Saimaa University of Applied Sciences
Unit of Technology, Lappeenranta
Mechanical Engineering
Mechanical and Production Engineering

Markus Olkkonen

Industrial company's spare part creation and harmonization strategy

Bachelor's Thesis 2011

ABSTRACT
Markus Olkkonen
Industrial company's spare part creation and harmonization strategy, 40 pages, 3 appendices
Saimaa University of Applied Sciences, Lappeenranta
Unit of Technology, Mechanical Engineering
Mechanical and Production Engineering
Bachelor's Thesis 2011
Instructors: Heikki Liljenbäck, Lecturer, Saimaa University of Applied Sciences; Pasi Sahlman, Maintenance Manager, Paroc Oy Ab

The purpose of the thesis was to create a spare part creation and harmonization strategy for Paroc Oy Ab. The object of this thesis was to establish instructions on how spare part items will be created into the information system and create a strategy on how the current spare part items can be harmonized and cleaned.

The thesis began by interviewing various Paroc plants' personnel who have been involved in the spare part creation process. The purpose of the interviews was to find out how the spare part naming is done at the moment.

Paroc spare part items are in four different languages and number series in the ERP database. The thesis researched various options for spare part harmonization. Different harmonization strategies' cost estimates and needed work resources were compared. The most profitable harmonization strategy was suggested.

Because the creation and naming of the new spare parts is done in many different ways, this thesis was to define a reasonable strategy for spare part creation and naming. The strategy was created while keeping in mind which employees should be responsible for creating new spare parts and how exactly it should be done.

The final result of this thesis was an instruction for Paroc Oy Ab on how the spare part harmonization and cleaning process should proceed and how the spare part creation should be managed in the future.

Keywords: spare part, harmonization, standard, information system

TIIVISTELMÄ
Markus Olkkonen
Teollisuusyrityksen varaosien luonti- ja harmonisointistrategia, 40 sivua, 3 liitettä
Saimaan ammattikorkeakoulu, Lappeenranta
Tekniikka, kone- ja tuotantotekniikka
Kone- ja tuotesuunnittelun suuntautumisvaihtoehto
Opinnäytetyö 2011
Ohjaajat: Tuntiopettaja Heikki Liljenbäck Saimaan ammattikorkeakoulu; Kunnossapitopäällikkö Pasi Sahlman Paroc Oy Ab

Tämän opinnäytetyön aiheena oli luoda Paroc Oy Ab:lle varaosien perustamis- ja harmonisointistrategia. Työn tavoitteena oli laatia ohjeistus siitä, kuinka varaosanimikkeet tulee perustaa jatkossa tietojärjestelmään sekä luoda strategia, miten nykyisten varaosanimikkeiden siivous ja päällekkäisyyksien poisto tulisi suorittaa.

Työ alkoi haastattelemalla Parocin eri tehtaiden henkilökuntaa, jotka ovat tekemisissä varaosanimikkeiden perustamisessa. Haastattelujen tarkoituksena oli selvittää, kuinka varaosien nimeäminen tapahtuu tällä hetkellä.

Parocin varaosanimikkeet ovat neljällä eri kielellä ja numerosarjalla toiminnanohjausjärjestelmän tietokannassa. Työssä selvitettiin erilaisia vaihtoehtoja varaosien harmonisoinnille. Eri harmonisointistrategioiden kustannusarvioita ja harmonisointityöhön tarvittavia resursseja vertailtiin. Niiden perusteella kannattavinta harmonisointistrategiaa suositeltiin.

Koska uusien varaosien perustaminen ja nimeäminen tehdään nykyisin monella eri tavalla, työssä määriteltiin järkevä strategia varaosien perustamiselle ja nimeämiselle. Strategiassa otettiin huomioon millaisten henkilöiden tulisi hoitaa uusien nimikkeiden luominen ja millä tavalla se tulisi tehdä.

Työn lopputuloksena laadittiin Paroc Oy Ab:lle ohjeistus siitä, kuinka varaosien harmonisointi- ja siivousprosessissa tulisi edetä, sekä miten varaosien perustaminen olisi hoidettava jatkossa.

Avainsanat: varaosa, harmonisointi, standardi, tietojärjestelmä

Contents

1 INTRODUCTION 6
1.1 Restrictions of the Thesis 7
2 PAROC GROUP 8
3 STANDARDS 10
3.1 International Organization for Standardization 11
3.2 European Committee for Standardization 11
3.3 Basic engineering standards – fasteners 12
3.4 Machine and equipment design standards 12
3.4.1 Rolling-element bearing marking 13
3.4.2 Chain marking 14
3.4.3 Belt marking 14
4 ERP 16
4.1 IFS 16
4.2 CMMS - Computerized Maintenance Management System 17
5 MAINTENANCE MATERIAL LOGISTICS 20
5.1 Maintenance material logistics supply network 20
5.2 Prediction of material need 22
5.3 Spare parts warehousing 22
5.4 Material item in information system 23
6 SPARE PART HARMONIZATION 25
6.1 Tools for spare part harmonization 25
6.1.1 Company X's software 26
6.1.2 Company Y's software 26
6.2 Harmonization strategy 27
6.3 Harmonization strategies' cost estimates 28
6.3.1 Self-service using Company X's software 28
6.3.2 Company X's project 29
6.3.3 Self-service using Company Y's software 29
6.3.4 Company Y's project 30
6.3.5 Summary of cost estimates 30
6.4 Course of action 31
6.5 Selection of harmonization strategy 32
7 SPARE PART CREATION PROCESS 33
7.1 Interviews 33
7.2 Tool for spare part creation 34
7.3 Authorization policy 34
7.4 Material creation template 36
8 CONCLUSIONS 37
FIGURES 39
REFERENCES 40

APPENDICES

Appendix 1 Spare Part Creation Questionnaire
Appendix 2 Summary of the Interviews
Appendix 3 Spare Part Creation Template

1 INTRODUCTION

The objective of the thesis is to establish instructions for Paroc Group on how to create maintenance spare parts into the IFS database and how the current spare part items in data base can be harmonized. The IFS is an enterprise resource planning (ERP) software that Paroc uses. Paroc Group is a multinational company, which has 12 production units in four different countries across Europe. There is no common instruction for spare part creation. Therefore, the spare parts can be duplicated in the spare part database and parts are difficult to search for.

In the beginning of the work various production plants are contacted and the personnel related to the spare part creation process are interviewed. The purpose is to investigate how the spare parts are created in different plants in order to obtain clarity of the current situation. A common instruction on how the spare part should be created and who should do it, will be created based on the interviews.

The objective of the thesis also includes research on how the maintenance spare part naming is done and how it can be improved by using Paroc Engineering standards. The goal is to improve the naming process so that afterwards the naming would always be consistent and clear.

For each different spare part used in Paroc, there is a spare part number. The problem is that every country has its own number code, for example Swedish spare part numbers are 65 prefixed numbers and Finnish numbers are 60 prefixed numbers. Spare part naming is done in local language. In this thesis opportunities to harmonize the naming and numbering internationally are researched. The benefits of different harmonization strategies will be compared and proper harmonization tools will be investigated and tested.

1.1 Restrictions of the Thesis

The work includes creating a spare part creation and harmonization strategy for Paroc Group and possibly testing the needed tools for the process. The thesis will include a proposal how Paroc should manage the spare part creation and harmonization process in the future. The work does not include the harmonization work itself.

2 PAROC GROUP

Paroc Group is the fastest growing and most profitable supplier of mineral wool products in Europe. Paroc Group Oy Ab was founded in 1952 as Partek Insulation and changed its name to Paroc Group Oy Ab in August, 1999. Its products include building insulation, technical insulation, marine insulation, structural stone wool sandwich panels, and acoustics products.

Paroc Group is divided into four divisions: Base Production, Building Insulation, Technical Insulation and Panel System (Figure 1). Base Production is internal stone wool provider and developer. It focuses on balancing demand, capacity, production productivity, efficient internal processes and product quality. Base division is responsible for R&D (research and development) and line technology. Building Insulation division manufactures insulation products for all types of buildings. Its main customers are distributors, construction companies, the prefabrication industry and private house builders. Technical Insulation division supplies value-added products for different industrial processes, machinery and ships. Its main customers are subcontractors, industrial users, distributors and the shipbuilding industry. Panel System manufactures structural sandwich panels for internal and external walls and ceilings. The panels are designed by architects and are mainly used in industrial and commercial buildings and public facilities. (Paroc Group Intranet 2010.)

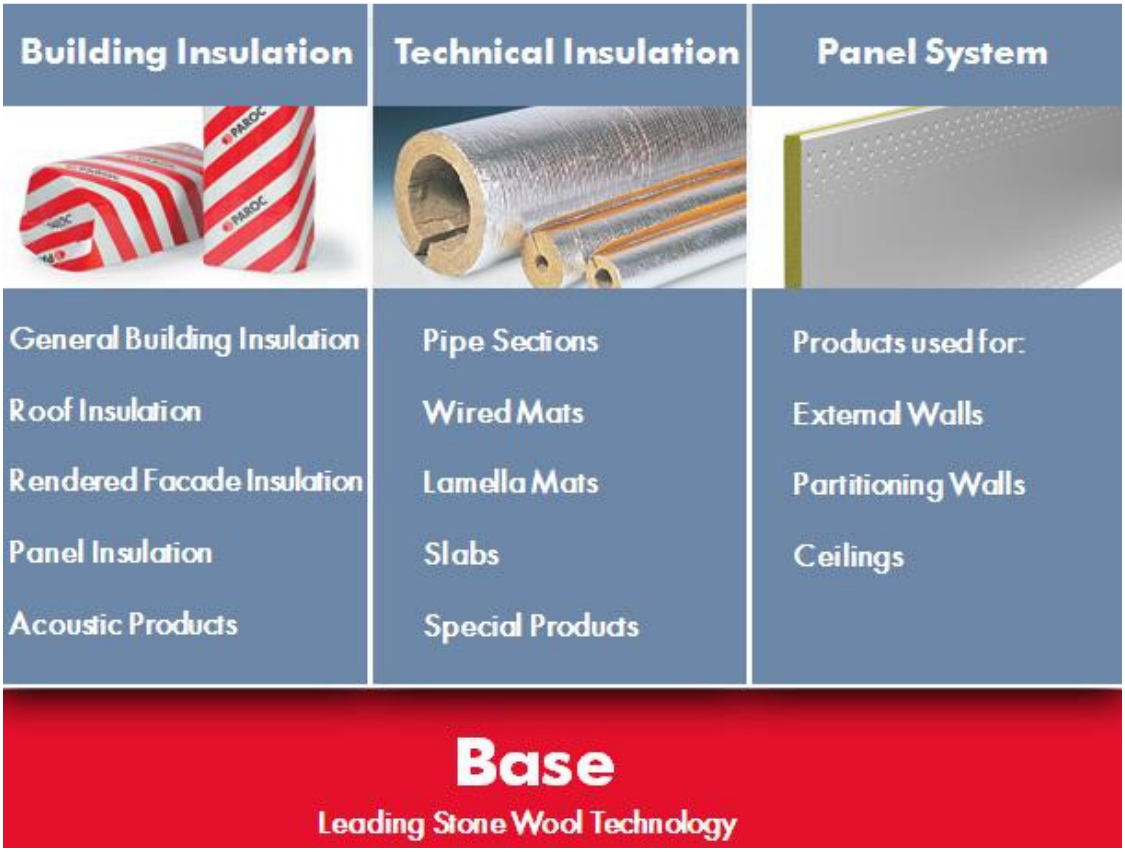


Figure 1 Paroc business areas and their products (Paroc Group intranet 2010).

The company operates in 13 countries across Europe, with production facilities in Finland, Sweden, Lithuania and Poland. Paroc Group's net sales in 2009 were 317 million Euros and personnel in average 1992 persons. Paroc Group is owned by a number of institutional investors, with a minority shareholding owned by Paroc's employees. (Paroc Group Intranet 2010.)

Paroc's mission is to contribute sustainable development by creating energy efficient solutions and to help people to live in a secure and comfortable environment. (Paroc Group Intranet 2010.)

3 STANDARDS

Standards have a great influence on companies and the importance of standards has increased continuously. Standards are used for to pursue compatibility, quality, productivity, savings and they are also used to evaluate product safety. (Alanko 2006.)

The need for standards transpires often when they do not exist. A good example of the need for standardization comes from history. In 1904 the whole downtown of Baltimore, USA was destroyed in a massive fire (Figure 2). The extent of the destruction was due to lack of national standards in fire fighting equipment. Fire engines that arrived to rescue from nearby cities, were not able to help since their hose couplings did not fit Baltimore's hydrants. (Alanko 2006; Maryland Digital Cultural Heritage)

Figure 2 Baltimore fire aftermath (Maryland Digital Cultural Heritage).

3.1 International Organization for Standardization

The International Organization for Standardization, widely known as ISO, is the world's largest developer and publisher of International Standards. It is a network of various national standards organizations representing 163 countries, one member per country. The Finnish Standards Association SFS represents Finland in ISO. ISO was founded on February 23, 1947 and it has headquarters in Geneva, Switzerland. Standardization affects units of measurement, alphabetization and transliteration, and specifications for parts, materials, surfaces, processes, tools, methods of testing, and machines. Because of technological evolution, ISO standards are optimally reviewed for possible revision every five years. (ISO)

3.2 European Committee for Standardization

The European Committee for Standardization, CEN (Comité Européen de Normalisation), is a non-profit organization whose mission is to foster the European economy in global trading, the welfare of European citizens and the environment by providing an efficient infrastructure to interested parties for the development, maintenance and distribution of coherent sets of standards and specifications.
The CEN was founded in 1961. Its thirty national members work together to develop European Standards (ENs) in various sectors to build a European internal market for goods and services and to position Europe in the global economy. Some of these standards are voluntary, whereas other standards such as harmonized standards have been made effectively mandatory under EU law. CEN is officially recognised as a European standards body by the European Union. (CEN)

3.3 Basic engineering standards – fasteners

It is no coincidence that around the world the same notations and practices are used in machine drawing, or that bolt and nuts are always exchangeable. All these things are thoroughly standardized and recognized worldwide. (SFSedu)

Fasteners include all kinds of products that are designed for two or more components to mechanically join so that they create a permanent or an open joint, or essentially affect this process, such as screws, nuts, washers, pins, rivets and hose clamps. All of these are standardized, for example ISO 4014 and DIN 931 are standards for hexagon head bolts. When marking information of a bolt to a drawing's part list, warehouse card, package or some other documentation, standard's instructions are used. Usually marking includes the following information:

- bolt's name, e.g. hexagon head bolt
- standard, e.g. ISO 4014
- thread type, e.g. M12
- length of the bolt from socket's underside to the tip of the bolt, e.g. x 80
- strength of the bolt's material, e.g. 8.8.

An example on how to mark a bolt correctly using information from above:
Hexagon head bolt ISO 4014 – M12 x 80 – 8.8
(SFSedu; Ansaharju 2009.)

3.4 Machine and equipment design standards

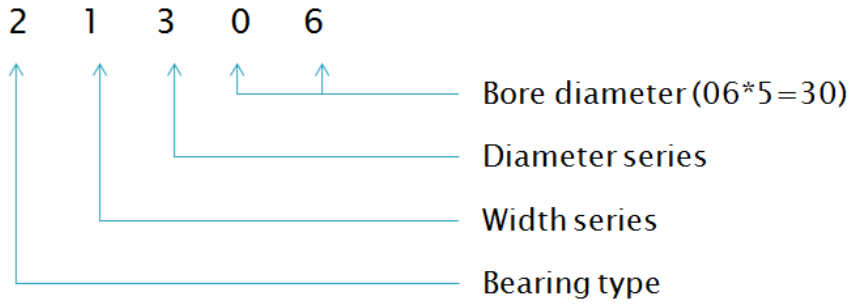
Machine and equipment design standards include all kind of mechanical devices such as machines, pressure vessels, transmission systems and device part standards. These standards often relate to product's compatibility, efficiency, sizing, safety, terminology and measuring methods. (SFSedu)

In this thesis the focus is on machine part standards and their proper marking. Some examples are gathered to give an idea on how the spare part naming should be done.

3.4.1 Rolling-element bearing marking

Rolling-element bearing is a bearing which carries a load by placing round elements between two pieces. The relative motion of the pieces causes round elements to roll with very little rolling resistance and with little sliding. Rolling-element bearings have the advantage of a good tradeoff between cost, size, weight, carrying capacity, durability, accuracy and friction. There are three basic types of rolling-element bearings. They are ball bearing, roller bearing and needle bearing. (Chastain 2008; Ansaharju 2009)

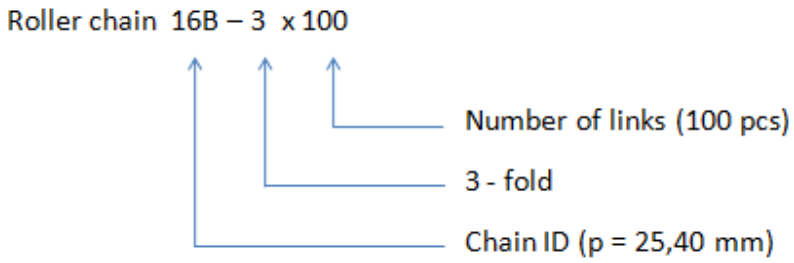
The International Organization for Standardization (ISO) has standardized rolling-element bearings markings and dimensions. Different manufacturers' bearings are exchangeable with each other. The correct marking for the roller bearing is, for example: **Spherical roller bearing – 21306**. (Ansaharju 2009.)



3.4.2 Chain marking

Chains are used in chain drive which transmits mechanical power from one place to another. Chain drive is used in wide variety of vehicles and machines. Usually the power is conveyed by a roller chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. (Chastain 2008; Ansaharju 2009)

The pitch defines the size of the roller chain. The pitch is in standard tables in millimeters, e.g. 15,88 mm or 31,75 mm. Dimension are not integers, because they are converted from inches. Proper marking for the roller chain according to ISO 606 standard is, for example: Roller chain 16B-3x100. Benefit of this standardization is that the choice of replacement chains can be based on economic and availability factors, rather than on a specific manufacturers' product. (Ansaharju 2009.)



3.4.3 Belt marking

Belt drives are used to transmit mechanical power. Belts can be used as a source of motion, to transmit power efficiently or to track relative movement. Friction between the belt and the pulley transmits the motion. V-belts are the most widely used type of belt drive in industry. (Chastain 2008; Ansaharju 2009.)

There are six different classical V-belts sizes Z, A, B, C, D and E. Where Z is the smallest and E is the biggest. For the narrow-groove v-belts there are four sizes

SPZ, SPA, SPB and SPC from the biggest to the smallest. V-belt has standard lengths. For the narrow-groove v-belts the length is the same as the nominal length in millimeters. For the classical v-belts the length is in inches and it comes from inner length. Proper marking for the v-belt is for example: **V-belt SPB 3150** or **V-belt A 80**. (Ansaharju 2009.)

4 ERP

ERP is the acronym of Enterprise Resource Planning. It is a computer based business management system that integrates all aspects of business, including planning, manufacturing, sales, and marketing. ERP aims to improve the efficiency of the company operationally and economically for example, by reducing warehouses. It is able to combine sections of the different departments into the same system, in which case real time data sharing between different sections is easy. With real time data transfer it is possible to reduce overlapping work, to speed up deliberations and decisions, because there is always current information available. ERP's downside is its complexity, e.g. introduction and use of the new system is very expensive and time consuming. Customizing ERP to suit a particular company and employee training causes additional costs. (Mikkonen, Miettinen, Leinonen, Jantunen, Kokko, Riutta, Sulo, Komonen, Lumme, Kautto, Heinonen, Lakka & Mäkeläinen 2009.)

4.1 IFS

IFS is a company that supplies, develops and implements IFS Applications. IFS Application is a component-based extended ERP system. IFS focuses on agile businesses where their four strategic core processes are service and asset management, manufacturing, supply chain and project. The company was founded in 1983 and now has over 2000 customers. IFS has more than 50 offices around the globe and a worldwide infrastructure for services and support with over 2600 employees in total. IFS' net revenue in 2009 was SKr 2,6 billion. (IFSworld)

IFS Applications is a single, integrated product supporting the management of four core processes combined with horizontal solutions such as financials, HR (human resources) and CRM (customer relationship management). IFS Applications is built using the production and assembly of components. IFS has service-oriented

component architecture where customer can choose only the needed business components. IFS Applications different business components can be seen in picture below (Figure 3). (IFSworld)

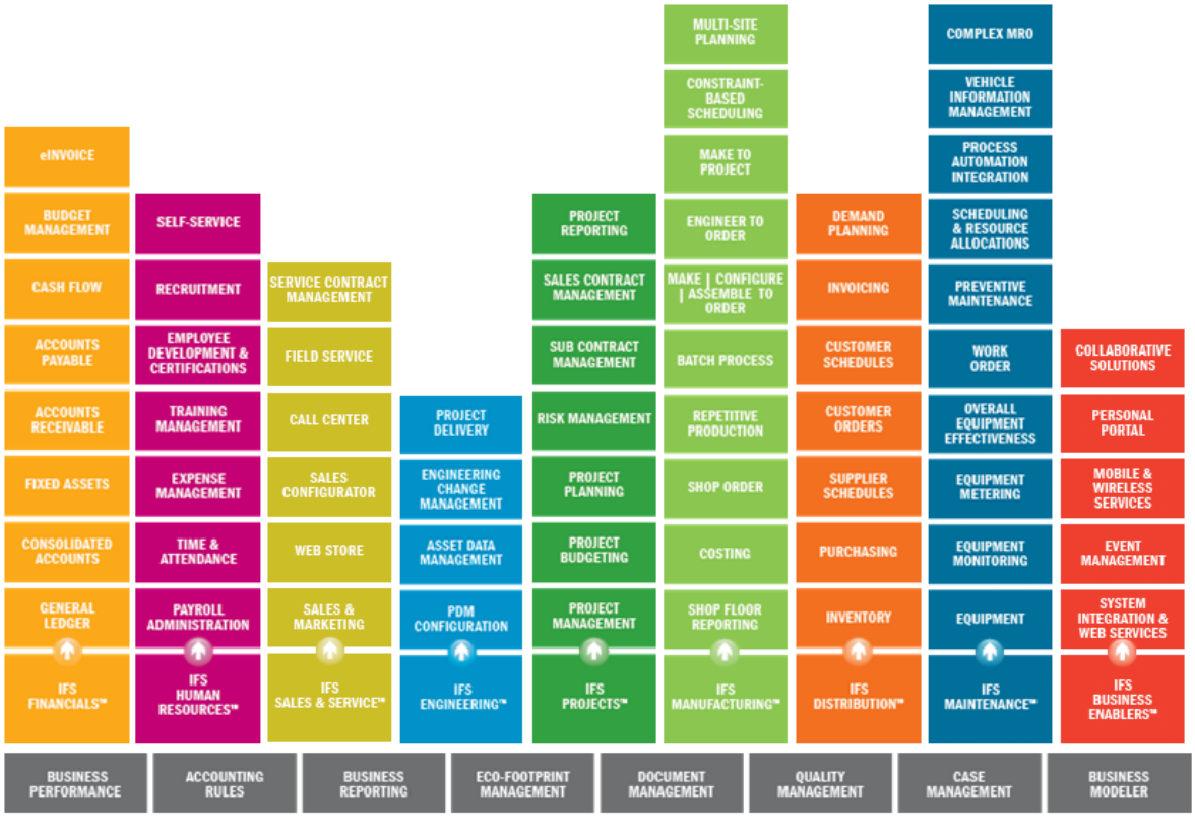


Figure 3 IFS Applications business components (IFSworld).

Paroc Oy Ab has used IFS Application as their enterprise resource planning system for five years.

4.2 CMMS - Computerized Maintenance Management System

Computerized Maintenance Management System (CMMS) is also known as Computerized Enterprise Asset Management System (EAMS) and Computerized Maintenance Management Information System (CMMIS). CMMS software maintains a computer database on organization's maintenance operations. (Järviö, Piispa, Parantainen & Åström 2007, 219)

Computerized Maintenance Management System can be divided into an integrated system or a separate offline system. In integrated system the CMMS is part of the other information systems. It can be used, in addition to maintenance, for managing finance, manufacturing and sales. SAP, Baan and IFS are examples of integrated information systems. (Järviö etc. 2007, 220)

CMMS is a useful tool in maintenance organization, when it is used in a work process how it is supposed to. Otherwise it is just an additional burden and causes unnecessary costs. Problem of CMMS is its low utilization rate and scarce exploitation. Some of the reasons for the problem are the difficult use of the program for an occasional user and a lack of basic IT training for maintenance staff. (Järviö etc. 2007.)

CMMS includes the following elements:

- machine and equipment register
- material management (spare parts)
- work order system
- preventive maintenance system
- failure report system
- purchase order system
- sales and billing
- document management
- contact information register
- resource management
- work time management system
- project management
- calibration.

Machine and equipment register forms a basis for the CMMS. It is used to manage objects' technical information, spare part lists, costs and equipment position and service history. Equipment and/or equipment positions are essential in machine

and equipment register. Equipment, equipment positions or both are individualized according to users' need. The purpose of the individualization is to recognise objects. (Järviö etc. 2007, 222-223)

Material management means mainly spare part management, but can be also used to manage tools and other materials. The following things are controlled in material management: warehouse data, item's data (suppliers, prices) and documents, work order's material planning, investments, order history, consumption statistics and following the warehouse value. (Järviö etc. 2007, 229)

Work orders includes scheduling jobs, assigning personnel, reserving materials, recording costs, and tracking relevant information such as the cause of the problem, and recommendations for future action. Typically the CMMS schedules preventive maintenance is automatically based on maintenance plans. Different software packages use different techniques for reporting when a job should be performed. (Järviö etc. 2007, 231-232)

5 MAINTENANCE MATERIAL LOGISTICS

This chapter illustrates the content and elements of maintenance material logistics.

Maintenance material logistics starts when a machine is installed and it includes all the actions needed for material and related information deliveries to a customer. The aim of the maintenance material logistics is to fulfill the material requirements of distinct industrial equipment. (Nopanen, Piispa & Lukka 2005.)

5.1 Maintenance material logistics supply network

In maintenance the material need is varied. One production plant can have over hundred thousand different material items. Therefore, there can be a large number of maintenance material suppliers. Suppliers create a supply network (Figure 4) for maintenance. Supply network consists of various supply chains. Material is rarely purchased directly from a manufacturer and more often it goes through a supply chain. Supply chains usually consist of different manufacturers, importers, wholesalers and local technical shops. (Järviö etc. 2007)

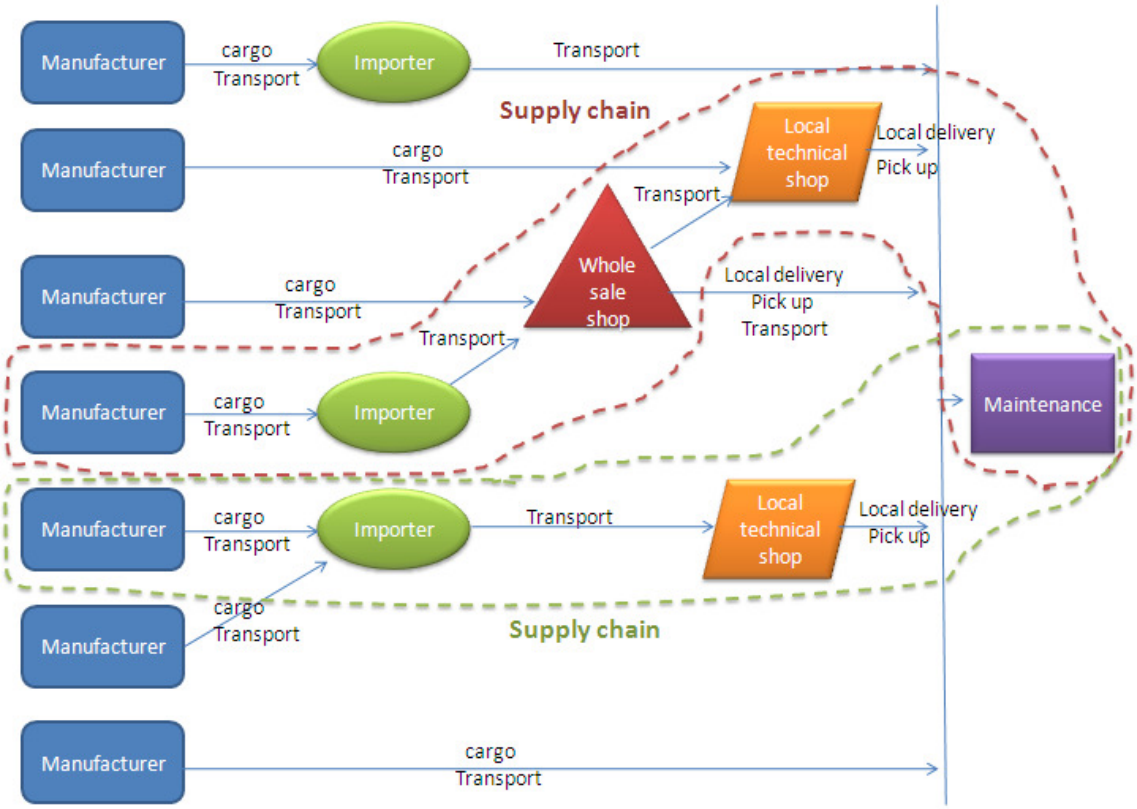


Figure 4 Maintenance materials' supply network (Järviö etc. 2007).

Maintenance's mission is to develop material logistic and maintenance work to a productive service package that improves production's reliability. Good maintenance demands predictive and well designed procedure. In maintenance's material logistic prediction requires inter alia active prediction of material need, knowledge of the supply network and preplanning supplying methods. In addition it requires maintaining such information as material items' data, consumption, device drawings' and maintenance history and plans. (Järviö etc. 2007.)

The meaning of the supply planning is to ensure fast deliveries in surprising material needs, which is typical and critical especially in maintenance. Production devices malfunction can not always recognise in advance. With the prediction information exploitation these rush deliveries can be reduced significantly. (Järviö etc. 2007.)

Better results are achieved in material logistic, when making longer term cooperation and contracts with the suppliers instead of focusing only to discuss on material prices. (Järviö etc. 2007.)

5.2 Prediction of material need

It is impossible to manage material flows and storages if the material need can not be predicted reliably. The prediction bases on measured and estimated initial data. All unexpected failures can not be known in advance, but with a good monitoring and equipment knowledge those can be predicted significantly better. (Järviö etc. 2007.)

Maintenance personnel task is to observe, measure and document data in which basis the material need can be predicted. They have to know how to define material need quickly and reliably when receiving a maintenance job or latest in troubleshooting phase. (Järviö etc. 2007.)

Prediction data and defined material need must always be taken in to warehouse and/or inform the purchaser as soon as possible. Then the warehouse and the purchaser can be prepared to an upcoming or a present material need. Only part of the materials maintenance uses are stored in own warehouse. Vast majority of spare parts and components has to be ordered from suppliers when they are needed, which makes the prediction of material need highly important. (Järviö etc. 2007.)

5.3 Spare parts warehousing

Warehousing constantly needed maintenance consumables and supplies and highly critical production spare parts is necessary. Slowly rotating spare parts can be stored outside the production site, as long as their delivery time doesn’t cause additional waiting time in case of emergency. Purchasing small and low-priced

parts and material for only to the current need is expensive. Therefore, these kinds of materials are kept in small storages nearby where they can be easily accessed. By doing so no additional time is required to retrieve the material. However excessive overstocking of the materials is just as bad and as expensive option than the lack of the warehouse. (Järviö etc. 2007.)

Well-managed logistics demands warehouse and procurement planning together with the suppliers. When considering each spare parts need for warehousing, the following matters must be taken into account: spare parts criticality, delivery time, cost, substitutability, storage requirements and costs, failure probability and repair possibilities of a failed component. Rarely failed and high-priced main components, which in case of failure can seize the entire production, are a problem. In stead of keeping these kinds of components in own warehouse, It is more profitable that they are stored by manufacturer. Another option is that several companies commonly owns and stores the components (edunet:kunnossapito).

Reliable operation of the warehouse requires continuous care and an accurate accounting. Warehouse accounting is pretty simple and clear, when everything that is taken and brought is documented immediately and correctly. Warehouse's good order is also essential to the warehouse's functionality. All persons using the warehouse are responsible for its order. According to Finnish law warehouse accounting has to be checked at least once a year to validate the correctness of the capital. This is called warehouse inventory, where items in the warehouse are compared to the accounting of the warehouse. (Järviö etc. 2007.)

5.4 Material item in information system

Critical information that unifies material logistic and maintenance materials is item code. Each spare part, component, article and substance need to have own unique code which can be used in only one material type. (Järviö etc. 2007.)

Responsibility of maintaining material items can be shared differently in different kinds of companies. There can be a specialized unit for maintaining material codes or the sales, warehousing and purchasing departments can have a specific person in charge of it. It is recommended that maintaining of material codes is concentrated to one or a couple of knowledgeable person (Järviö etc. 2007.)

When creating a material item, it has to be done thoroughly. Such information is needed for item recognition:

- Item code
- Search name
- Commodity group code
- Name
- Type
- Size
- Required accessories e.g. mountings
- Other required additional details e.g. quality requirements
- Manufacturer data
- Supplier data
- Required warehousing data.

Material item has to be created in the information system's item register before it can be included in inventory accounting. Based on the item code, material expenses, consumption and event history can be followed through reports. Material items' data content must be individualized that substituting products can be found to replace the original spare part. Item information has to be very specific in order to avoid subscription and delivery errors. (Järviö etc. 2007.)

6 SPARE PART HARMONIZATION

Before the implementation of the spare part harmonization, benefits gained from the harmonization work should be taken into account. It is not even worthwhile to carry out the harmonization work, if its benefits are little. It is impossible to evaluate direct financial savings from the harmonization, but there are some significant benefits and savings that can be obtained. The most important one is spare parts reduction in warehouses. Reductions can be achieved and savings generated when instead of ordering a new spare part from the supplier, it is ordered from another plant. Warehousing of critical and expensive spare parts can be centralized more easily. With these actions the capital of the spare part warehouse can be reduced. A minor warehouse capital reduction will most likely pay off the harmonization work. Spare parts search from the database is easier if they are properly harmonized. It will save time and work.

6.1 Tools for spare part harmonization

The harmonization work would be an overwhelming task without any appropriate tools. Spare parts can be compared somehow using spreadsheet applications like Microsoft Excel, but it would be too arduous and time-consuming. Therefore a proper tool for the harmonization process is needed.

There are a few software products that are focused on data cleaning and harmonization. With the help of the software, material items can be reduced by removing duplicates. In Paroc's database there can be approximately even 10 000 duplicates out of the total 36 000 material items. Mostly the duplicates are because of the different language, for example the same bearing can be in the database twice in Swedish and Finnish part description and number. There are also duplicates since the spare part naming and marking is done differently.

In next chapters there are comparing between the companies who provides tools for the harmonization. Since the thesis is a public work, companies' names and other information where they can be recognized are changed. With this procedure the cost estimates can be presented.

6.1.1 Company X's software

Company X is a software company that offers solutions for material cleaning and harmonization. Company X has users in many countries and it has big international companies as its customers.

Software X is Company X's software used for data cleaning. The benefit of using Software X for the harmonization is its comprehensive dictionary that comes with the software. In a web seminar held in January 2011 between Company X and Paroc, Company X demonstrated how their harmonization software works.

6.1.2 Company Y's software

Company Y is a software company that provides solutions for customers' product information management and item harmonization. It has a lot of users in many different countries. Company Y has some big international companies as its customers.

Paroc has cooperated with Company Y for 5 years. Company Y's Codemaster-software is used in Paroc's products management process. It was at first used in production name harmonization and now it is used to govern data. All the new products are created in Codemaster and from there transferred to IFS. Such attributes have been done manually to the Codemaster which prevents incorrect naming of the products and the creation of duplicates. It ensures the quality of the data and the same is pursued in maintenance material creation.

In a meeting between Paroc and Company Y, held in Parainen in November 2010, it was noticed that Company Y's software suits the maintenance data cleaning and harmonization. The software Company Y used in a presentation was Software Y, which is precisely meant for the data harmonization and cleaning. In a short demonstration it appeared that the software has good properties for comparing spare parts and finding the duplicates.

6.2 Harmonization strategy

In order to conduct the harmonization successfully, all the spare parts have to have a global name and number (global data). Global language that is understood in Finland, Sweden, Poland and Lithuania is English. Because we can not assume all the workers being involved in maintenance material data speak fluent English, material names in local languages must be retained. For this purpose a five lingual dictionary should be prepared or procured. Spare part numbers have to be unified. The easiest way is to change the country orientated numbers to a new number series. It could be for example 68 prefixed number, the first harmonized spare part number then being 68 00001.

Harmonization process can be done in a few different ways. Which software is used and who does the work, must be considered. Money primarily determines what kind of a strategy will be used, if there is a big difference in price. It is good to be aware of that harmonization costs have to be less than the benefits and profits gained from it. The harmonization can be outsourced as a Company Y's or Company X's project where they do the entire harmonization. It can also be done inside Paroc with own workers using Company Y's or Company X' harmonization software. In case the harmonization work is done with Paroc's own workforce, the needed resources and workload have to be evaluated.

If the harmonization work is done inside Paroc with own workers, it would be convenient to start the harmonization, for example from the Lappeenranta's plant's spare parts. Then harmonize the spares from Parainen and Oulu to match Lappeenranta's spare parts. At first the spare parts should give a global (English) name using the new dictionary and a global number.

If the spare part information is incomplete, it will be one of the most time-consuming issues in the harmonization process trying to resolve and fix the missing data.

6.3 Harmonization strategies' cost estimates

It is almost impossible to evaluate precisely how much the spare part harmonization requires work and resources. Harmonization work's efficiency varies dramatically in correlation between the processed material and the desired outcome.

6.3.1 Self-service using Company X's software

Company X charges a one-off fee of 0.65€ per line to use their software X for data cleaning. There are the total of 36,000 spare parts in Paroc's database, which sets the price for using the software as a harmonization tool to 23,400 euros. On top of the application fee Company X adds a fixed fee of 6,000€ per non-English language in the software dictionary. Paroc has four non-English languages and therefore translation and dictionary costs would be 24,000€. The harmonization and cleaning work would also require some project management, dictionary consulting and data analysis time to support the start of the work. It would take 15 days and cost 12,750€. An initial training pack is needed for the software training. Company X charges 4,750€ for the training pack. Calculating all fees together, the total one off project cost is 64,900€ plus a one year software subscription 10,800€.

Translation and dictionary costs could be avoided, if the dictionary would be prepared by Paroc's own staff. Savings gained from it would be so significant, that creating a self-made dictionary should be considered.

Addition to the Company X fees has to evaluate how much the harmonization will produce work. Company X's expert estimated that 100 harmonized items per day could be used as a good rule of thumb when calculating the workload. The needed work resources would then be about 360 man-days to manage the whole harmonization process.

6.3.2 Company X's project

Company X charges three different per line fees, if the harmonization work is outsourced for them. Those are application fee (0,65€/line), level 1 cleaning (1,00€/line), which includes items classification and level 2 cleaning (0,80€/line), which includes cleaning and de-duplication work. The total cost of per line fees is 88,200€. Dictionary and translation costs of four non-English languages are 24,000€ and they are added to the total cost. Company X estimated that the project requires 15 days of project management, 5 days of dictionary consulting and 10 days of data analyzing. The total price for this kind of work is 27,000€. The total cost for the Company X project would be 139,200€ plus a one year software fee of 10,800€.

6.3.3 Self-service using Company Y's software

Company Y recommends renting the harmonization software for the duration of the project, if the harmonization is done inside Paroc with own workers and with the help of Company Y's software. The rent is 2,000-4,000€ per month. Assuming that the cleaning work would take as long as using Company X's product (100 cleaned items per day), the rental time would be about twelve months. The software costs would then be (3,000€ x 12) 36,000€. Company Y's software does not include

dictionary, so own dictionary has to be prepared by Paroc. Project management and software training for the harmonization software will be needed from Company Y. It could be estimated to be 10-15 days. The project management and software training would increase the final price to about 50,000€. Harmonization work resources could be evaluated to be about the same 360 man-days as with the Company X's software.

6.3.4 Company Y's project

Company Y 's expert estimated, that before a more precise analysis, work plan creation and defining the scope a rough budgeted estimate of 1,000 harmonized item per day could be assumed for a workload when they manage the harmonization project. In some cases they have harmonized 5,000 items in a day in others less than 100.

Company Y's expert told that according to their experience, the desired outcome and quality of the harmonized data defines most of the workload. Since Paroc's goal is not only to remove duplicates, but also to clean and fix the data, 1,000 harmonized items per day might be a bit optimistic. Therefore even 500 harmonized items per day can be regarded as a good result and used as a more accurate evaluation when calculating cost estimates. Company Y charges about 1,000€ per day for the harmonization work. If it would take 72 days to harmonize 36,000 items then the harmonization work would cost 72,000 €. The work requires project management and instructions from Paroc how the harmonization should be done. This kind of work could take 10-20 days, which would set the final cost of Company Y project close to 90,000 €.

6.3.5 Summary of cost estimates

The cost estimates are not fully comparable between the harmonization companies, because Company Y could not provide the exact estimates before a

more precise analysis. Company X's cost estimates are detailed and give an idea of the price difference in case the work is outsourced or done inside Paroc. The table below (Figure 5) shows a summary of the total cost estimates of each harmonization strategy.

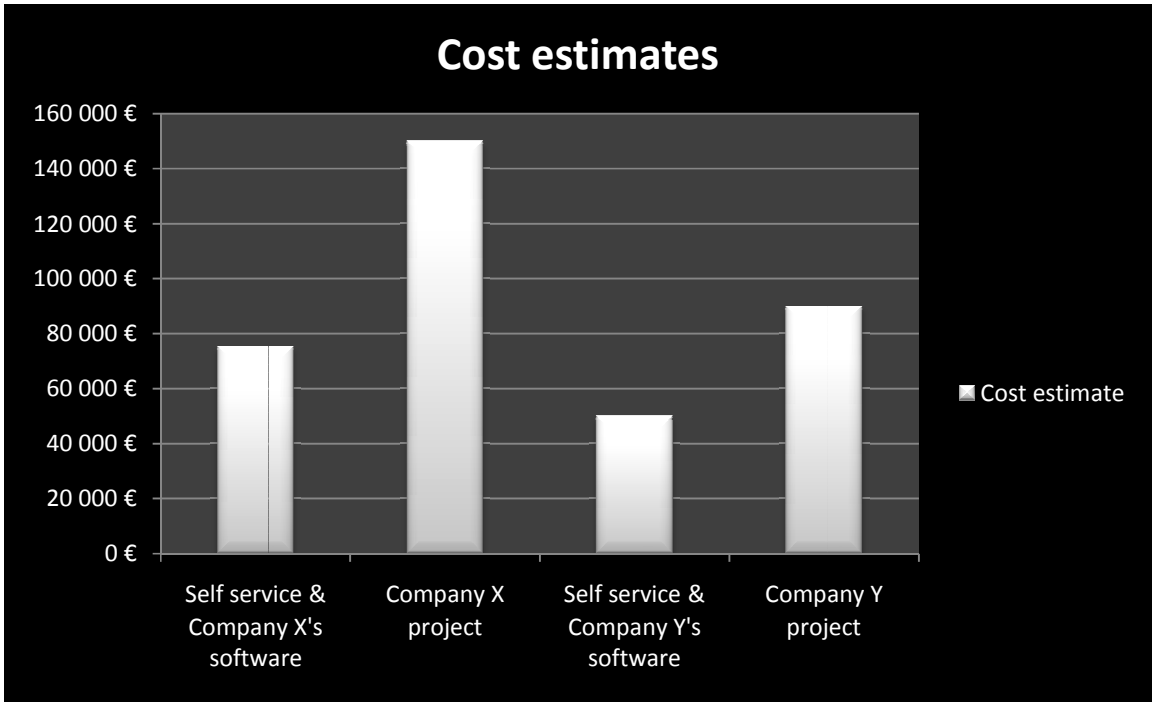


Figure 5 Harmonization strategies' cost estimates

The harmonization workloads are estimates but the difference between the software should not be remarkable. In self-service projects the needed workload could be about ten times higher than in outsourced projects. Therefore self-service project costs should be significantly lower in order to be a more profitable option. In Company X's case the price difference (~ 70,000€) might be enough but probably not in Company Y's case (~ 40,000€).

6.4 Course of action

Both software companies have given their own suggestion how to proceed in the harmonization process. Company Y suggests a three-day meeting where a more precise analysis, work plan creation and scope definition could be done. After this

Company Y could provide a more accurate cost estimate and evaluate the needed work resources. Company Y charges for this about 3,400€ and possible travel and accommodation expenses.

Company X suggests a proof of concept program for the next course of action. It would include a detailed project plan with costs and timings. Test data upload, closer investigation of the IFS integration and ROI analysis would also be included. According to Company X this allows deciding the best methodology and needed personnel for the harmonization. The cost of this work would be 17,500€ and it would take between eight and ten weeks to complete.

6.5 Selection of harmonization strategy

According to cost estimates the most inexpensive harmonization strategy would be the self-service using Company Y's software. But when the needed work resources are taken into account, harmonization as a Company Y's project would most likely be the cheapest and most reasonable choice. Therefore the recommendation is to contact Company Y at first and settle the three-day meeting where the more accurate cost estimates can be done. Only after that the final decision of the harmonization strategy can be made.

If after more accurate calculations Company Y prices are close to the evaluated level, it would be reasonable to continue harmonization work with them. In case Company Y has to increase harmonization costs, Company X should be considered. Company X's software seemed to be a better tool for harmonization at first sight. Another thing that draws towards Company X is that it is a company, which is exclusively focused on spare part harmonization and cleaning. They will most likely have more expertise on these kinds of harmonization projects.

7 SPARE PART CREATION PROCESS

At the moment the spare parts are created directly into the IFS and there are no common instructions on how to do it or who should do it. In this section recommendations are given on how the spare part creation process should take place.

7.1 Interviews

The purpose of the interviews was to investigate how the spare part creation has been done in different plants. Interviewees were maintenance managers, supervisors or other persons related to maintenance material management. One plant out of eleven was not interviewed because the interviewee could not attend the video conference. All interviews, except Lappeenranta and Parainen, were made with a video connection. Paroc has at least one video conference room in every plant which facilitates communication between plants.

The same questions were asked from everyone. Answers for the questions were written down during the interview and afterwards transcribed. Transcribed answers were emailed to the interviewees for reviewing.

Who creates spare parts and how the spare part creation is done in the IFS, were asked in interviews. How part description, type designation and other important text fields are filled, what information is written there and where the information is obtained were asked to be clarified.

Interviews revealed that in some factories the spare part creation process is not taken care of as well as it should be. Spare part naming is not as similar as wanted. The spare part creation questionnaire is attached and can be found in appendix 1. A more detailed summary from the interviews can be found in appendix 2.

7.2 Tool for spare part creation

Harmonization and data cleaning itself is not enough. When those tasks are completed, it has to be ensured that the data stays clean and duplicates do not start to accumulate. Otherwise the harmonization work will become pointless over time.

In a meeting with Paroc's Maintenance manager and Design manager we came to a conclusion that Codemaster should be used in the maintenance material management and creation process. With this decision we could ensure that the quality of the material data stays good. However, it requires creating the attributes to the Codemaster, which will most likely be a challenging task. Codemaster assistance from Paroc employees, who had been involved in creating attributes for production materials, is needed for the spare part attribute creation. Paroc should have a couple of Codemaster-licenses available so only a few new licenses are needed.

7.3 Authorization policy

It would be recommendable, that every country has its own material responsible person who creates new spare parts in Codemaster. It is not reasonable to share the responsibility of Codemaster among too many users. It would be reasonable to choose alternative users for the main users (material responsible), who can operate the Codemaster if needed. Paroc's own employees should be used in the Codemaster training, for example Paroc's Product data coordinator has wide experience from Codemaster.

When selecting the material responsible persons, it has to be taken into account, what skills are required. In addition to the local language, they have to have fluent English, since all the new spare parts are created in English. The material responsible should have previous experience on spare part creation on IFS,

because the new process does not differ much from the previous method. They also have to know how to use Codemaster, which they must be trained for.

A template should be used to provide the data for the material responsible when creating a new material item. The material creation process is demonstrated in figure 6.

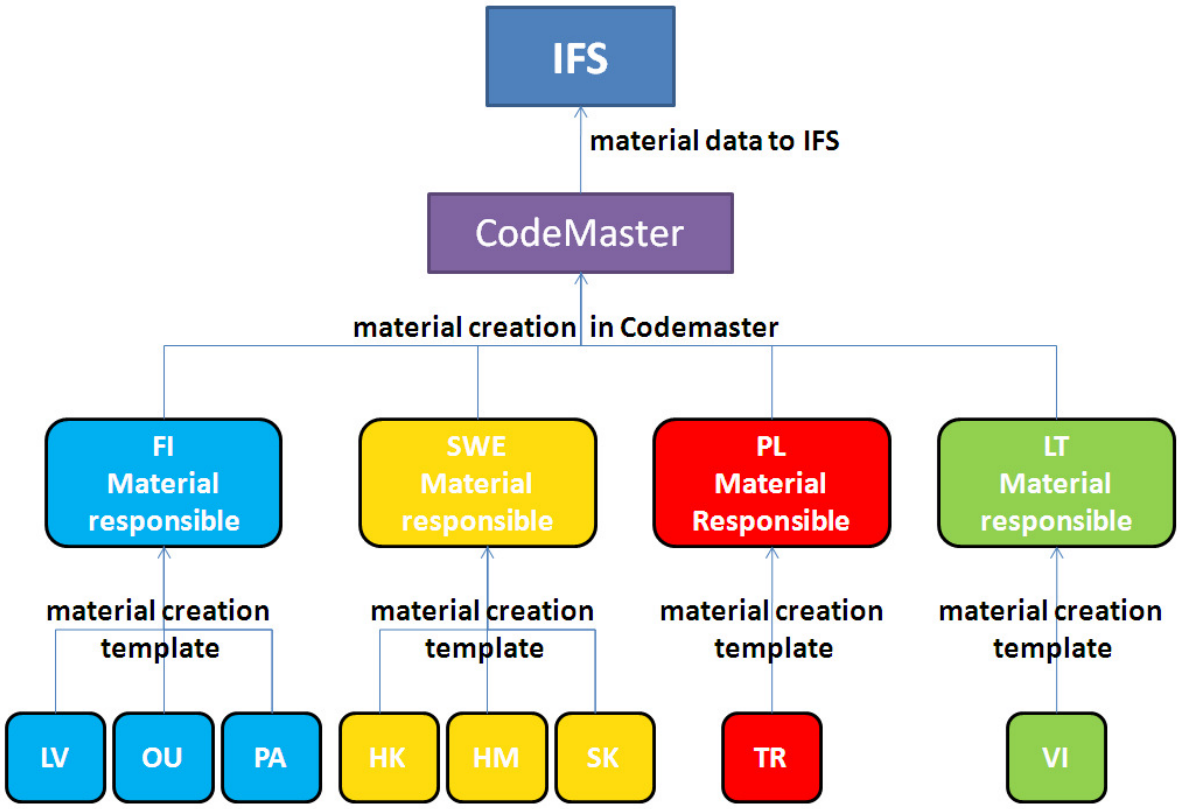


Figure 6 Maintenance material creation process overview.

In authorization policy it must be taken into account, which manufacturers' and suppliers' products can be used. In a meeting at Parainen it was stated, that Paroc's engineering department decides what spare part manufacturers can be used. Purchasing department should tender and choose the suitable suppliers.

7.4 Material creation template

When there is a need for creating a new material item into the database, the material creation template should be filled and sent to the material responsible. Material responsible enters the data from the received template to the Codemaster. When the material data is created in Codemaster, the data is sent to the IFS. The template could be an Excel based table to which it is easy and simple to add all the necessary information. It is also convenient to send it to the material responsible via email.

The material creation template has to have all the necessary information that is needed for the creation of a new material item. If the template is filled incorrectly or there is some missing data, the material responsible should send it back to be corrected and/or refilled. An example of Material creation template can be found in appendix 3. The material creation template also includes instruction on how to fill in some of the text fields in order to make spare part naming similar.

The use of material responsible and material creation templates should be considered even if Codemaster would not be used in the material creation process.

8 CONCLUSIONS

This Bachelor's thesis concentrated on Paroc Group's maintenance spare parts creation and harmonization strategy. The object was to create a reasonable strategy for the spare part creation and harmonization.

It was clear from the beginning that a proper harmonization tool will be needed in order to conduct the harmonization work properly. In this thesis different harmonization tools and strategies and their cost estimates were compared. Since the other harmonization company could not provide accurate estimates on the needed workload and costs, the final decision of harmonization strategy could not be made. Nevertheless, the thesis includes a recommendation for Paroc how to continue the harmonization process.

In this thesis the focus was also on spare part naming. Some examples of spare parts standard markings were given. Spare parts standard markings should always be used if possible. Unfortunately all spare parts and components do not have standard markings.

It is obvious that the more persons involved in spare part creation the more different methods there are to handle it. Therefore it is important not to share responsibility between too many persons. This thesis presented what kind of features material responsible persons should have. A spare part creation template was prepared, which should be used for sending data of a new material item to the material responsible. The material creation template included instructions on how some of the important text fields should be filled in order to make the naming identical. A tool used for the maintenance material management and creation process was recommended. It would prevent creation of duplicates.

It is most important to carry out the spare part harmonization at first. After the harmonization process is completed, the focus should be on proper naming and marking of the new material items in order to ensure that the quality of the harmonized data stays good and duplicates do not start to accumulate.

The fact that the thesis had to be done in English caused some worries at the beginning. At first writing the thesis was arduous and slow, but towards the end it became quite easy. Now I am pleased that I chose this as my Bachelor's thesis. The work was interesting and instructive. I was able to take advantage of what I had learned in school for this work.

The chief instructor and coordinator of the thesis changed to another workplace in the middle of this thesis, which slightly complicated and slowed the progress of the work. However, he was able to assist and instruct a lot before he left to his next workplace. In overall, I think that the work went well and I am quite satisfied with the outcome of the thesis.

FIGURES

Figure 1 Paroc business areas and their products, p. 9
Figure 2 Baltimore fire aftermath, p. 10
Figure 3 IFS Applications business components, p. 17
Figure 4 Maintenance materials' supply network, p. 21
Figure 5 Harmonization strategies' cost estimates, p. 31
Figure 6 Maintenance material creation process overview, p. 35

REFERENCES

Alanko, J. 2006. Standardeilla suuri merkitys yrityksille. Kunnossapitoyhdistys Promaint ry. http://www.promaint.net/alltypes.asp?d_type=1&menu_id=582&#1950 (Accessed on 25 November 2010)

Ansaharju, P. 2009. Koneenasennus ja kunnossapito. Helsinki: WSOY.

Chastain, L. 2008. Industrial mechanics and maintenance. 3rd edition. New Jersey: Pearson Education.

CEN. European Committee for Standardization.
http://www.cen.eu (Accessed on 10 December 2010)

Edunet:kunnossapito
http://www.edu.fi/oppimateriaalit/kunnossapito (Accessed on 17 January 2011)

IFSworld. IFS.
http://www.ifsworld.com (Accessed on 4 January 2011)

ISO. International Organization for Standardization.
http://www.iso.org (Accessed on 9 December 2010)

Järviö, J., Piispa, T., Parantainen, T. & Åström, T. 2007. Kunnossapito, Kunnossapidon julkaisusarja, n:o 10. 4. painos. Helsinki: KP-Media Oy.

Maryland Digital Cultural Heritage. Great Baltimore Fire of 1904.
http://www.mdch.org/fire (Accessed on 25 November 2010)

Mikkonen, H., Miettinen, J., Leinonen, P., Jantunen, E., Kokko, V., Riutta, E., Sulo, P., Komonen, K., Lumme, V.E., Kautto, J., Heinonen, K., Lakka, S. & Mäkeläinen R. 2009. Kuntoon perustuva KUNNOSSAPITO. Helsinki: KP-Media Oy.

Nopanen, E., Piispa, T. & Lukka, A. 2005. New operation model for maintenance material logistics in paper industry. Lappeenranta university of technology. Research report.

SFSedu. SFS-Oppilaitosportaali.
http://www.sfsedu.fi/www/fi/kone-tuotanto-ja_materiaalitekniikka/index.php (Accessed on 19 November 2010)

Date

Place

Present

Creating spare parts

1. **Who creates spare parts?**

2. **Spare part creation process**

2.1 How do you search for an existing spare part?

2.2 Do you use the closest matching spare part?

3. **What is the main difference in commodity group 1 between 5400 and 5420?**

4. **How do you define SPN and SPC?**

5. **How do you define:**
    - **Spare part description?**
    - **Type designation?**
    - **Dimension/quality?**
    - **Note text?**

6. **Do you a have protocol for defining spare part?**