

Cost Analysis of Creating Maintainable Manuals at Wärtsilä

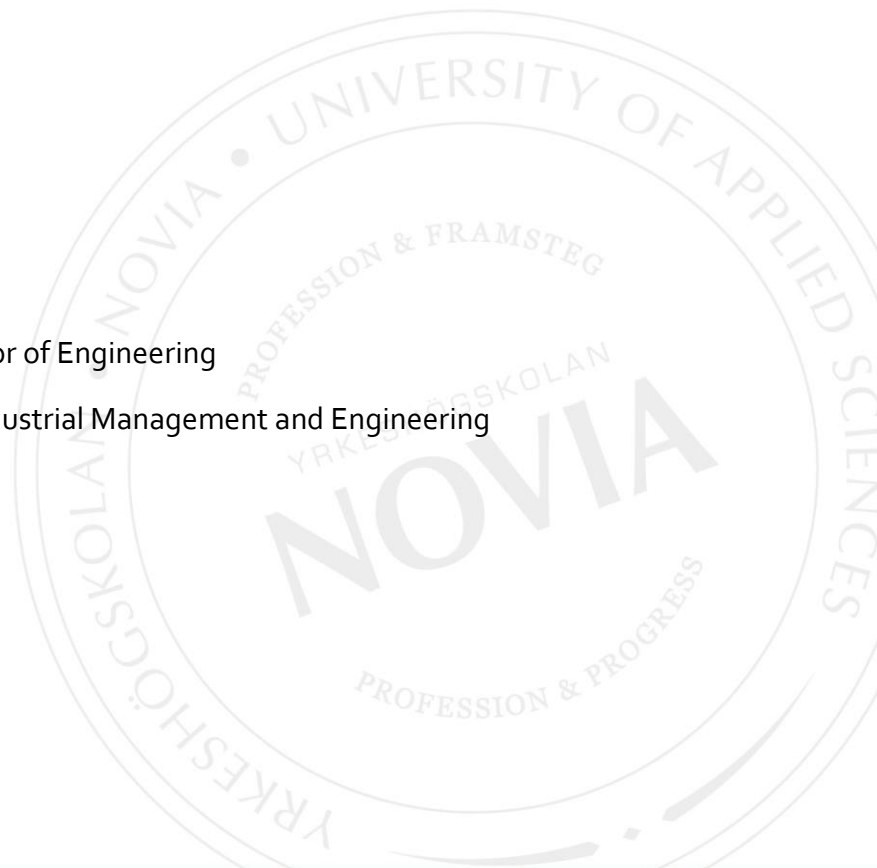
Wärtsilä Marine Solutions – Technical Information

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BACHELOR'S THESIS

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Abstract

This thesis is made for Wärtsilä Marine Solutions, Technical Information department. The objective of this thesis was to analyse the cost difference between doing tasks in-house versus if the tasks were outsourced. The tasks being: harmonising the operation and maintenance manuals and the maintenance of the manuals.

Wärtsilä, with the help of an external company, has harmonised one operation and maintenance manual to their own system and have started to maintain and update it but the rest of the manuals are made by an external company.

This earlier harmonising project was used as a base of this analysis to see if it would have been better to harmonise the manuals ourselves. Calculations of how much it would have cost to harmonise the two other engines' operation and maintenance manuals. Maintaining the cost of manuals were also compared if done in-house with outsourcing the task.

The results of the thesis are a deeper analysis of the costs between outsourcing work or having it done in-house. The results will be used as a guideline for Wärtsilä when they are planning on creating all the manuals in-house.

Language: English Key words: Cost analysis, Outsource, Cost management

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Bilagor 1

Abstrakt

Detta examensarbete är gjort för Wärtsilä Marines Solutions, avdelningen Technical Information. Syftet med examensarbetet var att analysera kostskillnaderna mellan att göra ett visst arbete internt eller att ha ett externt företag att göra jobbet. Arbetsprocesserna var: att harmonisera samt att underhålla drifts- och underhållsmanualerna.

Wärtsilä har med hjälp av ett externt företag harmoniserat en drifts- och underhållsmanual till deras egna system och har börjat underhålla samt uppdatera den men resten av manualerna är gjorda av det externa företaget.

Det tidigare harmoniseringsprojektet användes som grund till denna analys för att se om det skulle ha varit bättre att harmonisera manualerna själva. Uträkningar om hur mycket det skulle kosta att harmonisera två andra motorers drifts- och underhålls manualer har gjorts. Underhållskostnaderna för manualerna har också blivit jämförda med att göra det själva eller att outsourca processen.

Resultatet av examensarbetet är en djupare analys av kostnaderna mellan att outsourca arbete eller att ha det gjort internt. Resultatet kommer att användas som en riktlinje åt Wärtsilä när de planerar på att börja göra alla manualerna själva.

Språk: Engelska

Nyckelord: Kostnadsanalys, Outsourca, Kostnadsuppskattning

Table of contents

1	Introduction	1
1.1	Background.....	1
1.2	Purpose	2
1.3	Delimitations.....	3
1.4	Definitions and abbreviations	4
1.5	Disposition.....	4
2	The company.....	5
3	Theory.....	8
3.1	Cost accounting.....	8
3.2	Cost estimation.....	9
3.3	Outsourcing	11
3.4	Benefits with having documentation up to date	14
4	Method.....	15
4.1	Quantitative research	15
4.2	Qualitative data	16
4.3	Cost analysis method	17
5	Result	21
5.1	Quantitative results	21
5.2	Qualitative results.....	27
6	Analysis	28
7	Conclusion.....	30
7.1	Challenges of the thesis.....	30
7.2	Further research and development	31
7.3	Final words	31
8	References.....	32
9	Attachments	34

List of figures

<i>Figure 1. Nets sales by business in 2017 (Wärtsilä Corporation, 2018)</i>	5
<i>Figure 2 Elements of cost with the help of a chart (Kohli, 2010)</i>	9
<i>Figure 3 Project work breakdown structure (Wärtsilä, 2018)</i>	18
<i>Figure 4 Time schedule for the project (Wärtsilä, 2018).</i>	19

List of tables

<i>Table 1 Number of pages and the price per page</i>	21
<i>Table 2 Man-hours and costs for W20 O&MM</i>	22
<i>Table 3 The costs of the harmonisation of the W20 O&MM vs. the costs if all work were done in-house.</i>	23
<i>Table 4 Man-hours and costs for W32</i>	24
<i>Table 5 Man-hours and costs for W34 SG D O&MM</i>	25
<i>Table 6 Time taken per task for W20 & O&MM</i>	26
<i>Table 7 Time taken per page for each individual task when harmonising W20 in hours</i>	26

1 Introduction

This thesis will be an analysis of the costs of having the manuals maintained and harmonised by Wärtsilä compared to an external company. This assignment was given to me on behalf of Technical Information which is a department within Wärtsilä Marine Solutions.

Wärtsilä is always striving to do their work in a simple and easy way so that they get more time to focus on the problems that needs to be prioritized. And if they harmonise the manuals into their own system the maintenance of the manuals will get easier and faster.

Today Wärtsilä has one engine whose operation & maintenance manuals (O&MM) are harmonised to their own system. This manual is getting maintained on a daily basis but updated once a month for the customers depending on which W20 engine they possess. What separates the regular manuals with the maintainable manuals is that the regular manuals are not maintained unless there is an important change.

The TI department wants the thesis to be a cost analysis of having the operation and maintenance manuals made in-house or having them outsourced. This is also the case with the harmonising project.

This task is done by comparing the W20 engine's operation & maintenance manual with the manuals of the engines that were to be harmonised. After the comparison is done it is calculated how long it would take to harmonise the other engines' manuals to the system. After knowing how long that task would take the costs were calculated for producing the manuals. Afterwards calculations on costs regarding the maintenance of the manuals were made.

1.1 Background

Currently there is an external company that is in control of maintaining the operation & maintenance manuals except for the W20 engine's operation and maintenance manuals. The W20 engine's operation and maintenance manual has been harmonised from the external company's system to Wärtsilä's own system since 2015. All the data from the harmonising project has been written into a report.

The report has stated the benefits of having the operation and maintenance manual in-house and those are:

- It is easier to keep track of work status & situation when the team is in-house. It is also easier to understand the workload and keeping it even.
- The organization is more agile/flexible and there are fewer bottle necks when everyone can do almost everything.
- The technical writer can directly ask Technical Service for support.
- Communication is easier when all team members are in one place.
- Team morale is higher when each member is given more responsibility and liberties to make decisions.
- Changes/tweaks in way of working are easier to implement when the whole team is in one place. Since each change can be motivated to the team member it is easier to make changes happen, which is needed in order to get the whole organisation to change.

1.2 Purpose

My main purpose of this thesis is to create a cost analysis on maintaining the manuals and to harmonise the manuals to Wärtsilä's system. By analysing this Wärtsilä will use the results as a guideline concerning the manuals future.

This task is done by comparing the W20 engine's operation & maintenance manual with the manuals of the engines that were to be harmonised. The manuals are handed out by the external company. After the comparison is done it is calculated how long it would take to harmonise the other engines' manuals to the system. This is done by getting the values from comparing the lengths of the manuals. After knowing how long that task would take, the costs for producing the manuals will be calculated. Afterwards calculations on costs regarding the maintenance of the manuals will be made.

When the thesis is completed it should answer these tree main questions:

- How much it would have cost to harmonise the W20 operation and maintenance manual completely in-house?

- How much it would cost to harmonise the two other engine types if it would have been done in the same way as the W20 harmonising?
- How much it would cost to harmonise the two other engine types if it were done completely in-house?

1.3 Delimitations

In this thesis the documentation from three different engines were researched. The engines that were chosen are engines that have complex operation and maintenance manuals which would result in many hours of work. To retrieve these full master operation and maintenance manuals for this analysis it had to be outsourced to the company that is maintaining the manuals. This results in an extra cost for Wärtsilä which leads to there being only two engines, other than the W20, that were analysed to keep the price down.

- W20

This engine's bore size is 200 mm and the cylinder is the smallest of the engines that Wärtsilä produces (Wärtsilä, 2017). It can be configured in to 4L, 6L, 8L, 9L where the L stands for in-line.

- W32 E2

This engine's bore size is 320 mm and the cylinder output per cylinder is 580 kW (Wärtsilä, 2017). It can be configured in to 6L, 7L, 8L, 9L, 12V, 16V, 18V and 20V cylinders. This is the most common Wärtsilä engine. It can be a DE, GD or EDG.

- W34SG D

This engine's bore size is 340 mm and the cylinder output per cylinder is 500 kW (Wärtsilä, 2017). This engine is similar to the W32 engine but with a bigger bore size and this engine is running on gas. It can be configured in to 9L, 16V and 20V.

The W20 engine has already been harmonised to Wärtsilä's new way of working. The W20 manual will be compared with the engines that are mentioned above. Then the manhours and costs will be calculated for the engines.

1.4 Definitions and abbreviations

L = In-line engine

V = V-engine

DE = Diesel engine

GD = Gas or Diesel (Dual fuel)

TI = Technical Information

O&MM = Operation and Maintenance Manuals

SG = Spark ignited Gas engine

1.5 Disposition

Chapter 1 – Introduction

Chapter 2 – About Wärtsilä

Chapter 3 – Presentation of theory used

Chapter 4 – Presentation of methods used

Chapter 5 – Presentation of the results

Chapter 6 – Presentation of the analysis

Chapter 7 – Presentation of the conclusions

2 The company

Wärtsilä is an international company that provides smart technologies and complete lifecycle solutions for the marine and energy markets. The company is split into three main departments which is Marine Solutions, Energy Solutions and Services. Services will soon be united with Marine Solutions. The department of Technical Information (TI) are now within Services.

Wärtsilä has around 18 000 employees which is operating in over 200 locations in more than 80 countries. The company is listed on Nasdaq Helsinki and their net sales totalled EUR 4,9 billion in 2017.

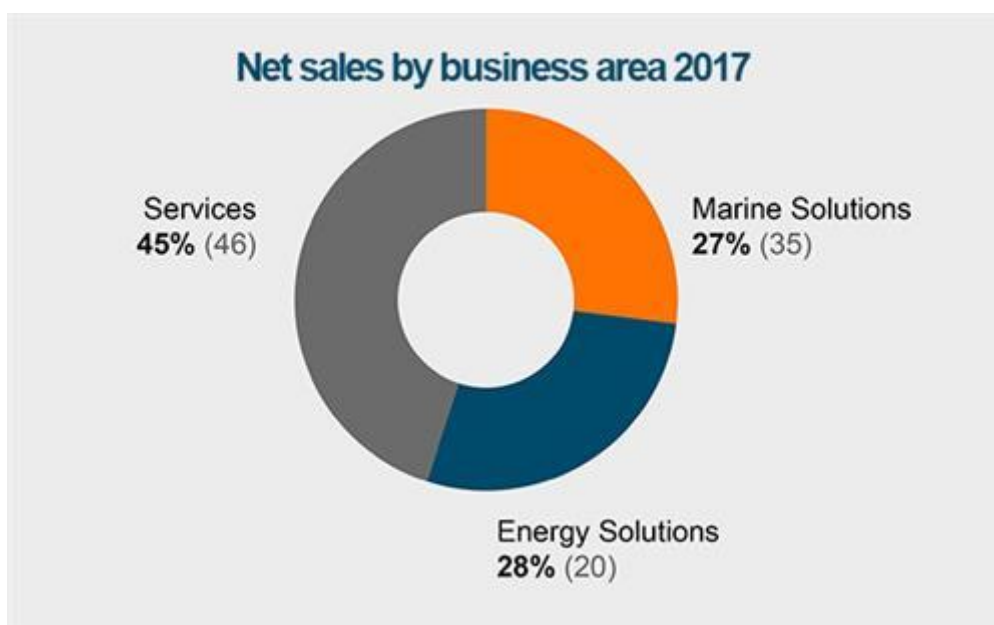


Figure 1. Nets sales by business in 2017 (Wärtsilä Corporation, 2018)

Wärtsilä Marine Solutions

Wärtsilä Marine Solutions is the leading provider of propulsion, ship machinery and manoeuvring solutions. Their net sales in 2017 were EUR 1,307 billion. Marine Solutions are selling reduction gears, engines and generating sets, propulsion equipment, control systems and sealing solutions for vessels and offshore applications.

Wärtsilä Energy Solutions

Wärtsilä Energy Solutions is supplying power plants for the decentralized power generation market. Their net sales in 2017 were EUR 1,401 billion. Energy Solutions are selling power plants for peaking and industrial self-generation purposes, baseload and for the oil and gas industry.

Wärtsilä Services

The third department is Wärtsilä Services which provides supports for their customers throughout the lifecycle of their installations. They are also selling maintenance and reconditioning solutions both for ship machinery and power plants. Their net sales in 2017 were EUR 2,215 billion.

Technical information, 4-Stroke Engine Services

The importance of having more and more accurate technical information is a big part of the Service business (Wärtsilä 2019). It is important that the information has no flaws and that the products will not break. The Technical Information mission is to efficiently create, provide and maintain excellent Technical Information products and Services. These services and products will also have to be easy, readable and understandable for the customers so that they can optimize their efficiency and performance throughout the lifetime of their installations.

The main purpose of Technical Information deliverables is to collect information in an easy structured way. This is to support stakeholders to find accurate and complete information with a purpose to explain how to operate, maintain, repair and overhaul the Wärtsilä solutions and its equipment. Examples of technical information are spare part catalogues, operation and maintenance manuals and service bulletins made available through systems like Wärtsilä Online Services.

Technical Information consists of:

- Content Distribution
- Content Management
- Parts Data Lifecycle Management
- Service Bulletins

- Change Management

This thesis is mainly written for Content Management and Change Management. Their daily tasks are to maintain and update the W20 operation and maintenance manuals. There are four persons currently working in the Content Management team.

3 Theory

This chapter will explain the theories of cost estimation, cost accounting, outsourcing and benefits with having documentation up to date. These theories will be the foundation of this thesis.

3.1 Cost accounting

Cost accounting originates from two words, “cost” and “accounting”. Cost can be defined as a resource that need to be sacrificed to achieve a specific object. Accounting includes: recording, collecting, communicating and evaluating the outcome from previous events. (Kohli, 2010)

Cost accounting are focusing on two big parts which is either ascertainment of costs or cost reduction. Ascertainment of costs is the calculations that forms the price of the product or service. Cost reduction or controlling the costs are aiming for a target cost and then the task is how to achieve it. (Pranav, u.d.)

Elements of cost are separated into three main parts which are: material, labour and expenses. Each of these parts are then separated with two more parts, direct and indirect. These can be explained like this (Dhanish, 2014):

- **Direct Material:** material that is included in the finished product.
Examples: Packing material, the product that was specifically purchased.
- **Indirect Material:** materials that are ancillaries.
Examples: Consumables such as oil or wastage.
- **Direct Labour:** Labour that are connected to the specific product.
Examples: Mechanical work.
- **Indirect Labour:** Labour that can't be traced to the specific product. These kinds of labour have not done a change on the products construction or condition.
Examples: Salesmen.
- **Direct Expenses:** Expenses of defective products or work.

- Indirect Expenses: Expenses that are not directly connected to the product.
Examples: Rent or office expenses.

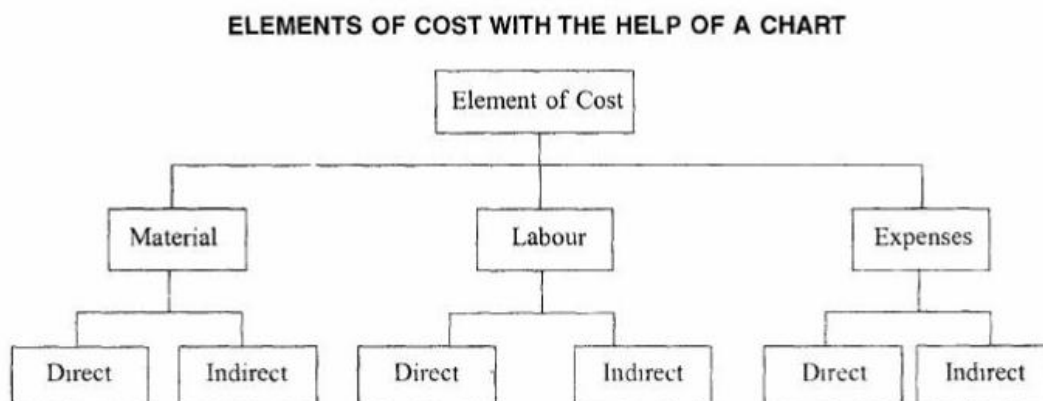


Figure 2 Elements of cost with the help of a chart (Kohli, 2010)

In this case cost accounting is used as a theory for when collecting, recording, communicating and evaluating the outcome from the previous harmonising project. It gives us the structure for how to consider different elements of the project.

3.2 Cost estimation

Cost estimation is to collect and analyse earlier data and then applying different quantitative models, tools, techniques and databases to this information. This is to get the best prediction of what a product/service will cost in the future. Cost estimating can also be called as an application of the art and the technology of approximating the probable cost which is based on the information at that time. (Mislick, 2015)

- Historical data: This is the evidence of what has been in the past and will help us to predict the future. There is a good deal of historical data out there so the challenge is to point out the valuable data. After the data is collected it is necessary to organise, normalise and find a way to manage it (Tcagley, 2014).
- Quantitative models: The models that are used in calculations are scientifically proved by using transparent, rationally defensible and reviewable quantitative models (Lisa, 2008).

- To predict: Some call prediction that it is basically guessing and that it could go either way. To predict is based on the historical data and the quantitative models to minimize the area that the prediction might occur. Some people state that when using the historical data of when failures were made, the new managers will make the same failures again. *Mislick* says that this is not true and that it is often external events that create the mistakes and when it's different circumstances and a different set of external events the same mistakes are most unlikely to occur again.
- Based on information available at the time: The information available at the moment is not always the correct information. If someone says that they are interested in buying 2000 stocks of a product and then the salesman estimates the value with that information. If, however the customer then chooses to buy 1700 stocks of the same product instead of 2000 stocks the price will not remain the same.

There are a lot of aspects that needs to be considered when making a good cost estimation. The essential aspects are reasonableness, completeness, credibility and analytic defensibility. Significant operating aspects are defined in the list below. (Sorrels, 2017)

- Cost estimation should be based on the historical data from previous, similar or related events to get the best result. The data should be named as data sources so that the one who uses the information knows that it is based on previous events.
- The cost estimation should take into consideration the constantly evolving technology which might make improvements to the manufacturing or the design of the product. These improvements will change the cost in different ways. Since there is no historical data on the new improvements and they have a value that needs to be included in the estimation it is often done with "subject matter expertise".
- It needs to be easy to understand for programs and business leaders. It is better if it is an easy approach than a complex approach, when it is concerning business leaders that don't always have the time to dig deeper into the subject before approving or declining. This means that if it is made too complex the leaders might not even look through all the information (Free management books, u.d.).
- It needs to be made clear which assumptions are made. When estimating the cost, the base of the analysis is the assumptions, so it must not to be forgotten that they are assumptions. To make the calculations as accurate as they can be, a sensitivity

analysis is included. The sensitivity analysis will create variations of the baseline ground rules and assumptions.

- The risks and uncertainties should be displayed in the program plan. When presenting the sensitivities, they should be arranged according to how large an impact they will make and how big a risk they are. This leads to a more confident result, when knowing what the risks are, which leads to one being more willing to estimate the cost.
- The cost estimate needs to follow some requirements for the project. The project itself needs to have minimums and maximums of different aspects. When buying a new car, the seller can't give a cost estimate before he knows which specifications the customer wants in the car. It's not needed to make a requirement list from scratch because there are several documents that accomplish this need. Some examples are: The Initial Capabilities Document, Capabilities Development Document or the requirement process in the Department of Defence.
- The description of a project should be well-defined because these sorts of things are also taken into consideration.
- The cost estimation should be auditable and traceable. When given the same information as the cost estimation was based on, then one would retrieve the same results (cost estimation). The standard is that a person with a high school degree should be able to, with the same data and arguments, get the same cost estimate.

We have used cost estimation as a tool: when we have used historical data and when we are trying to predict the costs of future manuals.

3.3 Outsourcing

Outsourcing is when you farm out a service to a third party. When regarding information technology it could include anything from a small service like data storage or a whole information technology department (Overby, 2007).

When outsourcing the management, it also includes the transfer of the management to the location where they are needed, so that they are able to execute their work on a day to day basis. In the beginning of the process the client organisation and the supplier will make a

contractual agreement of what services the client needs and what the supplier can offer. During the agreement the client is often in need of the service and then it is up to the supplier if they will provide the service, which the supplier generally will.

Examples of typical outsourcing services (outsourcinginsight, 2018):

- Legal services
- Human resources
- Social Media Marketing
- Payroll processing
- Accounting
- Customer support

To know when to outsource

It is on a strategic level that the decision to utilise outsourcing is made and it generally needs the board's approval before being taken into action. It starts with the client building a case on what they presume would be valid for outsourcing. Then they build a business case of the idea so that they can explain to the board why it is needed. When the business case starts to get on a high level then the client is ready to start searching for an outsourcing partner (Kitty, Choi, 2008).

Reasons why one should outsource varies by situation, but it includes one or more of the arguments listed below (Ostapchuk, u.d.):

- To reduce the costs.
- Variable capacity.
- Making more time to focus on the strengths of the company.
- Lack of resources.
- The work is done more effectively or efficiently.
- Making it easier to adapt to the changing business and commercial conditions.

- One knows what it will cost.
- Reduce the investments in the internal infrastructure.
- Availability to have innovation and thought leadership.

Different variants of outsourcing

There are different variants of outsourcing. To give examples: business process outsourcing (BPO), information technology outsourcing (ITO) and knowledge process outsourcing (KPO).

Business process outsourcing is used when it is for a specific business process task, an example of a process could be payroll. Business process outsourcing is generally split into two categories: front office outsourcing and back office outsourcing. Front office outsourcing is related to customer services such as technical support or marketing. Back office is internal business such as purchasing or billing. Information technology outsourcing is a subset of business process outsourcing (Bloomenthal, 2019).

Knowledge process outsourcing work is about selling your knowledge to another company. They have specific people for different tasks. It involves advanced research and technical, analytical and decision-making skills. Examples of what these can work with is datamining, patent research or IT support (Tripodsoftcs, 2010).

Obstacles with outsourcing

The continual struggle between the client wanting to reduce the price of the outsourcing service, making it cheaper than it would be if they did it in-house, and the suppliers need to make a profit, forcing them to try increasing the price.

In some cases when hiring an outsourcing company, their offer will look too good to be true. And it usually is. The supplier is trying to get long-term deals, but they are basing the contract on a price that is going to be outdated in six months. After the six months has passed they raise the price (Wong, 2006).

Some also use outsourcing as an escape or a quick fix for their problems. They turn to outsourcing when they think they can reduce the cost without building a proper case.

It is also common that there can be misunderstandings between the supplier and the client which leads to flaws in the supplier's work.

We have used outsourcing for the earlier manuals and it is still an interesting way of having work done, but for this case we are evaluating if it is going to be outsourced or having work done in-house. In this case it is considering Information Technology outsourcing.

3.4 Benefits with having documentation up to date

There are huge amounts of documentation throughout different companies. Some companies do not understand the importance of keeping them up to date.

To have up to date documentation is a very important part of ensuring that the company are meeting the standards and operating according to best-practice-principles (Frontline Care Solutions, 2017). An up to date documentation ensures that the documentation is being used effectively by staff members and the customers (if the documentation is open or has been sold as a service). This leads to having a fast way to communicate between staff members and avoiding misunderstandings.

The outcome of not having up to date documentation can lead the company to serious consequences. It can be work inefficiencies, miscommunications, sanctions, fines, loss of accreditation or even casualties. (Frontline Care Solutions, 2017)

If the documentation has faults it could also compromise these aspects of your business: marketing, sales and business development. There is a higher risk of having the documentation compromised if the company is dealing with business to business. This is because of corporate turnover rates can go up to 40% each year. (John Wieber, 2015)

In this case we have had to look into having documentation up to date because of when our external partner has been updating the manuals but haven't done it regularly. After the manuals are being harmonised to Wärtsilä's system, they are staying up to date.

4 Method

In this thesis there are several different methods used for the predictions and calculations. The research that was made includes both a qualitative approach and a quantitative approach. This is due to the fact that data for one manual has already been gathered in a project earlier at Wärtsilä. Approaching this data both qualitative and quantitative will get a more reliable result. (Greener, 2008).

4.1 Quantitative research

The quantitative research method is often correlated with an analytical approach to testing theory. Numbers or facts are often used which leads to a positivist or natural science model. (Greener, 2008) In the analysis, data from an external company and data from the earlier harmonising project were used. This data was combined, and calculations were made. Then the results were made into charts and tables, so they would be easy to understand.

Data collection

Wärtsilä had outsourced different tasks to an external business partner. The partner oversees the operation and maintenance manuals for every engine type except W20. When an update is made to the operation and maintenance manual it is the external company that makes the changes. After they have made the changes they charge Wärtsilä for how many hours they spent at that task. The hourly cost depends on how demanding the task is.

For the thesis analysis, it is vital to know how many pages the full master operation and maintenance manuals are for the selected engine types. To get this information the external company had to export a full master operation and maintenance manual for each engine type. The manuals were converted into pdfs which were then analysed.

The full master operation and maintenance manual consists of every variant of that engine type. This means that most of the chapters are written in multiple different ways in the manual so that it covers every type of variant there is for the engine type. This leads to the full master operation and maintenance manual being a lot more pages than the operation and maintenance manual that the customer gets in their hand.

The full master operation and maintenance manuals were published by the external company except W20: s manual which was published by Wärtsilä. The data of how many man-hours

the different process stages took were given by the Technical Information department at Wärtsilä.

The engines that were chosen for this qualitative analysis are two other engine types that are in the newest design stage. The newest design stage was chosen because if the manuals would be harmonised today the newest design stage would be chosen. The reason why the older design stages aren't harmonised is because there would be too much information and they are not sold as much as the newest design stage.

4.2 Qualitative data

This method was used because all data can't be explained in numbers or charts. It explains more complex issues than a quantitative approach is able to. (Greener, 2008) Principal qualitative methods are: action research, participant observation, case study, focus groups, life history research, structured observations, participant diaries and interviews. An interview has been made for this thesis in order to compliment data for the qualitative research.

Data collection

For the interview, two persons with insight and experience with the harmonising project were chosen. A transcription is usually made during the interview but during this interview notes were made but no transcription as it would have been unnecessary. The interviewer received information of the previous harmonising project and what the outcome was. The information was then compared to the results of the quantitative research.

The interview for this qualitative research was an open-ended discussion with the two personnel that was in the working group of the harmonising project. An open-ended discussion is when the interviewer asks the questions while not knowing what the answer will be. This interview was done to get a better understanding of what Wärtsilä considers to be the benefits of the harmonising project and to have maintainable manuals. A list of the benefits was made and was complimented with the already existing list that is displayed in chapter 1.2.

The two persons that were interviewed were two of the five-man group that were in control of harmonising the Wärtsilä side of the project. They were rewriting and making conditions

of the material they received from the external partner. They have been maintaining and evolving the W20 operation and maintenance manual ever since.

The reason for doing a qualitative research is to confirm the results from the quantitative research and to state results that aren't possible to achieve with the quantitative method.

The questions that were asked during the interview was how they think that the work has improved since the harmonising, which tasks are now easier when maintaining the manuals, and how many softwares were used while updating the operation and maintenance manuals and how many are you using now?

These questions were asked because it covers a different area than the qualitative research. There were no more questions asked because they gave a clear picture of what they thought about the harmonising project and of how it differs to have maintainable manuals.

4.3 Cost analysis method

In this thesis, a cost analysis was made to identify the cost of the harmonising project of the W20 operation and maintenance manual and what it would cost to harmonise two other operation and maintenance manual's to Wärtsilä's system.

For the cost analysis, internal and external costs have been analysed by using the data from the previous harmonising project and by interviewing the personnel. The data was collected and calculated in the software Microsoft Excel. The next chapter further explains the harmonising project.

Harmonising project

The harmonising project of the W20 operation and maintenance manual was done by a team of five from Wärtsilä's side but there were also others working on it from the external partner. There is not a definite number on how many were working on it from the external partner, it is just the number of man-hours that have been received. This group contained a project manager, a technical documentation expert, a technical writer, a distribution expert and one worker from the external company who unlike the others were present with the group full-time. But there were also references in Wärtsilä that helped but wasn't in the project team. The information about the project was taken from a report about the harmonising project made by Wärtsilä.

The projects main goal was to migrate the W20 base manual in the content management system Infoshare into the Wärtsilä maintained Skribenta system technical documentation. Only new material is to be migrated, i.e. content for engines currently being produced. The old content is maintained in the old software. The published content is to stay exactly the same, so that readers do not notice that the W20 operation and maintenance manuals are published from a different system. Additionally, the project scope contains the creating of a new organization and way of working, which is needed since the W20 update and publishing processes are at the same time transferred in-house.

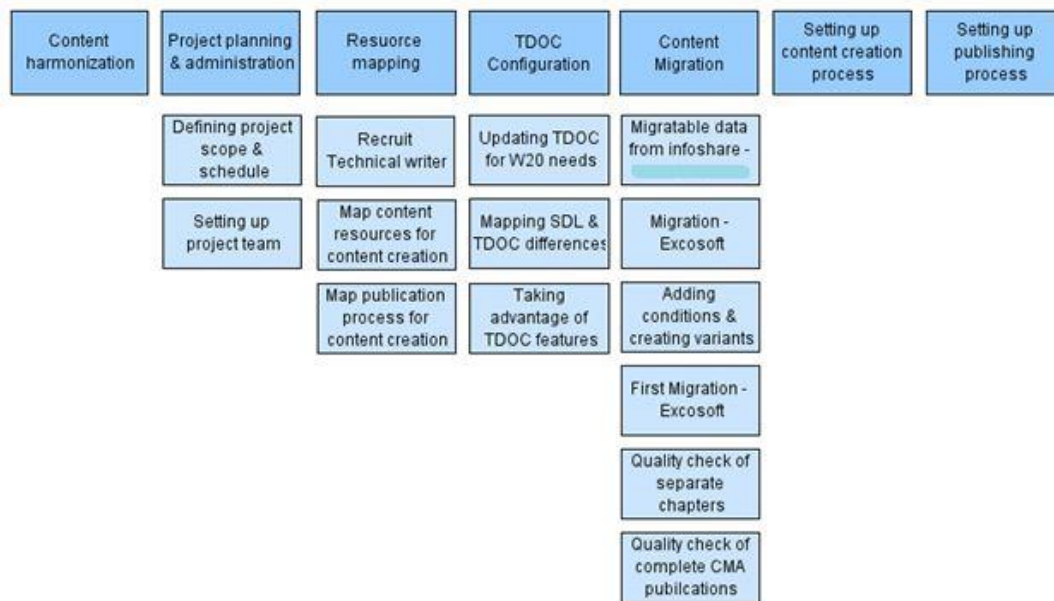


Figure 3 Project work breakdown structure (Wärtsilä, 2018)

Process 1 in the work base structure: Content harmonization

The harmonising was done by the external company. They had as a main goal to minimize the number of variants by making the content as common as possible. Another target was to enable mass updates of manuals already sent to customers.

The external partner created a special package of the content for semi-automatic migration of the content into the technical documentation. Then the technical documentation company performed a large part of the content migration. Due to the structural differences of technical documentation and Infoshare conditions the image references had to be added manually. The biggest benefit with the “semi-automatic migration” was that the tables and lists did not need to be created again in the technical documentation, which is very time consuming.

In the calculations and tables this process is under “Content harmonisation across the Chapter variants”, “WFI – Content migration into TDOC” and “Semi-automatic content migration into TDOC”.

Process 2 in the work base structure: Project planning & administration

Project planning & administration was to define the projects scope and schedule. What to achieve with this project and how the time table should look. When they had done that they started to set up a project team for the harmonising. The project team as mentioned earlier was containing a project manager, a technical documentation expert, a technical writer, a distribution expert and an external worker.

In the calculations and tables this process is under “WFI Change management”. Below is the schedule of the project.

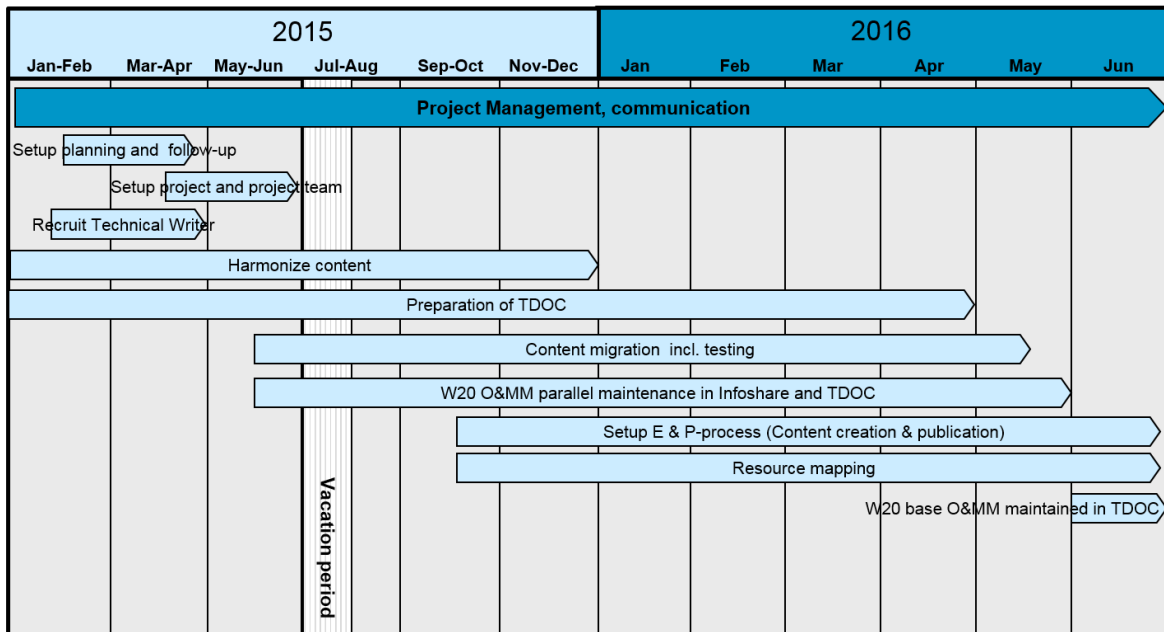


Figure 4 Time schedule for the project (Wärtsilä, 2018).

Process 3 in the work base structure: Resource mapping

This process was made by the change management team. They mapped the content resources for the content creation. They hired a technical writer for the project team.

The change management team created a map for how the publication process of the W20 O&MM was made earlier and how they wanted it to be.

In the calculations and tables this process is under “WFI Change management”.

Process 4 in the work base structure: TDOC Configuration

In the project team there was a technical documentation specialist that did configurations of the software, so it would be suitable for the W20 operation and maintenance manual’s needs. This was by making configurations so that the migrations from the Infoshare would work. These configurations made Wärtsilä save a lot of manhours, if not done everything would have had to be migrated manually.

In the calculations and tables this process is under “TDOC management during the migration project”.

Process 5 in the work base structure: Content Migration

This process step in the work base structure is for when the content got migrated from Infoshare to the technical documentation. The first step was to migrate it from Infoshare. When that was completed the migration into the technical documentation started.

When the material was in the technical documentation, conditions for the different variants had to be made. The conditions ensure that each variant gets the correct information. This work takes a huge amount of man-hours.

When the conditions are made, quality checks of each separate chapter are made. After the chapters are quality checked then the complete manuals are quality checked.

In the calculations and tables this process is under “WFI – Content migration into TDOC” and “Quality checking”.

Process 6 in the work base structure: Setting up content creation process

After the migration was completed, a process was created to manage the setting up process.

Process 7 in the work base structure: Setting up publishing process

There had to be a new process for how to publish material and how the customers should receive it.

5 Result

In this chapter the results from the qualitative research and the quantitative research. The results from the quantitative research is displayed in tables and in the text. The results from the qualitative is displayed in bullet points and in tables. In the calculations one year is 226 working days and one working day is 7,5 hours.

In this thesis we have been using Wärtsilä dollar (W\$) which is a made-up currency just for this project. It has been created to ensure that there are no outsiders knowing what the real values are. The numbers that this thesis is based on are confidential but if we would remove all the numbers from this thesis there would not be much left for the outsiders to read.

5.1 Quantitative results

Table 1 shows how many pages each of the full master operation and maintenance manuals are and how much the salary is per hour depending on if it is an external company or Wärtsilä doing the work.

The page numbers for the “W20 Full master O&MM before harmonising” is provided by Technical Information. The page numbers for the W32 and W34 SG D are provided by the external partner. The prices of the personnel have been provided by Technical Information and are based on the average salary for the departments that are working with manuals.

Table 1 Number of pages and the price per page

	Pages
W20 Full master O&MM before harmonising	1790
W32 Full Master O&MM	2317
W34 SG D Full master O&MM	3316
	Wärtsilä \$
Price of outsourcing per hour:	21,29
Price of doing it inhouse per hour:	13,07

Table 2 shows the processes for harmonising the W20 operation and maintenance manuals to Wärtsilä. The second column shows what the actual costs were. The third column shows

what the costs could have been if every process would have been done in-house. The costs that have orange as a background are the work done in-house and the costs that have the blue background is the work done by the external company.

The values in the second column are calculated by using how many man-hours the processes took and multiplying it with either the in-house price or the external partner price. Then the third column is calculated by only using the in-house price.

As we can see in the table below, it would be much cheaper if all work is done in-house. Some values are the same but that is because those processes are already being done in-house.

Table 2 Man-hours and costs for W20 O&MM

Work done in-house	Outsourced to another company	
Process	Total cost (W\$) W20	Costs if all work were done inhouse (W\$) W20
Content harmonisation across the Chapter variants	405 999	249 292
WFI - Content migration into TDOC	20 387	20 387
Semi-automatic content migration into TDOC	2 887	1 773
Quality Checking	27 067	16 619
Updating the content after migration	108 266	66 478
TDOC management during the migration project	29 472	29 472
WFI Change Management	83 097	83 097
Total cost (W\$)	677 175	467 118

Table 3 displays the costs of the harmonisation of the W20 O&MM vs. the costs if all work were done in-house. The orange staples are indicating the costs if all work were done in-house and the blue staples is indicating how the work was divided.

The table below is based on Table 2 but as we can see it would be much cheaper if all work were done in-house.

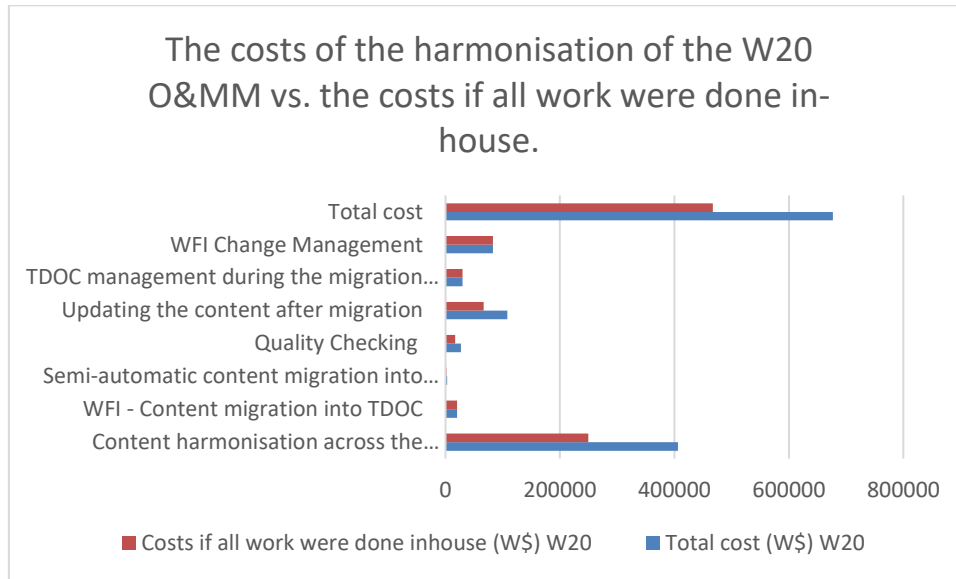
Table 3 The costs of the harmonisation of the W20 O&MM vs. the costs if all work were done in-house.

Table 4 shows the total cost per task in Wärtsilä dollar for harmonising the W32 operation and maintenance manual. The second column shows what the costs would be if the processes would be divided as the W20 operation and maintenance manual. The third column displays what the costs would be if all the processes would be done at Wärtsilä. The costs that have an orange background is if it would be done in-house and the costs with blue background is the work that would be done by the external company.

The values in the table below have been calculated by using the W20 operation and maintenance manual's page number and then estimated a value for how much one-page costs per process. Then we have multiplied that value with how many pages the W32 operation and maintenance manual has. We can see here that the total cost would be less if all work were done in-house.

Table 4 Man-hours and costs for W32

Work done in-house	Outsourced to another company	
Process	Total cost (W\$) W32	Cost if all work were done inhouse (W\$) W32
Content harmonisation across the Chapter variants	525 531	322 687
WFI - Content migration into TDOC	26 389	26 389
Semi-automatic content migration into TDOC	3 737	2 295
Quality Checking	35 035	21 512
Updating the content after migration	140 142	86 050
TDOC management during the migration project	38 149	38 149
WFI Change Management	107 562	107 562
Total cost (W\$)	876 545	604 644

Table 5 shows the total cost per task in Wäritsilä dollar for harmonising the W34 SG D operation and maintenance manual. The second column shows what the costs would be if the processes would be divided as the W20 operation and maintenance manual. The third column displays what the costs would be if all the processes would be done at Wäritsilä. The costs that has orange as a background are the would be done in-house and the costs with the blue background is the work that would be done by the external company.

The values in the table below have been calculated in the same way as the values in table 4, which used the price for one page from the W20 manual and then multiplying it with how many pages there is in the W34 SG D manual. We can see in Table 5 as in earlier recognitions that it would be much cheaper if all work were done in-house.

Table 5 Man-hours and costs for W34 SG D O&MM

Work done in-house	Outsourced to another company	
Process	Total cost (W\$) W34 SG D	Cost if all work were done inhouse(W\$) W34 SG D
Content harmonisation across the Chapter variants	752 119	461 817
WFI - Content migration into TDOC	37 766	37 766
Semi-automatic content migration into TDOC	5 348	3 284
Quality Checking	50 141	30 788
Updating the content after migration	200 565	123 151
TDOC management during the migration project	54 597	54 597
WFI Change Management	153 939	153 939
Total cost (W\$)	1 254 476	865 343

Table 6 displays the time taken per process when the harmonising was made for the W20 operation and maintenance manual. The y-axis is showing the time in years meanwhile the x-axis is showing the name of the process.

The values in the table below has been provided by Technical Information. We can see that the process that takes the most time by far is “Content harmonisation across the Chapter variants” and this process has the external partner done for the W20 harmonising project.

Table 6 Time taken per task for W20 & O&MM

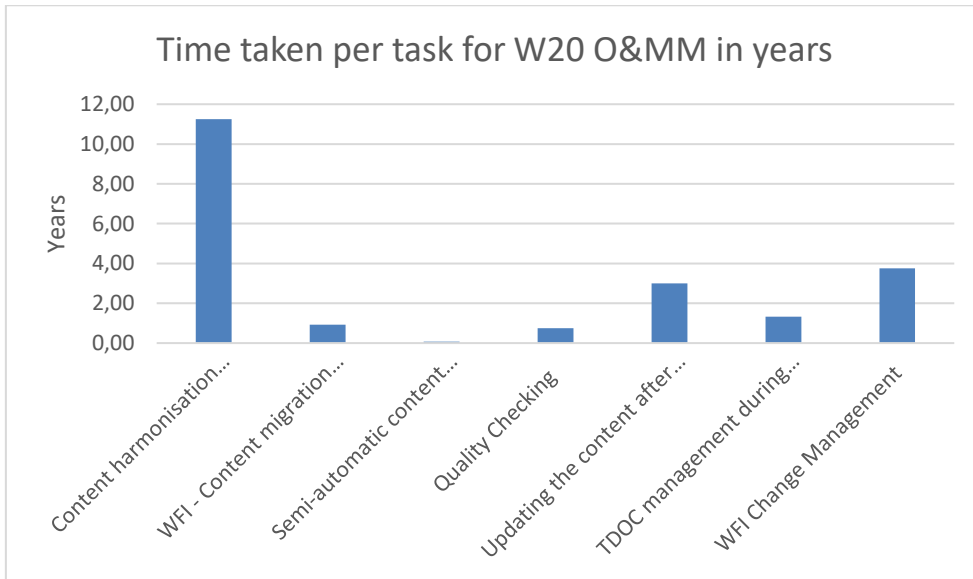
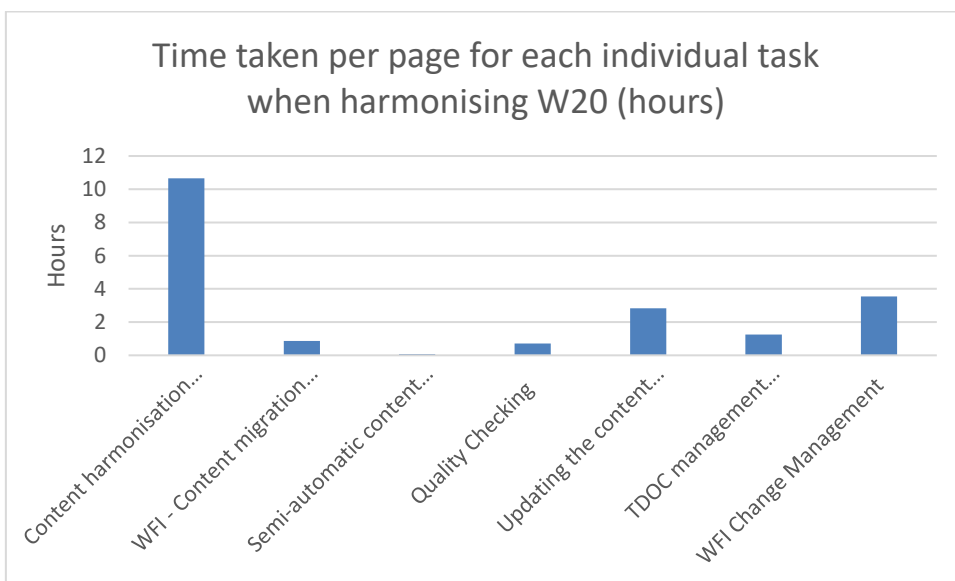


Table 7 is displaying the time taken per page for each individual task when harmonisation was made to the W20 operation and maintenance manual. The y-axis is showing the time in hours and the x-axis is showing the name of the process.

The values in the table below has been calculated by using the values in table 6 and divided them with how many hours each process took and how many pages there were. The values in table 7 has been used when calculating the prices of the manuals in this thesis.

Table 7 Time taken per page for each individual task when harmonising W20 in hours



5.2 Qualitative results

The qualitative results are taken from the answers given in the interview. The questions that were asked during the interview was how they think that the work has improved since the harmonising, which tasks are now easier when maintaining the manuals, and how many softwares were used while updating the operation and maintenance manuals and how many are you using now?

These are the answers from the interview:

- All the documentation following the same guidelines – To provide a “one Wärtsilä look and feel” across all our products.
- Improves the Wärtsilä customer experience.
- Provides continuity, by reducing inconsistencies to our documentation.
- Reduces the number of variants of our documentation.
- Uses simpler conditioning in our tool.
- Easier to update and maintain because of the operation and maintenance manuals are in one place instead of three places which have to be updated.

The technical writer needs to visit the technical support on some occasions to get the best clarity on how to explain certain things in the manual. When this occurs, it is better to have in-house workers that are close to the technical support. The travel distance for the external partner is longer and this will lead to more time wasted.

When updating the manuals, the in-house way of working is to update it in one software meanwhile the external partner needs to do the same update in three different softwares which leads to much extra time wasted.

It will go faster for the team leader to inform about a new task to the employee if he sits next to him than if he needs to send him an e-mail and wait for him to reply.

6 Analysis

In this chapter the results from the qualitative and quantitative research will be further analysed and explained. The intention of the quantitative and qualitative research is to use the results to analyse the costs and if it would have been better and cheaper to have Wärtsilä do the work. All results are calculated with the Wärtsilä \$.

This section will compare if Wärtsilä should use in-house workers or external workers to harmonise the operation and maintenance manuals and then to maintain the operation and maintenance manuals.

The harmonising project

The research shows a long list of pros with doing the work at Wärtsilä. The upsides of having outsourced work seems rather small. Starting with the quantitative research, when the W20 operation and maintenance manual was harmonised there was a large part of the processes that the external company did. If all the processes would have been done at Wärtsilä during the harmonising project, **it would have saved Wärtsilä 677 175 W\$ - 467 118 W\$ = 210 057 W\$ which is 31% of the current price they had to pay.** If we take the W32 operation and maintenance manuals calculations results Wärtsilä would save 876 545 W\$ - 604 644 W\$= 271 901 W\$. So why did Wärtsilä not do it themselves?

The reason being that in this specific project there were completely different softwares used at the other company which Wärtsilä's harmonising team would have had to learn to even make the first step. For them to learn these softwares would have required courses and plenty of man-hours, which are costly. Instead they had the workers that had been using the softwares at the external company for a longer time to do the work.

The project required 21,08 years when referring to attachment 1 this is with both Wärtsilä's five-man group and with the external partners hours. This is a lot of man-hours and for Wärtsilä to have done it by themselves in the same amount of time which was two years when referring to Chapter 4.3.1 would have required them to have had eleven employees working on the harmonising project. For this to happen Wärtsilä would have had to find seven more people when subtracting the team that was working on it and then hire them for the harmonising project. These workers would have been on a two years contract until the project is completed. **It only requires four persons to maintain the operation**

and maintenance manual for the W20 engine as it is right now. To find seven workers that are up to speed with the correct softwares are not that easy.

To state the theory this is also a perfect time to focus on Wärtsilä's strengths which is the new software that they started using instead of wasting time learning an old software that they are not going to use.

Another thing that is stated in the theory is when having the tasks outsourced, Wärtsilä knows how long the project is going to take and how much it will cost. This makes it safer than having to hire new employees and not knowing how long the learning phase is going to last for each one of them.

The costs that arise for having it done in-house is first of all to buy the software that the external company was using. Then the major extra cost is to hire more employees and have them learn how to use the software. **The length of the learning phase varies for each individual, which creates an uncertainty of how long the project is going to take, leading to extra costs if it takes longer than two years which it probably will.**

When having a project outsourced, one knows from the beginning how much it will cost. With a project like this it would be the best way to go because of the uncertainty with having to hire extra people and still needing to keep the same deadline.

Maintaining the manuals

The qualitative research shows that the external partner must update three separate softwares when updating one problem in the manual. When updating the manual in-house it is only necessary to do it in one software.

When questions arise for the TS regarding changes to the manual it is easier to get answers if the TW is located in the same building.

When having the manual maintained in-house it gets a faster and better result because of less miscommunications when speaking face to face. it will be faster because the system is better optimised and when the manuals need updating only one software is required to make the changes. The way to go when maintaining the manuals is to have the work done in-house.

7 Conclusion

The objective of this thesis was to make a cost analysis of having the operation and maintenance manuals in-house versus to outsource them, and also how much it would cost to harmonise two other engines to Wärtsilä's system.

The cost analysis displays the processes of when manuals are being harmonised into Wärtsilä's system. Information from the earlier harmonising project was used and compared to the engines that were used in this analysis. Data was received from the external partner for the cost analysis. The harmonising of the manuals should not be done completely in-house because of having a lack of knowledge in the other software. There would also be a learning phase for the people that are hired which can't be controlled fully. For maintaining the manuals which is a never-ending project it should be done in-house. It reduces much unnecessary time from having miscommunications and can ensure that Wärtsilä's services stays perfect.

This task was done by comparing the W20 engine's operation & maintenance manual with the manuals of the engines that were to be harmonised. The manuals were handed out by the external company. After the comparison was done it was calculated how long it would take to harmonise the other engines' manuals to the system. This was done by getting the values from comparing the lengths of the manuals. After knowing how long that task would take, the costs were calculated for producing the manuals. Afterwards calculations on costs regarding the maintenance of the manuals were made.

7.1 Challenges of the thesis

The challenges of this thesis have been to acquire all the data that was needed for the calculations. The full master operation and maintenance manuals were hard to get because they are usually not created. Since the full master operation and maintenance manuals are a combination of every variant of that specific engine it took a couple of hours for the computer to publish it and it could not be done on daytime because of intervening with the other publications.

7.2 Further research and development

To make further research would be to try to make a benefit analysis of having the manuals up to date. Then a survey would have to be sent out to the customers to see if they have noticed any difference since Wärtsilä started to maintain the manuals every month. With that information a sort of value could be produced of how much the maintainable part is worth.

7.3 Final words

I would like to thank Wärtsilä – Technical Information for giving me the opportunity to write my thesis for the company. A special thanks goes out to the Technical Information department and to my supervisors Guy Russell and Tommy Rodas for assisting me throughout the process.

I would also like to thank my supervisor Mikael Ehrs from Novia UAS for supporting me throughout the whole project.

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9 Attachments

Attachment 1

Process	Number of Personnel W20	Time taken W20	Total Man Time W20	Years W20	Working days W20	Working hours W20	Hours per page W20	Cost per page (M\$) W20	Total cost (M\$) W20	Costs if all work were done in-house (M\$) W20	Total man hours (W32)	Total cost (M\$) W32	Costs if all work were done in-house (M\$) W32	Total man hours (W34 SGD)	Total cost (M\$) W34 SGD	Costs if all work were done in-house (M\$) W34 SGD
Outsourced to another company																
Work done in-house																
					225 Working days	7.5h per working day										
Content harmonisation across the Chapter variants	3	3 years 9 months	11 Years 3 months	11.25	2543	19069	11	227	405999	249129	24683	525531	312687	35325	752119	461917
WFI - Content migration into TOOC	1	11 Months	11 Months	0.92	208	1559	1	11	20387	20387	2019	26389	26389	2889	37766	37766
Semi-automatic content migration into TOOC	1	1 Month	1 Month	0.08	18	136	0	2	2887	1773	176	3737	2295	251	5346	3284
Quality Checking	1	9 Months	9 Months	0.75	170	1271	1	15	27067	16619	1646	33035	21512	2355	50141	30788
Updating the content after migration	3	1 Year	3 Years	3.00	678	5085	3	60	108266	66478	6582	140142	86050	9420	200565	123151
TOOC management during the migration project	1	1 Year 4 months	1 Year 4 months	1.33	301	2254	1	16	29472	29472	2918	38149	38149	4176	54597	54597
WFI Change Management	1	3 Years 9 months	3 Years 9 months	3.75	848	6336	4	46	83097	83097	8228	107562	107562	11775	153939	153939
				21.08			4	Total cost (M\$)	671735	467118		876545	604644		1254478	865343