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Verifying of a PLM impact analysis

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BACHELOR'S THESIS

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Abstract

This is the official version of the degree thesis that excludes for the client sensitive information.

This bachelor thesis is done on behalf of Operational Development, Engineering within Wärtsilä Marine Solutions. The purpose is to investigate the results of a PLM impact analysis made by VTT for Wärtsilä Ship Power in 2012. The analysis was made by estimating the costs of a number of problem - items in the product information by selected persons in different functions. Then measures that could be taken to reduce these costs were proposed. The analysis was made using an Excel tool where the various functions filled in the estimated annual costs for each of the problems.

I have made the survey by correspondingly filling in the same Excel tool and thus getting updated estimated costs to compare with the situation from year 2012 to current situation. I have also, through a qualitative survey, found out which of the proposed development measures to reduce the costs that have been taken and how. In addition, in order to specify the problems, I have made a qualitative survey of how they are perceived by those who estimated the costs.

The result of the survey is that, despite the fact that some of the measures have been taken, the cost of the problems has increased. The conclusion is that these analyzes could be done more regularly and for more comparable results, the problems could be specified more clearly. Thus the problems could also be addressed more efficiently.

Language: English Key words: PLM, Analyse, Costs

EXAMENSARBETE

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Abstrakt

Det här är den officiella versionen av examensarbetet som undantar för uppdragsgivaren känsliga uppgifter.

Det här exmanensarbetet är gjort på uppdrag av Operational Development, Engineering inom Wärtsilä Marine Solutions. Syftet är att undersöka vilka resultat en PLM impact analys som gjordes av VTT för Wärtsilä Ship Power år 2012 har lett till. Analysen gjordes genom att kostnaderna för ett antal problem inom produktinformationen uppskattades av utvalda personer inom olika funktioner och därefter gavs det förslag på åtgärder som kunde vidtas för att sänka dessa kostnader. Analysen gjordes med hjälp av ett Excel-verktyg där de olika funktionerna fyllde i de uppskattade årliga kostnaderna för vart och ett av problemen.

Undersökningen har jag gjort genom att på motsvarande sätt fylla i samma Excel-verktyg och därmed få de uppdaterade uppskattade kostnaderna för att kunna jämföra situationen från år 2012 med dagens situation. Jag har också, genom en kvalitativ undersökning, tagit reda på vilka av de föreslagna utvecklingsåtgärderna för att sänka kostnaderna som har vidtagits och hur. Vidare har jag, för att precisera problemen gjort en kvalitativ undersökning angående hur de upplevs av de som uppskattat kostnaderna.

Resultatet av undersökningen är, att trots att en del av åtgärderna har vidtagits så har kostnaderna för problemen ökat. Slutsatsen av det är att dessa analyser kunde göras mera regelbundet och för att få mera jämförbara resultat så kunde problemen preciseras tydligare och därmed bättre åtgärdas.

Språk: Engelska Nyckelord: PLM, Analys, Kostnader

TABLE OF CONTENT

Abbreviations

ANC	Automation, Navigation and Communication system
EPC	Engineering Procurement Construction
HFO	Heavy Fuel Oil
IPIX	Information Publishing In XML
KPI	Key Performance Indicator
LNG	Liquefied Natural Gas
OSM	Order Specification Management
PDM	Product Data Management
PEx	Project Execution
PLM	Product Lifecycle Management
PV	Photovoltaics
R&D	Research and Development
SAP MM	SAP Material Master
TERPS	Total Engine Room Packages for Auxiliary Systems
VTT	Valtion Teknillinen Tutkimuskeskus
QMS	Quotation Management System

1 INTRODUCTION

This bachelor thesis is done on behalf of the then Engineering domain in Operational Development in Wärtsilä Marine Solutions. Operational Development, Engineering was a department that defined, developed and distributed features, information, tools and processes for the various technical features within Marine Solutions. Due to organizational changes the department does not longer exist under the name Operational Development, Engineering.

The thesis aims at verifying a PLM (Product Lifecycle Management) impact analysis that was made for the then Wärtsilä Ship Power in 2012 and resulted in several development ideas for some chosen product related items.

The outcome of the PLM Impact Analysis has now been applied for five years and my task was to investigate its contribution to different functions. To find out this, I would go through the analysis again with different people within the relevant project phases. I would also find out how improvements, if any, have been implemented.

The original analysis was made by VTT Technical Research Center of Finland Ltd, a Finnish state-owned research and technology company. VTT.s activities are aimed at helping their customers with technology research to improve business. (VTT Technical Research Centre of Finland Ltd).

1.1 Background

The aim of the original analysis was to gather knowledge of future product and information models, processes, IT-architectures and best practices for better management of mecatronic product structure, requirements, changes and all product information in networked global business environment during the whole product lifecycle.

Faults and problems with the product information can cause significant costs to companies, these problems can e.g. depend on Non-identified features, called White spots. White spots are also the item that contributes with the highest cost of all items in VTT.s analysis. These costs occur in cases where a company, for various reasons, has to include such features in a delivery that are not included in the quotation, thereby the customer cannot be charged for those features.

VTT made the investigation by interviewing persons from different parts of the organisation and gathered the material into an excel-tool. They then, in a first phase, gathered and consolidated product related items. In a second phase, they made priorities based on their importance in the value chain and their impact, and then in a last phase the top priority items were in a systematic way studied in detail regarding how much errors cost and also the potential investment cost for improvement.

1.2 The Excel-tool

The Excel tool used by VTT was made so that different functions in project phases within Ship Power first scored probability and criticality on a scale of 1-5 with respect to each of the various problem items. The tool multiplied the points for criticality with the probability points, giving the total points and also summarized the total points for all functions.

Then, the different functions estimated the annual error cost for each problem item, whereupon the tool calculated the total error cost for all functions per problem item. The tool also calculated the total cost of all problem items within all functions. A number of development proposals were then listed and an estimation of development costs was made.

1.3 Wärtsilä

Wärtsilä is a global company within the area of advanced technologies and complete lifecycle solutions for the marine and energy markets with the vision: “We will be our customers’ most valued business partner” and the mission: “We shape the marine and energy markets with advanced technologies and focus on lifecycle performance, to enhance our customers’ business and benefit the environment. Wärtsilä employs approximately 18.000 persons in more than 70 countries.

Wärtsilä is mainly known as an engine-manufacturer but the product portfolio also contains among other energy storage, gas systems, ship design and even toilets. Wärtsilä strive to bring efficiency, environmental solutions and fuel flexibility to the market through the three business areas Marine Solutions, Energy Solutions and Services.

Wärtsilä Marine Solutions is a provider of innovative products and integrated solutions in the marine and oil & gas industries and need to continuously develop and transform to meet changing customer needs. The passion is to do right for our customers and the environment

and the offering covers all the market segments; Oil & Gas, Merchant, Cruise & Ferry, Navy and Special vessels.

Wärtsilä Energy Solutions is a global systems integrator offering a broad range of environmentally sound solutions. The solutions provide value to customers and enable a transition to a more sustainable and modern energy system. The strategy is to grow strongly in large utility gas power plants market by capturing market share from gas turbines, to maintain the leading position in HFO & dual-fuel power plants, to gain market share in utility-scale solar PV business with EPC capability, to grow in battery storage solutions and to grow in small to medium-scale LNG terminals and liquefaction solutions by introducing new value propositions to selected markets.

Wärtsilä services shared passion is optimising customer operations whenever, wherever. The expertise and wide offering of services are developed to meet the needs of the customers according to their business objectives and match with environmental requirements.

Wärtsilä is also a smart technology company and takes a leadership role in the Smart Marine and Smart Energy ecosystems throughout their entire lifecycle. The aim is to increase efficiency while enabling a zero emission society and this is done through a unique market position, a deep customer understanding, predictive analytics and asset optimisation, a global service network, an extensive product range, engineering and technology expertise and significant investments in future technology.

Wärtsiläs focus is on research and development and they have a strong emphasis on product and solution innovation, particularly in the areas of efficiency improvement, fuel flexibility, total cost of ownership, and the reduction of environmental impact. Long-term co-operation with research institutes and partners is another bullet-point and in 2016 they made R&D investments for EUR 131 million, representing 2.7% of net sales. In 2016 Wärtsilä also made 54 patents for new inventions.

In order to secure their leading position in sustainable innovation, Wärtsilä must continuously look into new ways of developing the business. The digital transformation is important in this context and the key growth areas are defined around global megatrends like energy efficient solutions, gas based technology and innovative solutions. (Wärtsilä Corporation, 2017)

1.4 My purpose

My purpose with this thesis is to go through the excel-tool that VTT used, to find out todays situation and if any of the problems have actually been fixed and how. I will also try to find out how the investigated problems are experienced by the persons estimating the costs, probability and criticality of the problems and if they can give any examples.

1.5 Limitations

The original survey was carried out on Wärtsila Ship Power, a department that no longer exist. The corresponding department is now called Marine Solutions, but it is a completely different thing than the then Ship Power. Due to lack of time, I have therefore limited the survey to the business lines Engines and Auxiliaries. The investigation addresses the same items identified five years ago. New problems that might have arisen are not taken into account.

2 THEORY

Since the analysis concerns PLM impact, I have chosen to study the theory behind some PLM related things.

2.1 Product

Before studying PLM closer, it is important to clarify the term product. A product may, in addition to a tangible product, also be an intangible product, e.g. a service or an item. A product may also be sold at a price (The economic times). A company is defined by its products and for the company to have any income, customers are required, and products that can be sold to these customers (Stark, 2011).

A product generates data and the more products a company produces the more data has to be kept track of. Therefore, it is important for large companies to handle the data that, in many cases, complex and customized products generate. In order to effectively manage the further design of the products, deliveries and maintenance, it is also important that companies succeed in defining their products (Saaksvuori & Anselmi, 2010).

2.2 PLM

PLM is the backbone of a company's product information and is used to integrate data, processes, business systems and people in a company and in the company's extended enterprise (Wikipedia, 2017) (Siemens). The purpose is to cost-effectively manage a product throughout it’s life cycle (Stark, 2011), consisting of the four stages; development, growth, maturity and decline (Investopedia). PLM handles besides the product also the entire product portfolio (Stark, 2011).

2.3 Reasons to use PLM

From 1980 to 2007, global exports increased by almost 5% annually (Laszlo, 2015). This globalization may be one of the reasons why a company chooses to implement PLM, partly to match the new business environment and partly by improving its product deployment, increasing its future competitiveness in the global market (Stark, 2011).

As mentioned earlier it is important for companies to define their products, but that’s not an easy thing. Depending on the phase of the product lifecycle, there may be different departments responsible for it, such as Marketing, Engineering or Service, all of them having their own aspect of the product. In addition, if the company is involved in one or more extended enterprises, product-responsibility at different phases of the life cycle may even be in different companies (Stark, 2011).

An increase in the businesses product variations and complex supply networks has also made it difficult to find and maintain product-related information. The maintenance of item information and product data causes a lot of work and since the information may be stored on many different devices, the updating of it may become inaccurate. As a consequence of this, employees can’t trust the information in the company’s information management system and will start to use their own methods to manage information. To prevent the problem to escalate, a PLM system is a good option (Saaksvuori & Anselmi, 2010).

2.4 Benefits of PLM

Proper management of a product's life cycle has many benefits that may be divided in four main areas, which are **financial performance** that includes increased revenue with earlier market introduction and reduced product development costs, **time reduction including** reduced project overrun time and reduced engineering change time, **quality improvement**

including reduced manufacturing process defects, reduced numbers of returns and reduced numbers of customer complaints and **business improvement** including increase of the innovation rate, increase of the part reuse factor, increase of product traceability and ensuring 100% configuration conformity (Stark, 2011).

2.5 KPI

A KPI (Key Performance Indicator) is often the ratio of two numbers (Andersson, 2013) or quantities and can be defined as a measure of a company's efficiency in achieving key goals (Klipfolio). However, goals that are important may vary from department to department and, for example, finance and sales may use different KPIs (Wikipedia, 2017).

There are many KPI.s of varying types that you want a good mix of and you can divide them into lagging KPI and leading KPI (The balance). The difference between them is that the lagging KPI shows results that have already been achieved, while the aim of leading KPI.s is to predict the future (Investopedia).

The KPIs can also be divided into financial and non-financial (Investopedia). Financial KPIs are also classic examples of lagging KPI.s (The balance), thus confirming an existing pattern (Investopedia). Net profit is the most basic financial KPI and is simply calculated by subtracting expenses from incomes and is also called “bottom line” (Investopedia). An example of a non-financial KPI is employee engagement, often measured by human resources. (The balance)

Combining KPIs into a working whole requires a lot of work (The balance) and there will also, apart from generic KPIs, be KPIs that need to be designed specifically for specific businesses (Marr, 2017). According to some critics there is also a risk that significant KPI.s will be overlooked and instead only "easy" KPIs will be measured (Andersson, 2013), which results in the KPIs not reflecting the business . (Klipfolio)

In order for the KPI to function optimally and provide relevant and sufficiently comprehensive information (Andersson, 2013) requires managers and stakeholders to regularly analyse the results (The balance) and, if necessary, insert corrective measures. (Andersson, 2013)

3 METHOD

This chapter is about the method I have used to do this work.

This work began with my supervisor explaining the task and he did that by using a power-point presentation. After that I studied the task and wrote a theory-chapter about subjects related to the task.

In the beginning of January, I went with my supervisor through which persons that the study could involve to provide input. This would preferably be persons that also took part in the first survey, but since some of these don't work in the company anymore, also those who work on corresponding positions today or otherwise could give input were prioritized.

This resulted in a list of 6 persons, who were invited to a first introduction-meeting. This meeting was about my supervisor holding a presentation regarding the result of the first analysis and he also presented some of the measures that in fact have been conducted since then. This was followed by a discussion whether or not a verifying of the analysis is necessary, and among other, the point of view that everything today looks the same as it did five years ago was stated.

The participants, after all, concluded that it can be worthwhile to go through the analysis again, and a new meeting was scheduled to start to go through the excel-sheet.

In the second meeting, we would begin to go through the excel-sheet to see how it looks today. Before we began, we also agreed to empty the sheet. In that way we wouldn't be affected be original sheet in the evaluation.

After that it was time to start to go through the part were to estimate the probability and criticality on a scale from 1-5 and it was easier said than done, since the participants had quite a big difference in their opinions regarding this evaluation, which also can be explained by the participants knowing more or less about the different functions within the company.

It was also stated that it will take a long time to go through the whole point-chapter, if it for every point will be a discussion about the numbers of points that everyone can agree about. Because of that we decided to split this chapter, and the cost-chapter, in a way that one person fills a single column.

After this I sent out an empty table by email to all the respondents to fill in the different columns.

When all the columns had been filled in, I booked individual meetings with the respondents to get their views of the different issues. I also booked a meeting with two persons within the company who have insight in which of the proposed development-actions have been done and how.

4 DISCUSSION

The result shows that although several measures have been taken since the previous analysis, the total estimated error cost for the problems examined has increased. This can of course be because that the costs are just estimates and during the interviews it was also found that it is difficult to know how those who made the previous analysis perceived the different problems. Another reason for the costs may be that OSM, which is a central part of the results of the previous analyse, has not yet been taken into use.

Based on the comparison, it can also be assumed that measures taken to reduce costs can help to reduce costs in total or at least for some of the functions, while another function may suffer from increased costs as a result of these measures.

5 PROPOSALS FOR FURTHER RESEARCH

Since different faults in product information means high costs, I think it is important for Wärtsilä to allocate resources to try to identify and fix these problems.

In order to succeed, the excel tool could be used to do analyses on a regular basis. To get comparable output from different analyses, the result chapter this thesis could be used to specify the problem items. It should also be kept in mind that it is not enough to fix the problem items that are being processed in this thesis work, as these actions potentially create new problem items or causes costs to be moved from one function, or item, to another.

When comparing the estimated costs for 2018 with 2012, my first thought was to calculate the percental change. However, I soon realized the disadvantage of comparing the percental increase with percental decrease, as an increase from e.g. 2 to 5 means a percental increase of 150%, while a decrease from 5 to 2 means a percental decrease of only 60%, although the actual difference between the numbers is the same. Instead, I chose to make the comparison by subtracting the cost of 2012 from the cost of 2018 and getting the actual change. The disadvantage is then that the comparison does not take into account the ratio between the cost and the change. A better KPI to measure the change could be developed.

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