YRKESHÖGSKOLAN
NOVIA

Adding Value through Corrective Preventive Warranty Claims

Case: Wärtsilä Customer Assistance

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BACHELOR'S THESIS

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Abstract

This thesis is made on behalf of Wärtsilä Marine Power, Customer Assistance Warranty Services. The purpose of the thesis is to calculate how value is added to the company through corrective preventive warranty claims.

The theory chapter discusses central aspects, such as complaint management and cost of quality. Furthermore corrections, corrective actions and preventive actions are explained.

Quantitative research methods combined with a cost analysis have been utilized in this thesis. The quantitative research methods are used to gather and analyze historical data regarding component failures before, and after improvement of components. A cost analysis is made to determine the cost before and after the improvement.

The result of the thesis is a cost analysis of a chosen component, before and after improvement. The result also brings up the importance of warranty claiming and acting on time. The result can be used as a guideline in Wärtsilä Customer Assistance for calculating the possible added value from warranty work and to determine when actions need to be taken to minimize the costs.

Language: English Key words: cost of quality, complaint management, warranty

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EXAMENSARBETE

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Titel: Skapa värde via korrigerande samt förebyggande garantikrav

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Datum 31.3.2021 Sidantal 29 Bilagor

Abstrakt

Detta examensarbete är gjort för Wärtsilä Marine Power, Customer Assistance Warranty Services. Syftet med arbetet var att räkna ut hur korrigerande samt förebyggande garantikrav skapar mervärde till företaget.

Teoridelen förklarar olika centrala begrepp såsom klagomålshantering och kvalitetskostnader. Dessutom förklaras det vad en korrektion är, vad korrigerande åtgärder är samt vad förebyggande åtgärder är.

Kvantitativa forskningsmetoder i kombination med en kostnadsanalys har använts som metoder i detta arbete. Kvantitativ forskning användes för att samla in och analysera historiska data om komponentfel före och efter förbättring. Kostnadsanalysen har blivit gjord för att bestämma kostnaden före och efter förbättringen.

Resultatet av arbetet är en kostnadsanalys på en vald komponent före och efter förbättring. Resultatet tar också upp vikten av garantiarbeten samt att agera i tid. Resultatet kan användas som en riktlinje inom Wärtsilä för att räkna ut det möjliga skapade värdet från garantiarbeten samt att bestämma när åtgärder borde tas för att minimera kostnaderna.

Språk: engelska Nyckelord: kvalitetskostnad, klagomålshantering, garanti

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OPINNÄYTETYÖ

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Nimike: Arvon lisääminen korjaavien sekä ennaltaehkäisevien takuuvaatimuksien kautta

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Päivämäärä 31.3.2021 Sivumäärä 29 Liitteet

Tiivistelmä

Tämä opinnäytetyö on tehty Wärtsilä Marine Power, Customer Assistance Warranty Servicelle. Työn tarkoitus oli laskea, kuinka arvoa lisätään yritykselle korjaavien sekä ennaltaehkäisevien takuuvaatimuksien kautta.

Teoriaosuus kertoo avainkäsitteistä kuten valitusten hallinnasta sekä laadun kustannuksista. Lisäksi korjaus, korjaavat toimenpiteet sekä ehkäisevät toimenpiteet selitetään.

Työssä käytetyt menetelmät ovat kvantitatiivisia tutkimusmenetelmiä yhdistettynä kustannusanalyysiin. Kvantitatiivista tutkimusta käytettiin keräämään sekä analysoimaan historiallisia tietoja komponenttivioista ennen korjausta ja sen jälkeen. Kustannusanalyysi on tehty kustannusten määrittämiseksi ennen parannusta ja sen jälkeen.

Työn tulos on valitun komponentin kustannusanalyysi ennen parannusta ja parannuksen jälkeen. Tulososiossa käsitellään myös takuutyön sekä ajoissa toimimisen merkitystä. Tulosta voidaan käyttää ohjeena Wärtsilässä laskettaesa takuutyösta mahdollisesti syntyvää lisäarvoa ja määritettäessä, milloin tulisi ryhtyä toimenpiteisiin kustannusten minimoimiseksi.

Kieli: englanti Avainsanat: laadun kustannukset, valitusten hallinta, takuu

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List of Abbreviations

CRM	Customer Relationship Management
SWE	Supplier Warranty Expert
WE	Warranty Expert
SDE	Supplier Development Engineer
SAP	ERP (Enterprise resource planning) system used within Wärtsilä
Re-claiming	Sending of warranty claims received from customers to Wärtsilä sub-suppliers.

1 Introduction

As customers' expectations have been on a rising trend during the past years it has become a necessity to provide even better service than before to keep customers satisfied. This means that companies, both big and small have been forced to invest more in the customer assistance side of business.

This thesis is made for Wärtsilä, to show that the investments done in both customer assistance and quality in general generate added value to the company in the form of more satisfied customers and saved money in the long run.

1.1 Wärtsilä

Wärtsilä was established in 1834 in Tohmajärvi, Finland as a sawmill. Since its establishment, the company has changed its markets several times. Today Wärtsilä is a global leader in smart technologies and complete lifecycle solutions for both the marine and energy markets. Wärtsilä emphasizes sustainable innovations, total efficiency and data analytics, and through this maximizes the environmental and economic performance of their products. Wärtsilä has approximately 18,000 employees in over 200 locations and in more than 70 countries around the world. Wärtsilä net sales in 2020 were 4,6 billion EUR and in 2019 it was 5,17 billion EUR (About Wärtsilä, 2020).

1.1.1 Energy Business

Wärtsilä Energy Business is one of the leading global energy system providers offering a broad range of different solutions for power plants. Solutions that they offer are combustion based powerplants, LNG-terminals, both energy storage and integration solutions and utility-scale solar power plants. Wärtsilä Energy Business is also leading the transition towards a 100% renewable energy future by helping customers unlock the value of the energy transition by optimizing their systems.

At the end of 2020 Wärtsilä has delivered over 72 GW of power plant capacity to installations located in 180 different countries all around the world (Wärtsilä Energy, 2020).

1.1.2 Marine Business

Wärtsilä Marine Business is a global leader in marine technology with a broad product scope. Wärtsilä's scope of supply consists of both engines and generating sets, different propulsion equipment, reduction gears and different control systems for most vessels and other applications offshore. The products that Wärtsilä Marine Business offer are innovative, safe, efficient, flexible, environmentally and economically sustainable. With many years of knowledge about the products that they offer they are leading the industry's transformation towards a smarter marine ecosystem (Wärtsilä Marine, 2020).

1.1.3 Customer Assistance

Customer assistance is a global organization under marine business with skilled warranty professionals supporting Wärtsilä's marine customers world-wide. There are in total 9 different offices located close to locations where their customers have operations (Customer Assistance Wärtsilä, 2020).

Customer assistance is responsible for the handling of the contractual warranty period after a vessel has been handed over to the customer. Another main responsibility of the organization is supplier re-claiming and providing feedback to product improvement regarding issues noticed during the warranty period (Customer Assistance Wärtsilä, 2020).

Some of the core activities the organization has are keeping a high level of customer satisfaction, cost-efficiently, ensuring Wärtsilä's suppliers are informed regarding issues with their components and also ensuring that the suppliers will take the needed corrective actions for product development at the same time that they financially compensate for errors in their products (Customer Assistance Wärtsilä, 2020).

By the end of 2020 customer assistance had 98 employees in 12 different countries. These employees normally handle over 10 000 warranty claims and over 1500 supplier claims annually (Customer Assistance Wärtsilä, 2020).

1.2 Background

This Bachelor's thesis is done on behalf of Wärtsilä Marine Power Customer Assistance Warranty Services. The different duties in the organization vary from being the contact between Wärtsilä and the customer to be the contact between Wärtsilä and their sub-suppliers**.** The work in the department consists of handling customer claims from all over

the world, mostly concentrating on Marine installations. Different claims require different amounts of work put into them, some are very simple and with some**,** more expertise is required.

Because of my earlier working experience as a Supplier Warranty Expert and Warranty Expert in the re-claiming department I have a good overview of how the re-claiming works and from whom I can ask assistance if needed.

1.3 Purpose

The purpose of this thesis is to give an overview of how additional value is created by corrective preventive re-claiming. We are mainly going to concentrate on how the work and resources used on people working with corrective preventive re-claiming can show clear long-term gains in improved customer experience and possible saved money. To reach a valid conclusion we are going to investigate what cost of quality and complaint management is and calculate the cost of poor quality. The result of this thesis should show the importance of supplier re-claiming and it should in the future be easier to calculate the cost of non-conformities. At the same time, it should make it easier to estimate the acceptable payback period on an investment in a specific case and through this see how additional value has been created for the company in the long-term by improving the product.

1.4 Delimitation

This task is made for customer assistance organization and therefore we will not touch deeper into other organizations and their involvement in product/supplier development. The main focus of this thesis is to show how corrective preventive re-claiming leading to product development can create value in the form of improved customer satisfaction and money saved by the company.

1.5 Disposition

The first chapter will handle information regarding the company and the company structure followed up with the background and the purpose of the thesis. This chapter will additionally bring up the delimitation.

The second chapter presents relevant theory for the thesis.

The third chapter explains which methods are going to be used to reach a valid result in the thesis.

The fourth chapter explains the result of the thesis. The result of the methods used will be presented, analyzed and discussed.

The fifth chapter will bring up the conclusion of the thesis. Challenges and further development will also be presented.

2 Theory

In this chapter the relevant theories for the thesis will be brought up. This includes information regarding what complaint management is and why it plays an important part in both keeping a high standard for products that are supplied by the company and keeping a high level of customer satisfaction. Additionally, information regarding cost of quality, cost estimation, product improvement and LEAN will be brought up.

2.1 Complaint management

According to Ionos (2019) the term complaint management describes the handling of customer complaints within a company. No company is immune to complaints and when a company grows the amount of complaints also grow. This brings companies to the situation where introducing a process for managing complaints is a must. Management of complaints is all about managing the customer criticism methodically. It is therefore necessary to develop strategies and determine how and where complaints should be received, how one should respond to feedback, and to which departments or individuals the criticism should be forwarded. The assignment of responsibilities is also a part of complaint management, critique can only be turned into something constructive when it is clear who is to respond to each case (Ionos, 2019).

According to Ionos (2019), complaint management process has two main goals:

- To reduce customer dissatisfaction and strengthen customer loyalty

- To contribute to improvement of products or services through customer feedback

Customer satisfaction is often seen as a key differentiator within an environment where companies are continuously competing for customers. In environments like these the companies that thrive are companies that make customer satisfaction a central topic in their business strategy (Bramley, 2017).

To achieve better customer satisfaction there are a handful of tasks that should be considered. One of the tasks being making submitting a complaint as easy as possible so that the customer will turn to you first instead of venting their dissatisfaction on different social networks. Another important task that really should be considered is ensuring that the initial contact the customer has with you is positive. The customer is meant to feel like they are in good hands when submitting their complaint. To achieve this, it is of importance to have trained personnel that can make an unsatisfied customer feel that their opinion is valuable for your company. Customers usually expect an immediate action on their complaint, whether this is replacing the failed component or giving a discount on their next purchase, these are options that should be determined beforehand (Ionos, 2019).

Beside achieving a better customer satisfaction, long-term effects on the company's products is to be considered as well, as this is how the quality is improved. An important task to consider is analyzing the feedback received from the customer to notice patterns behind several and/or repeating failures. When noticing a pattern in the failures it is important to have an audit to see how the component in question could be improved. Thanks to the data that is collected in the form of complaints from customers, preventive matters can be concluded and used to save funds for the company in the future (Ionos, 2019).

Complaint management is a part of the management of customer relationships. CRM provides a fundamental client care framework and includes, among other things, an analysis of customer relationships (Ionos, 2019).

2.2 CRM

CRM is compilation of systems and tools for managing all the company's relationships and interactions with old and new customers. The goal of CRM systems is improving the business relationships and, by collecting data, helping you grow your business (Salesforce, 2020).

A CRM system is intended to give everyone from sales to customer service a better way of managing external interactions and relationships. By using a CRM tool, you can store contact information from your customers and prospects, identify possible opportunities to sell more, record and keep track of service issues and manage marketing assets from one location. The tool makes it easy for a company to store the interactions it has had with the customer or the service issues, this information can then be made available to anyone within the company needing the information. By having information available in one place, makes it easier to collaborate and increase productivity inside your company, saving time and money by not having to inform several people through e-mail regarding something and reducing the risk of double work (Salesforce, 2020).

If you intend for your business to last and keep growing, you will need a strategy centered around your customers which is supported by the correct technology. With a CRM tool, you can collect up-to-date data and reliable information from different departments within your company fast and easy.

CRM systems have traditionally been used solely as sales and marketing tools, but during the past years customer service and support has been a rising segment of the system, since it has grown to be such a critical piece in managing a good customer relationship. It has been noticed that customers expect faster, more personalized support at any given time, which means that having an easy platform where the customer feedback, issues and interactions can be saved has become an essential asset for companies to quickly find the answers to the customer**s'** needs (Salesforce, 2020).

2.2.1 Salesforce

Salesforce is the world**'s** leading customer relationship management platform, helping companies' different departments work as one so that companies can keep their customers around the world pleased. The platform is used for several different things, examples of which are providing great customer service, selling smarter and growing one's business faster. Salesforce is used by over 150 000 companies ranging from small to big all around the world (Salesforce, 2020). The platform has been used by Wärtsilä since 2007, first as a sales cloud helping the sales department and from 2010 the platform was also put in use as a service cloud to track customer queries and to gather an online knowledge base. As Wärtsilä maintains several hundred installations under long-term contracts, it is important

that their customers have several channels they can reach out through and receive the needed assistance as soon as possible (Salesforce, n.d.).

2.3 Correction, Corrective and preventive action defined

According to ISO 9000:2015 management systems, a correction is defined as the action that is taken immediately to eliminate a nonconformity that has been noticed. Corrections are the actions taken before a corrective action is implemented (ISO, 2015).

Corrective action is an aspect of quality management, that is used to investigate and eliminate the root cause of a detected non-conformity at the same time as it aims towards preventing future issues (ISO, 2015). The process of implementing a corrective action includes a clear identification of an issue and detailed documentation of the tools and measures that have been taken to fix the immediate symptoms. Ideally, corrective actions are only used to address serious and persistent issues or risks where a customer is demanding change (Smartsheet, n.d.).

Preventive action is an aspect of quality management, that is used to eliminate a non-conformity before it happens (ISO, 2015). By recognizing possible problems that could arise in a process or a product in time, the cause can be determined, and steps taken to prevent this from happening. Ideally, preventive actions should be implemented when a risk has been identified but the problem has not yet occurred (Hammar, 2020).

Both corrective and preventive actions use similar processes and tools, they are however not necessarily used together. A corrective action is reactive whilst preventive actions are proactive (Smartsheet, n.d.).

Corrective and preventive actions are often considered different methods of recognizing daily business processes within Six Sigma (Smartsheet, n.d.). Six Sigma is a technique and a set of tools that aims to improve quality and processes by using different available data (Eby, 2017). According to Kate Eby (2017) Jack Welch describes Six Sigma as follows:

"*Six Sigma is a quality program that, when all is said and done, improves your customer's experience, lowers your costs, and builds better leaders."*

2.4 Tools and methods used for corrective and preventive actions

Root Cause Analysis (RCA)

A root cause analysis is commonly done as a part of the corrective actions. A root cause analysis is a term for a collection of problem-solving methods that are used to solve the real cause of a non-conformance (Quality-One, n.d.).

The Eight Problem Solving Disciplines (8D)

8D is a problem-solving process that is designed to find the root cause of a problem, implement a short-term fix and a long-term solution, as to avoid recurring problems. 8D is an excellent first step on improving quality and reliability when it is clear that a product supplied by you is faulty or does not satisfy your customers (Quality-One, n.d.).

This process is divided into eight steps to solve the problems. According to Quality-One (n.d.) the steps are as follows:

1. Create a team - gather a cross-functional team with the required knowledge and have the team gather relevant information and data.

2. Describe the problem - by using the data and information found, you quantify and clarify the problem as a statement. This step utilizes tools like the 5 whys and Ishikawa diagram.

3. Develop a containment plan - define and implement containment actions**.**

4. Determine and verify root causes - identify and confirm all possible causes and sources of variation to explain why a specific problem har occurred.

5. Verify permanent solutions - collect data to confirm that possible solutions will resolve the problem.

6. Define and implement corrective actions - develop a plan on implementing the best solutions you have come up with

7. Prevention - modify the necessary systems to prevent the problem from recurring.

8. Congratulate the team - thank the team members for their involvement.

2.5 Cost of quality (COQ)

Cost of quality, COQ is a methodology which is used to measure and define the costs of obtaining and maintaining good quality opposed by the costs that come from failures

(Quality-One, n.d.). Cost of quality consists of two main components, cost of conformance and cost of non-conformance.

Cost of conformance, also known as cost of good quality, is divided into two separate costs, prevention costs and appraisal costs (Project-Management.info, n.d.).

Prevention costs are the costs that occur from actions that ensure the product is built right the first time. This category should be called an investment instead of a cost, as by avoiding a non-conformance from happening, a huge saving moneywise is already done and additionally the company reputation will be affected positively, which in turn helps the company with future deals (CQE Academy, n.d.). Some of the costs that belong to prevention costs are:

- Quality planning - keeping the quality high with training and education
- Prototype testing - new product reviews and verification
- New employee screening - educating and training
- Design qualification testing - testing that the quality of a new design is up to date
- Development of a quality data system
- Market research costs

According to CQE Academy (n.d.), Edwards Deming has once said that "*Quality comes not from inspection but from improvement of the process*". This means that instead of focusing on failures and appraisal to focus on prevention through improvement.

Appraisal costs are costs that occur from the checking and verifying that a product was built according to specification the first time. These costs are in the same category as prevention costs and should therefore also be treated like investments instead of a cost. Costs that belong to this category according to CQE Academy (n.d.), are:

- Inspection costs
- Testing costs
- Product audits

- Reviewing of inspection data
- Supplier audits

Cost of non-conformance, also known as cost of poor quality, is divided into two categories, internal failures and external failures (Project-Management.info, n.d.).

The internal failures are associated with the defects noticed before handing over the sold product or service to the customer. According to CQE Academy (n.d.), costs that belong to this category are:

- Excessive scrap - due to rebuilding or replacing equipment due to an issue/failure.
- Re-working or re-processing - scrapping or modifying product due to a design change.
- Re-inspection or testing - costs that accumulate from root cause investigations.
- Equipment breakdown or downtime - downtime which slows down production.
- Supplier corrective actions - can lead to internal corrective actions due to change in design.

The external failures are associated with defects that occur after delivery of the sold product or service to the customer. According to CQE Academy (n.d.), costs that belong to this category are:

- Warranty costs - customer complaints, investigations.
- Repair costs - costs that occur due to the need for repair.
- Return costs - component returns for the purpose of sorting out the root cause of the failure.
- Rejection costs - customer will not accept using several bad quality components and might demand different components.
- Shipping damage - components damaged during shipping.
- Incorrect components - costs for returns and sending of correct components.

This category is usually seen as the most expensive category of quality costs. This is because, aside from impacting direct costs like warranty costs and repair costs, it can impact indirectly as lost sales and in a worst-case scenario as lost customers. The external failure costs can also be avoided to some degree by improving the preventive measures (CQE Academy, n.d.) (Project-Management.info, n.d.).

To calculate the total quality cost, every category is to be considered. The formula for the total cost of quality is as follows:

Cost of Quality (COQ) = Cost of Conformance + Cost of Non-Conformance (Project-Management.info, n.d.) (CQE Academy, n.d.).

2.6 Product improvement

Product improvement is a process which is used to make substantial product improvements that result in increased performance, quality and/or saved costs which are both beneficial for you, as well as your current and future customers (Traynor, n.d.).

A solid product development strategy focused on customer needs and high quality will help you improve your reputation for quality, which in turn can help by increasing sales and by lowering the amount of costs accumulated from non-conformities. When a product is assessed for development it is important that the commercial side of things has also been reviewed. This means that it is ensured that the project will produce sufficient sustainable revenue which covers the development, manufacturing and possible marketing costs (Linton, 2019).

The most common trigger point for product improvement is data collected from customer feedback. One of the more important activities in product improvement is the investigation of what could have caused the failure in the first place and to fix said issue (QualityInspection, 2020).

2.7 Lean management

Lean management is an organizational management approach supporting the concept of continuous improvement, a long-term work approach that systematically seeks to achieve small, gradual changes to processes in order to improve both the efficiency and quality. By optimizing resources, the primary purpose of lean management is to generate value for the

customer and to create a workflow based on actual needs of the customers (McLaughlin, n.d.). According to McLaughlin (n.d.) the focus of lean management is on:

- Defining value from the customers standpoint
- Eliminating waste from the business processes
- Continuously improving processes, purposes and people.

The principles from lean management can be used as a universal tool to improve the overall performance in the company.

2.7.1 Kaizen

Kaizen is one of the philosophies that act as one of the main pillars for the lean methodology (Kanbanize, n.d.). The meaning of the Japanese term "Kaizen" can be directly translated as "*change for better*", or "*continuous improvement"* (Hargrave, 2021). The philosophy is based on the belief that everything can be improved. This means that there are continuous efforts on improving which will result in small changes over time. These small changes will add up to substantial changes long-term without having to go through any radical changes (MindTools, n.d.).

Under kaizen, all employees in a company are to identify inefficiencies and provide suggestions for improvement. Kaizen aims to improve productivity, efficiency, safety and waste reduction (MindTools, n.d.). According to MindTools (n.d.) the following can be found as gains for following this approach:

- More satisfied people - people have a direct impact on the way things are done
- Improved commitment - teams have more of a stake in their job and are more motivated to commit to doing a good job
- Improved competitiveness - increased efficiency contributes to lower costs and higher quality products
- Improved consumer satisfaction - from higher quality products and service
- Improved teams - working together to solve problems strengthen existing teams

Originally the philosophy was developed to improve the manufacturing processes but later it has been discovered that the kaizen approach is beneficial in many other working environments. According to MindTools (n.d.) most of the focus in kaizen is on reducing different kinds of "waste" such as:

- Movement – the moving of materials or information before any further value can be added to them.
- Time - spent waiting.
- Defects - usually requiring re-work or a completely new product.
- Over-processing - doing more to the product than is necessary to give the customer the maximum value for their money.

This approach is easy to implement within different scenarios, which makes it one of the most common practices nowadays.

2.7.2 PDCA

PDCA is one of the three major approaches used to achieve continuous improvement. This approach is also the most popular approach. PDCA, or Plan-Do-Check-Act is also known as the Deming circle after its founder William Edwards Deming, who was a pioneer in quality leading and continuous improvement. The circle itself is a never-ending loop that aims to help improve further based on results achieved (Kanbanize, n.d.).

According to MindTools (n.d.) the cycle will help you solve problems and implement solutions in a detailed, systematic way. The four stages of this cycle are:

1. Plan

Identify issue and make the issue understandable. Investigate the information available and generate some screen ideas and make up an implementation plan.

2. Do

Once a potential solution has been identified, test it safely in a small pilot project. During the time of running this project you should gather data, which will show if the change has worked or not.

3. Check

Analyse the results from your earlier pilot project and put the results against the expectations that has been made up in the first step, to see if the idea was a success. If the results are satisfying and the expectations have been met you can continue to step four, otherwise return to step one.

4. Act

Implement your new solution. Keep in mind that the PDCA is a continuous loop and that you've now only changed the baseline for continuous improvements.

PDCA can be used in all types of organizations and the cycle can be used to improve any process or product, by breaking them down into smaller steps. The cycle is especially useful for the implementation of total quality management or six sigma initiatives. It can also be used for the general improvement of different business processes (MindTools content team, n.d.).

2.7.3 Kanban

Kanban is the second approach in achieving continuous improvement (Kanbanize, n.d.). Kanban is a method used for workflow management. It defines, manages and improves services that deliver knowledge work. Its core purpose is to minimize waste activities without sacrificing productivity. The goal with Kanban is to create more value for the customer without generating additional costs (Kanbanize, n.d.).

If translated, the Japanese word Kanban means billboard or signboard. The whole method originates from manufacturing but it has later been used in Agile software development teams and recently has been recognized by other business units from various industries (Kanbanize, n.d.).

Kanban focuses on getting things done and the fundamentals of this method can be broken down into four principles. According to Kanbanize (n.d.) the core practices for Kanban are:

1. Start with what you know

Overlaying the method over already existing processes without disrupting what is already done as efficiently as possible. This method will highlight the issues that will need to be addressed.

2. Agree to pursue incremental, evolutionary change

Kanban encourages to continuous small changes in the already existing process.

3. Respect the current process, roles & responsibilities

The method acknowledges that the current procedures, roles and duties all have pre-existing values in them that are worth preserving. Taking a Kanban approach does not prohibit the change, but it cannot be prescribed as a "quick fix" either. The method is designed to encourage and promote gradual, logical changes without causing the fear of change.

4. Encourage acts of leadership at all levels

This practice is the newest one within the Kanban method. It is meant as a reminder that leadership comes from everyday acts on the working floor. Everyone must have a Kaizen mindset to reach optimal performance on several levels.

The basic idea of Kanban is to visualize every piece of work on a whiteboard. By using this method, you will quickly notice bottlenecks in your processes, and this will help you tackle the issues noticed as well. The method was originally created to meet customer's demand just in time. Today, Kanban makes it easy to respond to the customers changing requirements and allows organizations to be more agile and adaptive (Kanbanize, n.d.).

2.8 Cost estimation

Cost estimation is used to predict the total future cost of a project through historical data applied with different quantitative models, tools, techniques and databases (Mislick, 2015). Cost estimating is the fundamental part in project cost management, and it validates the budget for a project at the same time as it enables easier monitoring and controlling of the project costs (Viter, n.d.).

According to Mislick (2015) numerous different characteristics need to be involved in a cost estimation. The following list gives us a closer look at the most significant characteristics.

- A good cost estimation must be based on historical data from similar or related earlier experiences. These kinds of experiences should be named as data sources, so that the person using the data knows that the information is based on earlier experiences.

- The estimation should also reflect on the potential future processes which might have made improvements to the design of the product. The improvements, although there is no cost data available, still must be accounted for when making the cost estimation. These costs are usually estimated with "subject matter expertise".

- It needs to be easily understandable by different program and business leaders. A simple approach is usually better than a very complex approach, as business leaders don't always have the time dig deeper to understand the values you've presented before approving or declining.

- It is important that the rules and assumptions have been identified. The base of a cost estimation is assumptions and it must not be forgotten that these are only assumptions. To provide as accurate calculations as possible a sensitivity analysis is to be included. This will create different variations of the baseline ground rules and assumptions.

- It needs to take risks and uncertainties into account in the program plan. When presenting the sensitives, they should be arranged by the size of the impact in the cost estimation. By taking the risks and uncertainties into account we get a more credible result.

- It should be auditable and traceable. This means that the estimate can be created again from the data sources, ground rules and assumptions that it was based on. A cost estimate is standardized so that a person with a high school degree can, with the same data and arguments, come to the same conclusion as you have.

3 Methodology

In this chapter the methods of the thesis will be presented. The choice of methods as well as the approach will be explained to give a better understanding on what the results are based on.

3.1 Quantitative research method

A quantitative research method is correlated to an analytical analysis to test theories where numbers and facts are usually used to build up a positivist or natural science model (Greener, 2008). The data that was analyzed is historical data retrieved from the company databases and possible future data predicted by a simulation tool. Upon gathering the data, it was combined, and the necessary calculations were made. Lastly the results were gathered into tables so that they would be easy to understand.

Defining the value of the analysis

What is wanted from the analysis is to notice clear changes in failure amounts upon development of chosen product. To be more precise, the outcome of the analysis should indirectly show savings per year thanks to an updated product.

Data collection

For the thesis analysis, it is important to have the number of failed products and the cost of said products easily accessible. The information regarding the failed amount of products was retrieved from an internal statistics tool in Wärtsilä whilst the product costs were retrieved from SAP.

Data processing

The data retrieved was processed in an excel file and was collected for calculations of total product failure costs before an updated version was available and after a new version was released and implemented in use for approximately one year. After this the difference was calculated and used as a base for savings/costs per year so that the complete cost analysis involving different engineering and transport costs could be done.

3.2 Cost analysis method

A cost analysis was made to identify the costs that come from product improvement and to identify the amount that can be saved in long-term by investing in quality. For the analysis I have used an engine component, a now obsolete speed sensor as reference since there are new versions already out which helps us in making a more accurate cost analysis.

For the analysis, internal costs have been analyzed by using available data and personal/internal knowledge regarding the time that is put into activating Wärtsilä's suppliers to make improvements based on information from both internal and external root cause analysis.

The following costs have been considered whilst making the cost analysis:

- Product failure costs
- Engineer costs
- Transport costs

As this thesis is made for the warranty department in Wärtsilä we will also be taking the possible reimbursements during the improvement process received from Wärtsilä's suppliers into consideration. The way we have involved reimbursements is by going through old warranty claims regarding the product that we have chosen to use as an example and adding up the received compensations.

All the data was collected and calculated with Microsoft Excel.

Warranty/cost process explained

Below is the whole process explained for automation parts from when the component fails until a solution gets implemented. The process is also called "sensor mortality".

For other components the process might differ.

Step 1: Receival and registering of received warranty claim

A warranty claim is received by Wärtsilä employees either through e-mail or through the company CRM tool, Salesforce. Upon receival the warranty expert in charge of said vessel

or area is to register the claim to Wärtsilä's system. This is mostly done through SAP, but a new system called "one-touch" is being implemented to make the process quicker.

Step 2: Sending out replacement part and making an in-house task for the failure

As the sensor we are using as a reference is counted as an engine component**,** a replacement part is sent out to fix issue as soon as possible. After a new component has been ordered to the customer, a task is made in-house to a case manager, who will continue the process from here.

It should be noted that this process only directs it to engine components. Engine auxiliary components are handled through another process which will not be brought up in this thesis.

Step 3: Requesting the failed part back for investigations and investigation of part(-s)

The case manager in charge of automation parts will go through the received warranty claim and give return information which **is** to be followed by the customer.

When the failed component has arrived at our Vaasa location a technical expert will be informed about this and they will do an in-house investigation of the failed component before the component is forwarded to Wärtsilä's supplier.

It should be noted that only components that are of interest to us are requested back, if a failed unit is not of interest and/or a replacement part has already been implemented, then the failed unit is to be scrapped accordingly.

Step 5: Preparation of official warranty claim towards sub-supplier

Upon receiving closer to ten failed examples of the same components and when they all have been investigated in-house, an official claim towards the supplier is prepared by the case manager. With the warranty claim it is requested that an RCA-analysis is done on the sensors and that possible costs that have occurred to Wärtsilä will be credited if failure has been concluded to happen because of poor quality.

Step 6: Receival of RCA/re-imbursement from failed components

Filled RCAs are usually received as answers to the warranty claim within a month. RCAs handle the faults found in the components, if any. Based on the RCA a credit note for the costs occurred to Wärtsilä will be requested.

Step 7: Implementation of possible corrective and preventive actions

The failed components that are investigated will give a picture of why the material is failing to the supplier. Upon having enough of similar failures Wärtsilä will push their sub-supplier to start working with product improvement to meet both their and their customers' expectations. When a new and improved version of the component has been completed and found to be better than the original, a service letter is sent by Wärtsilä to their customers with similar components that a new version of component x has been implemented and that in the future when the old version fails new versions will be supplied as direct replacements. Wärtsilä's customers also are given the opportunity to order the new revised sensors for their engines if they want to play it safe and be preventive.

4 Results

5 Conclusion

In this chapter I will go through the conclusion of this thesis and discuss whether or not the objective of the thesis was met.

The objective of this thesis was to show actual value created through corrective preventative re-claiming. This was done with a cost analysis.

The cost analysis displayed the costs for non-conformities which also consider the transport and working costs. Historical data gathered from an internal statistics tool was analyzed and used to make a credible analysis.

It can be concluded that thanks to active warranty work in the chosen case a solution was found and implemented relatively quickly, resulting in the resources and investments put into the improvement paying themselves off 40 months after implementation and following this show clear savings per year. The importance of having clear and exact specifications already in the design stage of new components was also noticed, as most of the costs accumulated from our case could, most likely, have been avoided.

Despite the active warranty work with this case, it was also noted that even more active work towards the supplier Wärtsilä could have lowered the total costs and on the same time shortened the time from finding the failure to fixing it with a new component. The people in charge of supplier re-claiming should therefore have either an automated message informing them regarding re-occurring failures or have a person designated to go through the statistics once a month to find trends so as to be able to provide even more professional service to their customers.

The objective of this thesis has, according to me, been achieved.

5.1 Challenges

The challenges that I met making this thesis was acquiring the correct data needed for the calculations. Choosing components which would give the best picture of the whole process was hard due to the reason that sometimes components made by other manufacturers have been used as replacements, for a while or for the rest of the time the plant/vessel was under warranty.

5.2 Further development

The calculations could be used for close to any component possible, provided that the component has a Wärtsilä material number. To further develop the results a check-up on how the failure amounts have evolved, it could be done in the future at the same time as costs from other Wärtsilä organizations outside customer assistance involved in the improving process could be accounted for in the cost analysis, but to be able to do this more in-depth information is needed.

5.3 Final words

I want to thank Wärtsilä - Customer Assistance Warranty Services for giving me the opportunity to write my thesis for the company. A special thanks goes to my supervisor Henrik Lönnqvist for the assistance received during the process. I will continue my journey in the Customer Assistance organization as a warranty expert and I do look forward to what the future has in store for me, and for us as a company.

I would also want to thank my supervisor Niklas Kallenberg from Novia UAS for supporting me during the process.

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