance needs can be defined by the customer but are still up for discussion with the supplier. It is this category of needs that separate one supplier from the other. “In this category the product or service provides and answer to questions such as: What is the level of service? What is the price performance? What features does a product have?”, says Rotar and Kozar. (Rotar & Kozar, 2017, p. 343) Sörqvist states that these needs might be so essential and so obvious to the customer, that they might not even mention these needs in the discussion with the supplier. Just like the basic needs, these needs will not improve customer satisfaction if fulfilled, but the lack of fulfilment will cause dissatisfaction with the customer. (Sörqvist, 2013, p. 99)

The third and final category, the attractive needs, is also called “the delighters”. These are needs that if fulfilled will improve customer satisfaction. These are the kind of needs that the customer does not know they have, so if these are fulfilled, it will come as a positive surprise to the customer. (Sörqvist, 2013, p. 99) Rotar & Kozar explains these needs as ‘undefinable’ and unspoken by the customer. If they are not fulfilled, the customer will remain neutral in regard to satisfaction, as the customer was unaware of these needs and did not expect them. (Rotar & Kozar, 2017, p. 343)

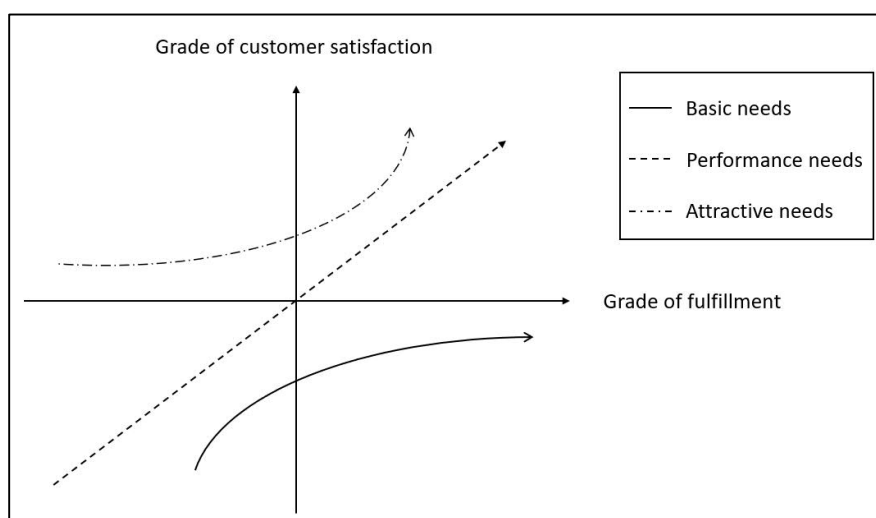


Figure 2. The Kano model showing how different needs affect customer satisfaction. (Rotar & Kozar, 2017, p. 343)

The result of analysing these three categories can be used to understand the customer expectations on the product, in other words, the requirements of the customer. (Rotar & Kozar, 2017, p. 343) Sörqvist explains that in normal cases, the expectations of the customer are at a level where all expected needs are fulfilled, otherwise it will result in a dissatisfied customer. It is important to remember that the expectations of a customer might vary from time to time depending on the situation, and are often affected by various factors such as previous experience, marketing and sales strategy, image of the company, price etc. (Sörqvist, 2013, pp. 101-102)

### 2.1.2 Requirements management

Once the requirements have been identified, and the customer needs and expectations are known, the requirements should be managed. Coventry explains that requirements management is a process that ensures collecting, documenting, refining and managing changes of requirements, with the aim to satisfy the needs to the satisfaction of the customer. (Coventry, 2015) According to Coventry, it is important to have a plan on how to manage requirements. The plan should include but not be limited to identifying stakeholders, analysing and documentation of requirements, and communication, monitoring and reporting of requirements. Project Management Institute explains that how the requirements are documented, tend to vary between a simple document to complex forms with attachments describing all requirements in detail. (Project Management Institute, 2008, p. 109)

## 2.2 Lean Office

According to Ljungberg & Larsson some basic principles of Lean are to focus on the customer, to develop what is done for the customer, to eliminate waste, to produce only when there is a demand, and to respect the human being. (Ljungberg & Larsson, 2019, p. 47)



Within the principles of Lean there are seven types of waste that one should try to eliminate:

- overproduction (to produce more than needed)
- overworking (to make something better than needed)
- waiting time (due to something or someone missing)
- transportation
- warehouse management
- movement.

Sometimes an eight waste is also listed; unused creativity. There are many ways to use lean to improve a business, but there are also negative sides to lean. If a business becomes to lean it might deprive the business from being flexible and agile, which becomes more and more important. (Ljungberg & Larsson, 2019, pp. 47-49)

In a case study performed by Chen and Cox, it is highlighted how the concept of lean manufacturing can be applied in the office environment. “The application of Lean principles in a manufacturing area means identifying the value-added and non-value-added activities in manufacturing process, and then eliminating the non-value-added activities while improving the value-added activities.” (Chen & Cox, 2012, p. 28) Chen and Cox propose a systematic approach to transfer Lean manufacturing principles into the Lean office.

The difference between lean manufacturing and lean office being that participants in implementing lean office face more difficulties with a greater number of process variations, less basic information, and less available literature in the matter. Most tasks within the office environment are performed by sending and receiving e-mails, causing more variation in time used for specific tasks and difficulty to determine arrival and departure times of information beforehand. (Chen & Cox, 2012, p. 17) According to Bruzelius & Skärvad, eliminating waste in the office environment, such as introducing processes of flow where bottlenecks are eliminated and waiting time is reduced, warehouse volumes are eliminated, and minimizing the area where the work is performed, will create the business to be more resource efficient or simply, lean. (Bruzelius & Skärvad, 2011, p. 266)

A lean organization can usually be described by highly skilled workers that can perform many different tasks. The competence of the workers should be utilized by giving them the opportunity to improve products and processes. Communication and openness are important

in order to be able to create a lean office. (Bruzelius & Skärvad, 2011, p. 267) One way to involve the workers in improving the products and processes, is to conduct a value stream mapping (VSM) session with the team members. (Chen & Cox, 2012, p. 18) VSM is one of the most powerful Lean tools and will be explained further in the chapter regarding Value Stream Mapping.

### 2.2.1 Value Stream Mapping

According to Chen and Cox Value Stream Mapping (VSM) is a tool of Lean that combines production flow and flow of information into a map of the complete process. Mapping the complete process enables team members to easier visualize in a flow chart, how the complete flow of materials and information are intertwined rather than having knowledge of a single process within the value chain. (Chen & Cox, 2012, p. 18) Sörqvist argues that a VSM should be made based on understanding the customers and their needs, and systematically create a map that visualizes the added value of the current process. (Sörqvist, 2013, p. 129)

As per Chen and Cox, the VSM in an office environment can be described in four steps of execution. Firstly, a product family or service needs to be selected for the VMS session. Once the product family or service is selected the VSM team is to draw the current state map of the selected process. The third step is to brainstorm and develop a future-state map for the selected process. The fourth and final step still belonging to the VSM, is proposing a plan that enables the company to reach the future-state map drawn in the previous step. (Chen & Cox, 2012, pp. 19-20) Sörqvist on the other hand lists nine steps in a VSM; to create an understanding for the customers' needs and requirements, to identify a suitable and well defined flow, to put together a team with good knowledge in the selected flow, to identify the main activities of the flow and create an understanding for work that needs to be performed, to determine how to measure flow, to follow the flow upstream and generate the value stream map, to analyse the current state based on the generated map, to develop an improved future-state and implement it, and finally to follow-up and prepare for a new mapping session. (Sörqvist, 2013, pp. 129-137)

When initiating a VSM session it is important that it is only the process that concerns the selected product or service that is mapped. The map will become too complicated if everything in the business was to be mapped. (Chen & Cox, 2012, p. 19) As Chen and Cox

stated, Sörqvist also claims that it is important that the specific flow that is to be the focus of the VSM initiative, is well limited so that the workload doesn't get too big. If the workload is too high, it can have a directly negative impact on the result as well as on the satisfaction of co-workers. (Sörqvist, 2013, p. 131)

Chen and Cox says that creating a current-state map should start with identifying the customer needs and working your way upstream of the customer end of the value stream as the business is driven by customer demands. (Chen & Cox, 2012, pp. 18-19) Sörqvist is on the same topic as he mentions that a VSM should always be made based on the needs and requirements of the customers of the flow. If good understanding for the customer is achieved, one can easier define the work that needs to be performed. (Sörqvist, 2013, pp. 129-130)

According to Chen and Cox the current-state map is intended to illustrate and present the flow of materials and information. Creation of the current-state map is not possible to perform over a conference call. The members that are involved need to be able to physically see, feel and change the map as it is being created to fully understand what is meant by each step. (Chen & Cox, 2012, pp. 18-19) Furthermore, Sörqvist explains the start of the VSM initiative as one of the most important steps. In order to be able to perform a VSM that truly focus on the work that is performed today, it is important to put together a team with enough knowledge of the daily work the VSM concerns. Members from all concerned areas, such as Project Management, Supply Management, Engineering, should be included in the team. Furthermore, the selected team needs to be trained so that they will possess the knowledge required to carry out a VSM initiative. Sometimes it is good to include a facilitator that fully understands the theory of VSM. (Sörqvist, 2013, pp. 131-133)

Before the mapping itself can start, the team should have a common understanding for the selected flow and the team should identify the main activities of the flow. Another important thing before the mapping can start is to remember to collect facts and information relevant to the flow e.g. customer requirements and needs, lead times, available working time, waiting times, available resources etc. (Sörqvist, 2013, p. 133)

The mapping should begin with the end-customer and understanding the requirements and needs the customer has. The team starts working their way up-streams from the customer and should always keep in mind the previously mapped activities. The focus should always

be kept on how work is actually performed in the selected flow, therefore current process and work instructions should not be taken into account. (Sörqvist, 2013, p. 134)

Chen and Cox explain that after having drawn the current-state map, each team member should be able to fully understand each step of the process. The map should now be able to provide enough information for the future-state map. (Chen & Cox, 2012, pp. 18-19)

The future-state map should focus even more on the customer needs and requirements. The starting point for the future-state map is blank, but the current-state map should be used as a reference. The aim of the future-state map is to have a “chain of processes, where individual processes are linked to their internal and external customer, streamlined so that each process should only produce what its customer needs, when they need it.” (Chen & Cox, 2012, p. 20)

For creation of the future-state map the members conducting the mapping session should look at the current-state map and answer several questions for each task listed.

- What is it the customer need and when?
- How do we track what we are doing with remark to the customers' needs?
- Are there steps that does not create value in this process?
- How can we streamline the work to decrease number of interruptions?
- How do we manage work between interruptions?
- What do we prioritize?
- Can we balance workload and activities?
- What improvements are needed?

Once the team has been able to answer the questions above, the future-state map can be made. As soon as the future-state map is complete the team should think of how to make the future-state map a reality. Therefore the team should propose a plan. Without a plan to reach the future state, the map itself is useless. The purpose of a future-state map is to illustrate the ideal process of the company. (Chen & Cox, 2012, p. 20)

## 2.3 Business Process Management

A process can often be described as a chain of events, activities and decisions. From time to time these processes need to be managed. According to Dumas, La Rosa, Mendling and Reijers, business process management can be described as the art or science of monitoring how work is performed within an organization to ensure consistent results. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 1) Sörqvist explains that there are some key characteristics of a process. A process has a well-defined purpose, goal, beginning and end. It includes both customers and suppliers and describes the flow of material and information between these. Most importantly, a process can be repeated and will generate value to the customer. (Sörqvist, 2013, p. 112) Ljungberg & Larsson also state that detailed process maps and detailed rules for ways of working are best suited when a highly repetitive work is to be carried out with the intention of achieving the exact same result every time. (Ljungberg & Larsson, 2019, p. 55)

As already mentioned in chapter 2.2 Lean Office, Ljungberg & Larsson adds that if the customers and their requirements vary a lot, unnecessarily detailed processes might lead to longer lead times, poor flexibility and a less engaging work. (Ljungberg & Larsson, 2019, p. 55) According to Dumas, La Rosa, Mendling and Reijers the ideal of a business process is that the outcome should deliver some sort of value to all the involved stakeholders, (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 15) not the customer alone as stated by Sörqvist. On the contrary, Sörqvist also claims that all involved stakeholders are certain kind of customers as previously mentioned, in which sense Sörqvist agrees with Dumas, La Rosa, Mendling and Reijers.

All businesses have three main types of processes; main process, support process, and leading process. (Ljungberg & Larsson, 2019, p. 49) Main processes are based on the core business of the company and are directly related to customer requirements. Support processes are processes that are needed to make sure the main processes can be carried out. The main task of the leading process is to make sure that the main- and subprocesses work together to keep the business afloat. The purpose of a leading process is usually to determine and communicate goals, business follow-up, and to decide how to develop the business.

On a more detailed level there are all kinds of different processes within organizations and in this thesis, we will focus on what Dumas, La Rosa, Mendling and Reijers refers to as

*Order-to-cash* process. An *Order-to-cash* process starts when a customer submits an order to purchase a product or service, and ends when the product or service is delivered, and the payment for the product has been completed. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 1) This kind of process is very similar to what the focus group in this thesis is working with. The process starts when a new project is received (a customer places a purchase order) and ends with the delivery of the product.

A typical business process is built up by several events and activities. These events and activities all include decision making, a number of stakeholders, physical objects and often leads to different outcomes. (Dumas, La Rosa, Mendling, & Reijers, 2013, pp. 3-4) Sörqvist states that a process is compiled out of three different roles; the customer, the producer, and the supplier. In a process, a customer is usually both the supplier and the customer. When a process starts, it starts based on the input from a previous step in a process, and when it ends it delivers input to the next step in a process. This way the process itself is the producer. (Sörqvist, 2013, pp. 112-113)

Before a business process management initiative is started, one of the first questions to answer is “what business process are we intending to improve?” This question is meant to act as a guide to identify the current process. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 15) Harmon agrees with Dumas, La Rosa, Mendling & Reijers, and defines identifying the specific value chain as one of the first key steps in creating a business process, much like a VSM initiative. (Harmon, 2007, p. 82) Harmon discusses the definition of a business process architecture starting with specifying the selected value chain. After the specific value chain has been selected clear goals and Key Performance Indicators (KPI) for the value chain are to be set. Only after selecting the value chain and setting goals and KPI’s can the specific process identification begin.

### 2.3.1 Identifying the process

According to Ljungberg & Larsson a company that wishes to become more process aware, must understand what processes there are currently, determine how to best do work in those processes, see too that the developed processes really are used, and finally remove any obstacles hindering developed processes from working. (Ljungberg & Larsson, 2019, p. 39)

Process identification includes a set of activities that aims for systematic definition of a business process of the company. Identification of processes also aims to set a clear criterion of activities and prioritize them. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 33) This translates into looking at different processes in the company and prioritizing them according to strategic impact or even the survival of the company. Ljungberg & Larsson claims that employees should understand what processes there are within an organisation, and how these relate to each other. Each process exists with the purpose of delivering a certain result and satisfy one or more requirements. (Ljungberg & Larsson, 2019, p. 39) One business process could for example include problems such as bottle necks that has direct impact on delivery of products, another business process could be strategically impacted by change in market demand or introduction of new regulations, much like the case the focus group of this thesis are facing. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 33)

Several stakeholders are involved in implementing and managing the business process, yet generally only a handful of these hold the total overview of the process. Dumas, La Rosa, Mendling and Reijers claims that it is this overview of the business process that is needed in order to fully grasp what part of the process needs to be managed or improved. Hence, process identification is about collecting this knowledge from these stakeholders and keeping it up-to-date. (Dumas, La Rosa, Mendling, & Reijers, 2013, pp. 33-34)

## 2.4 Process flow chart

It might be difficult to determine how a process should be designed so that it is efficient, satisfies its customers, works in the best interest of the employees and in the same time, provides value to all other involved stakeholders. One way to make it easier is to create a process flow chart which is very similar to a VSM current or future state map.

We have already determined that a process starts with a need of a customer and ends with a satisfied customer. A process flow chart shows all the tasks and activities that happens from start to finish to achieve a satisfied customer. (Ljungberg & Larsson, 2019, p. 109) The chart itself should provide an understanding for what work needs to be done, otherwise it will most likely become a “graphical to-do list”. If the flow chart manages to provide

understanding and a view of the big picture it will according to Ljungberg & Larsson, not only provide guidance for employees, but also encourage them.

To fully understand the different activities and tasks within a process flow chart, the naming of these charts is of utter importance. According to Ljungberg & Larsson there are a few tips and tricks to follow so that the naming can provide the reader with full understanding of the flow chart. (Ljungberg & Larsson, 2019, p. 110)

- It should be possible to use the word 'To' before each task or activity.
- If the flow chart concerns a complete process, its naming should reflect on why something is done rather than what or how something is done.
- Never use process names that can be misunderstood for organizational departments.
- No work is done in a trigger or a result. A trigger or result should be defined with a noun.
- Explain everything as simply as possible. Use simple wording and avoid abbreviations.

Ljungberg & Larsson state that it is a common understanding that a task should be defined in as much detail as possible, and that it is not so important to understand what is done or why. It is important that the task is defined, but it is also important to understand what and why something is done. We have already determined that if a process gets too complex and must be followed to the detail, the company might misplace its flexibility, customer adaptation and swiftness. A well-defined process flow chart should explain what is needed to get work done and nothing more. (Ljungberg & Larsson, 2019, p. 107)

#### 2.4.1 Business Process Diagram or Business Process Model

Business Process Modelling Notation, or BPMN, is another, much like process flow charts, simple way to determine how a process should be designed and is best described as a method to illustrate business processes. (Rouse, 2010) Even if the output of a BPMN is simple, it may also be described as a complex language with over 100 symbols. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 63) Thanks to its complexity, BPMN is able to define a



Business Process Diagram (BPD) by using symbols that graphically explains business operation models. (White, 2004)

A business process diagram or model is identified by three qualities; “mapping, abstraction and fit for purpose.” In theory this means mapping of real-life events, documenting the relevant areas, and serving a purpose for a real-life aspect. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 66)

#### 2.4.2 The four elements of BPMN

There are four categories of elements used in BPMN; Flow Object, Connecting Object, Swim lanes and Artefacts. (White, 2004, p. 2) Here follows a short explanation to the different symbols used in BPMN. (Harmon, 2007, p. 515) A list of main BPMN symbols can be studied in Appendix I of this thesis.

The first category, Flow objects, consist of three core elements; events, activities and gateways. Events are visualized with a circle and is used to describe something that is happening in a process. For activities, rounded rectangles are used to symbolize work or tasks that is performed by the company. A gateway is visualized by a diamond shape and is used to determine decisions in the process, as well as to fork, merge and joining of paths in the process. (White, 2004, p. 2)

The connecting objects is the second category and they are used to indicate sequence flow, message flow and different kind of associations. A sequence flow is illustrated by a solid line with a solid arrow head and indicates the order of the activities that are performed in a process. A message flow is used to indicate exchange of messages or information between two different process participants and are symbolized with a dashed line with open arrow head. Associations are indicated with a dotted line and line arrowhead. They are used to associate Artefacts such as data and text, with flow objects. (White, 2004, p. 3)

The third category is swim lanes that are used to sort and organize activities with different responsibility and functionality. There are two types of swim lanes that are used in BPMN; pools and lanes. (White, 2004, p. 4) A pool is normally used for modelling a business party or organization. This pool can then be divided into lanes. (Dumas, La Rosa, Mendling, &

Reijers, 2013, p. 83) “Pools are used when the diagram involves two separate business entities or participants”. (White, 2004, p. 4) All the activities within a pool are treated as self-contained processes, which means that a sequence flow is not allowed to flow from pool to pool. Instead a message flow is described as a mechanism to indicate communication between two participants and in this case, between two pools. (White, 2004, p. 4) Each lane within a pool will then represent e.g. a business unit, team, software or equipment. (Dumas, La Rosa, Mendling, & Reijers, 2013, p. 83) That way a lane is used to organize different activities based on responsibility, function and role. (White, 2004, p. 5)

The fourth and final category of elements used in BPMN is artefacts. Artefacts are used to allow process designers some flexibility, which enables the modeler to add information specifically related to the process being modelled. There are three types of artefacts; data objects, groups, and annotation. Data objects are symbols that intended to show what data or information is required by or for activities. Groups are indicated by a rounded corner rectangle with a dashed line and are used to grouping different objects, activities etc. Grouping as such does not affect the sequence flow in a process. The final element of artefacts is annotations that are used to include additional text to be visible in the process. (White, 2004, p. 6)

#### 2.4.3 Process flow chart implementation

Once the business process model has been made in accordance with the theories above, all who are included in the process should be involved in its implementation. To succeed with the implementation of a new process, there must be a common understanding for the proposed solution, or in this case the process. The biggest challenge is to actually start following the new process. In a study made at Lund University, Lagerstedt states that changes in the working environment often face resistance from the affected individuals (Lagerstedt, 2011, p. 85). According to Ljungberg and Larsson employees introduced to new processes are often concerned that co-workers will not start following the process. The tip given by Ljungberg and Larsson is to be more concerned about one self and think “How will I perform? Will I follow the new process?” (Ljungberg & Larsson, 2019, p. 41)

To only think of the processes themselves in order to become more process aware is not enough for a company. A well explained process flow chart should not be mistaken for well

performed work. When trying to implement new ways of working there are often several obstacles hindering the implementation. Often several big obstacles can be found within the culture of the company itself, the use and development of competence of employees, and within the management team. If instead the newly developed process flow chart stands as a foundation for further development, the need for change and development of different sub-areas within the company will be more important. This will over time lead to either a leaner more efficient company or the conclusion that the proposed change does not work. (Ljungberg & Larsson, 2019, p. 89)

A leader's role is important in implementing a new way of working based on developed process flow charts. According to Ljungberg & Larsson there is always a high risk that the management does not support a process aware way of working, and instead tend to follow old habits with different kind of demands and follow-up of activities etc. For a leader to implement and manage the use of a more process aware way of working, it is important to highlight the mission and vision of the company, so that employees may understand the purpose of the company. The leader should through his or her own actions, emphasize the values of the company and contribute in creating a desired organizational culture. The leader should also set goals based on the developed process flow chart and create basic foundations to execute the daily work. In short, the leader should make sure that sufficient competence, needed tools and other resources are available to create a working environment based on the design of the process. (Ljungberg & Larsson, 2019, pp. 129-131)

Ljungberg & Larsson lists some common obstacles for not being able to fully implement a business process. The most common being that the beginning and the end, and the purpose of a process are not defined in accordance with customer requirements, or the basic foundations of the organizational culture. The process might lack relevant goals due to a missing purpose and the process definitions might not be in line with those who should carry out work within the process. The company might lack resources, or the resources might lack competence needed to implement out the process. If a process implementation is successful rewarding is important, but the complete team should be rewarded, not only individuals. (Ljungberg & Larsson, 2019, pp. 137-139)

## 2.5 My theoretical frame of reference

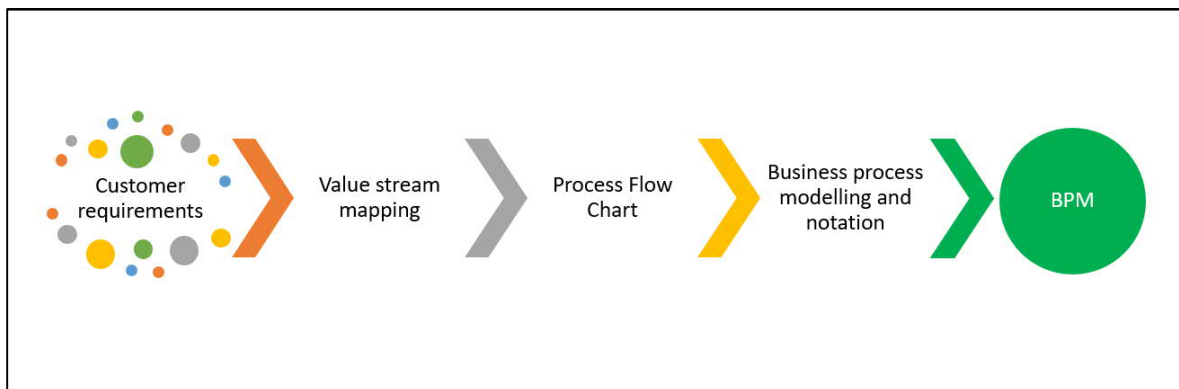
In this chapter I have researched the main theories related to the topic in this thesis. We have learned that a customer is a person or organization that purchases the goods or services of another company. If a company wants to fully understand the significance of its internal processes, it needs to look at its business through the eyes of the customers. The different customers have different needs and expectations. It is important to understand these needs and expectations before starting to manage the different requirements set out by the customer. Managing customer requirements in the end comes down to being able to collect, document, refine and manage changes of requirements, with the aim to satisfy the needs to the satisfaction of the customer.

Some key principles within lean manufacturing is to develop what is done for the customer, identifying value-added and non-value-added activities, with the goal to eliminate the non-value-added activities. Lean within an office environment can be more challenging as most tasks are performed by sending and receiving information through e-mails. This makes it difficult to determine precise lead times for specific tasks. Even if the task itself is challenging, eliminating waste in the office environment will create the business to be more resource efficient. Although, if a business becomes too lean with unnecessarily detailed processes, the business might lose its flexibility, might lead to longer lead times, and less engaged workers. The trick is to find the right level of detail.

Value stream mapping is one of the most common tools of lean and can be used to identify the current processes if they are unknown. Within a company, the employees should understand the processes in place, and how they relate to each other. One should understand that each process exists with the purpose of delivering a certain result and satisfy one or more requirements. This can easily be shown using process flow charts. A process flow chart explains what tasks and activities need to be performed from start to finish to achieve a satisfied customer. Another way to indicate what needs to happen from start to finish within a process is to define a Business Process Model by using the complex language BPMN that graphically explains business operation models. It does so by using Flow Objects, Connecting Objects, Swim lanes and Artefacts.

The conclusion of my research is that there is not one correct way to create and implement a BPM. However, in this thesis we could use the theories about customer requirements and

needs to identify what the customer expects. As illustrated in Figure 3, I will start with identifying customer requirements such as, agreed scope of supply, delivery times, requested documentation and more, to try and determine the expectations of the customer. Based on the expectations of the customer, we can together with the focus group, create a value stream map to follow the current process upstream to identify tasks, events and activities. Here added-value and non-added value tasks can be identified, with the goal to eliminate as many non-added value tasks as possible. When tasks, events and activities are known, we can create a process flow chart that should explain what needs to be done to achieve customer expectations. The process flow chart should also be able to illustrate how different tasks are depending on each other, and who the responsible person for a specific task is. Finally, using standardized BPMN to visualize the streamlined process, the process flow chart can be used as a foundation to create the final BPM for the focus group.



*Figure 3. Illustration of how different theories will be used when shaping the BPM.*

## 3 Methods

This chapter will focus on the methods used for creating a BPM for the focus group. Based on the theoretical research done for this thesis, it was concluded that there is not one correct way to develop a BPM for the focus group. All theories however mention the importance of identifying what the customer really wants, how the group are doing work today and visualizing how this is happening today.

### 3.1 Data and previous research

Within the company, process documentation has previously been created and implemented for the focus group. Attempts to improve processes have been made with the help of VSM sessions where both current state and future state maps have been drawn. This documentation has stood as a firm foundation in the creation of the BPM, and I personally have been part of the VSM initiatives as a participant. The biggest problems with the existing process documentation have been, that documentation has not been updated, the lack of details in documentation, and that no focus group has been assigned to keep working with updating process documentation. Different groups were assigned tasks after the previous VSM session attempt, but these tasks were not improving the processes of the focus group as such but focusing more on specific elements of the delivery projects, such as creating a standard portfolio for product offering.

One bottle-neck that was highlighted in the current way-of-working was the creation and delivery of documentation. This thesis has not focused on the individual process for creating and delivering documentation, as the engineering team working with the specific tasks have developed a 'Design work process'. This process should improve the creation and delivery of documentation. The 'Design work process' has been shared with me, so that I have been able to include it in the creation of a BPM for the focus group.

## 3.2 Interviews and work-shop

Based on my theoretical frame of reference, I needed to collect customer requirements, create a value stream map and a process flow chart before shaping the BPM. As already stated in this thesis, VSM is one of the most powerful lean tools, and a very effective way to involve the workers in improving the products and processes. Therefore, I decided that a workshop where both a value stream map and a process flow chart could be would be a good way to involve the focus group more in the shaping of the BPM.

To get a better understanding for the current situation in the focus group, an interview with a member of the management team was conducted at the start of the thesis. The details of the interview will not be included in this thesis as the interviewee desires to remain anonymous. In the interview it was however concluded that the focus group is part of a team experiencing so called “growth pain”. Due to a rapidly growing market demand the department has not been able to keep up the pace with updating relevant end-to-end process documentation. New roles and responsibility areas have emerged, and the team is forced to manage more and more projects, with shorter and shorter delivery time. All this while still pushing to deliver products of high quality. (Management Team Member, 2019)

Following the interview, a workshop with team members stationed at the main office location was arranged so that the focus group could be part of defining the BPM. According to Ljungberg & Larsson the term “process flow mapping” can arouse mixed feelings, which is why I decided to call it a workshop instead of a value stream mapping session. (Ljungberg & Larsson, 2019, p. 107) The workshop was arranged as a whole day session with the members of the focus group. The intention of the workshop was not to conduct just another value stream mapping session, but to further investigate the areas of responsibility within the team, who is doing what and when? Is there something that we are doing in our daily work which we are not focusing enough on? Or are we putting too much focus on things that bring no added value to the different stakeholders?

The workshop started with a small introduction discussing the different requirements, and expectations of the customer. It was agreed that we needed to include tasks for identification of project specific requirements and expectations. Based on known customer requirements we started identifying different events and activities occurring in order to achieve the requirements of the customer. In the VSM session we found areas where duplicate work is

performed, this came to be a very good example of a non-added value task. We also found missing tasks, that we agreed was needed to ensure customer requirements are followed. Having identified the main events and activities, the areas of responsibility was discussed. After having actively discussed the different areas of responsibility, a proposed way-of-working, in the form of a process flow chart, started taking form. This flow chart was going to be the rough draft of the BPM to come.

As all member of the focus group did not have the possibility to participate in the workshop, individual interviews were conducted with the remaining members. The work that was done during the workshop was carefully explained, and the members were asked to comment on their area of expertise. This way the majority of the team, and from all different positions from engineering, development, purchasing, project management and more, all had their say in shaping the business flow chart.

### 3.3 BPMN

Based on the research made for this thesis, BPMN could help visualize roles and responsibilities, as well as information flow and task definitions. BPMN is a fairly complex language complete with hundreds of symbols for illustrating processes within the company. I was not familiar with BPMN before this thesis, so I had to learn the basics of the language and quickly learned that a BPM for the focus group could be realized in MS Visio using the built in BPMN tools. The company already had instructions in place for how internal processes should be created in MS Visio, in order to align with other processes existing within the company, where the company's own symbols and descriptions were used.

Once the business flow chart was ready, I started working on a draft of the BPM in MS Excel format. I chose MS Excel for drafting as it is one of the most usable tools when needing to highlight and shift between specific cells. In this case the cells represented individual tasks to be performed. When the draft was ready, I shifted to using MS Visio for creation of the final product, the BPM for the focus group. The complete BPM will be presented in the Results chapter.



### 3.4 Implementation

Implementation of the newly created BPM has been done by publishing the business process to the daily tool used for handling customer delivery projects. A tool all members of the focus group have access to. The BPM has been introduced to the focus group where each and every step has been shown and described in detailed. To fully be able to implement a business process like the one created will be challenging, time consuming, and will require close follow-up. And as mentioned in the introduction, there are certain limitations within the company that restricts me from fully publishing the BPM to the company's portals. Therefor the results will be presented before the BPM is fully operational. Once my thesis is done, the results will be handed over to the department responsible for implementing processes. I will be assisting in the implementation itself to make sure all parts of the BPM are understood and visualized correctly.

### 3.5 Conclusion

The vision the focus group had was clear from the beginning, there was an urgent need to develop work processes based on the needs of the customer. The biggest concern was to agree on a way of working that was closest to the reality. As one can imagine, different customers have different needs. Creating a BPM with the mindset of satisfying all different customer needs, will simply not be possible. Therefore, continuous communication is always going to be important when creating a BPM. Finding the correct level of detail, and not locking any process down, will help the group stay flexible within the process in their daily work.

After a closer look upon the different methods available for creating a Business Process Model, I choose to start with mapping the current workflow. Based on the mapped workflow, I could create a BPM using the theories of BPMN in MS Visio software. I needed to learn the basics of BPMN, and I had no previous experience working with MS Visio. Once I could understand the basics of BPMN, this was by far be the best option for me personally to create a current state workflow, complete with responsibility areas and tasks, divided into different steps of the process. Although the company had its own instructions in place for process development, I opted not to follow the guidelines provided. The main reason I did not opt

for the company way of working, was that it does not go hand in hand with the theories surrounding Business Process Modelling. The company uses its own symbols, with their own descriptions, that are tailored to fit the best interest of the company. Instead I created, in my own opinion, a very basic BPM which can be updated and used for further development.

## 4 Results

In this chapter I will present the results of my thesis work. I will present the different steps in the business process, while giving a description to why the process has been shaped as shown in the results. The process itself can be accessed by all team members of the focus group, but members will not be able to make changes to the process without manager approval.

### 4.1 Business Process Model introduction

When accessing the BPM, the first thing the user will see is an overview of the different steps in a typical customer delivery project. This main process is built up of several sub-processes that can be opened for further details. Internally, the company is using what is referred to as a gate model. This gate model is complete with project specific gates and milestones that needs to be achieved within a project. Each step, or sub-process, in the BPM overview has been named in accordance with company processes that indicate specific gates or milestones. To reach a specific gate or milestone, each task before and in the desired process needs to be accomplished. The issue faced when combining the company gate model and the created BPM, was that the gate model uses more gates and milestones than required by the BPM. This results in that there appears to be some missing steps in the BPM, when the fact is that they are not missing, they are simply not applicable to the BPM of the focus group. During the workshop specific gates and milestones were selected to be included in the BPM as separate sub-processes. They are as follows:

- G0 – Sales Initiation
- G1 – Decision to develop detailed offer
- MS0 – Offer review / Tailor offer
- MS1 – Contract Review
- MS2 – Contract Signing
- MS3 – Sales Order Review
- MS5B – Detailed Engineering Start
- MS5C – Product Design Completed
- MS5D – Start Production

- MS6A – Product Acceptance Test
- MS6B – Ex Works
- MS7 – Commissioning Kick-off
- G3 – Start of Warranty Period
- G4 – Close Project

By clicking on the gates and milestones visualized with task boxes seen in Figure 4, the user can navigate in the BPM. The overview of the complete BPM is also called the main page, or simply ‘Main’. To fully explain the details of the BPM each gate or milestone will be explained in the text to follow.

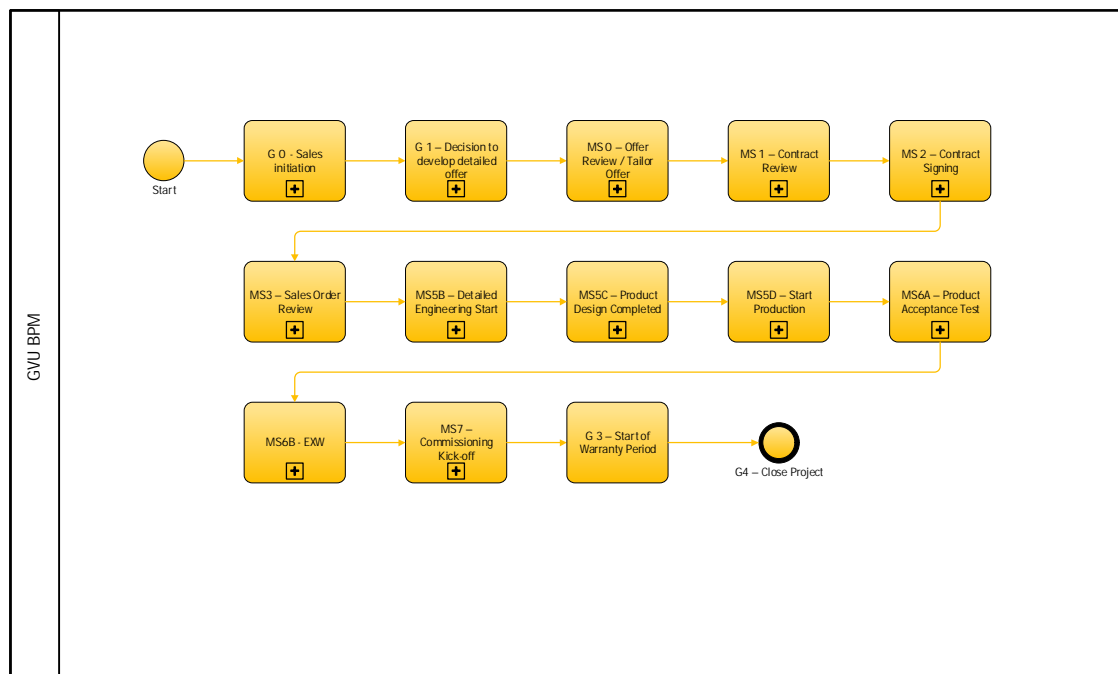


Figure 4. Overview of active BPM.

By clicking on the first task box after project start, the user will be directed to a new page called G0 – Sales initiation, which can be seen in Figure 5. This page shows the specific sub-process for how a project is initiated. The initiation comes from the customer, who sends a request for a quotation to the sales representant for the focus group. After the request has been received, the first sub-process, G0, is complete. The user can now navigate back to the main page by clicking on the ‘Back to Main’ button.

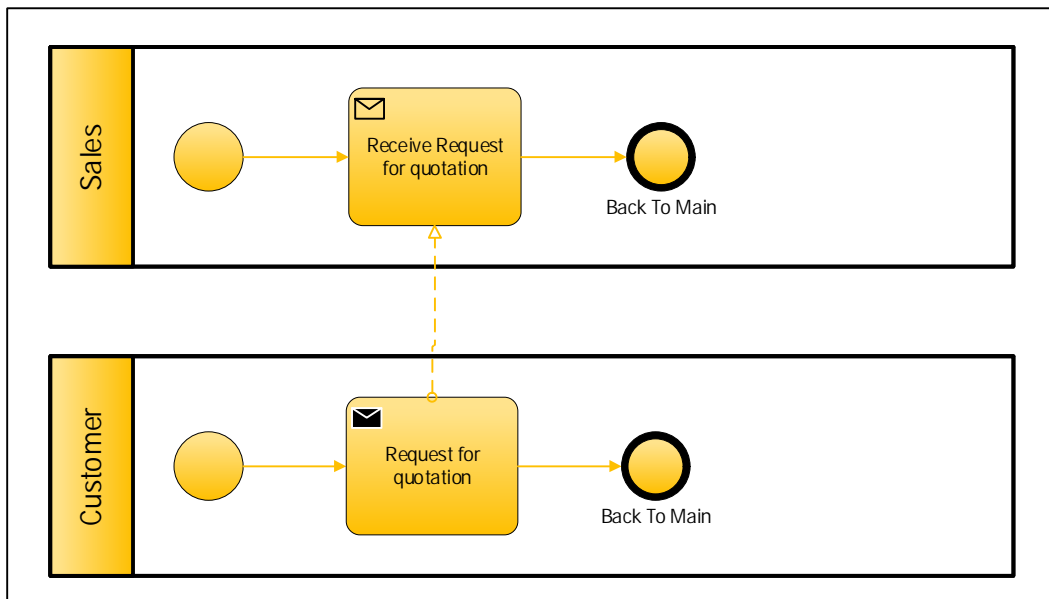


Figure 5. Gate 0 - Sales initiation.

The next process is another gate, G1 – Decision to develop detailed offer, which can be seen in Figure 6. In this step the sales representative should take a decision based on the current and future situation. Is there production capacity available for such a project to be performed? It is important to already in this stage identify the requirements of the customer. Is it an “easy project” or are the requirements too complex? Do we accept the request and send a quotation, or do we have to decline the request? When the decision is made, the user can navigate back to the main page.

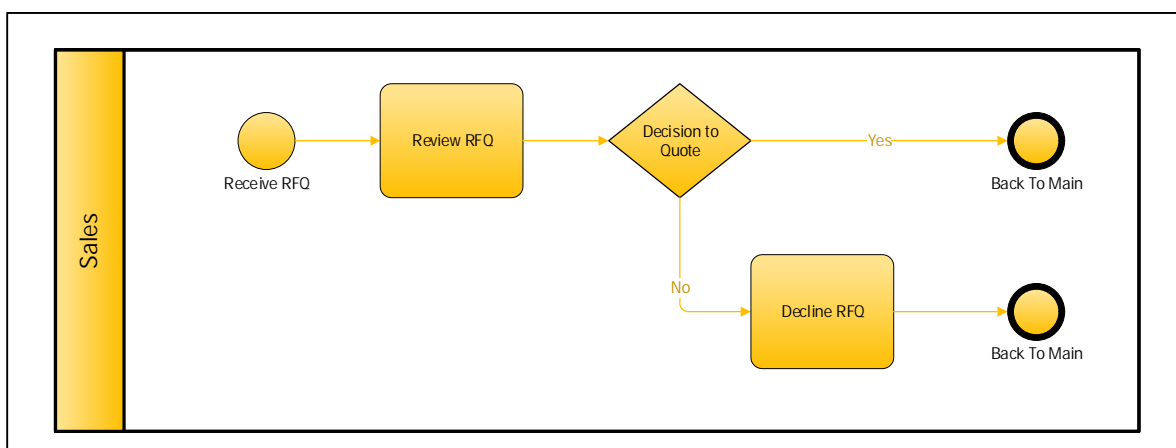


Figure 6. G1 - Decision to develop detailed offer.

If the outcome of G1 was that a quotation is to be sent as a reply to the customer request, the process moves on the next step which is milestone MS0 – Offer review / Tailor offer (Figure 7). In this step the sales representant creates a quotation based on the customer request received in G0 – Sales initiation.

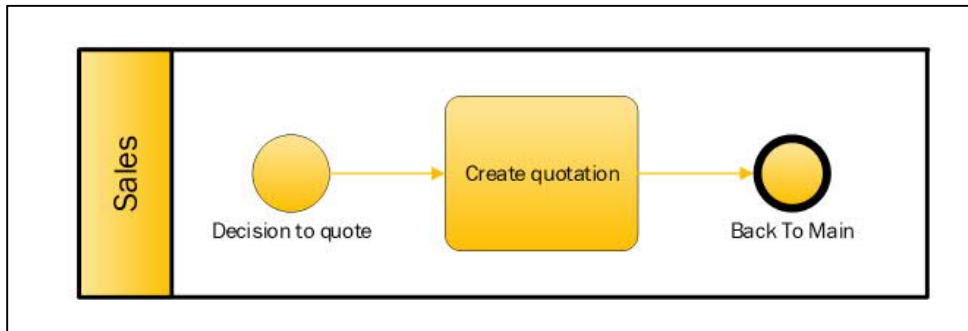


Figure 7. MS0 - Offer review / Tailor Offer.

When the quotation has been made in MS0. The quotation will be sent to the customer in milestone MS1 – Contract review (Figure 8). When the customer receives the quotation, it is highly probable that some sort of negotiation will be initiated. By clicking on the sub-process ‘Review Quotation’, the user will be guided to a new page that shows a typical process when negotiating a contract with a customer.

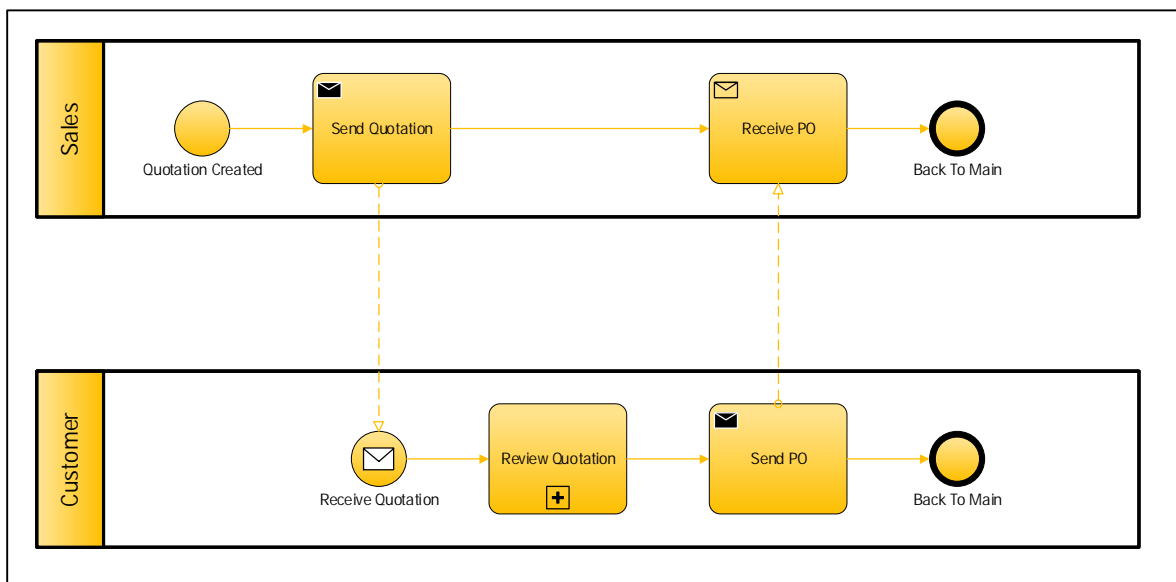


Figure 8. MS1 - Contract review.

A typical contract negotiation in a case like ours, where the customer has initiated the project, usually starts with the customer reviewing the sent quotation. If the quotation does not live up to the expectations of the customer, the customer will, based on experience, issue a request for change in the quotation. The process becomes a loop that continues until both stakeholders have come to an agreement where the customer can accept the quotation. This loop is visualized in Figure 9. It is again important that all involved stakeholders understand the requirements set out in the project. When the customer accepts the quotation, they will have to issue an official purchase order.

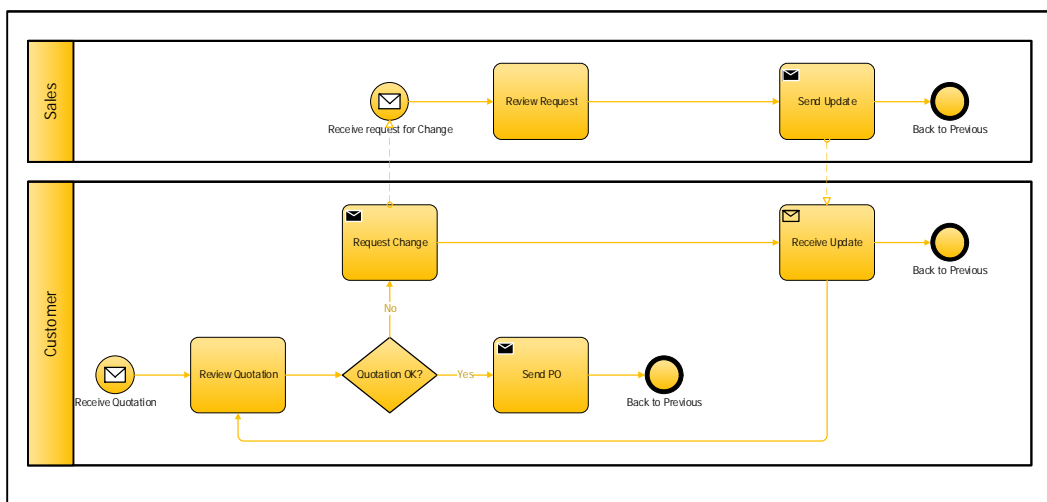


Figure 9. MS1 - Contract negotiation.

When the purchase order is received it marks the start of the next milestone, MS2 – Contract signing (Figure 10). In this step the purchase order is signed and sent back to the customer as an acknowledgement of order. When the purchase order has been signed, the sales representant need to start creating a notice of contract, that will later be distributed as an official announcement of a new project.

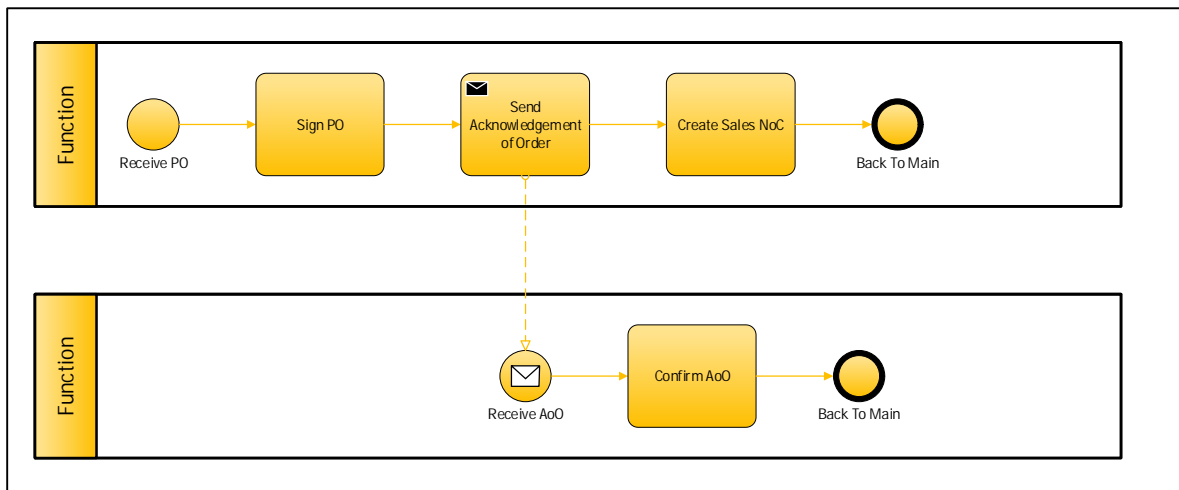


Figure 10. MS2 - Contract Signing.

The next step in the BPM is milestone MS3 – Sales order review, which is illustrated in Figure 11. The Notice of contract is distributed to the project creation team, which is responsible for the creation of the work breakdown structure, WBS, of the project in the company’s internal systems. An invitation to join a sales order review (SOR) meeting is sent to all involved stakeholders internally. In the SOR meeting, the agreed requirements are shared with involved stakeholders. When the SOR meeting has been held, it marks the end of milestone 3.

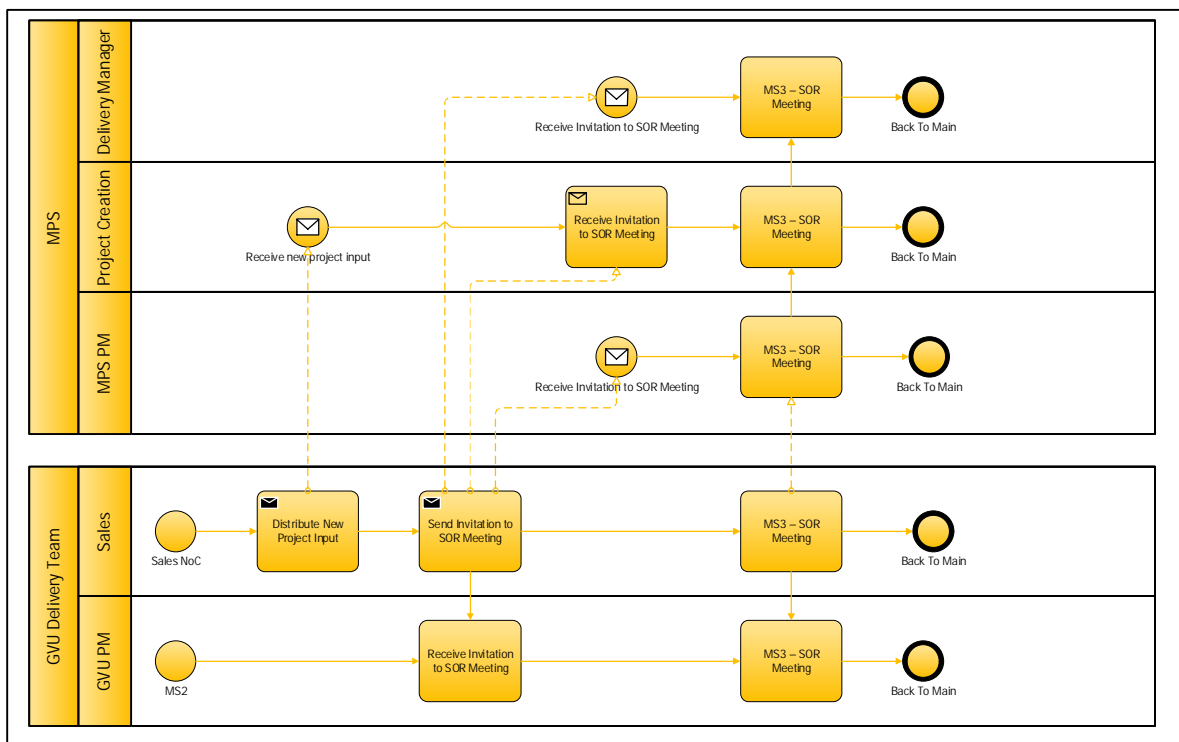


Figure 11. MS3 - Sales order review.



After the sales order review meeting, the next step in the BPM starts, MS5B – Detailed engineering start (Figure 12). The Project creation team finalizes the notice of contract and opens the project WBS. When the WBS is open the project creation team sends out the notice of contract and the involved stakeholders are informed by receiving an official announcement of a new project. Here the distribution of contractual documentation has been included as a task, to ensure the project team get the information needed for project delivery as early as possible. At this stage a project engineer or project manager is appointed who will be responsible for the product delivery.

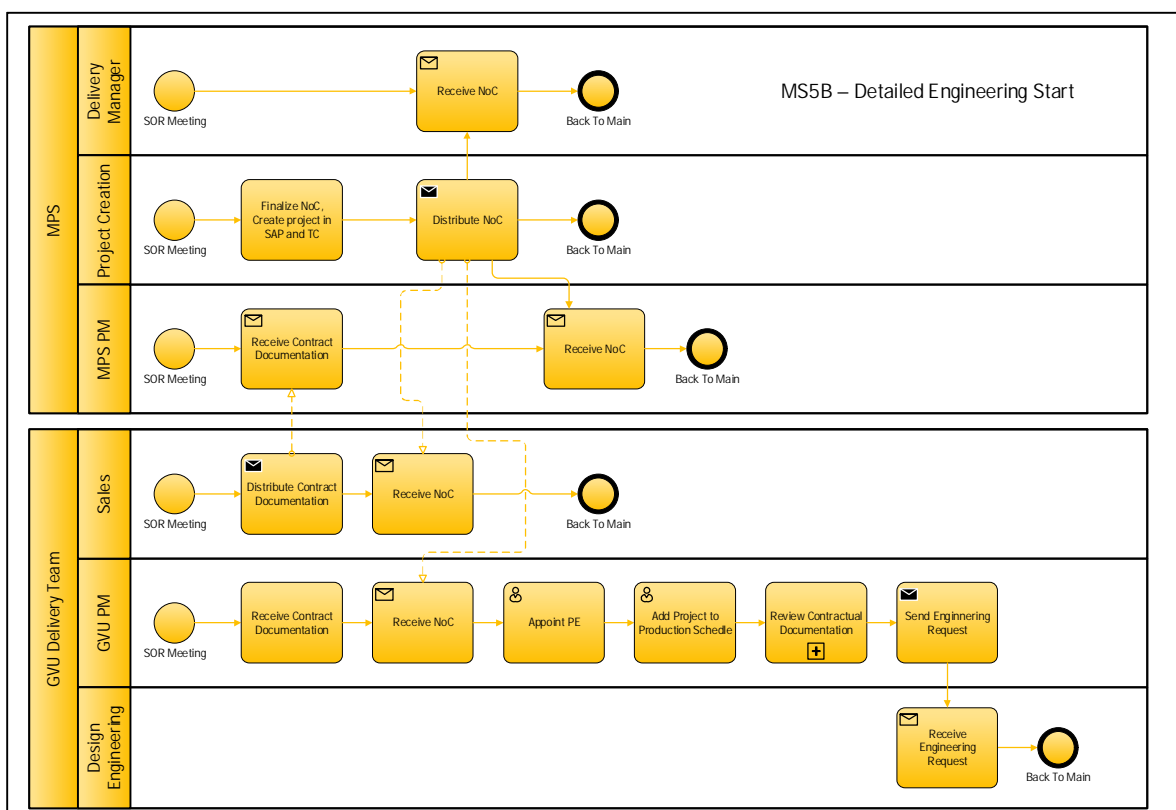


Figure 12. MS5B - Detailed Engineering Start.

The project responsible reviews the contractual documentation according to the steps in the sub-process seen in Figure 13. Previously this has not been an official task. Now it ensures, that if any input is still needed from the customer related to the project, it is communicated in a relatively early stage of the project. A checklist, displayed in Figure 14, is available to ensure that all required contractual information is checked. The communication between project management and the customer in this sub-process stays active until all the required

information is available. Once all needed information has been received, an engineering request can be sent out to the engineering team.

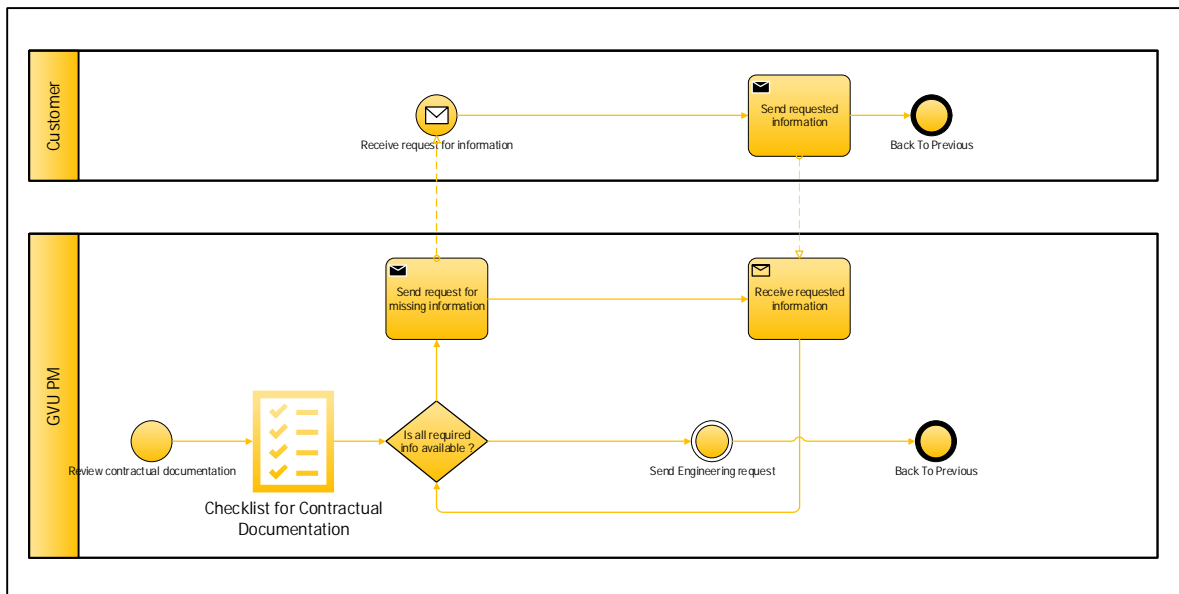


Figure 13. Review contractual documentation.

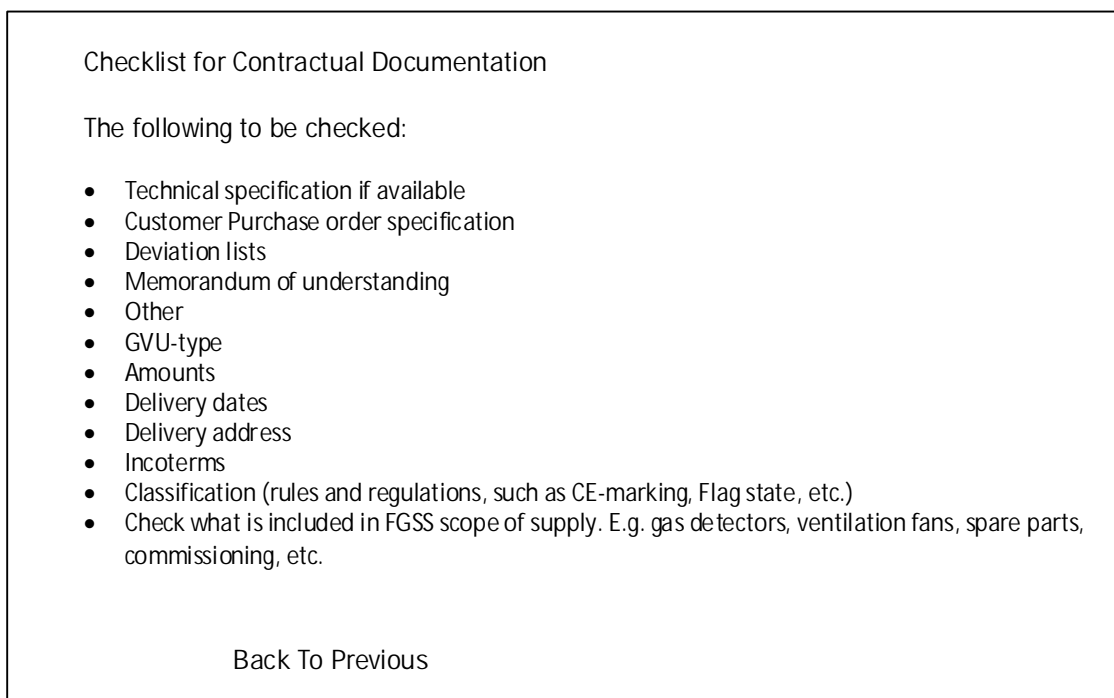


Figure 14. Checklist for review of contractual documentation.

When the engineering request has been sent, the following milestone, MS5C – Product design completed is initiated. The engineering team receives the engineering request and initiates the respective sub-process for engineering of mechanical and electrical documentation as seen in Figure 15.

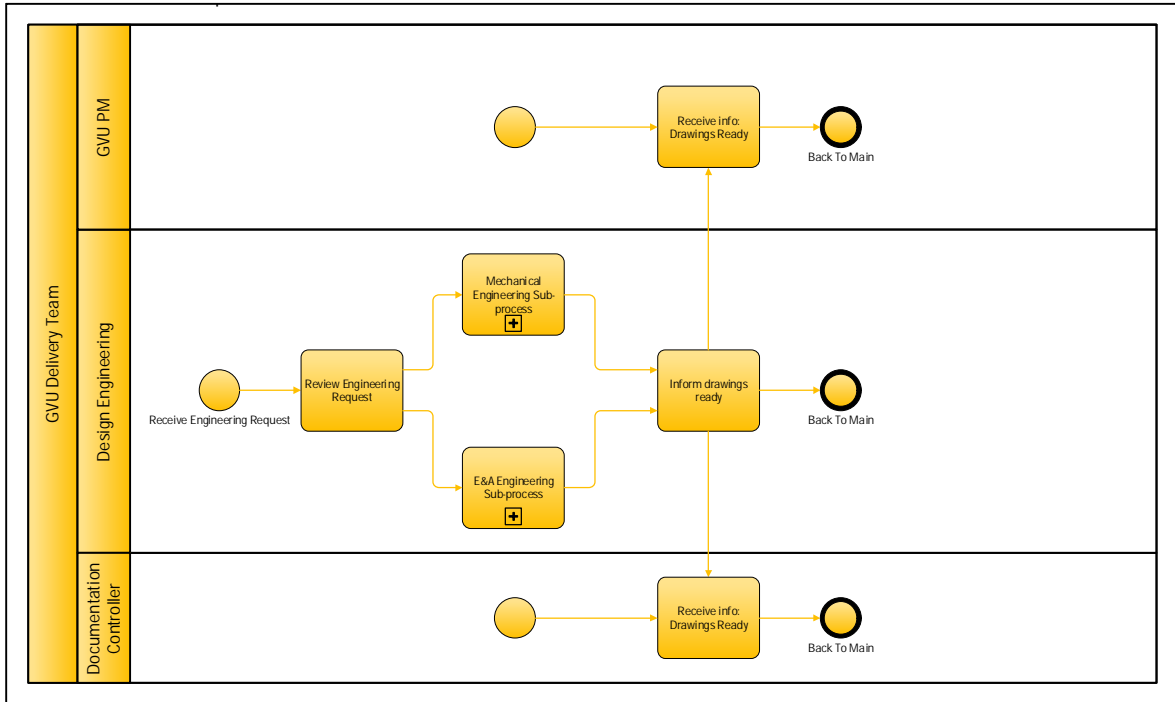


Figure 15. MS5C - Product design completed.

The main task of the Engineering sub-processes, or 'Design Work Process' is to ensure that drawings are made according to the customer requirements. Each drawing made will have to be checked and approved before it can be sent to the customer. If any errors are found in the checking or approval tasks, the drawing will need to be corrected as shown in figure 16. To ensure good quality of documentation, the engineering sub-processes has been re-designed to ensure that as many documentation related errors as possible are eliminated. Over time the overall delivery of documentation will improve.

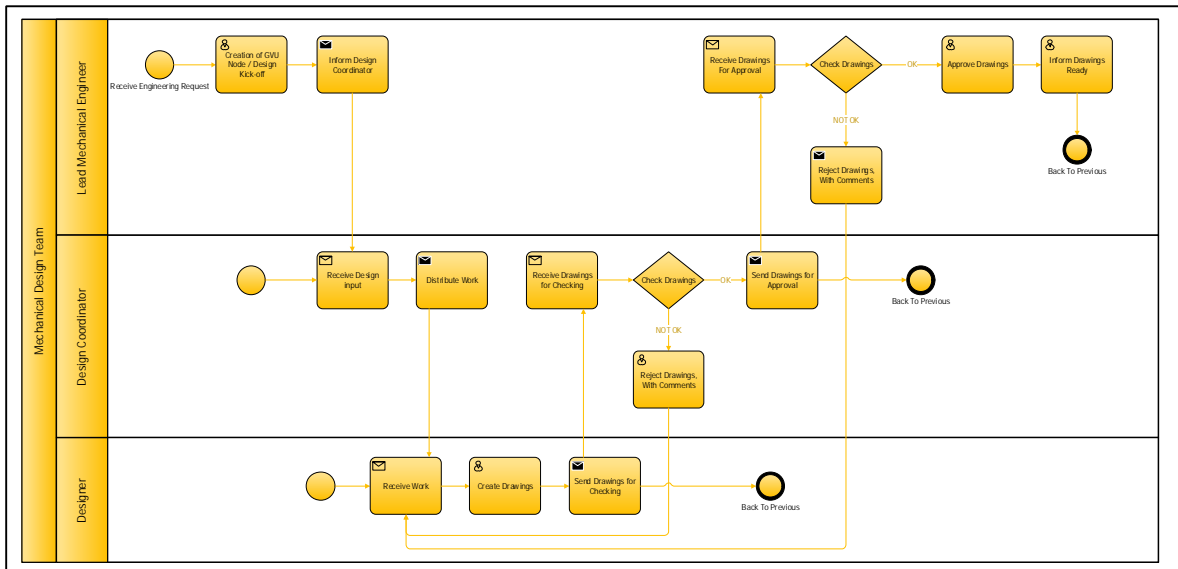


Figure 16. Engineering sub-process "Design Work Process".

When the product design has been completed, the BPM moves on to MS5D – Start Production (Figure 17). This is one of the most important milestones as this is where the project responsible will be able to estimate a final delivery time of the product. Based on the estimates, the project responsible will know if the project is on schedule or not. The main task of MS5D is to distribute the project specific documentation and start procurement. The distribution of project specific documentation has been included as a separate task. This should further improve the communication between stakeholders, eliminating possible late comments or late requests for change, that might cause delays in the project delivery.

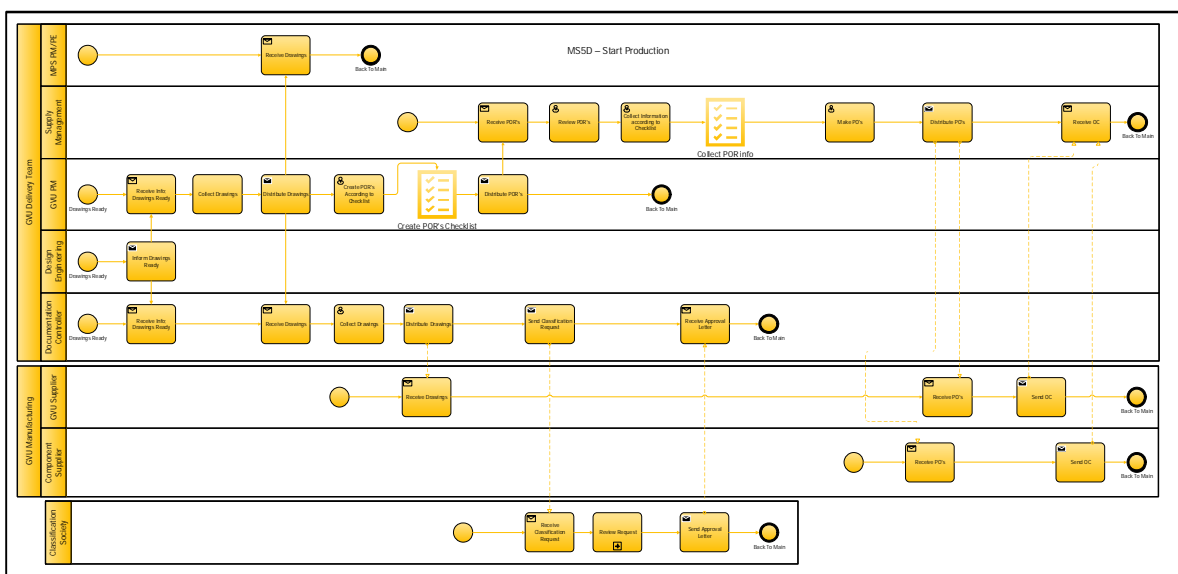


Figure 17. MS5D - Start production

Procurement is done by creating purchase order requisitions, or POR's, according to the checklist available in the BPM (Figure 18). Once the POR's have been made, they are sent to a purchaser who then creates and issues the purchase orders, PO's, required based on the received POR's.

Check the following when creating POR's:

- Material Number
- Item name
- Purchasing Group
- Vendor
- Amounts
- Requested dates
- Class info such as: Yard, Hull No., IMO Number, Vessel type
- Flow meter parameter settings for FM POR if FM included in FGSS Scope of supply
- Painting requirements
- Is this a repeat project, part of series or completely new project?
- Unloading point
- Related drawings
- Related offers
- Include Serial numbers of GUV's in POR Long Text

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*Figure 18. Checklist for Purchase order requisition creation.*

The purchaser has their own checklist for collecting certain information for the creation of PO's (Figure 19). Once created, the PO's are sent to the different suppliers and sub-suppliers. The suppliers and sub-suppliers confirm the orders by sending an official order confirmation, OC, to the purchaser where order, quantity, price, delivery time and other requirements are confirmed.

The Following information to be collected:

- Check input e-mail for:
- GUV manufacturer
- Control cabinet manufacturer
- Requested dates
- POR numbers
- Class info such as: Yard, Hull No., IMO Number, Vessel type
- Control cabinet drawing
- Part list
- Network and Activity for classification of components
- Special settings for Flow meter
- Painting requirements
- Is this a repeat project, part of series or completely new project?

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*Figure 19. Checklist for collecting information for purchase order creation.*

For marine projects, safety is always a top priority. To ensure safe operation in the future, the product needs to pass an inspection by a selected classification society. For this inspection to be possible, a request needs to be sent to the classification society, who will review the request as shown in Figure 20. This has been implemented as a completely new sub-process to ensure all projects are made in accordance with international rules and regulations, as well as in accordance with selected classification society's specific rules and regulations. Approval by the classification society is critical, as milestone MS6A – Product acceptance test cannot be performed without it. Official approval is provided in the form of an approval letter that is to be distributed to the assembler, and be made available to the inspector from the classification society during the Factory Acceptance Test.

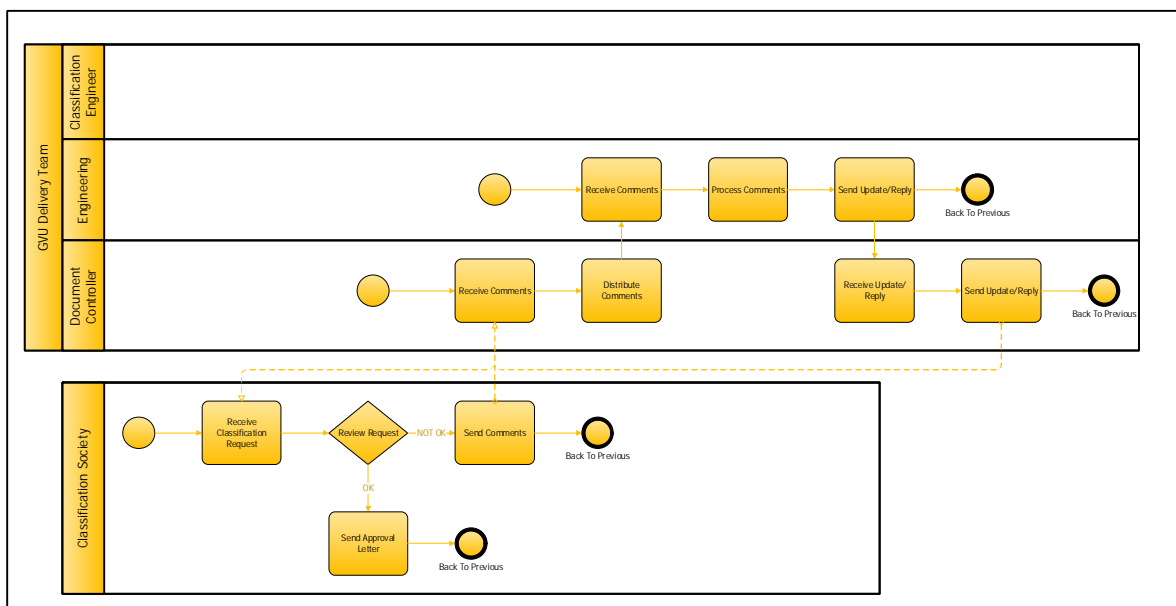


Figure 20. Classification request sub-process.

When the purchaser has received order confirmations it marks the end of MS5D, and the start of milestone MS6A – product acceptance test which can be seen in Figure 21. The most important task in this milestone is to continuously follow up on the manufacturing of the product, hence frequent production follow-up meetings are arranged. Only one meeting is displayed in the BPM, but meetings are reoccurring at a minimum pace of once a month. When manufacturing is done and the product is ready, a factory acceptance test, FAT, for the product is held where the classification society participates to make sure the product has been made in accordance with the previously sent approval letter. When a successful FAT has been held, the MS6A milestone has been achieved.

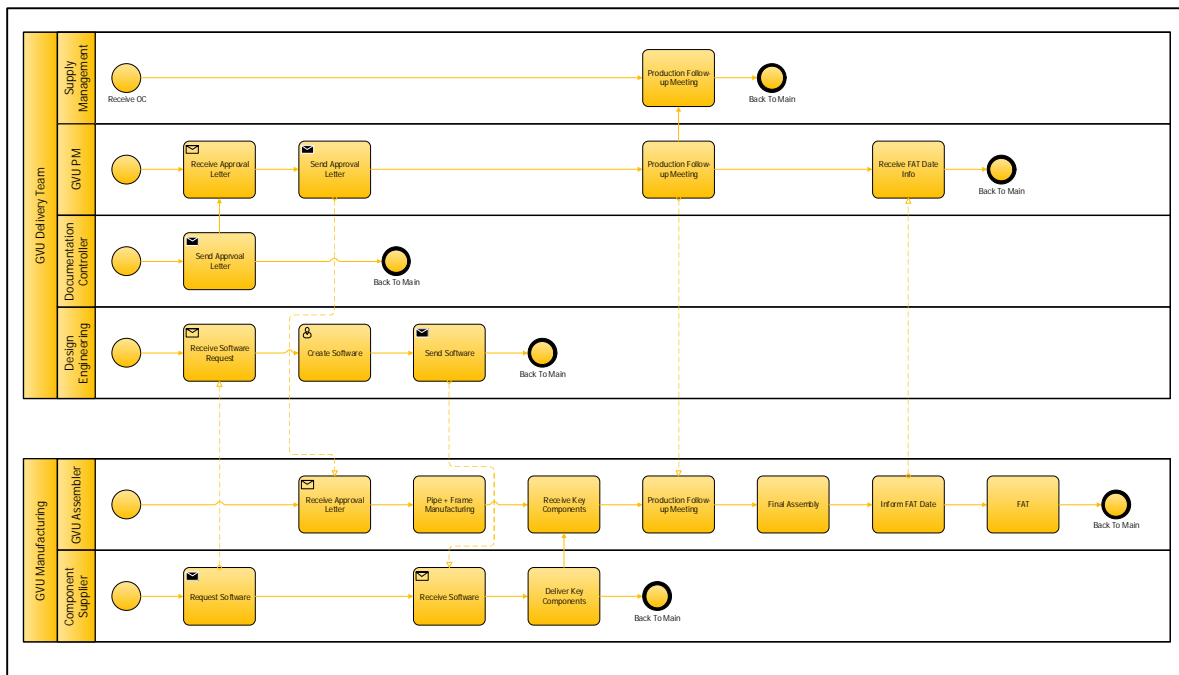


Figure 21. MS6A - Product acceptance test.

The successful FAT marks the start of MS6B – Ex Works. Between the FAT and Ex Works the products are packed in wooden boxes. The boxes are weighed and measured, and the dimensions are informed to supply management who then creates a pack list for the product, as seen in Figure 22. When the goods are packed, and the pack list is received the product is ready to be shipped to a consolidation point. Now MS6B – Ex Works has been achieved.

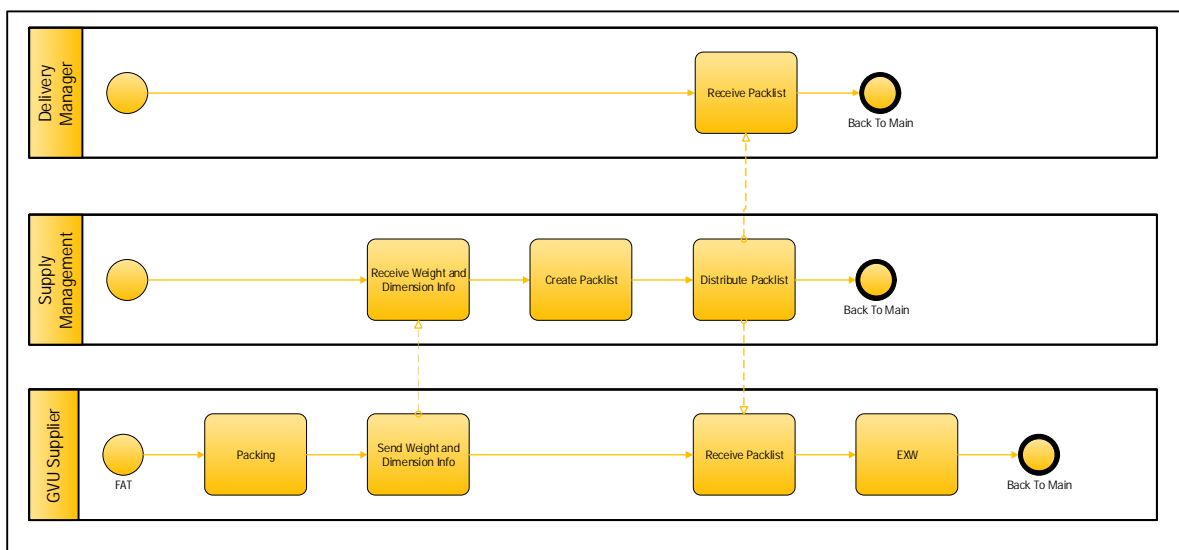


Figure 22. MS6B - Ex Works

After Ex Works, there is still tasks to be performed in milestone MS7 – Commissioning kick-off. In case the project is for a 2-stroke engine licensor, service notifications are to be made for ordering of spare parts catalogues and for commissioning of the product onboard the vessel as seen in Figure 23. If, however, the project is for a 4-stroke project, the main contracting party will handle ordering of spare parts catalogues and commissioning. In this milestone, purchase orders are to be closed when shipment has been done, and final documentation is to be delivered to the customer. Some information or drawings needed for final documentation, might be missing so that needs to be informed to the team creating the final documentation package. Once final documentation has been delivered, MS7 – Commissioning kick-off has been achieved.

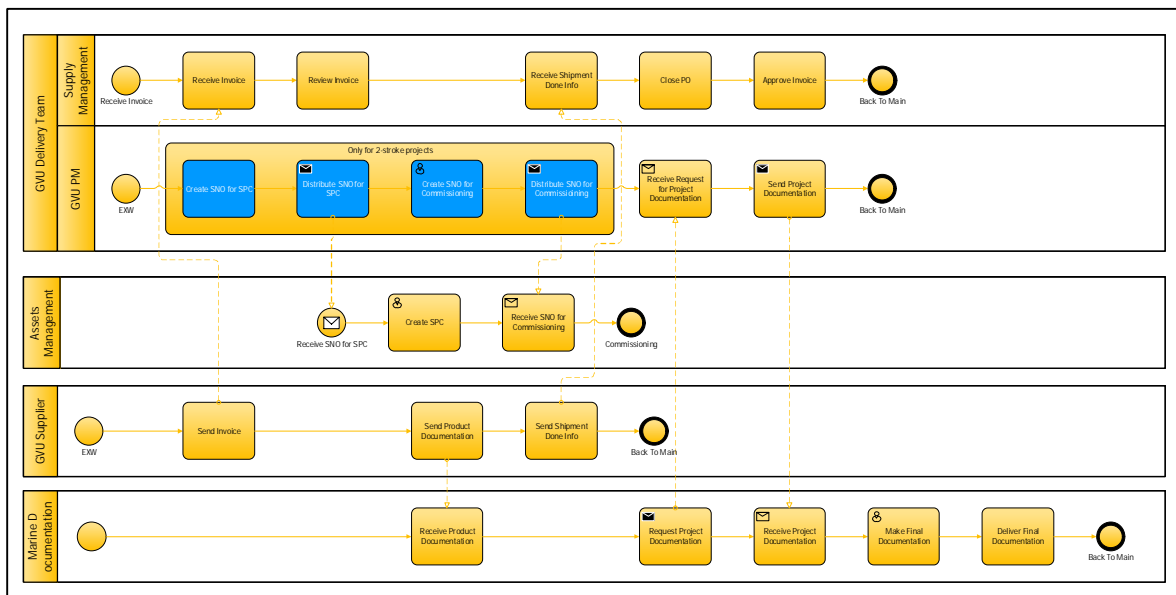


Figure 23. MS7 - Commissioning kick-off.

The next step in the process is gate G3 – Start of Warranty. In this gate approval of installation is received and warranty period is confirmed according to contractual agreements. Once the warranty period is over the project can be closed. Closing the project also indicates that the final gate has been reached, G4 – Close Project.

## 4.2 Implementation and continuous update

The BPM is effective immediately and has been introduced and made available to the focus group through the most commonly used communication channel within the focus group. The



focus group is using MS Teams application for communication and follow-up of projects. Introduction meetings to the model will continue to be held frequently in the beginning to further evaluate if, and how the BPM is working, and if necessary, changes will have to be made. The BPM can easily be accessed without the need for special software, as it is stored on a server within the MS Teams application. A master version of the BPM is also stored in the documentation controlling application M-files, used by the company. It is important that the BPM is continuously developed and updated. The process might need fine tuning and there is always a possibility that the requirements of the customer change, which then will also lead to changes. When making updates, the master version stored in M-files should be revised. After having revised the master version in M-files, the version stored MS Teams should be updated accordingly.

The BPM has been handed over to the management team of the department and will be implemented into the complete BPM made for the company. As I do not have access to perform this implementation, the final implementation of the BPM will be performed by the management team. I will be in an assisting role to make sure all parts of the BPM are visualized correctly based on my research. Once this implementation is done, the master stored in M-files will have to be replaced with the latest version.

## 5 Conclusion

The main purpose of this thesis was to create and implement a Business Process Model and update the current end-to-end process for customer delivery projects. The purpose has been achieved, as the result of this thesis is a first version of a newly implemented BPM for the focus group. The BPM visualizes the end-to-end process of a typical customer delivery project. It shows the different areas of responsibility for different tasks and activities within the project, both within and to some extent, outside of the focus group. During the process of designing the BPM, the focus group has agreed on what is thought to currently be the more correct way of working.

The second purpose was to provide a better understanding for the complete process and find areas where lead time could be shortened, costs lowered and quality improved. If the BPM can be followed in the future, the purpose is achieved as the BPM is thought to improve the overall delivery of the project. To ensure customer requirements and expectations are achieved, the requirements are checked and discussed several times during the project when the BPM is followed. With the agreed way of working presented in the results, the project team is now aiming towards delivering documentation of better quality and within given time frame. Delivering project related documentation of better quality on time, should automatically reduce number of late comments and changes related to project specific design. By following the BPM, the risk of not being able to deliver projects on time is smaller. Resulting in lowered costs for transportation, as the focus group hope to be able to avoid expensive airfreight costs.

### 5.1 Discussion

Even though the focus area in this thesis was clearly limited, it was still quite a task to create a BPM for the focus group, starting from sales initiation to delivering the product, and finally closing the project. Due to the amount of work needed I propose that it would be better if there was a dedicated team developing a BPM within the company. There are stages in creating the BPM that requires some discussion before a final decision can be taken. It is here where I have had great support from my colleagues in discussing how the BPM should be designed to reflect reality. If the BPM is compared to how work was carried out before

this thesis, there are tasks that have been added to ensure good quality, such as using checklist to perform different tasks. Other tasks might have been removed or transferred to make the project more lean. An example of this is duplicate work that several persons used to perform. In the new BPM it is enough if one person performs a specific task.

Although the purpose of this thesis is believed to have been achieved, it still comes down to one of the biggest questions or concerns related to the newly implemented BPM. Will the focus group start to follow the model or not? If they start following the model, how will they react to possible changes in the ways of working? As explained in this thesis it is common that individuals face changes to their daily work with resistance. I believe that the focus group in this thesis will accept possible changes and start to follow the BPM closely, but there is always a risk that the focus group will draw back to its old habits. To prevent this from happening, close follow-up will be necessary, and employees should be encouraged to follow the model. However, it should not be necessary to strictly follow the BPM, as the focus group need to stay flexible and able to quickly react to possible changes in market or customer demands. The BPM should stand as a support pillar and help the focus group understand the end-to-end process.

As international rules and regulations, customer requirements and the focus group itself will keep changing in the future, it is important to continuously update and develop the BPM to reflect reality. New roles might emerge with new responsibilities, and possible organisational changes might force other changes to the focus group. If the BPM is kept up to date, it will be easier to react to possible changes.

## 5.2 Further research

Currently there are ongoing developments within the company to introduce a new tool for general project follow-up called Cock-pit. The new tool is meant to display different gates and milestones within a project. I would propose that further research is done to see how the developed BPM could best be included or embedded in Cock-pit. Generally, the use of gates and milestones should be revisited, to research the use of these. As mentioned in this thesis, the focus group are not able to utilize all available gates and milestones as all are not applicable for the focus group. The use of milestones and their naming could be changed to better reflect the reality.

KPI's have not been included in the BPM as the main purpose is to visualize the end-to-end process. I propose that KPI's could be researched and included in the BPM. A decision should be taken to what KPI's should be included. What should be measured? Within the office environment it might be difficult to include specific KPI's to processes, but at least lead times for different activities and events should be monitored.

Finally I would like to thank my supervisor at Novia University of Applied Sciences, Mr. Roger Nylund, for his valuable feedback and continuous support. I would also like to thank the focus group of this thesis for their support and shown interest in the development of the BPM. Without your involvement it would not have been possible to create and implement a working BPM. Overall it has been an interesting and educative project, where I have learned a lot about different processes within the company and how these depend on both internal and external factors. Still the project is not finished, as we together with the focus group, should thrive for continues improvement and should keep updating the model as the market and its demands changes.

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



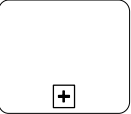
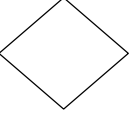
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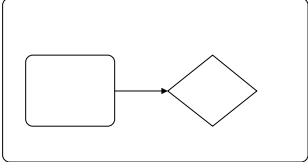
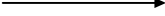
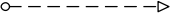




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## Appendix I – List of common BPMN symbols

Symbol	Name	Description
	Swimlane	Swimlanes organizes activities within a pool.
	Pool	A Pool consist of several swimlanes.
	Start Event	The Start Event indicates where a process will start.
	Intermediate Event	Intermediate Events occur during the process.
	End Event	The End Event indicates where a process will end.
	Task	A Task is an activity that is included within a process.
	Collapsed Sub-Process	A Collapsed Sub-Process is an activity whose details are not visible in the diagram.
	Gateway	Gateways control divergence and convergence of the sequence flow and often model decisions.



	<p><b>Expanded Sub-Process</b></p>	<p>An expanded Sub-Process is an activity whose details are visible within its boundaries.</p>
	<p><b>Sequence Flow</b></p>	<p>A sequence flow shows the order in which activities in a process will occur.</p>
	<p><b>Message Flow</b></p>	<p>Message flow is used to show communication between two organizations.</p>
	<p><b>Association</b></p>	<p>Association is used to show relationship between information and flow objects.</p>
	<p><b>Data Object</b></p>	<p>Data objects provide information on the data created or used by activities in the process.</p>
	<p><b>Message</b></p>	<p>Represents a communication between two participants.</p>
	<p><b>Data Store</b></p>	<p>Data Store provides a mechanism for tasks or sub-processes to retrieve or update stored information that will persist after the process is complete.</p>