# How to Optimize the Way of Working Within Commissioning

Daniel Åbonde

**BACHELOR'S THESIS**

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**Abstract**

This thesis is made on behalf of Wärtsilä Marine Solutions with the purpose of improving the way of working within the commissioning department, both for the commissioning coordination team and the site management team.

The methods used in this thesis are a Value Stream Map and a RACI matrix. The Value Stream Map analyzes the part ordering process within commissioning. More specific the process from that a Wärtsilä Service Engineer identifies a part that needs to be replaced, until the moment that the spares have arrived at the destination and have been signed at the receiving end. After the signing the engineer can replace the part. The value stream map then ends when the signing has been done.

The RACI matrix is used to map the responsibilities related to the commissioning department. In the matrix it is also stated who is accountable, consulted and informed in the different tasks.  The matrix does not only show the current way of working but also a new way of working which will add more value to the customer.

The result of the thesis explains different proposals to improve the spare part ordering process and how the rearranging supported by the RACI will improve the process. The result of the RACI matrix will explain how the matrix works and, in the conclusion, it will be explained how Wärtsilä will use the matrix.

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**EXAMENSARBETE**

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Titel:  Optimera arbetssättet vid idriftsättning

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**Abstrakt**

Detta examensarbete är gjort på uppdrag av Wärtsilä Marine Solutions med syftet att förbättra arbetsättet hos idriftsättningsavdelningen. Förbättringarna gäller både idriftsättnignskoordinatorerna och Wärtsiläs chefer på varvet.

Metoderna som använts i detta examensarbete är en värdeflödesanalys och en RACI-matris. Värdeflödesanalysen analyserar hur man beställer reservdelar under idriftsättnings-processen. Mer specifict, processen från att en Wärtsilä service ingenjör identiferar en del som behöver bytas ut, tills att delen som identifierades har skickats till destinationen, blivit mottagen och signerad. Efter att delen har blivit signerad vid destinationen kan delen bytas ut. Värdeflödesanalysen slutar när delarna blivit signerade vid destinationen.

RACI-matrisen används för att kartlägga de ansvarsområden som är relaterade till idrifsättningen. I matrisen anges också vem som bär ansvaret, vem som gör uppgiften, vem som kan konsulteras och vem som skall bli informerad. Matrisen visar inte bara det nuvarande sättet att arbeta utan den visar också det nya arbetssättet som kommer att ge mer värde till kunderna.

Resultatet av avhandlingen förklarar olika förslag för att förbättra reservdelsbeställningen och hur omändringarna som stöds av RACIn kommer att förbättra processen. Resultatet av RACI-matrisen kommer att förklara hur matrisen fungerar och i slutändan kommer det även förklaras hur Wärtsilä kommer att använda matrisen.

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# List of Abbreviations

CM          Commissioning Manager

CC          Commissioning Coordinator

SM          Site Manager

PM          Project Manager

PE          Project Engineer

FS          Field Service

Resource      A traveling service engineer within the Wärtsilä services network.

SAP          An ERP (Enterprise resource planning) that is used within Wärtsilä.

EGC          Exhaust Gas Cleaning

VSM          Value Stream Map

MS Visio      Microsoft Visio

NC          Non-Conformity

NBH          Non-Conformity before handover

# 1 Introduction

This chapter will present the background and purpose of the thesis, it will also include the issues, scope and a disposition of the thesis explaining every chapter of the thesis.

## 1.1 Background

The thesis is made on behalf of Wärtsilä Marine solutions and more specific Marine Commissioning, which is part of the Wärtsilä corporation. To explain commissioning in one sentence it would be following: Commissioning is the phase between that the product has been delivered to a shipyard until it has been handed over to the customer.

The commissioning function has long been a bit of a challenge for Wärtsilä and has not presented its best in financial and customer satisfaction. There has already been significant improvements in the past 5 years in both of the topics just mentioned, but it is believed that more can be done to improve. In 2017 there was a change in the organization where the commissioning coordination team was moved from the service business to the marine business in order for the Commissioning Manager to work closer to the customer. This thesis is part of the next steps to develop commissioning with one of the targets to be even more customer friendly. Commissioning has also been identified by marine solutions upper management as one of the key areas that needs to be improved for their long-term strategy.

The visions that Wärtsilä has for commissioning is making commissioning faster, more cost-effective, have a higher customer satisfaction, get an easier life for everyone involved and a better success rate on each project.

The background of the thesis is based on a project that will make commissioning more reliable and bring the customer satisfaction forward. The projects name is Alexander and is made up by the Director of Site management & Commissioning and the name is taken from Alexander the great therefore the state after the project will have great changes. In the old way of working the commissioning manager has focused on only one product for example the engine or the propulsion. In the future when the project is implemented there will be one manager per project instead of one manager per product. That means that one manager could have a project that has 3 different products. These products could be Engines, Propulsion and Scrubbers. After the implementation the aim is to have better customer satisfaction and

overall improvements. The thesis will help this project and compare if the changes will have a positive impact on the commissioning function.

The risks in the development are that there will be new employees and new roles for the coordinators and managers. The roles must be carefully explained and the responsibility between different tasks in the managers and coordinators daily work must also be mapped and explained.

## 1.2 Purpose

The assignment of the thesis is to support the development of the new way of working within commissioning and compare it to the old way of working. Also to have a good overlook of what can be done to further improve the way of working. The purpose of implementing the new way of working, will be that the processes will be optimized and developed to strengthen the service level. The goal is to give the customer a clear picture of Wärtsilä as one united company. Not to give a picture that Wärtsilä would be many different companies with one name.

Further improvements that the management wants to accomplish after implementing a new way of working within commissioning are to be more cost effective, have a higher customer satisfaction and be faster. To implement the new way of working a responsibility matrix will be made so that the new way of working will be clear for everyone involved. The responsibility matrix will be in the form of a RACI matrix that will describe who is responsible, accountable, consulted and informed.

The more precise purpose of this thesis is to compare the old way of working versus the new way of working by doing a value stream mapping which means mapping a processes flow and seeing where the value is and where to improve. The Value stream mapping is a lean method for analyzing where we are now in a process and where we can be in the future by changing certain things and how much time or value will improve. With the value stream map we will aim to find out if the new way of working is better and how much better it will perform in theory and if there are also more future state improvements that can be implemented to improve the way of working.

## 1.3 Scope

This thesis is focusing on the way of working for the commissioning manager and coordinator and how it will be improved by implementing a new way of working. The commissioning manager is a position that is there to make sure that the commissioning phase will be executed and that all resources, parts, tools and documentation will be prepared. The development will be done by mapping the value stream in one of the work processes. It will then compare the old way versus the new way of working, that is not yet implemented. It will also map new ideas for a future state map. A value stream map shortened VSM is a process map made to see which steps in a process are value adding and which steps are non-value adding. The result in the future state map, which is the upgraded version of the VSM should be that the percentage of the Value adding processes should be higher than the percentage of the non-value adding processes. Comparing to the current state map which is the first version of the VSM.

The theory will be covering the very basic of lean production and walking towards the theory of value adding processes. The thesis will also cover roles of responsibility since it is an important part of the new way of working. The roles of responsibility will be done by a RACI matrix which is a tool used for showing who is responsible for which tasks in a process or in a project. RACI stands for Responsible, Accountable, Consulted and Informed and in the matrix you can read which groups or persons are responsible for which tasks. The RACI will be important for the departments so that double work will be avoided, to keep everyone in the right direction of the projects and for everyone to understand their role in their work.

The value stream map will be focusing on one of the products processes since doing many similar VSMs will not be value adding in this situation. The processes between the marine products are similar to each other and will be aligned in the future. Therefore it will not be necessary to create one VSM for each product. The scope that was selected for this thesis is that the product has been limited only to engines and the delivery place has been limited only to projects in Korea.

## 1.4 Disposition

The first chapter is introducing the background and the purpose of the thesis to the reader. The issues, assignment and the scope are also discussed in this chapter.

The second chapter is presenting Wärtsilä in brief, it will also explain a bit of the structure and the recent history of the commissioning team.

The third chapter will present a theoretical understanding of the methods that will be used in the thesis.

The fourth chapter will explain the methods that are used in the thesis work.

The fifth chapter will explain the result of the thesis. The result of the methods used will be presented in this chapter, results will also be analyzed and discussed.

The sixth chapter will explain the conclusion of the thesis and will also include some proposals for future research on the topic and what can be done next.

## 2 Wärtsilä in brief

Wärtsilä was founded in 1834 and started as a sawmill, the sawmill turned to an ironworks and today Wärtsilä is a global leader in smart technologies and complete lifecycle solutions for the energy and marine markets. Wärtsilä is now emphasizing sustainable innovations, total efficiency and data analytics and maximize environmental and economic performance. Wärtsilä has over 19 000 employees in over 200 locations and in more than 80 countries around the world. Wärtsilä net sales were 4.9 billion euro in 2017 and in 2018 it was 5.2 billion (Wärtsilä, 2019, p. About).

Wärtsilä was in 2018 divided in to 3 main businesses, Marine Solutions, Energy Solutions and Services. (Wärtsilä, 2018, p. About)
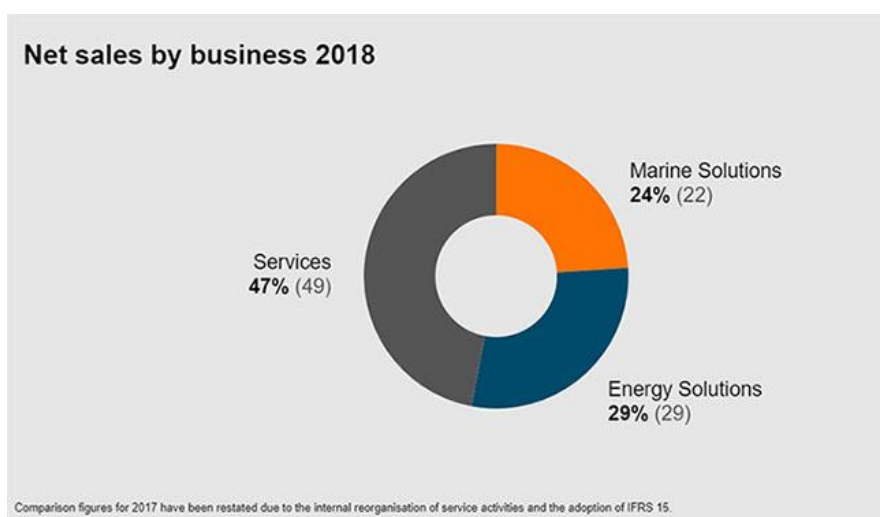


**Figure 1. Net sales by business area 2018. (Wärtsilä, 2019, p. About)**

### 2.1 Services

Wärtsilä Services is supporting its customers under the whole products lifecycle and are also optimizing the products efficiency and performance. As of 1.10.2018 Wärtsilä made a press release that Wärtsilä three business will become only two businesses, meaning that services will be divided in two and one part will be transferred to Marine Solutions and the other part to Energy Solutions (Vasabladet, 2018, p. 3) (Wärtsilä, 2019, p. Wärtsilä redesigns organisation to enhance customer value).

## 2.2  Energy Solutions

Wärtsilä Energy Solutions is one of the leading global energy system integrator and they are offering a broad range of solutions for power plants. They are offering combustion engine based powerplants, utility-scale solar power plants, energy storage and integration solutions and also LNG-terminals. At the end of year 2017 Wärtsilä had installed over 67 GW of power plant capacity. The installations are also divided in 177 different countries around the world. (Wärtsilä, 2018, p. Energy)

## 2.3  Marine Solutions

Wärtsilä Marine Solutions is the leading provider of ship machinery, propulsion and other ship solutions. Wärtsilä supplies both engines and generating sets, reduction gears, propulsion equipment, control systems and sealing solutions for all type of vessels and offshore applications. (Wärtsilä, 2018, p. Marine)

Wärtsilä Marine Solutions is providing innovative products to their customers by providing innovative products, safe solutions, environmentally sustainable, efficient, flexible and economically sustainability. (Wärtsilä, 2018, p. Marine)

Being a technology leader, having a significant amount of know-how, experience and dedicated personnel gives Wärtsilä the power to make customised products for all different marine projects which can provide optimal benefits for all Wärtsiläs customers. (Wärtsilä, 2018, p. Marine)

## 2.4  Marine Commissioning Coordination

Commissioning Coordination is a part of Marine Solutions that has the responsibility of commissioning Wärtsiläs marine products. The team has now the responsibility of engines, propulsion and environmental business. The team has the responsibility to take care of the products from when the product has been delivered to the yard and to the moment that the ship is handed over to the customer and warranty department. In the figure below you can see the commissioning phase and the Commissioning Manager is first involved at MS6 and then hands it over to warranty at G3.
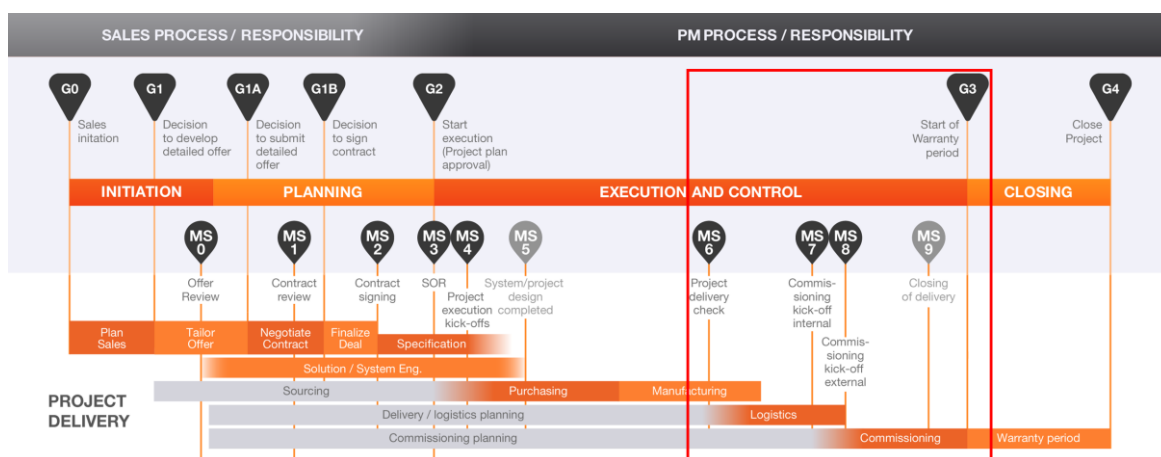
**Figure 2. Wartsila gate model with the commissioning teams involvement marked in the box**

This involves creating work orders, ordering parts, ordering resources, solving non-conformities before handover and solving additional issues that has appeared in the commissioning phase.

The coordination department has about 30 employees in the spring of 2019. Half of the employees are located in Europe (Finland, Netherlands, Norway and Italy) and the other half is located in Asia (China, Korea and Japan). All of the employees in Asia has been hired to the commissioning department late 2018 or spring 2019. Being closer to the customer in Asia will expectantly give the result of better customer satisfaction since the coordinators in Asia knows the local language and local culture better.

If you also include the site managers, developing team and the other managers there will be a total of at least 40 employees with the aim of expanding even more.

In the beginning of 2017 the Marine Commissioning team was still handled by Service business but in the summer of 2017 Marine Commissioning was moved from Service business to Marine Solutions business and Project Management and Site Management was also connected to the Commissioning team. Soon in the early 2018 the department was moved again to Marine Solutions Sales, one reason for this change was to get closer to the customer and reach a higher level of customer satisfaction.

In the early 2019 Marine Commissioning & Site Management was moved again to the Project Management organization which seem to be the best fit for the department. Mostly these changes has not affected the daily work, instead the changes has been on a higher management level.

# 3 Theory

The theory will bring up the basics about Lean production. Then it will focus a bit more on value stream mapping and RACI. The theory will explain how to make value stream maps and why it is important and then the same with RACI.

## 3.1 Lean

Lean is a tool that has been used successfully in companies for many years now. According to (Kanbanize, u.d., p. What is Lean Management) lean relies on 3 simple ideas

1. Deliver value to your customer.

2. Eliminate waste.

3. Continuous improvement.

With these three simple ideas you can maximize customer value and remove waste by different types of streamlines. The basics of lean were made by Toyota Production Systems and was for a long time known as just that Toyota Production Systems. But today it is a very well-known tool in manufacturing. (Kanbanize, u.d., p. What is Lean Management)

Lean has also been implemented in services and is explained in a very simple way by (Motwani, et al., 2012, pp. 1-3) that lean can be implemented everywhere whether it a service organization or a manufacturer, in this case they say that the lean six sigma tools can be implemented in every process since the tools are a way to eliminate wastes in every process. Lean in services is something that is very helpful, but it is a bit trickier than lean in manufacturing since the wastes are trickier to find. The processes is ran by people and not machines which also makes it trickier since all people have different knowledge in the processes.

Lean office also has the same difficulty of seeing the wastes as lean services has. Lean office still has the same tree ideas that lean manufacturing has. The goal is also here to improve the quality, lead time and to reduce the costs. (Keyte & Drew, 2004)

## 3.2   Value Stream Mapping

The Value stream map is a tool that is used within lean-management. Value stream map is shortened VSM and with a VSM you can map a process and see where value is gained or lost. With the method you will first make the current-state drawing and then you make a future-state drawing (Shook & Rother, 2003, p. 9). But first we need to know what a value stream is.

The Value stream map is the actions happening in the process, both the value adding steps and the non-value adding steps. For example, waiting that the process can be carried on is a non-value adding step in the map. (Shook & Rother, 2003)

The goal in the value stream map is to show all the value adding and non-value adding steps in the process of delivering products or services, in that way you can improve the process and aim to minimalize the non-value adding processes and maximize the value adding processes (Canning, 2012).

According to (Canning, 2012) it is possible to create a Value stream map in the following 6 steps.

**Create a mapping team**

Gather the people who will do the mapping and make sure that the team understands why they are doing the mapping and what the expected outcome is.

**Define what product, service or specific process will be mapped.**

The VSM will create a detailed map so therefore it is important to limit the VSM to usually one key product, service or process. It is a good idea to choose a process that will go through as many businesses processes and people as possible. (Shook & Rother, 2003, p. 5) also explains that it is too complicated to do a VSM on many products and that you should focus on one product. (Shook & Rother, 2003, p. 5) also say that it is important to choose a product that goes through many businesses.

**Identify the customer's value**

The purpose of VSM is to improve the value we are giving to the customer. To identify what the customer wants interviews or questionnaires can be done. According to (Jones & Womack , 2003, p. 18) you can imagine yourself to be the customer and ask if you would pay less for the product or be less satisfied with it if given steps and time for the steps were left out. But you cannot just eliminate the non-value adding steps, since in administrative work there are many steps that do not add value to the customer. However, the tasks could still be needed to support the different needs of the business (Keyte & Drew, 2004, p. 16).

**Mapping the current state**

Mapp how the process is being done today. The best thing is to walk through the whole process yourself and not have someone else give the information about how much time each process is taking, that can give someone the opportunity to affect the result, but you should of course interview the people doing the processes to get a better understanding. In (Shook & Rother, 2003, p. 14) there are several tips for making the current state map that you find below.

- Collect current-state information by walking the actual pathway of the material you are following

- Walk from the end to the start, by doing this you are closest to the customer in the beginning.

- Bring your stopwatch and do not rely on standard times given by anyone else.

- Map the whole process yourself to fully understand the whole process.

  (Shook & Rother, 2003, p. 14)
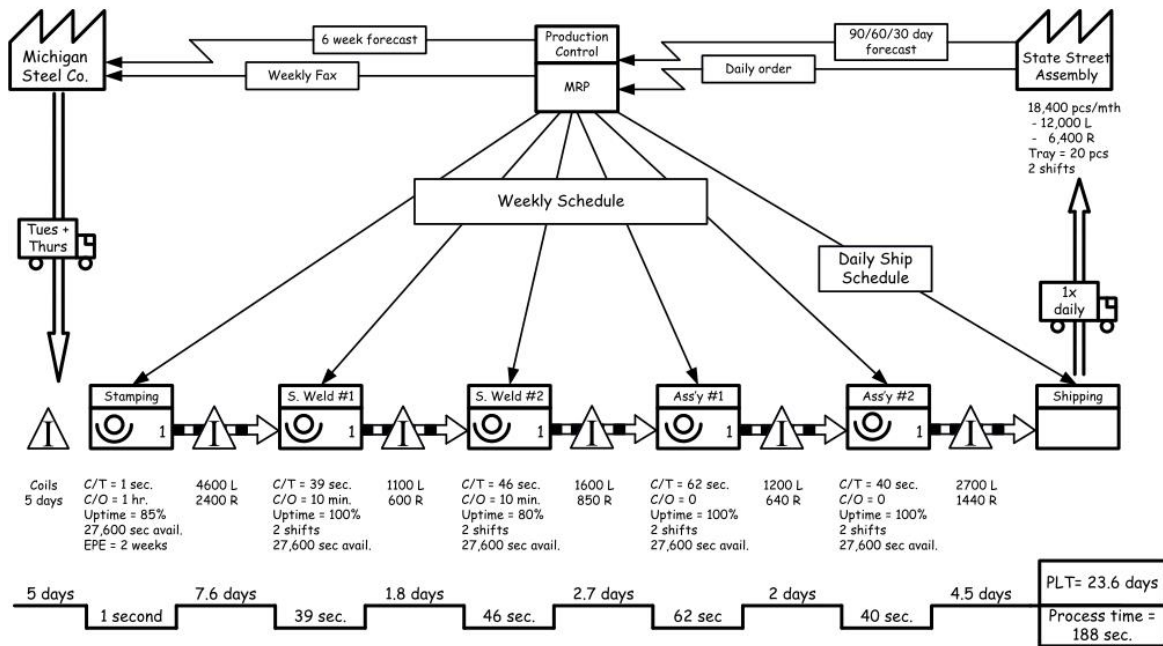
**Figure 3. Example of Current State VSM (Canning, 2012, p. Value Stream Mapping)**

The VSM can be done on a sheet of paper when walking through the process (Canning, 2012, p. Value stream mapping) like you can see on the example above, but Microsoft Visio also has their own template which is a great tool to get the VSM to look nice (Microsoft, 2019, p. Create a value stream map). You can also find the standard symbols used below from (Shook & Rother, 2003), those symbols are also used in Microsoft Visio.
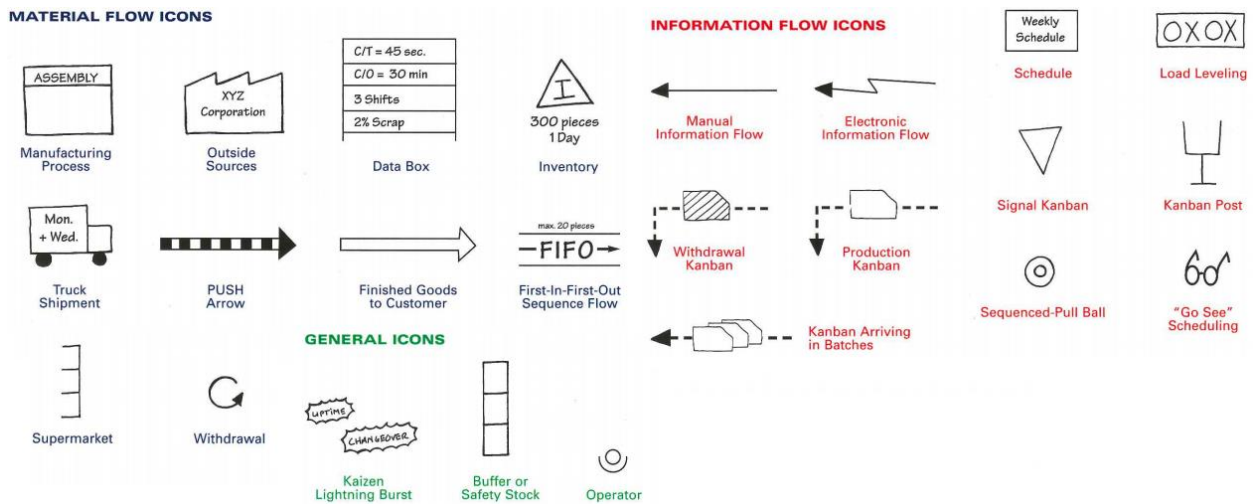


**Figure 4. Symbols used in value stream mapping from (Shook & Rother, 2003)**

**Identify improvements**

Use the current state map to find improvements. You can use the 8 wastes in lean to easier find the wastes. Below you can find a list on the 8 wastes with the authors (Kavanagh & Krings, 2011, pp. 18-24).

- Defects
- Rework and correction
- Inspection and checking
- Waiting
- Inventory/Backlog
- Transport
- Over processing
- Underutilizing people's abilities

  In the book Lean Enterprise, we can also read about additional 2 wastes (Keyte & Drew, 2004, p. 17)

- Overproducing
- Excess motion when people walk around the workplace or to other offices

**Create the future state map**

The future state map is the process drawn out again but with all the waste removed. This is called the future state map (Canning, 2012). When the future state map is done it is used to develop and implement the improvements in the business.

When drawing the future state map we should look at the problems that we can eliminate by implementing the future-VSM and that can become a reality in a short period of time (Shook & Rother, 2003).

Below you will find an example of a future state VSM
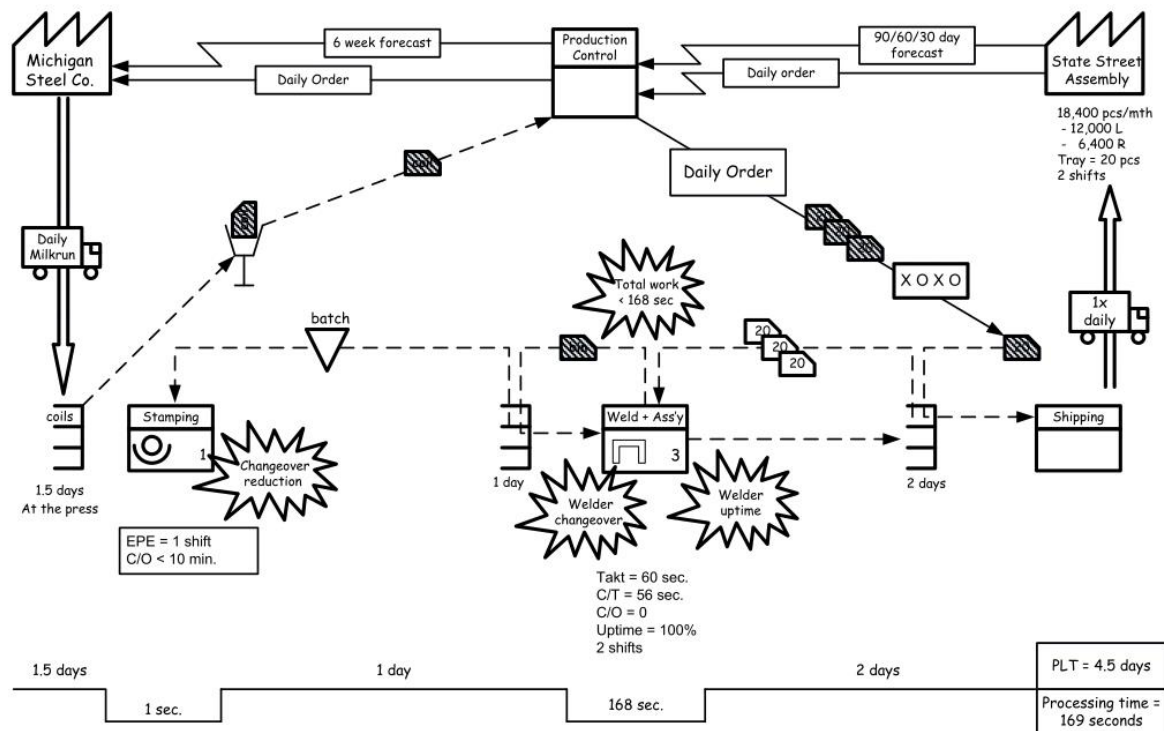
**Figure 5. Example of Future State VSM (Canning, 2012, p. Value stream mapping)**

## 3.3 RACI

RACI is a responsibility matrix that is user-friendly and makes it easy to understand the responsibilities. RACI is short for Responsible, Accountable, Consulted and Informed and is a common tool used to divide work. According to (Ariscommunity, u.d., p. Overview of RACI) Responsibility Charting is a simple method that you can typically use in project start-ups, reorganization procedures or in business processing modelling. It is used to show who is the responsibilities of various roles in a project or in business processes.

There are also different ways to describe the roles and responsibilities but in most cases they fall into 3 different categories, the first one being a hierarchical-type organizational chart that shows the responsibility's in a hierarchy chart, the next one being a text-oriented format which describes the responsibility's in text form, the last type is the Matrix-based chart which RACI is a type of (Project Management Institute, 2004).

The RACI tool is straight forward and is a simple matrix and you can see an example of it below. The example is from (Fagan, 2018) where you can see the layout of the RACI.

**Figure 6. Example of RACI model (Fagan, 2018)**

Other common names for the RACI matrix is according to (Meredith & Samuel J Mantel, 2012, p. 240) responsibility matrix, a linear responsibility chart, an assignment matrix, a responsibility assignment matrix and similar names. (Project Management Institute, 2004) also talks about RAM which is short for Responsibility assignment matrix. All of the mentioned names will not be a "RACI" since there are many alternatives to the RACI but in the end they all have the same task and that is to divide the tasks in a smart way between either departments or persons. (Smith & Erwin, 2005)

( Wärtsilä, 2011, p. ARCI Creation Guide) is explaining the titles below, these titles will also be used in the thesis since it is the way of working within Wärtsilä. (Smith & Erwin, 2005, p. 5) also confirms the same understanding of the different titles.

**Responsible** – Department responsible of completion of the task.

Department who completes the task or delegates it.

People can share the work and more than one responsible can be assigned per task in the matrix.

**Accountable** – The department that makes the final decision and takes the answerability.

There can only be one accountable per task.

Has the ultimate responsibility that the task is taken care of.

Is the doer if there is no other department or person responsible.

**Consulted** - It is required information or confirmation from this department.

There can be more than one consulted per task.

Requires a two-way communication.

**Informed** – Information, documents or details have to be given to this department.

Only has to be a one-way communication.

Can be assigned to several people or departments.

The difference between Responsible and Accountable can be hard to understand since they have a similar meaning when spoken. The difference between the two words can be described as the Accountable person is the one that will take the final decision on the task if something is unclear, while the responsible person is the one performing the task. The person who is Accountable will also be the responsible person as long as the responsibility is not assigned to anyone else. A real-life example of this is when a restaurant customer is not satisfied whit the dinner he had and wants to talk to the manager of the restaurant. The restaurant manager is the person that is Accountable for what is being served in the restaurant. Meanwhile it is the chef or the waitress which are responsible that the customer was unsatisfied.

It was chosen to use RACI since it is a good way for the workers to see their tasks by just looking in their column and they can see their responsibility in the different tasks.

## 3.4  Implementing Change

There are many ways to implement change and according to (Youker, 1983) there will sometimes be resistance in the working force causing additional problems for the management and sometimes change will just be accepted as good improvements.  Some change are easy for us people to implement, for example changing from a cord phone to a mobile phone, 8-track tapes to CDs to i-pods, changing clothes, changing the road to work since they build a new better road, there are many things that change every day that are easy to implement. But if the incentive is not explained and the people that are going to implement it do not believe in it there will be some more resistance (Carleton, 2010, pp. 69-70).

But there are things that can be done so that change will go more smoothly and one of the methods that can be used are Kotter's 8 steps method. Kotter's 8 step method will be explained below in a short but information giving way.

1. **Help others see that change is needed fast and why.**

   This means that you must convince everyone in your organization that this change is needed and inform about the risks that the company will meet if the change is not implemented. Kottler has given a number, you need 75 % of all managers to engage in the change to have success. Another tip is to give the impression that the time is running out now and that change is needed very soon, that will give motivation to your co-workers to work for the change.

2. **Have the leaders believe in it.**

   This point explains that you cannot implement change by yourself, you need 3-5 persons in a group that can sponsor your change. These persons also need the correct competence, status, influence, job title and power. If the sponsors have the correct abilities and right respect the employees will have a harder time to argue against the change. It is also important to form a team of sponsors that are different and will cover all the areas and give the change a good impression. It is even stated that behind every successful change there is a strong network of sponsors.

**3. Make up the vision and show what will change.**

To get all the involved parties involved in the change it is important to create a vision where it clearly states what improvements the change will have after the change and how great everything will be after the change. A well formed vision will create a common goal between the co-workers which is needed to have great success. When you make the vision you will probably have a lot of great ideas drifting around but focus on the great ones, the ones that sticks and are easy to explain to your co-workers so that everyone will understand the change and you will have a clear vision.

**4. Have all the people move in the same direction.**

Share your vision and communicate it. Make everyone aware of the vision before the change has happened, communicate the vision frequently and clear so that everyone can move in the same direction. Additionally, demonstration or showing the change will give better impressions than just talking about it. Also it is good to use all the different channels to give information, take in consideration that people snap things up in different ways, some will understand the information given in an email while some need to hear or see a presentation to understand the vision. Communicating the vison in many ways will give a clear vision for as many people as possible and the more motivated people you have the easier the change will be.

**5. Remove the barriers that comes up.**

In this stage you must remove all the barriers that comes up. Obstacles can be limited time, money, lack of competence, support or people that do not want to take in the new change. What you can do is hire leaders who want to change, reward people that promote the change, help people that are resisting the change see why change it necessary. To conclude remove the barriers as soon as possible so that you can move on fast.

**6. Motivate with short-term wins.**

On this point you should celebrate with short-term wins to motivate your co-workers and employees. Give your team a taste of victory in your process of changing, this is to motivate your employees so that the negative thinkers, if there still are some, will change their negative mind. If you can prove that the change is successful it will be hard to give negative comments about it.

7. **Push the change harder after successes.**

Now when the change is motivated with short terms wins you must remember that the work is not done yet. The change still needs to be pushed and informed about so people will not forget about it and fall back into old habits. Also this is the point where you should keep improving and find even better solutions.

8. **Make sure the changes are kept and not going back to old habits.**

Have the change be a natural part of the work and the processes. This is the part you reach when the project has succeeded, here it is important to review the change and still see that people do not fall back in old habits and will keep the change working. It is also important if you get new employees or leaders to inform these leaders to keep the change that is made so you will not fall back.

(Astrakan, 2015) (Mind Tools Content Team, 2016) (Beijar, 2015) (Kotter, 1996, pp. 33-145)

These 8 steps are one way to help people understand why we need the change and have them stay positive to the change. People often fear change because they feel uncertain and do not know how the change will affect them (Lotich, 2017). However doing things the same way will produce the same results as before and if improvement is wanted, change has to be implemented (Lotich, 2017).

# 4 Methods

This chapter will explain how the methods was used in this thesis. After reading this chapter it will be understood how the methods was performed. The methods that are explained are how the value stream mapping was done and how the RACI was done.

## 4.1 Value Stream Mapping

This chapter will explain how the value stream mapping, shortened VSM, was used in this thesis.

### 4.1.1 Picking VSM as a Method

The VSM was picked as a method because it was a straight forward method that would measure time and value in the process. A map has been done before how the process is done but a map where time is showing was requested by Wärtsilä to see where the improvements can be done and if a new way of working will improve the process. The VSM was also a great tool to see where waste is located and how it can be eliminated.

### 4.1.2 Defining what to be mapped

The choice on what to map was done according to the theory. What was chosen to map was engine parts and auxiliary parts shipped to Korea for different projects that commissioning has been active on in the last year. The map was limited from that the service engineer found the non-conformity until that the needed part had arrived at the yard or in this case Wärtsilä Korea. The following map will involve Engineers, Service Coordinators, Commissioning Coordinators, Commissioning Manager, Part Order Support Coordinator, Warehouse and the delivery company.

Further to get valuable data, 20 different non-conformity cases was mapped out and analyzed. The different improvements that could be done for each case was also analyzed.

### 4.1.3 Defining the Value

What is wanted with the value stream map is to eliminate waste and gain value. More exactly we want to gain the customer's Value. It was chosen to measure time as a Value in this VSM since delays in the parts delivery process can have very big consequences if it is the wrong

part being delayed, delays in the part deliveries can even result in penalties such as a fine for being late in delivering the whole product.

### 4.1.4 Data used in the VSM

The data that was used in the VSM was gathered from different places but the main place for information gathering was SAP. SAP is the enterprise resource system, also called ERP-system, that is used by Wärtsilä. The first two of the steps below was found in the report that is made by the Service engineer then step 3-6 was collected from SAP. The last two is collected through the shipping company's data.

By using the time data given by these 8 different tasks it was put into an excel that would count the process time and the lead time for the process and put it into numbers.

The steps were chosen by going back as far as possible in the digital process. The first digital footprint is the report that the service engineer makes. From the report we got the first 2 steps. The next 4 steps is chosen when the different resources hand over the NBH to the next responsible person these 4 steps also sets digital footprints from which it was possible to pick the time from. The last 2 steps were picked even if the responsibility is handed over to the shipping company but the delivery time is still quite interesting.

- **NBH found** according to report. This step is when the "Non-Conformity before handover" is found at the shipyard.

- **NBH report** created by Service Engineer. This step is when the "Non-Conformity before handover" is reported by the Service Engineer.

- **WG notification** created by Service Coordinator. This step is the time that a "WG-notification" is created in our database SAP. WG is not anything that is shorted, it is simply a notification type used in Wärtsiläs SAP system.

- **WSG order** created by Commissioning Coordinator or Manager. This step is the next step in the SAP system and it is also timed in SAP as the WG notification.

- **Quote** created by Commissioning Coordinator or Manager when a part is identified. This part is where you make a quote for the needed parts which is then sent to Part order support.

- **Sales order** created by POS/WEBATCH when a part is ordered by Commissioning Coordinator or Manager. This part is the Part order support handling the quote, that has been made and setting it to action.

- Loading by shipping company (**MRN**). This part is when the shipping company loads the product at Wärtsiläs warehouse in Kampen.

- **Goods signed** at destination. This part is when the goods have reached its destination and someone has signed the papers and collected the parts.

### 4.1.5 Data processing

The data was processed in an excel file and was collected in 20 different calculations as the one below in Figure 7. The cells filled with green is the cells that are from the collected data that you can read about above. The rest of the times are calculated as estimates of what it would normally take to go through the process. The estimates are done by the thesis writer as he has experience from the process.

| DSME2442 FBR02 Lube oil leak_side stud - 5000277839 | | | | | | |
|---|---|---|---|---|---|---|
| Process | From | To | Minute | | Days | |
| | | GMT +2 | | | | |
| NBH found | 14-05-2018 09:30 | 14-05-2018 10:00 | 00:30 | 30 | 0,0 | |
| Lead Time | 14-05-2018 10:00 | 15-05-2018 09:27 | 23:27 | 1407 | 1,0 | |
| NBH reported | 15-05-2018 09:27 | 15-05-2018 10:27 | 01:00 | 60 | 0,0 | |
| Lead Time | 15-05-2018 10:27 | 15-05-2018 10:52 | 00:25 | 25 | 0,0 | |
| NBH reviewed by SC | 15-05-2018 10:52 | 15-05-2018 11:07 | 00:15 | 15 | 0,0 | |
| Lead Time | 15-05-2018 11:07 | 15-05-2018 11:07 | 00:00 | 0 | 0,0 | |
| WG Notification Greated | 15-05-2018 11:07 | 15-05-2018 11:37 | 00:30 | 30 | 0,0 | |
| Lead Time | 15-05-2018 11:37 | 15-05-2018 11:47 | 00:10 | 10 | 0,0 | |
| NBH reviewed by CC | 15-05-2018 11:47 | 15-05-2018 12:17 | 00:30 | 30 | 0,0 | |
| Lead Time | 15-05-2018 12:17 | 15-05-2018 12:17 | 00:00 | 0 | 0,0 | |
| WSG order by CC | 15-05-2018 12:17 | 15-05-2018 12:27 | 00:10 | 10 | 0,0 | |
| Lead Time | 15-05-2018 12:27 | 15-05-2018 12:27 | 00:00 | 0 | 0,0 | |
| Quote created | 15-05-2018 12:27 | 15-05-2018 12:32 | 00:05 | 5 | 0,0 | |
| Lead Time | 15-05-2018 12:32 | 15-05-2018 12:32 | 00:00 | 0 | 0,0 | |
| Sales order created by POS | 15-05-2018 12:32 | 15-05-2018 12:35 | 00:03 | 3 | 0,0 | |
| Lead Time | 15-05-2018 12:35 | 16-05-2018 08:09 | 19:34 | 1174 | 0,8 | |
| loading by shipping company (MRN) | 16-05-2018 08:09 | 16-05-2018 08:39 | 00:30 | 30 | 0,0 | |
| Lead Time | 16-05-2018 08:39 | 18-05-2018 14:05 | 05:26 | 3206 | 2,2 | |
| Goods arival | 18-05-2018 14:05 | 18-05-2018 14:15 | 00:10 | 10 | 0,0 | |
| | | | | | | PT+LT=days |
| Process Time | | | PT= | 223 | 0,15 | 4,2 |
| Lead Time | | | LT= | 5822 | 4,04 | |
| PT/LT=AR | | | AR= | 3,83 % | | |

**Figure 7. Excel of the collected times**

When the data of the 20 different non-conformities had been collected it was time to make a map on the different scenarios and an average. To calculate the best case scenario the

=MIN formula was used and connected to all the different cases in another tab. The meaning of the best case scenario is that we have the shortest time from every non-conformity case put together and the result is a very attractive lead time.

The worst case scenario has the same concept as the best case scenario but the formula used to calculate it is =MAX. This scenario makes every process that has gone imperfect show up.

The Average column is made with the formula =AVERAGE and has taken the average time from all of the 20 non-conformities which should give a good estimate over the normal time for this process.

| Process | Best Case Scenario | | Worst Case Scenario | | Average | | Future State | | Future State Process |
|---|---|---|---|---|---|---|---|---|---|
| | Minutes | Days | Minutes | Days | Minutes | Days | Minutes | Days | |
| NBH found | 30 | 0,0 | 30 | 0 | 30 | 0 | 30 | 0,0 | NBH found |
| Lead time | 0 | 0,0 | 15798 | 11 | 3676 | 3 | 2304 | 1,6 | Lead time |
| NBH reported | 60 | 0,0 | 60 | 0 | 60 | 0 | 60 | 0,0 | NBH reported |
| Lead time | 0 | 0,0 | 20829 | 14 | 5418 | 4 | 1440 | 1,0 | Lead time |
| NBH reviewed | 15 | 0,0 | 15 | 0 | 15 | 0 | 15 | 0,0 | NBH reviewed |
| Lead time | 0 | 0,0 | 0 | 0 | 0 | 0 | 120 | 0,1 | Lead time |
| WG notification created | 30 | 0,0 | 30 | 0 | 30 | 0 | 30 | 0,0 | WG notification |
| Lead time | 0 | 0,0 | 5538 | 4 | 539 | 0 | 0 | 0,0 | Lead time |
| NBH reviewed | 30 | 0,0 | 30 | 0 | 30 | 0 | 0 | 0,0 | - |
| Lead time | 0 | 0,0 | 0 | 0 | 0 | 0 | 0 | 0,0 | |
| WSG order | 10 | 0,0 | 10 | 0 | 10 | 0 | 10 | 0,0 | WSG order |
| Lead time | 0 | 0,0 | 18523 | 13 | 1136 | 1 | 1136 | 0,8 | Lead time |
| Quote created | 10 | 0,0 | 10 | 0 | 10 | 0 | 10 | 0,0 | Quote |
| Lead time | 0 | 0,0 | 58977 | 41 | 3362 | 2 | 3362 | 2,3 | Lead time |
| Sales order | 10 | 0,0 | 10 | 0 | 10 | 0 | 10 | 0,0 | Sales order |
| Lead time | 310 | 0,2 | 5280 | 4 | 1500 | 1 | 1500 | 1,0 | Lead time |
| Loading by shipping company (MRN) | 30 | 0,0 | 30 | 0 | 30 | 0 | 30 | 0,0 | Loading by shipping company (MRN) |
| Lead time | 3272 | 2,3 | 9501 | 7 | 5995 | 4 | 5995 | 4,2 | Lead time |
| Goods arival | 10 | 0,0 | 10 | 0 | 10 | 0 | 10 | 0,0 | Goods arival |
| | | | | | | | | | |
| Process time | 235,000 | 0,163 | 235,000 | 0,163 | 235,000 | 0,163 | 205,000 | 0,142 | |
| Lead Time | 3582 | 2,5 | 134446 | 93,4 | 21627 | 15,0 | 15857 | 11,0 | |
| PT/LT = Activity Ratio | 6,56 % | | 0,17 % | | 1,09 % | | 1,29 % | | |

**Figure 8. Clip from Excel where the times are calculated**

### 4.1.6   Visibility of the current state map

The visibility was made in Microsoft's software Visio to get the look of a VSM. You find the figure of the current state map below and you will also find it in a larger version in the result chapter of the thesis.
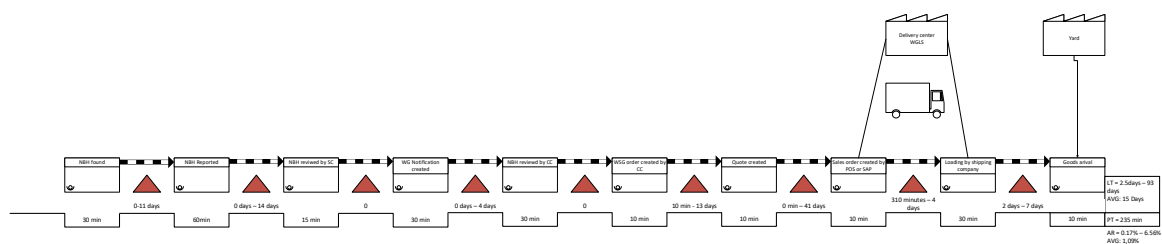


**Figure 9. Current State Map**

For presenting purposes the visuals of the VSM map made in Visio was not the best since it creates a very long chain of tasks. Therefore it was chosen that a chart would be better suited to show the VSM in a presentation. The long bars that are between the process texts are the lead times between the process. The very shorts tabs that are directly after the text are the process time for each task.
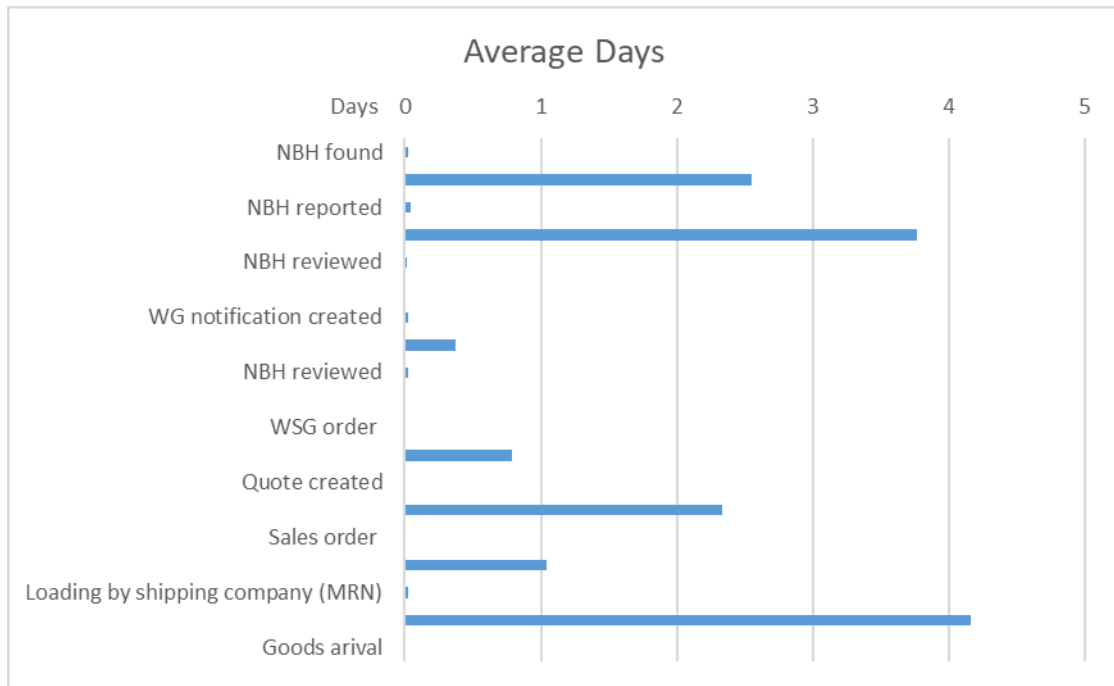


**Figure 10. Visual chart of the current state map. The tabs after the text shows the process time and the tabs between the texts shows the lead time.**

### 4.1.7 Future state map

A future state map has also been done. The future state map shows how the process will be done in the future and an estimate is done on the improvements that are done by re-arranging how the process is done.
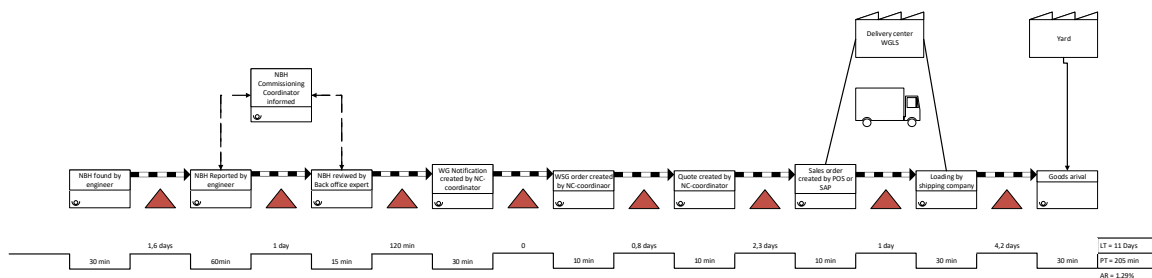


**Figure 11. Future state map from MS Visio**

## 4.2 RACI

This chapter will explain how the RACI matrix was made for this thesis. The whole process will be explained from how RACI was picked as a method, identifying the format to be used, how the coding was done and how all the responsibilities, accountabilities, consulted and informed was defined.

### 4.2.1 Picking RACI as a Method

The RACI was picked as a method because there was a need for writing down a new way of working and making the new way clear for everyone involved and to all the new people joining the departments. It was also noticed that the RACI will be a good tool to show how the different departments will corporate with each other since it will show all the 4 different categories Accountable, Responsible, Consulted and Informed. The RACI was also chosen because it is easy to understand and to just look at the responsibilities of one of the groups. Another reason why it was chosen is because it can handle many tasks and the whole commissioning execution can be written within it.

### 4.2.2 Identifying the format to be used for the RACI model

The first task for the RACI was to identify what kind of RACI model should be used. First thing that was done to identify the model was to search through how RACI matrixes has been done before at Wärtsilä. After doing the search there was several different documents that has been in use during the past years. The big difference between the documents is that some was done in Microsoft Excel and some in Microsoft Visio.

To further investigate which model would be the correct one to use a check-up was done with a representative of the quality department. After the check-up it was recommended that a RACI in Visio would be a good option but there was no directive that forced that the Visio model had to be used.

Therefore to identify the format to be used the different models was reviewed. It was clear that a good option would be to implement the RACI coding described below from an internal document and implement that to the existing roles and responsibility document. In that way the model would suit the department's needs in the best way.

Additionally since the theory allowed to have the same group to be for example both responsible and accountable. The cells explaining the different groups was merged, making it possible for a group to be both responsible and accountable. In Figure 12 you can see how to excel file was formed.



**Figure 12. A cut from how the RACI was formed. The cut shows 19 of total 195 tasks.**

### 4.2.3 Excel Coding

The excel file that is used for the RACI is from the ground a Roles and Responsibilities document with a few columns that was explaining the project phase, the task, who is responsible if there is a Site manager and who is responsible if there is no Site manager assigned to the project. There was also a column for notes which has been used to write down information that has been discussed through the different meetings that has been held during the making of the file.

To make the file easy to read a code was made so that each letter would have different colours for better clarity. The Conditional Formatting Rules Manager was used to code the colours and letters, you can see in Figure 6 how that was done. The coding means that when filling in one of the letters in the matrix it will show the letter and a colour will also fill the cell depending on what letter you would enter in the cell. (Microsoft, u.d., p. Manage conditional formatting rule precedence)
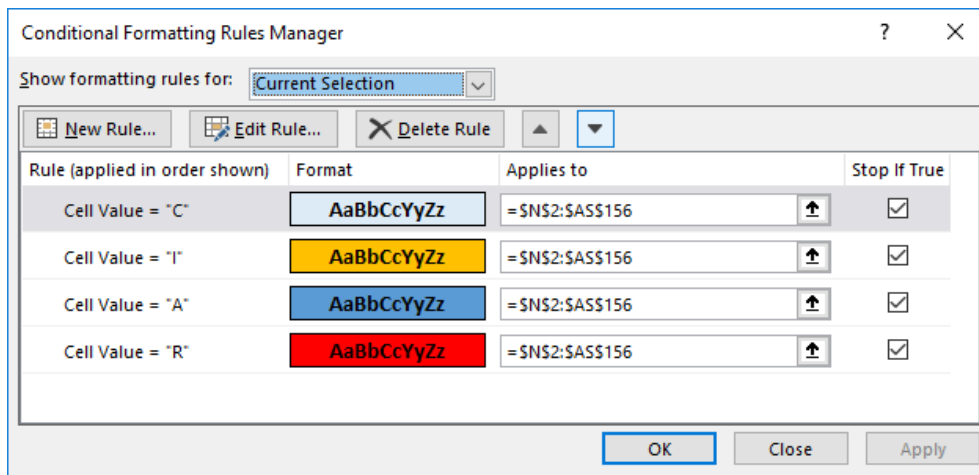
**Figure 13. Conditional Formatting Rules Manager for RACI**

A data validation was also set in to the cells that are supposed to be filled with the R, A, C or I letters so that it would not be possible to enter different data than supposed to the matrix. In Figure 14 you can see how to data validation was made in excel. (Microsoft, u.d., p. Apply data validation to cells)
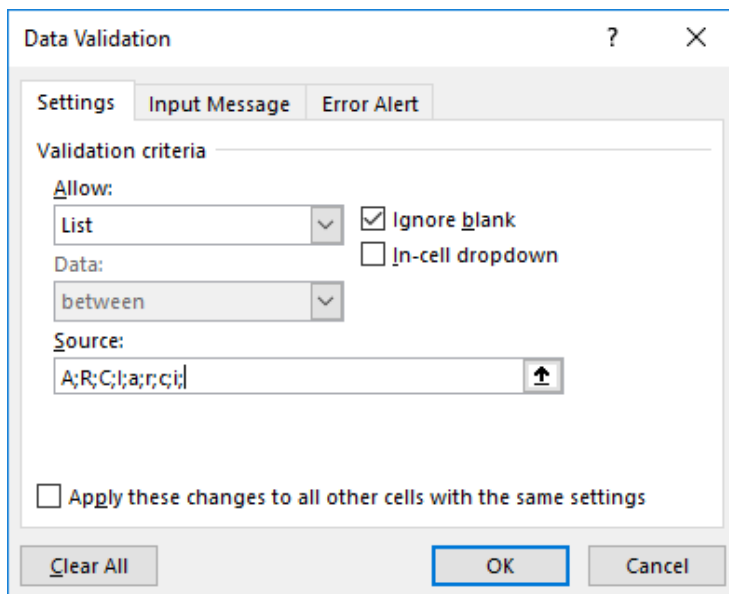


**Figure 14. Data Validation in excel to only allow certain letters to the RACI cells**

### 4.2.4   Data used

The data that was used to make the RACI is collected from a roles and responsibility document that has been made and reviewed with the different departments that are involved in the RACI. That means that the roles and responsibility document has been reviewed with

about 10 different persons from the different businesses Site management, Project management, Field Service and Commissioning.

The thesis writer has also been involved in the way of working in these businesses from before. That has been a huge advantage in both gathering the input data by the doers and understanding the information for the RACI.

Other methods that was used to gather the information needed to fill in the RACI was with short conversations with the people doing the tasks on a daily basis.

### 4.2.5 Defining the ACI

Defining the different terms for all the tasks and all the different teams was done by the thesis writer. The defining was initiated after having a meeting with the Operation of excellence Manager for Site Management and Commissioning which was the author of the Roles and responsibility document. Both parties made each other understand the meaning of the different terms in the RACI which are explained in the theory part of the thesis.

When all the definitions was filled in the RACI the author of the RACI booked additional meetings with the Operation of Excellence Manager. In the meetings it was further discussed the tasks that was unclear on how the work should be divided between the different groups. The second meeting the operation of excellence manager had a few points that was discussed, the document was then finalized to be taken to the next step. The next step was that the concerned managers or stakeholders would review and accept the document.

### 4.2.6 Further development of the RACI

After the reviews with the different stakeholders it was stated that there was a need to further involve the site managers different value adding tasks into the RACI. Since these was not well defined from before there was additional meetings with the managers to define the value adding tasks that can be performed by the site manager. When the definition of the value adding tasks was done there was another 40 tasks implemented to the RACI. When deciding of the site managers value adding tasks it was also decided to further split the RACI in 3 different tabs. The tabs being projects with a site manager that has up to 2 projects in parallel, projects with a site manager that has more than 2 projects in parallel and projects without a site manager.

### 4.2.7   Implementing the RACI

The implementation of the RACI will be done by having meetings with the concerned department's managers and stakeholders. The concerned managers will review the RACI in the meetings and then accept it when they are satisfied.

When the green light has been given by all the involved managers and stakeholders and all modifications are done. The roll out will start and the RACI will be implemented in the daily way of working. For the rollout of the RACI there will be a date set that all the future projects will use the RACI as a guideline to perform the projects. Support how the implantation can be done is further discussed in the result chapter 5.2.4.

# 5 Result

This chapter will explain the results of the thesis. First it will explain the VSM and give proposals for improvement. The second chapter will explain the RACI table and how it works.

## 5.1 Value Stream Mapping

This chapter will explain the results of the Value stream mapping that has been done in the thesis. It will also give 5 different proposals to improve the process.

### 5.1.1 Current state map

The current state map was made with 20 different non-conformity cases that was timed. In the process there was 8 different processes that had digital footprints which was used in the Current state map. The reliability of the test is strong enough to locate problems and improvements but is not strong enough to give an exact number. In one month for engines there are about 130 different non-conformities over the whole world and to Korea about 40 different non-conformities each month. Below you can see the current state map attached in a larger version than the one in the method. The different steps in the current state map are explained in the method of VSM.
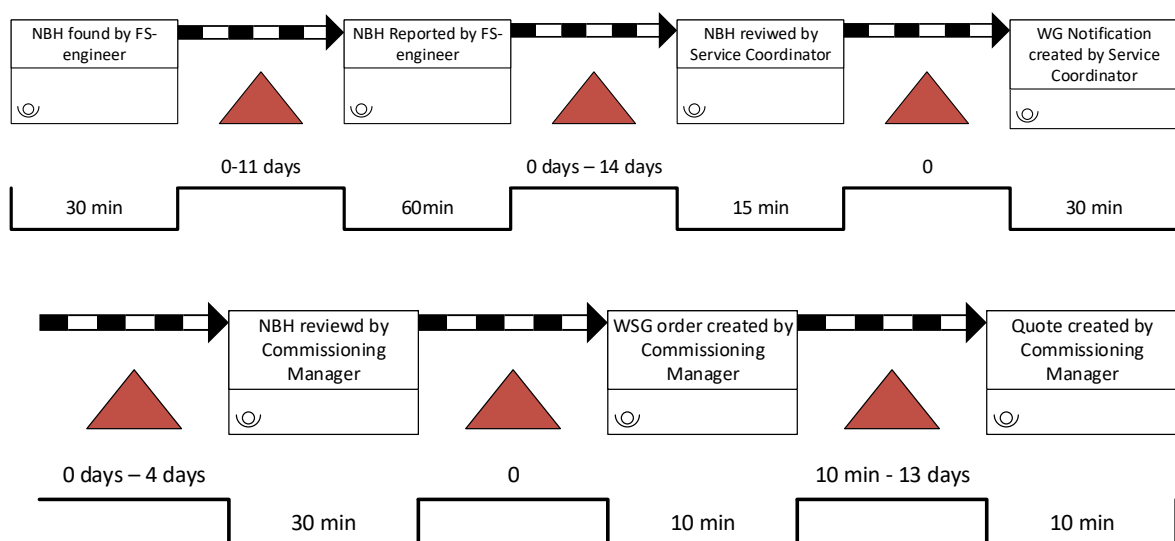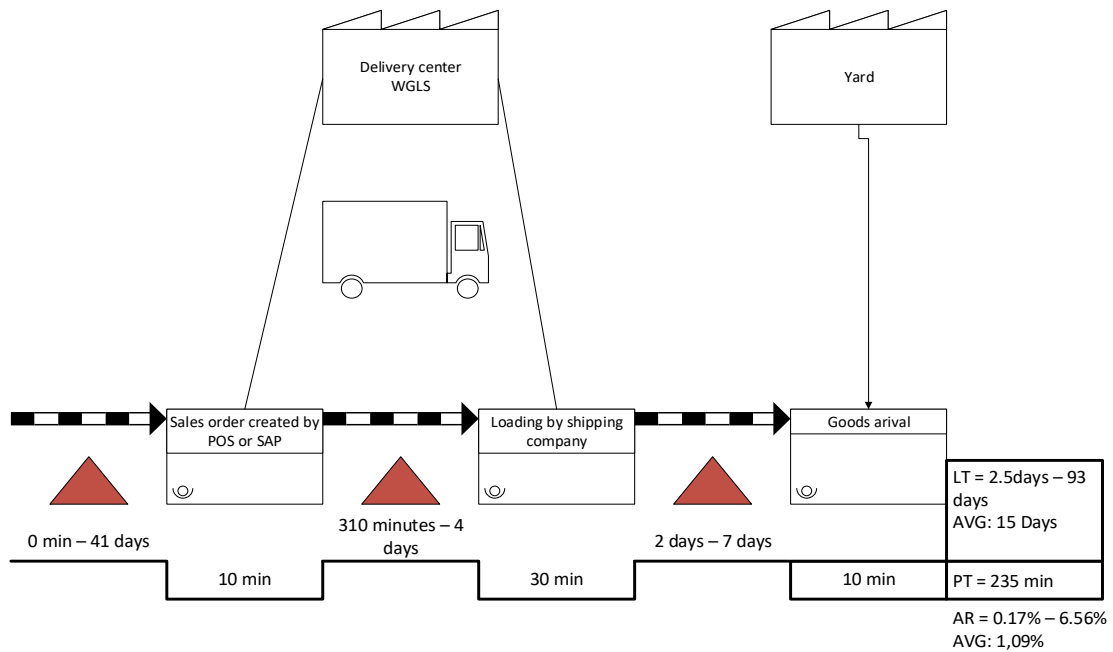
**Figure 15. Current state VSM**

In current state below, it is visible to see the average days used for each part of the process. When looking at Figure 16 below it is visible that the longest lead times are in the beginning and in the end of the process. In chapter 5.1.3 there will be different proposals explaining how to further improve the process and in the next chapter it is explained how rearranging the process is done in the new way of working.
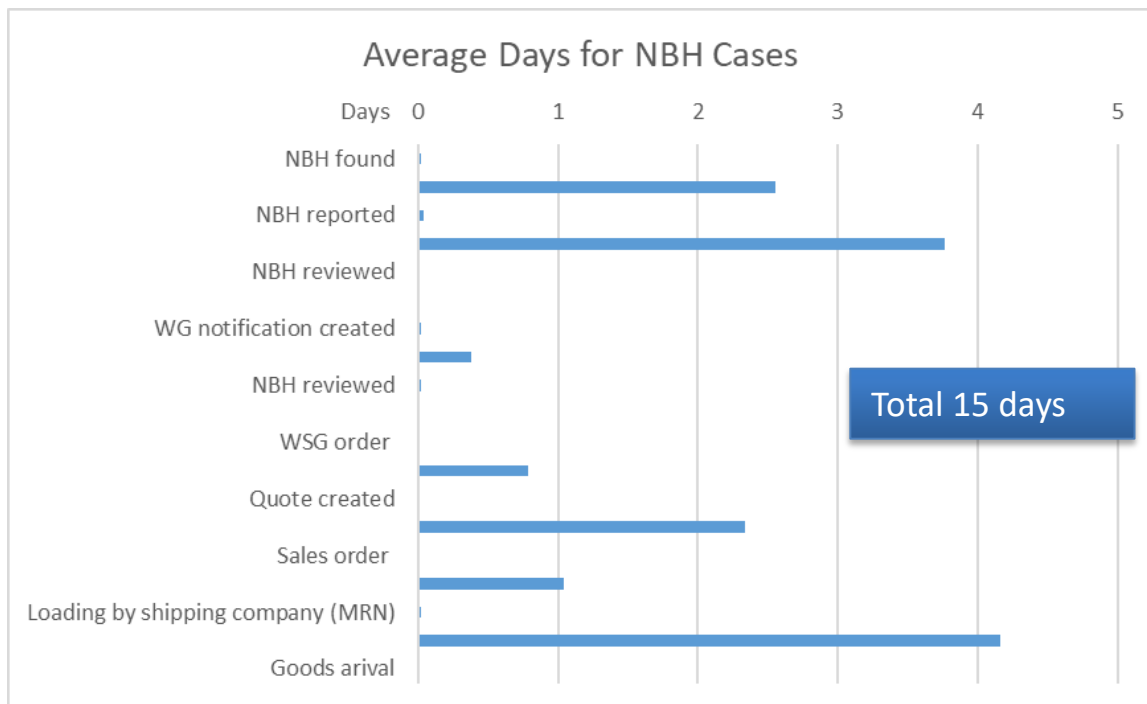


**Figure 16. Current state map in different view. The tabs after the text shows the process time and the tabs between the texts shows the lead time.**

Below there is a worst- and best-case scenario visible, this is the worst parts of the process gathered from all the 20 different case. In reality the worst of the 20 cases is 44 days which is still a lot. There is also a tab included showing the best case scenario, this is counted in the same way as the worst case scenario and if you take the best single case it would be 4 days. The best case scenario is basically zero lead time between all the processes and about 2 days of shipping time from central warehouse in Kampen to the ship to warehouse in Korea.
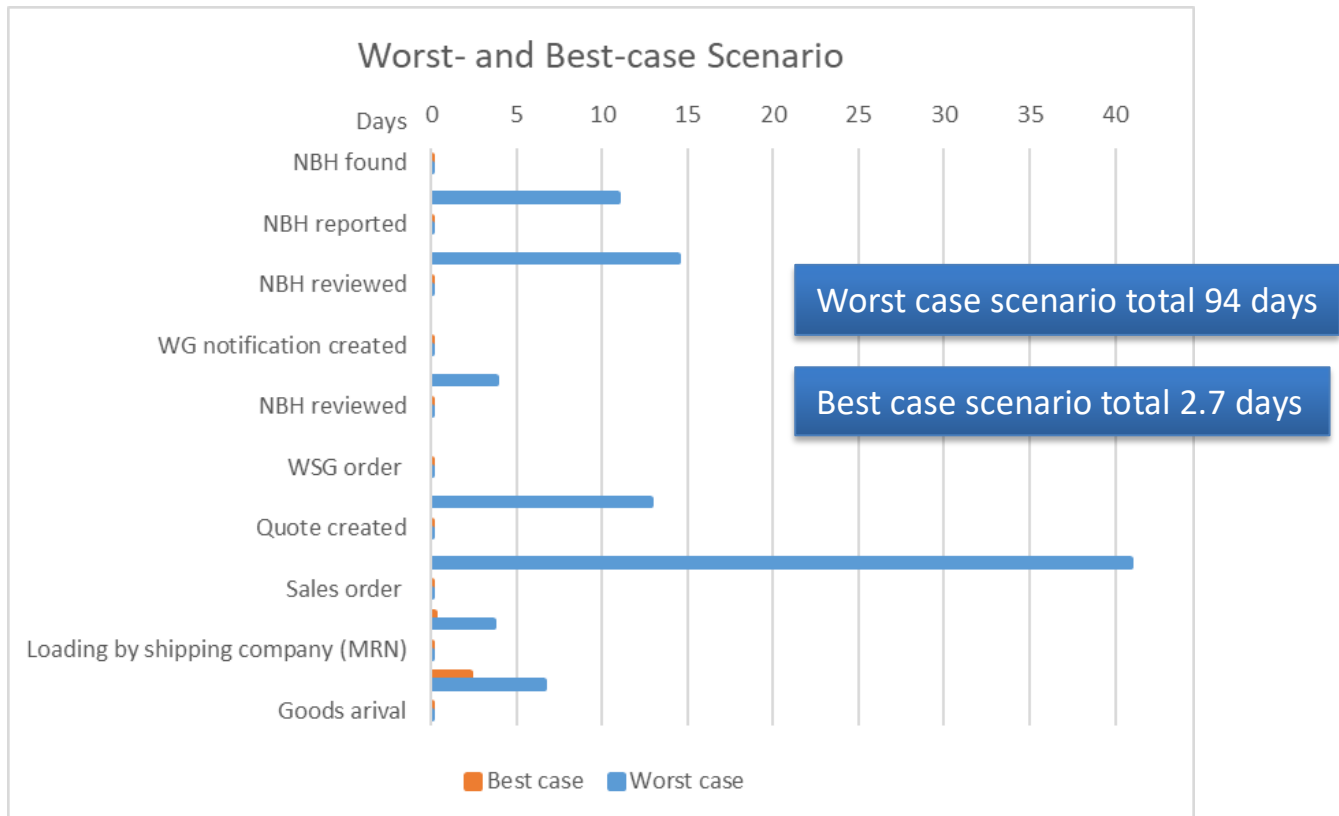


**Figure 17. Worst case scenario. The tabs after the text shows the process time and the tabs between the texts shows the lead time.**

Below is the last graph related to the current state map which shows how many cases there are in each category. The categories being 1 to 7 days, 8 to 14 days, 15 to 21 days and 22 days & over. The result of this graph is that the biggest group of cases are delivered in 1 to 7 days which is good but there are also many cases that are delivered in 15-21 days and those should be improved. Related to this graph it also needs to be considered that some cases are not as urgent as others which means for some deliveries of spares the 15-21 days are ok but

if the spares would not be in stock further delay will happen. Therefore it is important that the field service engineers report the non-conformities as soon as possible.
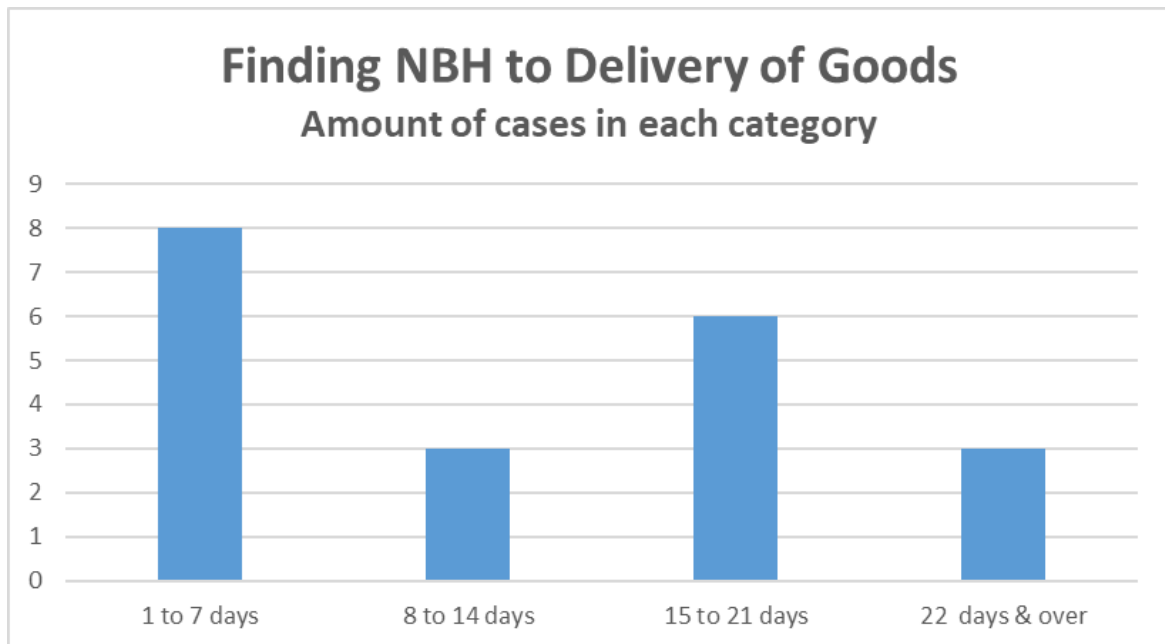


**Figure 18. The 20 cases divided on the amounts of days**

### 5.1.2    Future State Map

The future state map is made by re-arranging the way of working so that it is supported by the RACI table, which half of the thesis is about. In the future state map you can see that one of the reviewers will just be informed or consulted about the case and therefore will speed up the process. The process commissioning teams role in SAP will also be done by one individual which eliminates the need for rechecking SAP work done by an individual that are not so familiar with the process in SAP. By changing so that one individual does the whole process this person will also have a better contact with POS team and will better learn the best way to cooperate so that both teams will both gain quality and decrease their non-value adding time.
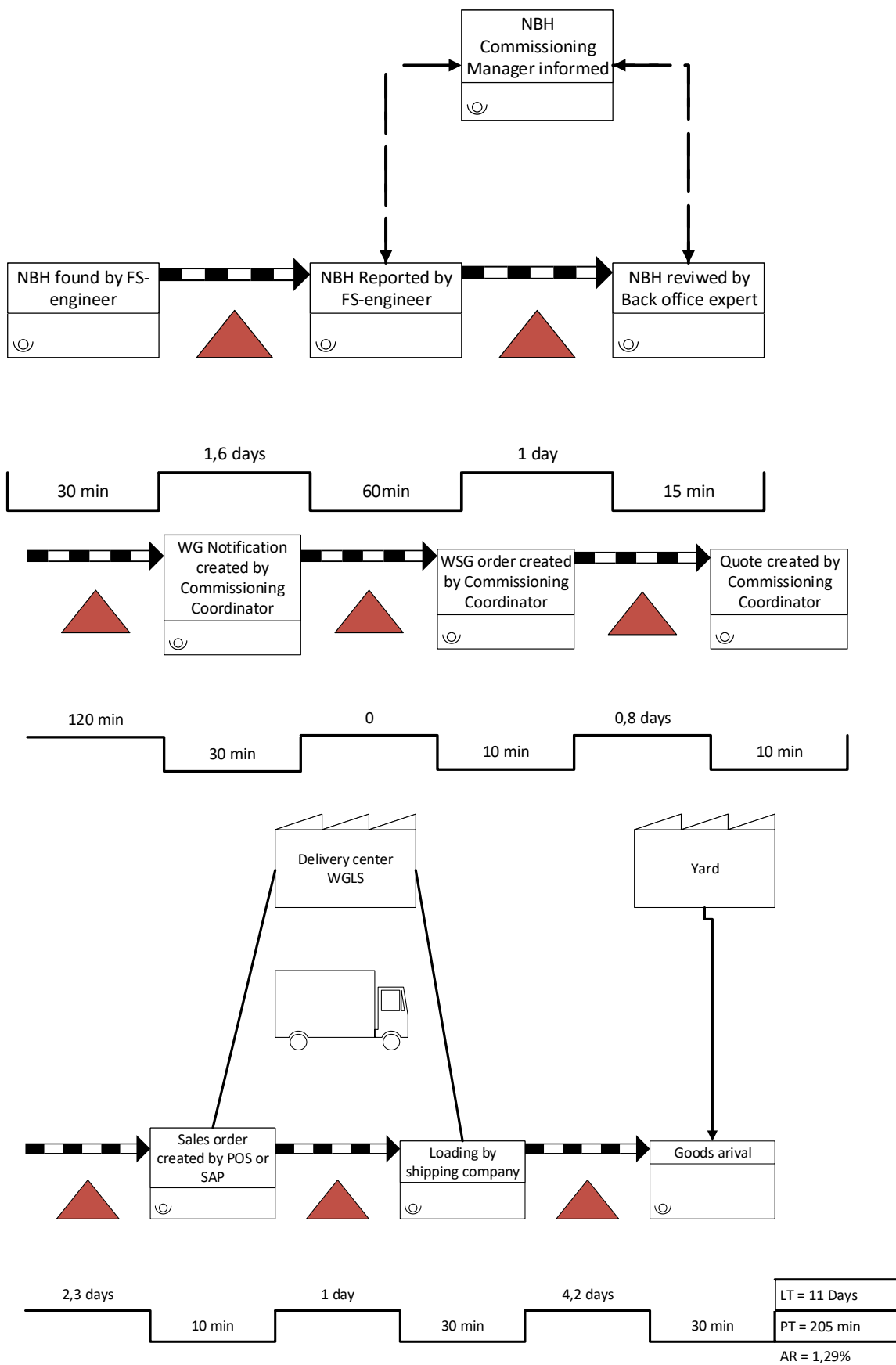
**Figure 19. Future state map**

### 5.1.3 Improvements

**The first proposal** is to promote a good contact between the field service engineer and the back-office experts. That is to improve the reporting time between these two individuals. Before, the service coordinator was responsible for many different tasks and not only commissioning. Now when the service coordinators from the main areas is in the commissioning team they can focus more on commissioning tasks so that they will not pile up. Additionally when the commissioning team have better control it is easier to have the team focus on the right things.

**The second proposal** is to promote proper standard reports that has all the information that the Commissioning Manager, Expert and Coordinator do not have to go back and make a phone call to the Field Service Engineer or vice versa. Proper reports will eliminate a big percentage of the fail ratio in the process. In Korea which has been investigated the standard reports are already in use but promoting these and implementing them all over the world will eliminate a lot of phone calls between these parties. Also not to forget is that a field service engineer can be hard to reach if he is inside a vessel with no mobile service. This can extend the whole process a couple of days if he cannot be reached which is what we want to get shorter. Promoting good reports and implementing them will have positive effect for everyone involved.

**The third proposal** is to make the technical identification process faster. The technical identification process shortened TECH-ID is a process where parts are Priced, delivery time is looked up, vendor data is checked, costs are checked and also availability. The TECH-ID process also makes a Wärtsilä material number if there is not already one. To improve the process on change notices, which are upgrades that are needed on the product, that was not already identified in the manufacturing, there often are new materials that are needed in the upgrade. The parts needed for upgrades has sometimes not then been delivered from our delivery center earlier, that means a tech id is needed on these parts. If it would be possible to initiate this tech id process earlier in the phase, for example the ones that creates the CN could initiate the tech id process instead of that the tech id process is initiated by the commissioning coordinator, a couple of weeks can be saved on the delivery dates. The commissioning managers also identified that the tech id process should be improved, this was also confirmed when interviewing one of the commissioning managers (Sjövall, 2018).

**The fourth proposal** is to have a smaller spare part inventory at the shipyard which could include the most common bolts, nuts, sealing sets and sensors that are commonly used. This would eliminate the whole process for parts where the process is more expensive than the spare part. It will also give value to the customer when the customers sees that the Wärtsilä engineers can fix these things very fast and do not have to wait for the spares or borrow spares from the customer or a sister vessel.

**The fifth idea** would be the solution to all the problem and that is to not have any non-conformities at all. Unfortunately that may not be possible today but there are still things that can be done to eliminate some of the non-conformities. In the RACI there has been added tasks that the commissioning team will arrange and attend quality meetings to give feedback to the delivery centers and the design teams. It is important that the commissioning team promotes and encourages these quality meetings so that in the future there would be fewer non-conformities which will give value for all the stakeholders involved.

## 5.2   RACI

### 5.2.1   Explaining the excel table

The excel table contains 195 different tasks and the same tasks are found on 3 different tabs. The different tabs being different project setups that you can sort in 3 categories. The categories are projects with a site manager that has up to 2 projects in parallel, projects with a site manager that has more than 2 projects in parallel and projects without a site manager.

The first column is Phase and there are 4 different phases in the RACI. The phases are defined from the gate model that you can find in the second chapter of the thesis on page 7. The phases being manufacturing and logistic, commissioning planning to commissioning start, commissioning execution and after commissioning, these phases explains very good where in the project execution the project is.

The next column is quite simple. It is the task number of the task and the first number tells which phase it is in and the next number is to tell the tasks apart. Next column is high level and that is a high level definition of the a group of tasks that are related to each other. The design is also so that you can easily tell the high level groups apart from each other. This was made to have a better overview and easier understanding of the very detailed RACI.

The fourth column has the topic Tasks and that column is describing the tasks in a very detailed level. As said before there are 195 different tasks that are all related to commissioning and all of them are very detailed so that everything will be clear for the reader of the RACI. The next four columns are dedicated to sort the different products that the commissioning department are handling. In excel the sorting function is very easy to use but if the department would want to make a printed version or a PFD version these can easily be hidden in excel.

The rest of the columns are the different roles which is described in the next chapter, it is also under these roles that the R, A, C and I letters are added, it is also made possible to enter up to two different letters for every role. For future edits to the RACI which will be needed when things change in the future it is easy to edit the letters since the editor can just delete the old ones and enter a new letter and the colour coding will be automatic.

On the below cut from the RACI table you will see all these columns.

| Phase | Task n° | High level | Tasks | | | | | Commissioning Manager | GM, Commissioning Coordination | Site Manager | GM, Site Management | Commissioning Coordinator | Commissioning - Quality responsible | Engine Expert - Back Office | Propulsion Expert - Back Office | EGC Expert - Back Office | FS - Engineer | FS - Site Teamleader | FS (*)(Office) | PE - Engine | PE - Propulsion | PE - EGC | PM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commissioning planning (from MS7 to commit) | 2.31 | for punch list, CN, Service letter | Open a WSG order for each CN or EKW punch list items or Service letter (for full scope of supply). | x | x | x | x | I | A | | | R | | I | I | I | | | | | | | |
| | 2.32 | | Order needed spare parts for implement CN and FAT open items or Service letter (for full scope of supply). Communicate to back office expert the expected delivery date for the parts | x | | | | C | A | I | | R | | I | C | I | C | I | C | | | | |
| | 2.33 | | Verify availability of needed resources and tools for implement CN, FAT open item and Service letter (engine equipment) in order to be compliant to preliminary plan made | x | | | | I | A | I | | | | R | | | | | | C | | | |
| | 2.34 | | Verify availability of needed resources and tools for implement CN, FAT open item and Service letter (propulsion equipment) in order to be compliant to preliminary plan made | | x | | | I | A | I | | | | | R | | | | | C | | | |
| | 2.35 | | Verify availability of needed resources and tools for implement CN, FAT open item and Service letter (EGC equipment) in order to be compliant to preliminary plan made | | | x | x | I | A | I | | | | | | R | | | | C | | | |
| | 2.36 | Verify resources and plan for punch list, CN, Service letter. Re-plan if needed | Verify if the preliminary plan for implementing CN, Fat open item and Service letter for full scope of supply is still valid. In case modify it accordingly | x | x | x | x | A | C | R | | | | C | C | C | C | C | C | | | | |
| | 2.37 | | Contact the shipyard, in order to understand the ship building status, in order to define the optimal slot when the modification can be implemented. Verify if the condition at yard are good for perform the rectification or modification. All possible modification should be performed before the | x | x | x | x | A | C | R | | | | I | I | I | C | C | | I | I | I | I |
| | 2.38 | | Re-plan parts, resources and tools accordingly to the feedback from shipyard. Inform CC team and back office expert involved | x | x | x | x | A | C | R | | I | | I | I | I | C | C | | I | I | I | I |
| | 2.39 | | Manage delivery dates of ordered spare parts according to re-plan made by CM | x | x | x | x | A | C | I | | R | | I | I | I | | | | | | | |
| | 2.40 | | Formalize resources and tools order to Field Service for the activity that can be perform at this stage | x | x | x | x | R | A | C | | | | | | | | | C | I | | | |
| | 2.41 | | Plan and secure resources requested for rectification implementation requested by commissioning manager according to Field Service process | x | x | x | x | C | A | C | | | | | | | | | R | | | | |
| | 2.42 | External kick-off | Arrange external project commissioning kick-off meeting | x | x | x | x | I | | I | | | | C | C | C | | | I | I | I | I | R A |
| | 2.43 | | Identify during external project commissioning kick-off meeting the needed document and or training to access to shipyard | x | x | x | x | R | | C | | | | | | | I | I | I | | | | A |
| | 2.44 | Create PO and verify resources for arrival inspection, | Create a Z8/PO addressed to field service resource at yard for performing arrival inspection for full scope of supply | | | | | I | | I | | | | | | | | | | R | R | R | A |
| | 2.45 | Then preform and repot arrival inspeciton | Verify availability of needed resources for arrival inspection | x | x | x | x | R | A | C | | | | | | | | | C | | | | |
| | 2.46 | | Open an order for arrival inspection. Create a service order for the job | x | x | x | x | R | A | I | | | | | | | I | I | I | | | | |
| | 2.47 | | Perform arrival inspection if ordered. Document the shipment status with a picture attached to a report and distribute | x | x | x | x | C | I | R | | | | | | | C | C | | | | | A |
| | 2.48 | | Collect arrival inspection report and share it with Project team (PM and PE) | x | | | | C | I | R | A | | | I | I | I | | | | I | I | I | I |

**Figure 20. Cut from the RACI table showing 19 of the 195 tasks**

## 5.2.2 Explaining the Different Positions

### Commissioning Manager

The Commissioning Manager is the main coordinator that will be the first point of contact for the customer regarding all products in the commissioning phase. Previously the Commissioning Manager was the Commissioning Coordinator but were upgraded to Commissioning Manager.

### GM, Commissioning Coordination

The GM is the General Manager for the Commissioning Manager, Commissioning Coordinator, Commissioning – Quality responsible and Back Office experts. This person will divide the projects between his employees and be their manager.

### Site Manager

The Site Manager is a person that will be located at the shipyard. He will be the customers first point of contact when at shipyard. The site manager could also be assigned to more than one shipyard and he will then focus on the more value adding tasks.

### GM, Site Management

GM, Site Management is the General Manager for the site managers and will act as their manager. He will also assign Site Managers to the projects that have a need for a site manager.

**Commissioning Coordinator**

The Commissioning Coordinator was previously the NC Coordinator and will handle the more administrative tasks, for example ordering non-conformity parts.

**Commissioning - Quality responsible**

The Quality responsible is a person in the commissioning team that will have biweekly meetings with the different design teams and delivery centers to improve the quality of the products.

**Engine-, Propulsion- and EGC Experts - Back Office**

The back office experts are the persons that can support and consult the Commissioning Manager in his different product specific tasks. The Experts can and will also be Commissioning Managers on the same time.

**FS - Engineer**

The FS Engineer is short for Field Service Engineer and he is the one doing the work at the shipyard on Wärtsiläs products.

**FS - Site Teamleader**

The FS – Site Teamleader will be a working teamleader and will have the same tasks as the FS – Engineer and some additional teamleader related tasks.

**FS - Office**

The FS – Office are the persons leading the resource groups and supporting the Engineer with different tasks. They will also do assign the FS – engineers to the different projects.

**PE – Engine, PE – Propulsion and PE – EGC**

PE is short for Project Engineer and their task is to handle the engineering side of the projects.

**PM**

PM is short for Project Manager and this person will be the head of the projects and will be Accountable for the most high level tasks and PM will also be in charge of the whole project.

### 5.2.3 Explaining the charts

On below charts it is visible how many tasks each of the roles have in the RACI. What is interesting and should be compered between the charts is the number of tasks that the site manager has in the different project types. In Figure 22 it is visible that the site manager will only have the very value adding tasks on his table while on Figure 21 he will have a lot more tasks that he will perform since he is located at the yard at all times. Figure 21 below explains the task divided when a site manager is appointed with up to 2 projects I parallel.
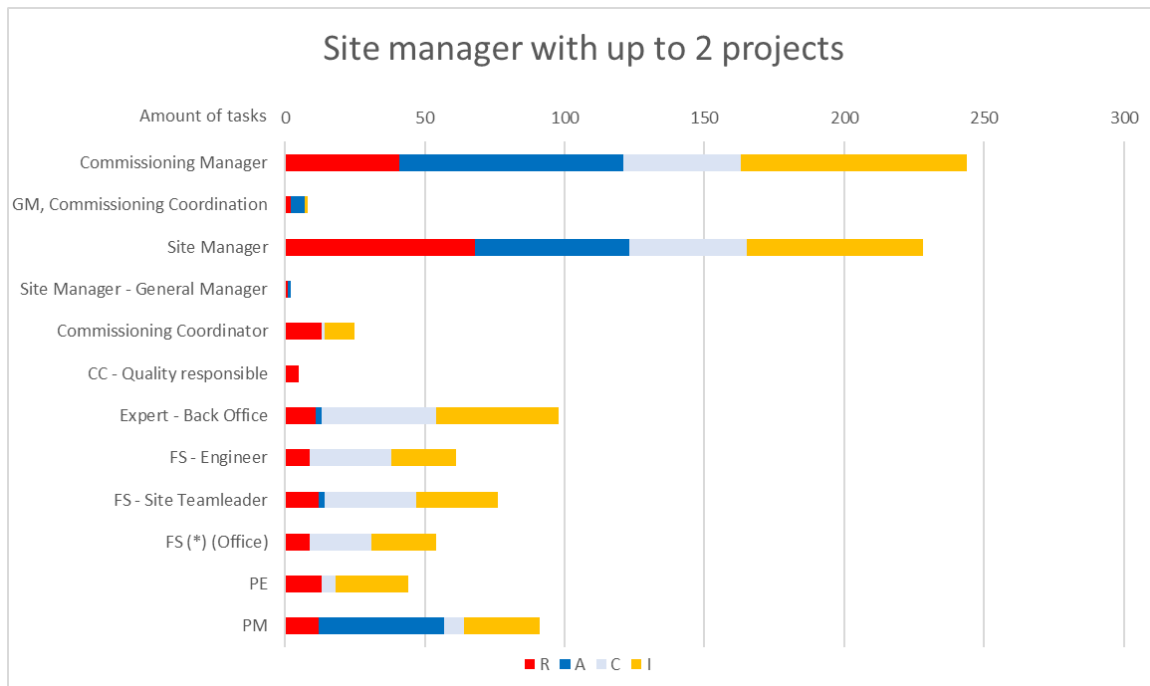


**Figure 21. Amount of tasks per role for projects with a site manager with up to 2 projects**

Figure 22 below explains how the tasks are divided when a site manager with over 2 projects in parallel is appointed. This is often the case in Asia where there are more than one shipyard located close to each other or more than two projects at one shipyard. If that is the case Wärtsilä wants a site manager that can be at the site for the more important tasks.
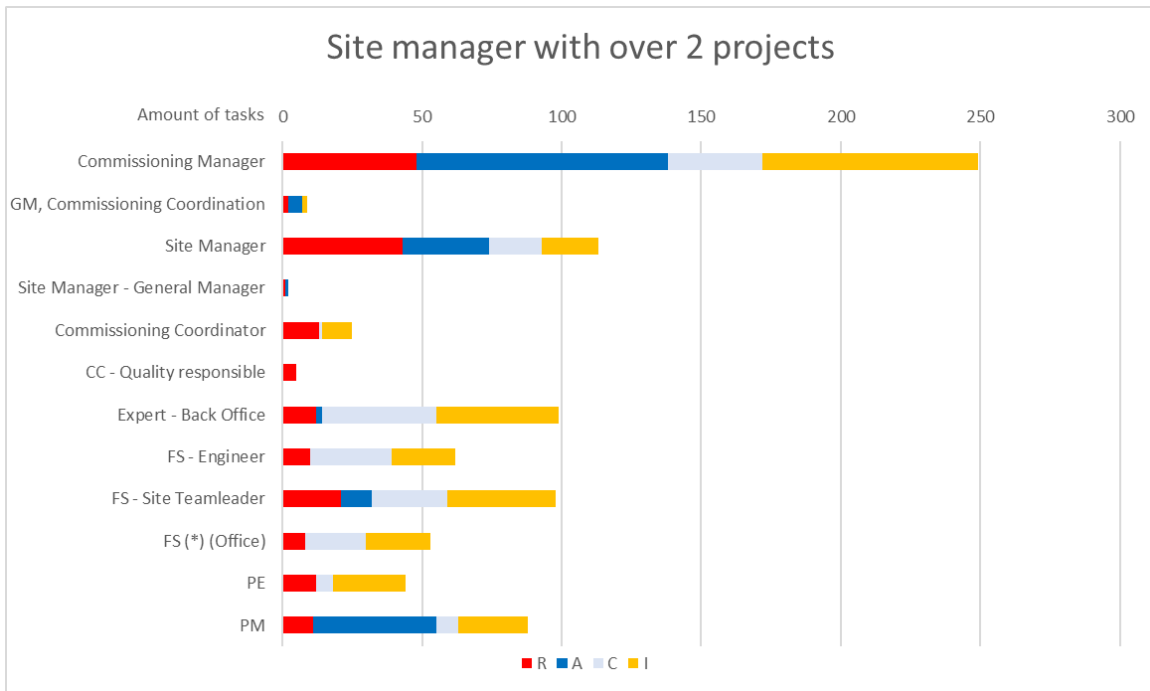
**Figure 22. Amount of tasks per role for projects with a site manager with over 2 projects**

Figure 23 is the last graph from the RACI and shows the tasks of the different roles when there is no site manager assigned to the project.
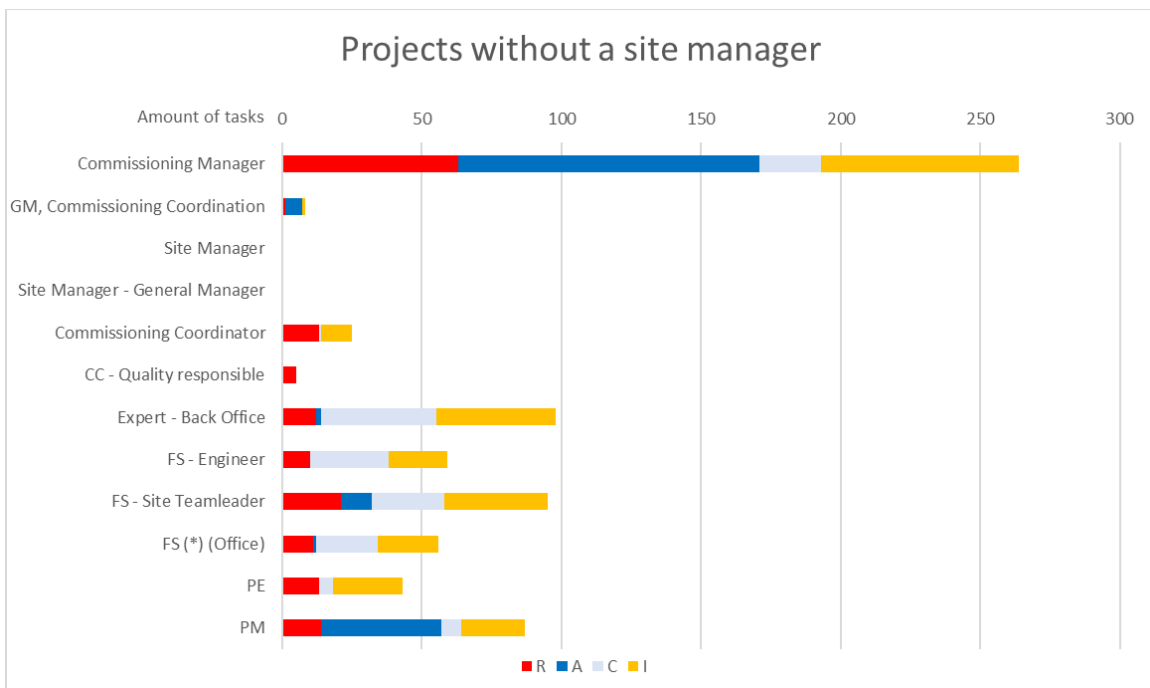


**Figure 23. Amount of tasks per role for projects without a site manager**

**5.2.4  Implementing the RACI**

What is left after that the RACI is complete is to implement it so that all the new guidelines can be put into use by all the concerned persons. The implementation will be done by the managers and an implementation plan will also be made by the developing team to make the implementation as smooth as possible. Kottlers 8 step method that is described in the theory chapter of the thesis will be thought of when making the implementation plan.

To give example what can be used and what to think about when implementing this change. The change that comes with the RACI means that there will be new roles, new way of working, and new value adding tasks for all of the people involved. Below Kotters 8 steps from the theory will be explained how they can be used in this project.

1. **Help others see that change is needed fast and why.**

   On this topic the part of giving value to the customer by having only one commissioning manager per project. This needs to be explained how it will give a better impression of the company and why the customers will gain value from this.

2. **Have the leaders believe in it.**

   On this point the leaders must believe in the change and all of the concerned leaders has to be involved before the launch of the new way of working.

3. **Make up the vision and show what will change.**

   The vision should show what will change and should be distributed in different ways, by info sessions, emails and by other material like the RACI. Here it is also important that everyone gets the information. For example you can map that everyone has been on the info sessions regarding the change and received all the info.

4. **Have all the people move in the same direction.**

   Here it is important to make the vision clear and have all the people involved understand the new change that will happen. If there are someone that do not understand why this change is needed, it is important to further explain it to them. Also it needs to be clear what will change and what will not. The RACI will be a great tool for this.

5. **Remove the barriers that comes up.**

   Here it is important to convince all the people that is not yet convinced that the change will have a positive impact. It is also important to see that everyone have enough time to change their way of working and not fall back to the old way because of old habits.

6. **Motivate with short-term wins.**

   Since this change will be related to projects, successful projects can be easily be promoted. It is also important to not be finished in this point, you must keep motivating the change and keep on with the new way of working.

7. **Push the change harder after successes.**

   This point is also about to keep motivating the change, so that people will not fall back in old habits. In this case the leaders can frequently ask how the change is going, if everything works as planned or if further changes are needed or keep explaining why the new way is the better way.

8. **Make sure the changes are kept and not going back to old habits.**

   In this part it is important to review the new processes and find new improvements and to see that the employees do not fall back to old habits. It is also important to see that the new employees understand the way of working and does not start doing the process in an old way.

# 6 Conclusion

The purpose of the thesis was to research if a new way of working would be effective and to help set up the new way of working. The research if a new way of working would be effective was reached by doing a Value stream map. By doing a VSM I came up with 5 different proposals for improving the process and also came to the conclusion that by rearranging the process the process can be done faster. From the proposals that I came up with two of them are already under investigation how they can be improved.

The RACI has also already started to be used even before the official launch and the purpose of the RACI was so that the involved parties could have support of the RACI when training and deciding who should do what in the project. Since the RACI is very detailed it is good for training people that are unfamiliar to the process. The new way of working is also included in the RACI so when the new way of working will be implemented the RACI will support it. And about it already being in use, that is for the reason that developers found it very interesting and have had support of the RACI when mapping different tasks and trying to understand different parts of the processes. With the RACI already being in use and some proposals from the VSM already being investigated in I will say that the purpose of the thesis is reached.

The main thing I came up within the VSM was that by rearranging the process, the overall lead time will be faster. Additionally by doing the VSM I also came up with 5 different proposals and recommendations that can me value adding. The RACI was also successful and I was able to make 195 different tasks for 3 different projects types, the types being projects without a site manager, projects with a site manager that does not have more than 2 projects in parallel and the third tab being projects that has a project manager with more than 2 projects in parallel. This was to support all the different projects.

The problem I met in the time writing and researching the thesis was that in the beginning it was hard to draw a line between the development project for the new way of working and me writing my thesis. My tasks for the thesis was a bit unknown in beginning but when deciding on the more concrete methods that could be used for the thesis and getting the scope clearer I was able to make a good research with the different methods. I was also lucky to do the RACI since I had a lot of experience in the process from my time as a trainee for the commissioning coordination team. Without my experience, the RACI would not have turned out this good and I would also have needed someone to guide me through all the processes.

To do further research after this thesis I can recommend further investigate the non-conformity process from an engineer's point of view or to test it again with different countries or areas and compare the different lead times between countries and see what is being done differently in the different locations. In the RACI I got the feedback that a simplified model of the RACI would be good for presenting the different responsibilities to new people and people that just need a quick overview of the processes, but I also received that this detailed version is what is needed so that no responsibilities is left untouched and so that everything I clear. I further also recommend keeping the RACI updated after all the future changes that will come so that it will not get outdated.

To end the thesis I would like to thank everyone involved. I would like to thank my supervisor Fredrik Hansten from Wärtsilä for all the discussions, constructive feedback, support and for him acting as a mentor to me through the Thesis. I also would like to thank Antonino Aloi, the departments operation of excellence manager, for supporting in the making of the RACI and giving a lot of support in the methods that was used trough the thesis. Also a big thanks to all the other individuals at Wärtsilä for being involved in the thesis. Lastly I would like to thank my supervisor Mikael Ehrs from Novia doing an excellent job providing feedback and supporting me through the whole thesis.

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