YRKESHÖGSKOLAN
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Reducing Rest (Partial) deliveries

Improvement of Visibility in the Procurement Process

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Abstract

This thesis is made on behalf of Wärtsilä Marine Business with the purpose of reducing the amount of rest deliveries that occur in projects. The improvement of visibility in the procurement process should ultimately lead to an improved procurement and shipping planning process as well as improved performance within the procurement management and the ability to follow up. This thesis strives to identify which functions and data that is crucial for enabling a successful procurement process.

Qualitative research methods have been used in this thesis. Data has been gathered through individual interviews and discussions with Project Managers, Project Engineers, Delivery Managers, Purchasers and Invoicing & Export documentation coordinators. The theory used in this thesis has been attained through inventory of both literature and journals.

The result of this thesis is research regarding the current situation and proposals on how the Order Specification Management (OSM) tool could be further improved to increase the visibility in the procurement process. This includes suggestions on data for measurement metrics of the procurement process. Also, an estimation of the cost and amount of the rest (partial) deliveries are included in this thesis.

Language: English Key words: Visibility, Procurement Planning, Partial Delivery

EXAMENSARBETE

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Titel: Reducering av restleveranser – förbättring av synligheten inom inköpsprocessen

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Abstrakt

Detta examensarbete är gjort på uppdrag av Wärtsilä Marine Business, med syftet att minska antalet restleveranser som uppstår i projekt. Genom en ökning av synligheten inom inköpsprocessen skulle leverans- och inköpsplaneringsprocessen förbättras såväl som uppföljningen och prestandan. Detta examensarbete strävar till att identifiera vilka funktioner och vilken data som är viktig för att möjliggöra en framgångsrik inköpsprocess.

Metoden som har använts i detta examensarbete är kvalitativ. Data har samlats in genom individuella intervjuer och diskussioner med projektchefer, projektingenjörer, leveranschefer, inköpare och fakturerings & exportdokumentations koordinatorer. Teorin bakom detta examensarbete har samlats in från både böcker och artiklar.

Resultatet av detta examensarbete är en kostnadsuppskattning över restleveranserna för år 2019 samt forskning kring nuläget samt förslag på hur Order Specification Management (OSM) verktyget skulle förbättras för att öka synligheten inom inköpsprocessen. Detta inkluderar förslag över data för att bestämma mätare över resultatet av en potentiell implementering.

Språk: Engelska Nyckelord: Synlighet, Inköpsplanering, Rest leverans

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ABBREVIATIONS

This chapter presents the central terminology, difficult terms and abbreviations used as follows:

EXW	Product Finished and confirmed according to order specifications.
Gate	A mandatory project management decision point.
MS	Milestone, A significant point or event in the project.
OSM	Order Specific Management, A program used and developed by Wärtsilä for Procurement Process
PDP	Project Delivery Plan
PE	Project Engineer
PLM	Product Life Cycle Management
PO	Purchase Order
POR	Purchase Order Requisition
SAP	Systems, Applications and Products in data processing. The ERP (Enterprise Resource Planning) software used at Wärtsilä
TERPS	Total Engine Room Package for auxiliary Systems
TM	Transport Manager
VOR	Variation Order

1 Introduction

This chapter will present the background as well as the problem area and purpose of this thesis. The chapter will also include the delimitations and confidentiality and lastly the disposition including an explanation of the content in every chapter.

1.1 Background

This thesis will process the subject “Reducing rest (partial) deliveries, Improvement of visibility in procurement process”. The assignment was given to me on behalf of Project Management in Marine Business MPS which is a part of Wärtsilä Finland Oy.

Rest (partial) deliveries are a problem within the delivery process that are caused by many different factors. The rest (partial) deliveries seem to correlate with the amount of visibility in the procurement process from the Project Engineers point of view. The responsibility of the Project Engineer is to create the purchase order requisitions that is an internal way of specifying what is needed to be purchased for the project. Poor visibility in this situation means that the Project Engineer is not able to have a visual overview of, for example, what is needed to be delivered, what is about to be delivered or what has been delivered. This also has an impact on the possibility to plan or take appropriate actions if there is something that is becoming critical in terms of delivering correctly.

Since Wärtsilä is always striving towards improving their performance, the amount of rest (partial) deliveries is needed to be reduced. By identifying the causes, it is possible to improve the procurement process in such a way that could benefit the project team members, which could minimize the risk of error and make their work more efficient. This thesis will be a step towards improving the procurement process and reaching the target at Wärtsilä of improved performance.

Project Management has adapted a new web-based application called Order Specification Management, OSM. This application or tool is meant to be used for different Purchase Order Requisition tasks. My task will be to investigate how OSM could be used to its full potential regarding the procurement planning and follow-up, and what could be further implemented into the application. The visibility regarding planning of procurements is not available in the application. Identifying specific outputs and inputs of data that would enable procurement

planning and creating a visual user interface, including the data, would be a step towards making the procurement process more efficient and reliable.

According to (Francis, 2008) the term visibility can have many different meanings depending on the area. The term supply chain visibility is however defined by (Schoentaler, 2003) as:

> *"Visibility means that important information is readily available to those who need it, inside and outside the organization, for monitoring, controlling and changing supply chain strategy and operations, from service acquisition to delivery. Deploying Web-enabled applications simplifies the challenge of getting the right information to the right person at the right time. "*

1.2 Purpose

This thesis will review the amount and associated cost of the rest (partial) deliveries for the year of 2019. This will be done to further emphasize the need for a change, the cost of the rest deliveries is a motivation for further research. The data needed for the cost estimation will be attained through the contact with the General Manager of operational project logistics.

The Order Specification Management application which has recently been integrated into project management as an effort to optimize the procurement process, still has potential to be improved and further functions to be implemented. The purpose of researching the functions that could be further implemented is to give a suggestion on how the procurement process could be improved, from a procurement planning aspect.

Therefore, the problem is that currently there are parts of the requirement specification that have not yet been implemented and the aim and goal of this thesis is to further investigate these unimplemented areas and give suggestions of what functions could be further integrated into the OSM application. The areas included in this thesis are the functionalities related to procurement planning and follow-up.

The focus of this thesis will firstly be to review the amount of rest deliveries for January – October for the year of 2019 and estimate the associated costs, including labour and transportation. The other goal of this thesis is to document the current functionalities of OSM, with regards to the procurement planning and follow-up. There are many possible causes to why the rest deliveries occur. This thesis will try to focus on the root cause, which is the lack of visibility. The enhancement proposals that will be presented in this thesis are

also focused on from the procurement planning aspect, since this can be related to improving the visibility from the Project Engineers point of view. Lastly, the goal is also to give suggestions on measurement metrics for a possible implementation of the procurement planning function in the OSM application, meaning metrics that would enable Wärtsilä to check how well the implementation of the function is working.

Wärtsilä has a wide range of project types within Marine Business, these projects include products such as propulsion and engines and therefore different processes. This thesis will only focus on the Customer Delivery Projects including Engines and auxiliary equipment.

The information for this thesis will be attained through discussions and interviews with stakeholders that are involved in the procurement process. The Project Engineers have the knowledge of the procurement process since they are responsible for creating the purchase order requisitions for their projects. Since they are familiar with this process through their work, they have the knowledge of what in their opinion would increase the visibility of the procurement process. The Project Managers are also included in this process and will therefore also be interviewed. The Delivery Managers bear the responsibility of collecting the scope of supply and co-ordinate the outbound transport arrangements, and to support in all kind of transportation related questions. The Transport Managers also support in warehouse management both in execution and sales phase on project level, therefore they will be interviewed.

1.3 Problem area

The main problem area that is addressed in this thesis is that the amount of rest (partial) deliveries in the customer delivery projects process needs to be reduced. The other problem connected to the rest (partial) deliveries is the lack of visibility in the procurement process. Today, there is no possibility to have an instant overview over what has been purchased, what has been delivered and what is to be delivered. These three factors are contributing to the amount of rest deliveries. There is now no uniform way for the Project Engineers and Project Managers to have an overview of the project regarding the to-be ordered or ordered scope.

Rest (Partial) Delivery

The term rest delivery is used within Wärtsilä and has a similar meaning to the two more known terms partial delivery and back order. Rest (partial) deliveries refer to items that have

been delivered to the customer in a so-called rest delivery, outside of the main shipment, due to wrong or faulty part being delivered. In some cases, the product may not have been ordered or delivered at all. Wärtsilä is responsible for the related costs of both the part and the delivery.

Rest (partial) deliveries occur due to different reasons. The root causes were discussed in a meeting with a Project Manager and some of which are listed:

- The item was delivered to late, and the item was not included in the main shipments.
- Purchase order Requisitions are created too late. This makes the room for error much smaller if as an example the sub-supplier suddenly has problems with their lead-times being long and there is not enough time fix the problem.
- Initial wrong specification; the level of detail between what has been sold/delivered can be unclear.
- Lack of knowledge and experience can lead to the Project Engineer creating a Purchase Order Requisition for the wrong part ~~and therefore also~~ leading to the purchaser ordering the wrong~~ful~~ part.
- Lack of project planning; this is today hard to follow up and update since there is no standardized process for it.
- Problematic sub-suppliers; either problems ~~with~~ delivering on time or technical issues.
- The part is broken, stolen or confiscated.
- Lack of communication between Purchaser and Project Engineer. The specification of the part has been incomplete or undetailed.
- The part has for some reason been left in the warehouse or is not found in the warehouse.

1.4 Disposition

This thesis is divided into seven different chapters, and the setup is as follows

Chapter own includes an introduction of the background, purpose and the researched problem area.

In chapter two, the company and the two business areas, including project management is presented and explained.

In chapter three, the theoretical aspect of the thesis is presented and in chapter four the method for reaching the purpose of the thesis is explained.

The fifth chapter includes the result where the following is presented: The interviews with the Project Engineers, The associated amount and cost of the rest deliveries for the year of 2019, the study of the current functionalities regarding procurement planning in OSM, the enhancement proposals regarding procurement planning and lastly the measurement metrics for the potential implementation.

In chapter six the conclusion is stated, including a motivation of my contribution, the challenges of this thesis and the proposals for further research.

The seventh and last chapter includes the references used in this thesis.

2 Wärtsilä in brief

This chapter will briefly explain the history of Wärtsilä and give insight in the different business lines of Wärtsilä, as well as an explanation of the Wärtsilä customer delivery gate model.

Wärtsilä was established as a sawmill in 1834 in the municipality of Tohmajärvi by the governor of the county of Karelia. The sawmill and iron works company later became Ab Wärtsilä Oy in 1907.

As a world leader within the marine technology, Wärtsilä offers a wide variety of innovative products and solutions. Smart technology and complete lifecycle solutions for both the marine and energy market is their speciality. The Net sales at Wärtsilä totalled at EUR 5.2 billion 2019 with approximately 19,000 employees at 200 locations in more than 80 countries.

The company's previous three businesses; Marine solutions, Energy Solutions and services has of January 2019 been merged into two businesses; Marine Business and Energy business. Services is no longer a separate part of Wärtsilä but integrated into the two current business areas.

Wärtsilä has stated that their purpose and strategy is to enable sustainable societies with smart technology. With the help of the Smart Marine and Smart Energy visions, Wärtsilä is striving to meet the demand for more clean and flexible energy (Wärtsilä, 2019)

2.1 Energy Business

Wärtsilä Energy Business stood for approximately 36 % of Wärtsilä's Net sales the year of 2019. The goal at Wärtsilä is to offer customers an optimal path towards using 100% renewable energy sources. The main customers segments within Wärtsilä Energy Business are utilities, independent power producers (IPPs), and industrial customer. Providing both solutions and services.

The utilities segment supplies electricity and gas to both residential and industrial end users. The IPPs intentions with purchasing power generation and storage assets are investments, they operate through selling the generated power to end customers or to utilities. The

industrial customers mainly consist of private companies who are in require of high electrical loads. (Wärtsilä, 2019)

2.2 Marine Business

The former business area Marine solutions now called Marine Business stood for approximately 64 % of Wärtsilä's Net sales the year of 2019. The strong position is within the marine and oil & gas industries. Aiming to enhance the development of sustainable societies, Wärtsilä has a broad understanding of the customers' businesses with extensive knowledge in service work.

The main customers are covered by all the main segments such as traditional merchant vessels, cruise & ferry, gas carriers and special vessels.

The former business area Services is now an integrated part of both the Marine and Energy business. Standing for 48 % of the total net sales in the year of 2019. Services are active in over 160 locations globally providing full lifecycle service for customers. Wärtsilä offer the customer a wide range of different services, ranging from spare parts to field service and training services. (Wärtsilä, 2019)

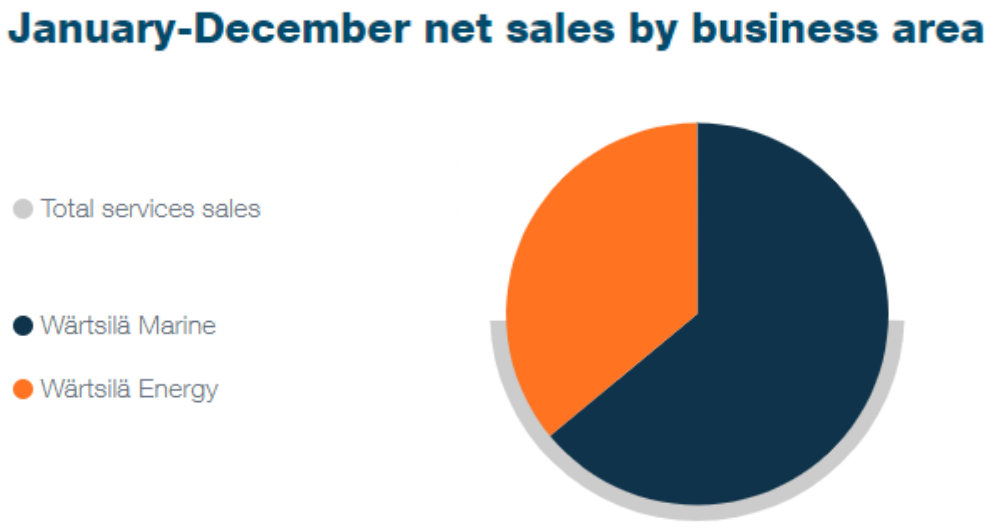


Figure 1 January-December net sales by business area for Wärtsilä 2019
(Wärtsilä, 2019)

2.3 Marine Business Project Management

Project management is defined as how knowledge, tools, skills and technique is applied to the activities within a project to meet certain requirements. Project are managed according to the Project Management Body of knowledge, divided into logically grouped processes that have been categorized into a group of five processes. The five groups are the following:

- Initiating
- Planning
- Executing
- Monitoring and controlling
- Closing

(Project Management Institute, Inc., 2013)

Project management is a part of the Wärtsilä Marine Business, optimized within each business to suit its individual business needs. The projects within Wärtsilä have been divided into three main categories due to the nature of the projects. The three categories are following:

1. Customer Delivery Projects
2. Product & Solution Development Projects
3. Operational Development Projects

Marine Business Project Managements main task is to secure the project execution and delivery, meeting the expectations of the customer. They are also in charge of planning, executing, monitoring & controlling and closing the individual project.

The processes, within Customer delivery project management. include engineering, purchasing, manufacturing, logistics and all service-related processes defined in the project contract. The process follows the Wärtsilä gate model shown in Figure 1.

The project management work starts at gate two, with the start execution. At this point, the scope is imported into OSM, Order Specification Management project and the project is created in SAP. SAP is the enterprise resource planning software used at Wärtsilä. The purchasing plan of the project is also created within gate two. The Sales Manager will thereafter hand over the responsibility to the Project Manager.

During gate two and milestone 4 the main goal is to finalize the project plan. This involves needed inputs such as high-level project schedule, scope of supply and Project budget. The contractual documents are, at this stage, made available to the Project Manager. The knowledge and customer requirements are transferred during milestone four, this enables the Project team to release the Internal Order Specification.

At the end of milestone five the confirmations of the done purchase order are received. The transport arrangements are also approved. This confirms that everything is in place for start of manufacture.

At milestone six the project progress is followed up and the status is reviewed for Procurement, logistics/shipment, Finance and so forth. The shipment/delivery plan and budget are updated. These dates include amongst others contractual delivery dates, delivery date information for the products delivered from sub-suppliers. If everything is in line and with the contract and complete the on-time delivery can be ensured. This requires regular status checks with the team to clear up issues.

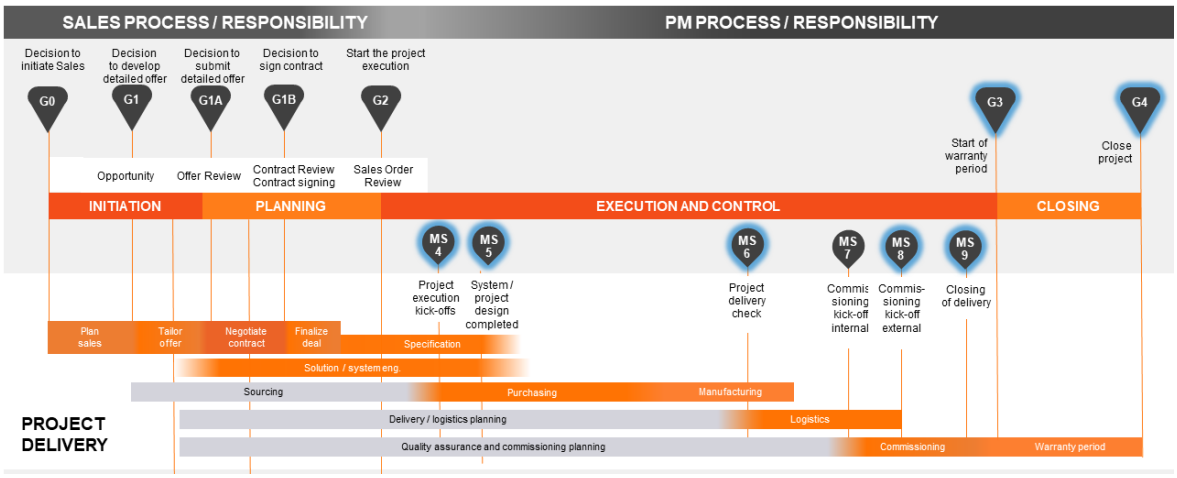


Figure 2 The Marine Business Customer Delivery Gate Model

(Wärtsilä, 2019)

The main purpose of the Wärtsilä gate model shown in Figure 1 is most of all to show what should be done be able to execute the customer delivery project as succesfully as possible. This requires that the predefined actions for every phase, gate and milestone should be followed. The predefined tasks vary according to the complexity and class of the project.

The Wärtsilä gate model is also used to visually present the gates and milestones and give a high level of overview of the process and their relations to project execution. (Wärtsilä, 2019)

3 Theory

This chapter will describe the theoretical aspect of the thesis. The theory of this thesis will explain about the procurement process in general, about the order follow-up process and project and procurement planning as a base of this whole thesis. The chapter also includes theory regarding measurement metrics.

3.1 The procurement process

Procurement is defined as the function of purchasing inputs that are used within the company's value chain. These include in this case the auxiliary equipment within the project. The term procurement is a broad term referring to a process including all activities required for getting the product to its desired destination from the supplier. (Weele, 2014) The procurement process is visualized by (Weele, 2014) and can be seen in Figure 2.

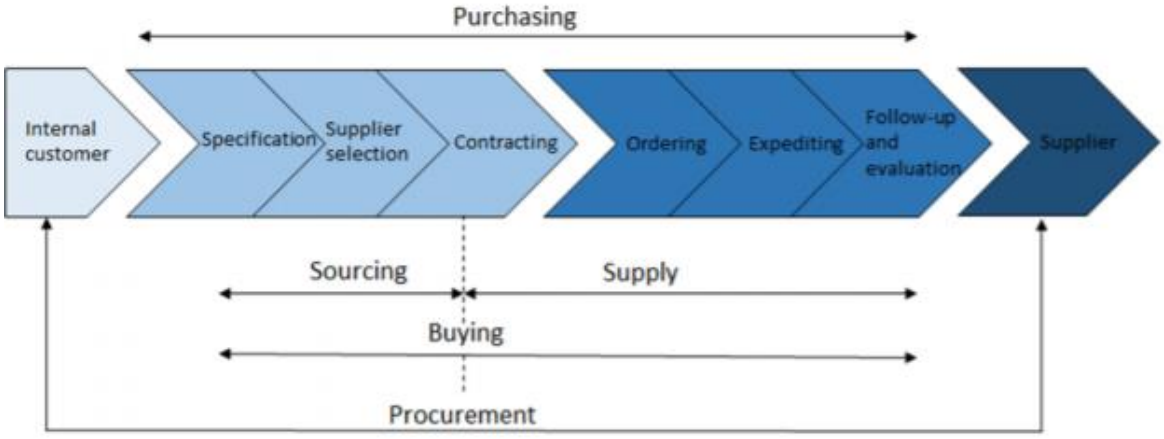


Figure 3 A model of the purchasing process with related concepts

The Project Engineer will prepare and initiate the purchase order requisition which serves as a description of the internal customer requirements for the goods that need to be obtained from the supplier and will serve as a base for the purchase order that the purchaser later facilitates. It is important that the purchase order contains the right information that describes the product that must be delivered towards the supplier. The following data needs to at least be included in the purchase order.

- Order number
- Concise description of the product.

- Unit price.
- Number of units required.
- Expected delivery time/date.
- Delivery address.
- Invoicing address

It is usually requested from the supplier to send a confirmation once each individual purchase order have been received.

(Weele, 2014).

Order follow-up

According to (Weele, 2014) in order to have visibility in the procurement process there needs to be a way of monitoring the orders. In this case this information would also need to be communicated to the Project Engineers/Managers so that they can have a better overview over the orders.

(Weele, 2014) also states that the deliveries of the goods need to be monitored and checked that they align with the agreements. As a buyer there are different exception reports that can be used in SAP for example:

- **Delivery overdue report**
  This list includes all the ordered products that have not yet been delivered and the date that should have been delivered by.

- **Incoming inspection report**
  This list included the products that have been rejected by Quality Control at delivery. If this situation occurs the buyer will need to take immediate action to solve the problem.

- **Signalling reports**
  If possible, in the purchasing system a code can be assigned to certain unreliable suppliers, strategic materials and purchase orders to generate different reports that enable the buyer to take preventative actions in an early stage. This also often requires that the supplier need to confirm via email that they will be able to meet the required delivery dates.

- **Field expediting**
  If delivery consists of products that are vital for the project, it can sometimes require several visits to the supplier

Purchase order monitoring in SAP

purchase order monitoring in SAP can be used for tracking of specific dates and events that are included in the procurement process. When a purchase order is created the monitoring can be started. The Monitoring process includes steps beginning with the creation of a purchase order with external vendors to when the goods are received in the warehouse. This continuous type of monitoring ensures that events such as date discrepancies and the effects they have on the other processes are recognized in an early stage, allowing the correct necessary measures to be taken accordingly. So that for example the dates that are affected still can be met. (SAP Help Portal, u.d.)

According to (SAP Help Portal, u.d.) activities that can be performed either manually or automatically within purchase order monitoring are the following:

- Date shift, reminders
- Cancellation of order items
- Reaction to open purchase order quantities (Under deliveries)
- Cancel delivery of the remaining quantity
- Insist on delivery of the remaining quantity

There are two different views of the Purchase Order Monitoring. An active and a reactive view, where in the active view the current procurement process is monitored throughout the whole logistic supply chain. This supply chain consists of operational dates in the dateline. In the reactive view it is possible to check whether dates have been overrun or not. (SAP Help Portal, u.d.)

This type of function in SAP could be used together with the procurement planning function. Wärtsilä has access to the Supply Chain Management function in SAP (Wärtsilä, 2020), where the SAP Event Management application exists within. With the SAP Event Management application events can be captured and monitored, since the system analyses the data with predefined planes and alerts the necessary stakeholders of deviations that are

found. The application increases the visibility within the supply chain by comparing the planned process with the process that is going on (Wilson, 2017).

Explaining the Process flow, the calculated dates are transferred to SAP Event Management where the actual dates are monitored and if a date is not posted at the correct expected time, the program can automatically perform predefined actions or have the order item transferred into the reactive purchase order monitoring view. (SAP Help Portal, u.d.)

3.2 Project Management Planning

One of the Project managers most important responsibilities are to plan, integrate and execute project plans. It is crucial that the Project Manager is well integrated into the planning process in an early stage to ensure project success. The planning process needs to be systematic but also flexible enough to take account of unique activities. (Kerzner, 2013)

It is of importance that all project participants are aware of all the required work, and that the work is defined. This can be communicated through a documented project plan and is necessary because:

- Preplanning is made possible when the work task is well understood in beforehand
- Lack of knowledge regarding work task could lead to changes in schedules and priorities since the knowledge must be gained during the actual task.
- The demand of information increases if the task is of an uncertain kind, this is crucial for ensuring effective performance. (Kerzner, 2013)

The main benefits of project planning are that the efficiency is improved of the different operations, uncertainty is minimized or reduced, and the objectives are clearly communicated

Procurement Management Planning

The definition of the term procurement is the acquisition of goods or services. Procurement often refers to the final act of purchasing but it also describes the process leading up to the final decision of purchasing. (Young, 2019)

The Project Management plan consisting of many different components undoubtedly also includes the process of procurement planning. This process defines how the project team

acquires their goods and services apart from the performing organization. (Project Management Institute, Inc., 2013)

The onset of procurement process consists primarily of planning for purchases and acquisitions. This calls for the development of a procurement plan that clearly states what needs be procured, how and when.

The different steps included in the process are amongst others the following:

- Definition of project specific needs.
- Defining schedule and timing for major milestones.
- Detect long lead procurement.
- Preparation of list including potential procurement and project risks.
- Procurement plan is needed to be developed.
- Identify and decide on potential prequalified sellers.
- Use of procurement metrics providing clarity to the managing of contracts.

(Kerzner, 2013)

The procurement plan works as guidance for all the listed activities. The items that are known to have a long lead-time needs to be handled early to have the time to add the extra time if needed. A procurement management plan does not necessarily have to be extremely detailed or formal, but it supports with describing how the procurement process will proceed from start to finish. The extent of the plan varies according to the needs of each individual project. (Project Management Institute, Inc., 2013)

The procurement process and all details related to it is included in the procurement management plan. The information that is included is therefore planned delivery dates of the equipment, how many vendors that will be involved, the impact of purchasing on constraints and assumptions for the project plan, lead-times coordination for purchasing with regards to the development of the project schedule. (Project Management for Instructional Designers, u.d.)

3.3 Measurement metrics

If an implementation of the procurement planning function in OSM would take place there would also need be metrics that measure how well it is working. Wärtsilä has certain goals and key performance indicators used to see how well they are achieving their goals. The measurement metrics for the procurement planning in this thesis will strive towards supporting the KPIs that are already in use at Wärtsilä.

The project metrics are also a way of tracking progress in project management. These measurements can be chosen on basis of what the goals and critical factors for success are within the project. (Guinan, 2019). Depending on the type of metric it is necessary to monitor it over a longer period to see the whole picture. (Chittoor, 2012) It is though important to remember that many key performance indicators and metrics does not necessarily result in better project management (Montgomery, 2019).

The first step before deciding what to measure, is to determine what success is for this specific case (Harrin, 2015). To decide on what type of metrics that are required for the specific projects certain questions must be answered. (Kerzner, 2015) states that What exactly is to be measured? When should it be measured? How it should be measured? And who will do the measurements? Are questions that require answers.

Some benefits of using the right metrics according to (Kerzner, 2015) are:

- Metrics inform the stakeholders of the progress, if it is going better or worse.
- Metrics allow for early identification of mistakes that can lead to bigger problems
- Metrics can improve the customer satisfaction
- Metrics improves the performance in the future
- Metrics track how well the project’s critical success factors are being met
- Metrics can improve estimations in the future

The abbreviation used for the term Key performance indicator is KPI. The term metrics is not to be interchanged with KPI, since they have different meanings. KPIs basically measure how efficiently your business achieves its goals, when metrics however only track the status of the business process (Taylor, 2017). Both KPIs and metrics are quantifiable measurements, whereas KPIs are strategic activities and metrics tactical. KPIs reflect

strategic business goals and how successfully they have accomplished the goal. Metrics reflect how successful the tactical activities are of supporting the KPI. (Hatheway, 2016)

Metric categories

(Kerzner, 2017) states that metrics have throughout history most often been used in evaluating business strategies. However, metrics can be categorized according to the purpose of the metrics. These categories include:

1. Business-based or financial metrics
2. Success-based metrics
3. Project-based metrics
4. Project management process metrics.

Project-based metrics is the type of metric that will be used in this thesis. This type of metric includes according to (Kerzner, 2017) time, cost, scope and number of scope changes, rate of change in the requirements and customer satisfaction with project performance.

Selection of metrics

It is important to choose the correct type of metrics, selecting an inappropriate type of metric will result in getting data that is useless. Finding a compromise of not having too many metrics, and not having too few is not always easy. Having too many metrics can result in that too much information is received leading to the involved stakeholders not being able to analyze what is critical of the information. Having too few metrics results in the opposite, meaning that the amount of critical information provided is not enough. (Kerzner, 2017)

The metrics that were found to be most suitable for this situation were the following:

1. Schedule Variance = ((Actual calendar days – Planned calendar days) + Start variance)/ Planned calendar days x 100.
2. Effort variance for a phase = (Actual effort for a phase – a planned effort for a phase)/ (planned effort for a phase) x 100.

(Simplilearn, 2020)

Metrics visibility

Having a visible and easily accessible dashboard of the relevant KPI data keeps it on the top of the stakeholder's minds. There is however no need to make it more difficult than necessary. Simple ways such as posting the KPI metrics on the company's internal website.

As in the case of trying to reduce the amount of rest deliveries through implementing a new procurement planning process. A way to keep the stakeholders responsible for the improvement updated on the progress would be to inform them in weekly or monthly meetings of the amount of rest deliveries that have occurred compared to the target goal. This will motivate the stakeholders and keep them reminded of the goal. (Berman, 2007)

Wärtsilä uses the Microsoft Power BI application currently, and this would be a good place as to where to present the metrics.

4 Methods

This chapter will include the work methods of gathering information and material regarding the process of improving the visibility and functionality of the procurement process. The method supports the fulfilling of the purpose and goal of this thesis.

The choice of method will first be explained and then the individual interviews will be further explained in detail. The principle of the OSM application will also be explained in this chapter to clarify the purpose of the thesis.

4.1 Choice of method

The research method used in thesis is a qualitative method. This type of method is best suited according to the type of research done in this thesis. This method has been used to attain deeper understanding of the problem and to reach the goal.

The information for this thesis has been gathered through interviews with Wärtsilä stakeholders from different parts of the Marine Business Project Management team. Information has also been gathered through analysis of internal documents to get a further understanding of the different processes within Wärtsilä, the Wärtsilä gate model as an example.

The meetings and interviews provided a deeper insight into the problem area. They also contributed to developing ideas of what should and needed to be done. The communication and regular meetings with the supervisors helped to avoid misunderstandings and other problems related to lack of communication.

4.2 Meetings

Together with the supervisors, the respondents of the interviews were chosen according to their level of involvement, experience and knowledge of the procurement process.

The meetings arranged have varied from shorter 30-minute meeting to one-hour meetings. The conducted meetings and interviews have been held individually. The techniques used when collected data and conducting interviews have been both structured and unstructured. This due to the nature of the questions, and what the anticipated result was.

Other more specific information regarding the processes and departments at Wärtsilä have been gathered from the internal Wärtsilä website. This material is used to educate Wärtsilä employees and give them deeper understanding of various areas.

Meetings in detail

The first meeting included both supervisors at Wärtsilä. This meeting was held in the beginning of the process, where the goal and purpose of the thesis was not yet indefinitely decided. During this meeting the problem area and goal of the thesis was briefly explained

When the supervisors at Wärtsilä had agreed on the specific goal and purpose of the thesis a second meeting was arranged. In this meeting, the supervisors from Wärtsilä and the supervisor from Novia University of Applied Sciences participated. This meeting was held to ensure that the supervisors from both sides were on the same page. This ensures that guidance becomes more accurate and helpful for all parts involved. Here of course the goal and purpose were presented, and the limitations of the thesis was decided. Lastly the supervisors agreed on that the scale of the thesis was appropriate.

There were smaller meetings arranged with one of the Wärtsilä supervisors every other week. As previously mentioned, these meetings involved feedback of my work and gave an opportunity for both sides to ask questions and provide ideas and help if that was needed. This guidance was crucial to ensure that the thesis was following the right track and was in line with the right goals and purposes.

Meeting with Project Managers regarding rest (partial) deliveries

This meeting was conducted with one of the project managers in project management, Marine business. The interview subject for this discussion was chosen because he has been involved in many cases of rest (partial) deliveries in different projects, and he also has experience in this area. The purpose of this meeting was to get a deeper understanding of the nature of the rest (partial) deliveries. The meeting was held in an unstructured way as a discussion.

The questions asked during the discussion were the following:

1. Why do rest deliveries occur?
2. How can they be minimized?
3. How do they affect the customer/Wärtsilä?

4. What are the associated costs and impacts?

Meetings with the Project Engineers

These meetings were held as 30-minute-long interviews with 4 different project engineers at Project Management. The reason for interviewing these people was that they are the main users of the OSM application. Since the application was implemented in the autumn of 2019, not all Project Engineers have gotten as familiar with the application. Those Project Engineers which were interviewed were chosen on the basis on their experience with the OSM application, availability and their knowledge and expertise within the area of the procurement process together with my supervisor.

The questions that were asked during the interviews were the following:

1. How do you plan the procurement process at this moment?

2. How long would you say that the ordering process approximately takes?

3. Which type of data is most important and critical for planning the delivery and to have in OSM to be able to increase the visibility in the procurement process? (Lead times, shipment dates, ExWorks and so forth.)

4. What type of data would decrease the risk of potentially ordering the wrong parts, forgetting to order a part or to order it too late?

5. How do you keep track of all the different lead times for all items that needs to be purchased? From where do you receive information regarding lead times?
    a. What are your thoughts on how this process could be improved?

6. How does the current project planning (Project Plan) support your procurement process? how do you plan your upcoming procurements?

7. How do you derive the EXW date from the contractual delivery terms?

8. What are your ideas regarding deciding the consolidation time?

- Do you have any other ideas of what type of data or functionality would improve the way of working in OSM? What functions or data would you want to be integrated in OSM?

The interviews were of varying result. Some of the Project Engineers gave more useful answers than others. Especially one of the interviewees answers were used and presented in the results chapter. The Project Engineers answered all the questions asked. The answer that seemed relevant were included in the result, and the irrelevant ones were left out. The result

from these interviews consists mostly of the answers from three of the Project Engineers. One of the Project Engineers that was interviewed had been involved in the implementation process of OSM, therefore he was able to provide more useful answers for these specific questions than the other Project Engineers.

The method of interviewing the users of OSM, that would be the Project Engineers turned out to not be as effective as previously thought. Since they mostly have more practical ideas on how the procurement process could be improved, and not so much on the specific data that is needed to enable those functions. But the interviews gave an overview over their opinions and suggestions on what they would like to have available in OSM, even though all suggestions were not completely relevant for this study.

Discussion with Development Manager regarding OSM

The data that was collected and summarize in Figure 9 which works as a base for the procurement planning function in OSM. This was done through a brainstorming session with the development manager involved in the OSM implementation.

The discussion was held in three meetings that were half an hour to an hour long. The first meeting was an introduction to the machinery behind the Order Specification Management tool, and how implementation of new functions is done. The second meeting focused on the possible procurement planning function, and a discussion regarding the input data for the outputs would be. The discussion of the third and last meeting was of:

- The possibility of implementing a procurement planning function in OSM.
- How would the procurement planning function work in practise?
- Where the different inputs would be imported from?
- Who the responsible person for the procurement plan would be?
- How the procurement planning function would be kept updated

4.3 OSM

Order Specific Management is the new way of managing the scope of supply to customers. OSM is a web-based application, that is integrated with SAP and Teamcenter. The application can today be used for different purchase order requisition tasks such as creating, updating and deleting purchase order requisitions. (Wärtsilä, 2019)

Since OSM is a tool that includes all the scope items for the project, this would be a perfect opportunity to include the procurement planning function in, that is discussed in this thesis. To give the Project Engineer and Project Manager the opportunity to in the same tool have an overview of all the scope items in a list, and the relevant data for planning also. This would enable a more efficient way of planning, and to follow up proactively with the help of different measurement metrics.

Principle

The information that is used in OSM is built on product lifecycle management data, the user then needs to verify the scope of supply and add or remove items if it is needed. When the data is verified the project-engineer releases the item to the purchaser.

This creates new possibilities for the user, such as:

1. Purchasing Scheduling
2. Material Numbers can be used in delivery phase
3. Integration of Installation Planning Instructions
4. Optimization of the product portfolio by comparing As-Specified with As-sold data (Wärtsilä, 2019)

Figure 4 shows the view from where the Project Engineer creates the purchase order requisition by specifying all the technical data for the specific parts, so that the Purchaser then can create the Purchase Order based on that information and order the part.

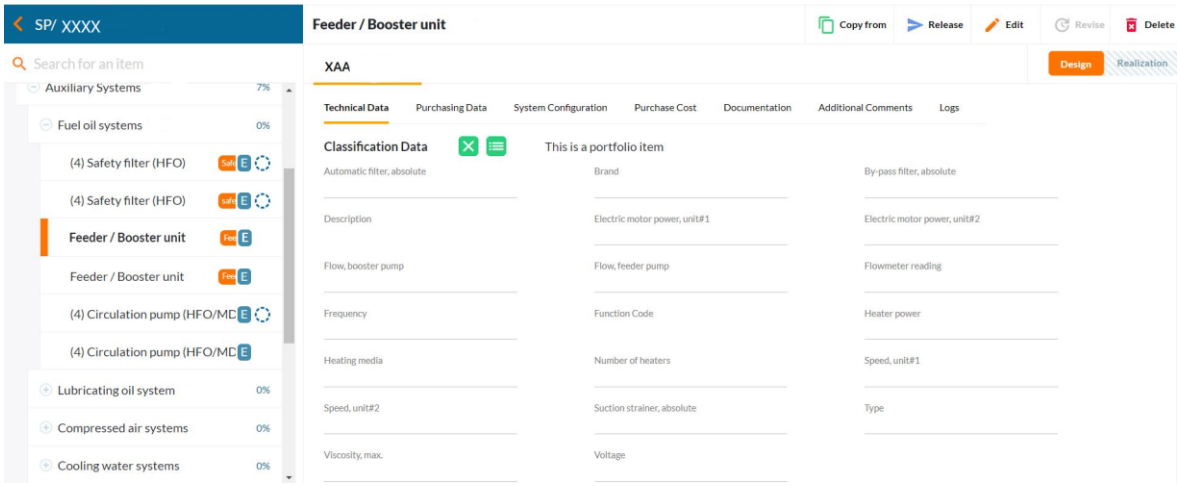


Figure 4 An example of the technical data view for one of the components

The view shown in Figure 4 however does not as can be seen include any type of functionality regarding the procurement planning or the contractual delivery terms. Therefore, another type of view would have to be implemented into OSM, to enable the procurement planning function.

The current situation

The OSM application is currently being optimized and improved to work as smoothly as possible. As the focus of this thesis is primarily on the auxiliary systems this is only shown.

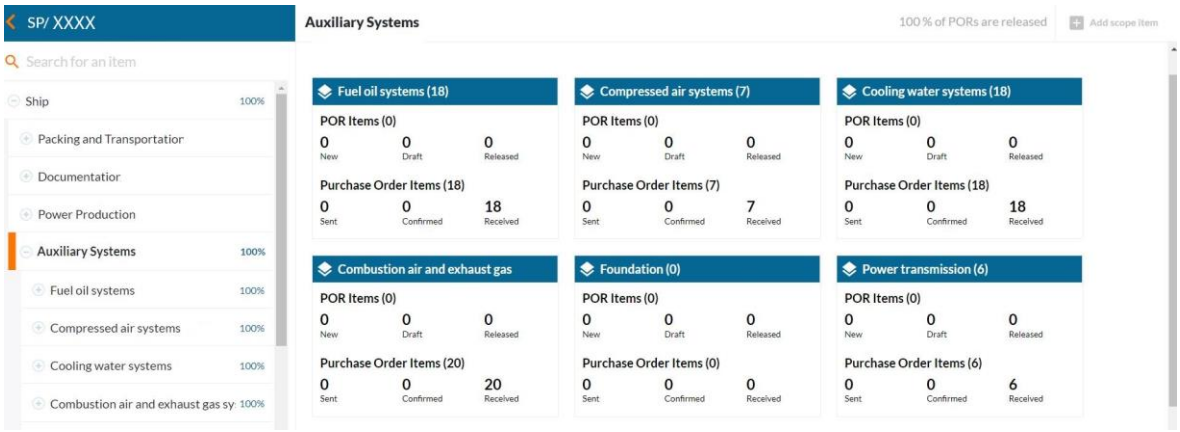


Figure 5 An example om the auxiliary systems view in OSM

The first page of the application allows the user to search for a specific project and open it. When the project is opened the user can navigate to the wanted level. Which in this case is on the auxiliary systems view. Figure 5 shows the view where indications of new, drafted and released purchase order requisitions are. There are also indications of whether the

purchase order has been sent, confirmed or received. This is summarized from all the levels of the scope of supply. As can be seen in Figure 5 all Purchase orders have been received by the supplier and nothing else is pending.

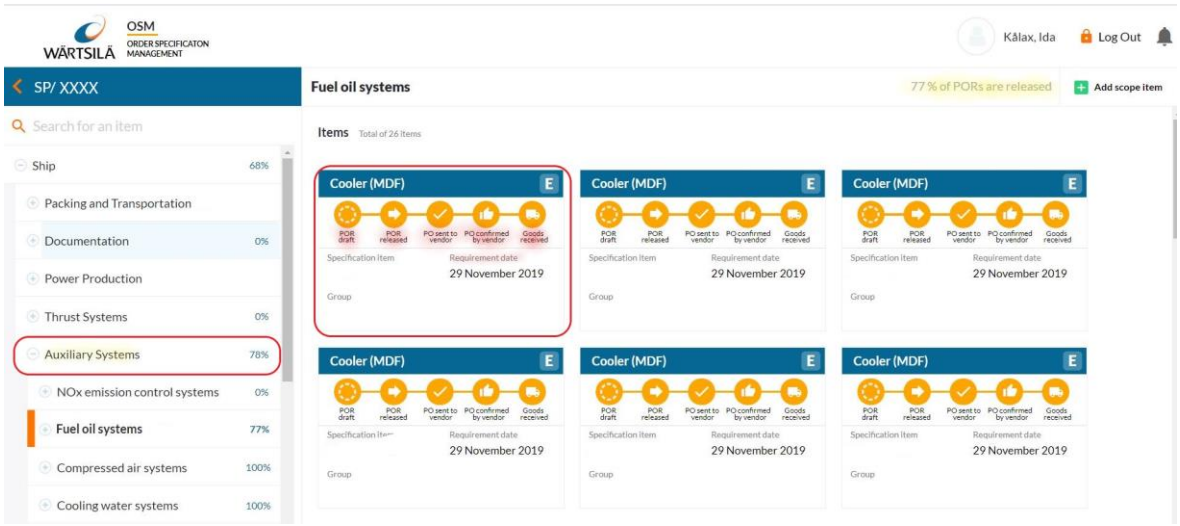


Figure 6 An example of the view inside the fuel oil systems level in OSM

Figure 6 shows a view in OSM and in this example a view of the scope of supply for the fuel oil system. What also can be seen in the Figure marked with red is the process diagram of the procurement process explaining if the Project Engineer has released the purchase order requisition for the item, if the purchaser has created and sent the purchase order to the vendor, if the vendor has confirmed the purchase order and lastly if the goods have been received. The requirement date, the date that the item must be at certain consolidation point is also visible in the same window.

5 Result

This chapter will include the result found in the interviews, the estimated cost of the rest deliveries in 2019, a documentation over the current functionalities in the OSM application with regards to procurement planning and follow-up, and also give suggestion on process measurement metrics to measure how well the possible implementation of the procurement planning is working.

Interviews were conducted with four experienced Project Engineers within the project management in Wärtsilä in order to be able to gather the information needed to fulfil the purpose of this thesis. That would be input regarding what type of data or functionality that could be implemented into OSM to improve the visibility in the procurement process.

5.1 Interviews regarding the procurement process

The result of the four interviews held with the Project Engineers was of varying result. The most useful answers will be summarized and considered when giving proposals of how the procurement process could be improved. The Interviews are summarized and sorted into different categories based on their nature. The categories are based on if it is a statement regarding the situation now, an action or a request.

Comments regarding the situation now

- There is no standardized way of planning the procurement process is used. The Project Engineers are today responsible of memorizing everything on their own and taking in account all the different factors.

- There is lack of traceability of items, since there are no specific tags on the packing list or on the item itself.

- The visual overview of the process is virtually non-existing today.

- The Project Engineer must check with the Purchase what has arrived at the warehouse today, which is very inefficient.

- The Project Manager has often today the responsibility of informing the Project Engineer when all the necessary equipment is needed at the warehouse. This information is based on the experience and knowledge of the Project Manager. And the date is in round terms derived from counting backwards from the contractual

delivery date and approximated according to the duration of the different steps of the process and then subtracting that from the contractual delivery date.

Actions that the Project Engineers already take

- The Project Engineers identify items that have a long lead-time and demand specific calculations.

- Some Project Engineers make a logistics plan in excel that includes data received from SAP when the purchase order requests have been made. A sort of scope list is created based on this information, and the Excel sheet includes consolidation points and different lead-times such as when the items must be delivered at the customers site.

Improvement suggestions from the Project Engineers

- The contractual delivery date would need to visible and easily accessible

- There would always need to be a possibility to identify loose parts disregarding circumstances at consolidation points. Therefore, a specific tag for all ordered items making it traceable in packing lists and on components would be necessary.

- There would need to be a visible confirmation of delivery dates from the supplier.

- Continuous feedback from the supplier is needed, notifying the project team of eventual delays so that this can be fitted into the plan.

- There would need to be a report of what has arrived at the warehouse. It would be good to have indicator of missing items when the shipment date is approaching.

- There would need to be a summary of all the scope items in the project in OSM. Showing all the items. This would enable the Project Engineer to check if the components are being ordered with the right specifications to avoid rest deliveries (For example amount or kW). It would make the work easier and more efficient if it was easier to double check that everything is correct.

- There could be standard lead-times for the suppliers incorporated in TERPS. TERPS is a database used by Wärtsilä that contain all technical information about the auxiliary equipment delivered with the engines.

- There could be a project plan with integration of planning of delivery lots for all equipment which are locked according to the contractual delivery date. This would be done in the beginning of the project together with the Delivery Manager

- The Transport Manager would need to state a date which the Project Engineer can strive towards regarding procurement. If they determine that by a certain date all equipment must be at a certain consolidation point. This would need to be done since the Transport Manager has more knowledge regarding how much time that is needed. For example, what the difference in lead-times are between China and Romania.

- The planning of the project would be improved if the ExWorks-, and lead-time dates were visible.

5.2 Associated amount and cost for rest deliveries 2019 (Confidential)

This subchapter has been removed from the public version of the thesis due to the content being confidential.

5.3 Current OSM functionalities regarding procurement planning/follow-up

Before the implementation of the OSM application, interviews took place as a base for the requirement specification. Different stakeholders involved in the projects were asked regarding their requirements for the application. This list included many different areas of functions and requirements that had different priority levels ranging from not now, could, should and Must.

One of the goals of this thesis was to analyse the requirement specification and to see what was included and how it corresponded with reality. All the relevant requirements for fulfilling the purpose of this thesis were summarized into a separate list. Many of the requirements mentioned in the list were not relevant for the procurement process aspect, and therefore also not mentioned in this thesis. The relevant requirements were the following:

REQUIREMENT	PRIORITY
Contractual delivery terms shall be visible in the application. - This is not available in OSM at this moment. This was also mentioned partially in the interview by one of the Project Engineers, stating that the contractual delivery date would need to be visible in OSM.	**Should**

Contractual delivery time for every project shall be in the application. - This involves the same subject as the previous requirement.	**Should**
The application shall have the information of the consolidation point and delivery address for all products. - This requirement is also of the same type as the first one.	**Should**
The application shall have the information of delivery address for products (Customer). - Same with this requirement.	**Could**
The application shall have the information of delivery address for project (Customer). - Same with this requirement	**Should**
Required product factory ex-works delivery date shall be available.	**Should**
Information of required date for 3rd party components shall be in the OSM application.	**Could**
Information of 3rd party components delivery date shall be in the OSM application.	**Could**
Each project shall have SAP project status visible in the OSM application.	**Should**

Many of these requirements were set with the priority should and therefore not everything has yet been implemented in the OSM application. However, having the contractual delivery terms in OSM would not be impossible by any mean. And if this is seen from the Project Engineers point of view as something that would make their work more efficient, it would need to be implemented.

Functions implemented in OSM

In the means of visibility of the OSM application there is a small window for every component indicating what stages the item has gone through leading up to the customer receiving the item. This is the only type of visibility of the procurement process that is available at this moment.

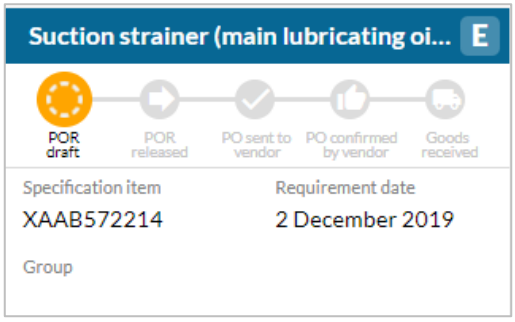


Figure 7 Process chart for individual component

5.4 OSM enhancement proposal regarding procurement planning

To improve the visibility of the OSM application, a procurement planning function could be implemented. Another suggestion for what to call it could be project scope of supply planning, since this would be a more explanative name. This function would need certain inputs to be able to give the user specific outputs, that in this case could be a suggested release date or creation date for the purchase order requisitions to help the Project Engineer, and also a suggested shipment start and end based on the same inputs. Other outputs that would be generated by the inputs are a shipment description that is based on the input from the project level and an additional buffer lead-time.

	Input	Output
Project Level		
MS2 - Contract signing	Potential risks in project	Additional buffer lead-time
MS3 - SOR	Special requirements	
MS4 - Project Execution kick-off	Transportation	
	Custom declaration	
		Project level lead-time
Scope of supply level		
MS2 - Contract signing		
MS3 - SOR		
MS4 - Project Execution kick-off		
MS5- Project design completed	long lead-time items, Identified	
	Planning of shipment lots	Shipment Description
	contractual delivery address for products & project	
	Lead-time for POR creation	
	Lead-time for PO creation	
	Lead-time for Standard procurement (manufacturing)	
	Inbound transport lead-time from supplier	
	Lead-time for shipment preparation (consolidation)	
MS6- Project Delivery check	Standard shipment lead-time to destination (shipping)	
	Other risk factor for the scope of supply	**Suggested POR release date**
Shipment level		
MS2 - Contract signing		Suggested Shipment Start
MS3 - SOR		Suggested Shipment End
MS4 - Project Execution kick-off		

Figure 8 Inputs and outputs for procurement planning concept in reference with the Wärtsilä gate model

The concept

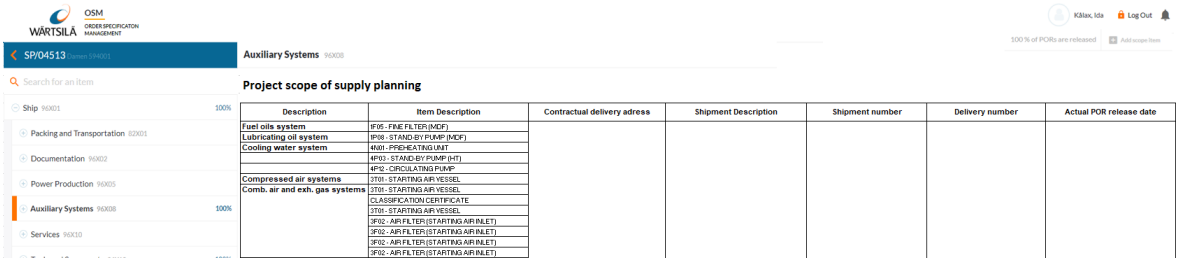
A suggested date for when the purchase order requisition must be ready and released, would help the Project Engineer. It was mentioned during the interviews that the Project Manager today often bear the responsibility of informing the requirement dates for the project scope. This information is today estimated based on the experience of the Project Manager.

The idea would be that the procurement planning function would use the inputs to estimate a date based on that. The OSM application would basically do the same work that the Project Manager or Project Engineer previous has done manually. This could make the process more efficient and hopefully more reliable.

A simple suggestion for how the function could look like in OSM, inside the Auxiliary systems view. The SAP transaction ZPSOS, standing for Project scope of supply has been

used as inspiration, since this is something that the Project Engineers are already familiar with. This would perhaps not make the procurement planning function feel too unfamiliar.

The procurement planning function, or project scope of supply planning view would arrange the different scope items according to their description and item description. The delivery address, suggested POR release date, suggested shipment start, suggested shipment end, shipment description, shipment number, delivery number, actual shipment start and lastly actual shipment end would be listed according to the scope items, giving the Project Manager a more visual overview over all the scope items and the data needed for the planning.



Description	Item Description	Suggested POR release date	Suggested Shipment Start	Suggested Shipment End	Actual Shipment start	Actual shipment end
Fuel oils system	1F05 - FINE FILTER (MDF)					
Lubricating oil system	1P08 - STAND-BY PUMP (MDF)					
Cooling water system	4N01 - PREHEATING UNIT					
	4P03 - STAND-BY PUMP (HT)					
	4P12 - CIRCULATING PUMP					
Compressed air systems	3T01 - STARTING AIR VESSEL					
Comb. air and exh. gas systems	3T01 - STARTING AIR VESSEL					
	CLASSIFICATION CERTIFICATE					
	3T01 - STARTING AIR VESSEL					
	3F02 - AIR FILTER (STARTING AIR INLET)					
	3F02 - AIR FILTER (STARTING AIR INLET)					
	3F02 - AIR FILTER (STARTING AIR INLET)					
	3F02 - AIR FILTER (STARTING AIR INLET)					
Engine control and monitoring	9N36 - POWER UNIT.					

Figure 9 Suggestion of procurement planning function in OSM

The suggested release date for the purchase order requisition would be estimated by OSM subtracting the different lead-times and factors from the contractual delivery date.

Inputs and Outputs for the Procurement Planning function

Figure 9 shows the different inputs and outputs on different levels of the procurement planning process. The three levels include the project, scope of supply and shipment level. The inputs and outputs have been sorted based on Figure 1 the Wärtsilä Gate model, and when they occur in reference to it. The model was sorted in this way so that it is clear to as when the different inputs take place.

Project level inputs and outputs

The project level-lead time is the estimated time for the project to be completed. The project level-lead time includes:

- **potential risks in the project**, as for example if there are circumstances that could delay the project that need to be accounted for. An example could be a global pandemic that could cause delays.

- **Special requirements** from the customer is also included.

- The **transportation** input includes the estimations done by the Transport Manager and his/her team, these estimations are based on previous projects and the amount of time that certain transportation distances take for specific items.

- **Customs declaration** specifications are included since different countries have different requirements which can affect the amount of time that is needed for that process.

Scope of supply level inputs and outputs

A suggestion for a release date for the purchase order requisition, meaning a date for when the Project Engineer at latest would have to have the Purchase order requisition ready for the purchaser to also have time to create the purchase order. The inputs explained:

- **the long lead-time items**. These are certain types of items that are known from experience to have long lead- times due to the complexity of the scope items., therefore they must be ordered at an early stage. which is when the project design has been completed.

- **The shipment lots** are planned by the Delivery Manger

- **Contractual delivery address for products & product**. This input has an impact on other inputs since it will determine the lead-time for shipment to different locations. This data is available in SAP,

- **POR/PO creation lead-time.** The lead-time for the creation of the purchase order requisition by the Project Engineer and the creation of the purchase order by the purchaser would have to be manually estimated in the initial phase of implementing the procurement planning function.

- **Standard procurement lead-time** refers to the lead-time for the manufacturing of the ordered scope items. This data could be available from the project purchasing team or supply management team. This data is however not updated frequently enough but would be a necessary input for the procurement planning function.

- **Inbound transportation lead-time from the supplier** refers to the time it takes for the scope items to arrive at the warehouse from the supplier.

- **Shipment preparation lead-time (Consolidation)** refers to the time it takes for all the specific activities connected to the consolidation of all the scope items.

- **Standard shipment lead-time to destination** refers to the time it takes for the scope items to arrive at the contractual delivery address. This data is available in SAP. When the Delivery Manager creates the shipment and enters point A to B, SAP suggests a transit time.

- **Other risk factors for the scope of supply** refers to potential risks that need to be accounted for additionally, for the procurement plan to be accurate. This could as an example be if a certain supplier is facing problems with delivering according to the contracted date.

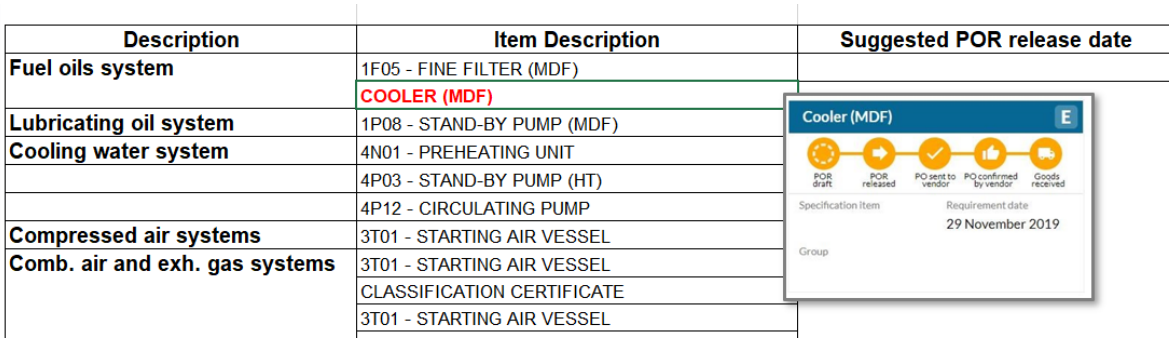


Figure 10 Suggestion for how the process chart could visible in the procurement planning function

A suggestion could also be that the same process chart that is visible inside the auxiliary systems view in OSM would be integrated into the procurement planning function. This could be helpful because it would allow for all the relevant information to be in the same place, making it easier and more efficient to check. As an example, the process chart could pop-up as the user hovers over or clicks on a specific scope item.

Problems and situations

The standard supplier lead-times are something that today is not readily available. There have been made excel documents containing a list of all the preferred suppliers and their lead-times. This type of list is of course not very reliable, since it is not updated frequently enough. However, as this thesis will try to support the importance of having this type of list, a suggestion is that the project purchasing team would need to establish this data. The lead-time also of course varies depending on the type of configuration of the ordered scope item. If the item is ordered with special classification certificates or tag plates, then this will affect the lead-time. This would need to be taken into consideration when estimating the lead-time for the supplier.

The OSM procurement planning function would therefore have to take account for many different types of configurations. Another problem is that the different lead-times can vary much between projects depending on the circumstances. This makes it harder to plan accurately for every project. However, if the planning function can adapt and learn according to previous projects, it would make it more reliable

Another aspect that would have to be taken into consideration is that the Project Engineers might have their own style of working.

Comments regarding the improvement suggestions from the Project Engineers

One of the Project Engineers suggested that the contractual delivery date should be easily accessible, this would not be necessary in the case of the procurement planning function. Since the Project Engineer would not have to estimate his or her work manually but OSM would do the estimation according to the contractual delivery date.

Another comment was that there could be some sort of list where the Project Engineer could quite easily check that everything seems okay. This could also be possible with the procurement planning function. A possibility could be that when you click on or hover over the scope item from the list of all the included scope items, all the specifications are shown. So that data such as type, flow or connection type can easily be checked.

Outcome

The visuals of the procurement planning function are something that would need further research, since the main goal of this thesis was not to focus on the user interface. This would require further interviews and research focusing more on the user interface and experience.

The procurement process today includes much individual planning without visibility. The potential scenario is that the Project Engineers have their own excel lists, the Transport Managers have their own and same with the Purchasers. All these separate lists have no possibility of interaction. By having a procurement planning function, visible throughout the different parts of the supply chain would mean that foreseeable mistakes could be more easily avoided, by ensuring that everyone is following the same plan. As a result, better and more accurate follow up and estimations could.

5.5 Process measurement metrics for procurement planning and plan adherence

Process measurement metrics in this case refers to how the project team members would be able to follow up the plan with the help of measurement metrics. These metrics would be derived from the inputs used for the procurement planning function.

To improve the planning, the metrics could be used to improve previous planning to give a more exact date of when each step is needed to be done for a successful process. But to be able to measure the process there would need to be a way of tracking the history, in form of revision history. Every time a change is made, or something is added to the procurement plan, the revision history changes. This list of revisions can then also be used for the follow-up and could also be connected to the success rate.

Defining success

To be able to know what type of metrics that is suitable for this situation, the success must also be defined:

- Reduced amount of rest deliveries
- Reduced amount of costs related to the rest deliveries (Including labour and transportation)
- Project delivered on time according to contract.

- Improved customer satisfaction
- Improved planning accuracy

The success in this case would of course ultimately be that the amount of rest deliveries is reduced, however this is quite an ambitious goal at this point, same with the reduction of costs related to the rest deliveries. Success would be that the planning that has been done, is proving to be accurate and efficient. The metrics are therefore chosen according to this, so that the project team members can check this.

Metrics

The types of metrics that are chosen to measure the accuracy, efficiency and effectiveness of the potential procurement planning process:

1. **Supplier lead-time accuracy** would have the purpose of assessing the accuracy of the supplier lead-times that are used for the procurement planning. These would include the comparison of the planned lead-time with the date stated on the order acknowledgment received from the supplier.

2. **Transportation lead-time accuracy** would have the purpose of assessing the accuracy of the transportation lead-times. Meaning how well the planned lead-time is corresponding with the actual lead-time later. This is something that is easier to estimate since it does not include other aspects than the transportation, and therefore the variance is expected to be lower.

3. **Planning accuracy for POR** would have the purpose of assessing when the purchase order requisition has been released comparing the planned date to the actual date. This comparison would show how well the planning is working.

4. **Effort Variance % = ((Actual Effort - Planned Effort) / Planned Effort) * 100.** Could be a way of measuring if the procurement planning actually is more efficient in terms of the work input from the Project Engineers point of view.

5. **Schedule Variance % = ((Actual Duration - Planned Duration) / Planned Duration) * 100.** This addresses the same point as the previous metric, meaning the measurement of the planned versus actual value.

These metrics could be as previously mentioned be used to assess the accuracy of the planning and improve the planning in future projects. In this case some sort of artificial intelligence function in OSM could be considered, that according to the set metrics and their goal values can learn and then automatically improve the procurement planning according to the goals.

6 Conclusion

This chapter will include a summary of my contribution to Wärtsilä through this thesis in section 6.1. In the section 6.2 the challenges and issues that have occurred during the process of writing the thesis will be presented. And lastly in the section 6.3 the proposals for further research is presented.

The purpose of this thesis was to research the visibility of the OSM application and give suggestions on features in OSM that could improve the visibility of the procurement process. The cost estimation of the rest deliveries was done to motivate as to why actions need to be taken to improve the situation. Suggestions of measurement metrics were also given, so that the success of a potential implementation can be measured later.

The OSM function suggested in this thesis was based on the requests of the Project Engineers and through an interview with other involved stakeholders of what type of data input that would be most important to enable procurement planning. The data input is the base of procurement planning function suggested in this thesis, this data input is needed so that the function can give an accurate output. The most important output in this case is a suggested Purchase Order Requisition release date. This date works as a guideline for the Project Engineer to strive towards in terms of procurement.

In terms of the estimated cost generated by the rest deliveries, there is potential for improvement. This thesis has been a step towards establishing the importance of improving the procurement process, in such a way that the amount of rest deliveries could be minimized and ultimately reducing the unnecessary additional costs of the rest deliveries.

6.1 My contribution

Together with the estimation of the amount and costs related to the rest deliveries an improvement would mean substantial savings for Wärtsilä. This thesis focuses only on improving the visibility by a potential implementation of a procurement planning function. To enable the Project Engineers to have a better and more easily available insight into the project supply chain, improving the efficiency and accuracy of their work.

The purpose of this thesis Is to try to emphasize the importance of visibility, at least from the Project Engineers and Project Managers point of view and that this type of procurement planning function could be taken into consideration. By minimizing the manual work, of

estimating and planning, the procurement planning process could be more efficient and accurate.

6.2 Challenges

The challenges in this thesis was to get an understanding of what data that was needed for the procurement planning and where to find it. Since based on my studies this seems to be quite an undiscovered area, there were not much information to be found on the internet. Same regarding finding similar cases or case studies addressing the issue of rest deliveries and lack of procurement planning. Also, the word rest delivery that is used at Wärtsilä seems to not be used by others. The term partial delivery seemed to be the most corresponding one.

Another challenge was to define what to include in the thesis, and where to draw the line between what is relevant for this specific study and what is not. During the process, many new aspects have come up that could have been discussed and researched in this thesis, the difficult part has been to decide on whether this thesis would benefit of it or if it would just make it seem incoherent.

The interviews could have been held with other stakeholders than just the Project Engineers, so that the results could have been more specified on certain areas. Now they were quite broad, and unspecific. There could also have been more detailed discussions with the Project Managers also, since they could have had a different view on the same problem.

6.3 Proposal for further research

This thesis includes results of different areas and works as a base for further research of the different parts. The enhancement proposals were researched to a certain limit, since this was only one part of the thesis. Further research could focus on other aspects of the supply chain and the visibility of it. The focus of this thesis was the visibility of the process from the Project Engineers point of view, however lack of visibility in other parts of the supply chain can lead to bottle neck situations.

Further research would also need to be done regarding the implementation process of the procurement planning function, and if OSM is the most appropriate application for it.

The conclusions of this is that a more in-depth study of the different aspects of thesis could be done, especially the improvement suggestions of OSM of the procurement aspect. There

is also a lot of actual work to be done before an implementation of this type of function could take place.

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